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SCIENCE

TERM-1

MULTIPLE CHOICE QUESTIONS

CLASS-10

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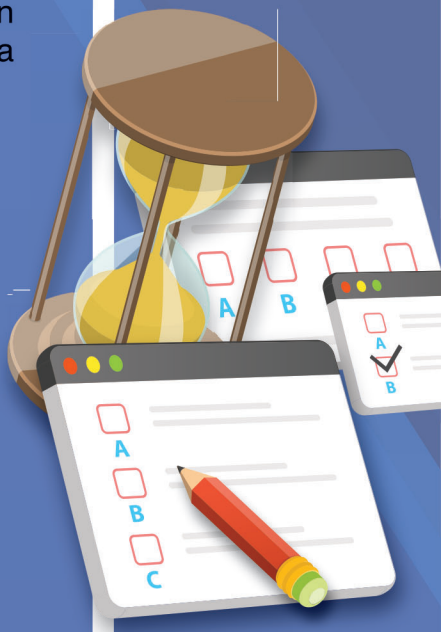

Case-based MCQs
Assertion-Reason Type MCQs
3 Practice Papers with OMR Sheets

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TERM–I

SCIENCE

Class-X (Code No. 086) (2021-22)

EVALUATION SCHEME
THEORY

Units	Term–1	Marks
I	Chemical Substances—Nature and Behaviour: Chapter 1,2 and 3	16
II	World of Living: Chapter 6	10
III	Natural Phenomena: Chapter 10 and 11	14
Units	**Term–II**	**Marks**
I	Chemical Substances-Nature and Behaviour: Chapter 4 and 5	10
II	World of Living: Chapter 8 and 9	13
IV	Effects of Current: Chapter 12 and 13	12
V	Natural Resources: Chapter 15	05
Total Theory (Term I + II)		**80**
Internal Assessment: Term I		**10**
Internal Assessment: Term II		**10**
Grand Total		**100**

TERM–I

Theme: Materials

Unit I: Chemical Substances—Nature and Behaviour

Chapter–1 Chemical reactions and equations

Chemical reactions: Chemical equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

Chapter–2 Acids, Bases and Salts

Acids, bases and salts: Their definitions in terms of furnishing of H^+ and OH^- ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Chapter–3 Metals and non-metals

Metals and non-metals: Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds.

Theme: The World of the Living

Unit II: World of Living

Chapter–6 Life processes

Life processes: 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

Theme: How Things Work

Unit III: Natural Phenomena

Chapter–10 Light—Reflection and Refraction

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification.

Refraction; Laws of refraction, refractive index.

Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens.

Chapter–11 Human Eye and Colourful World

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

TERM–1

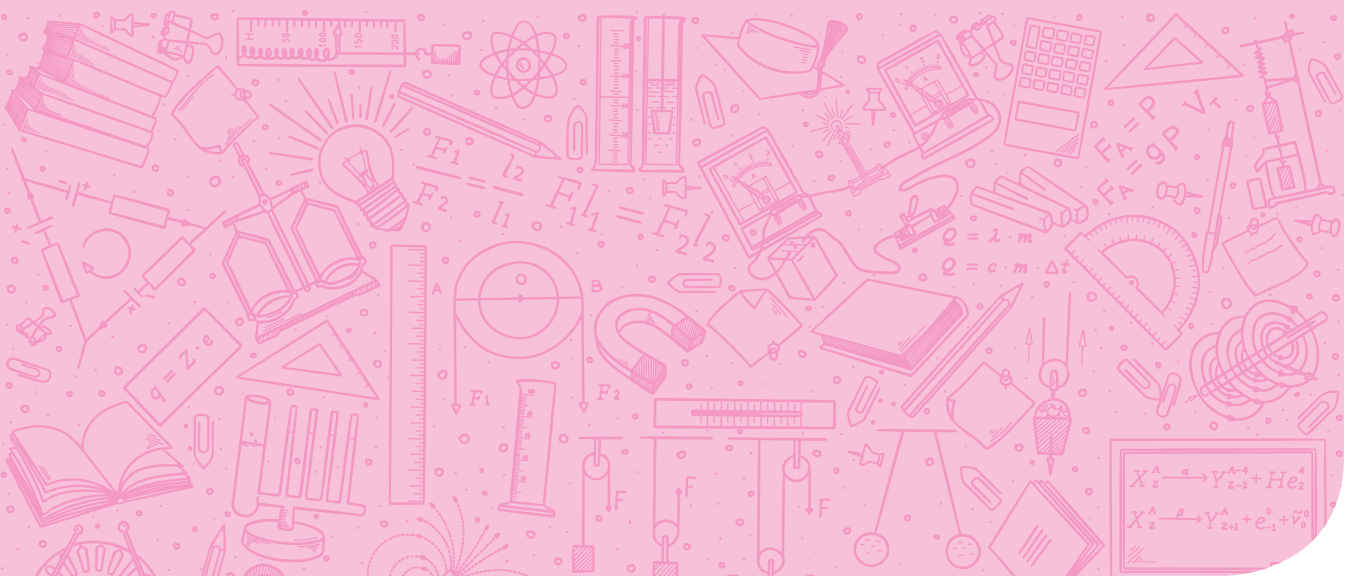
SCIENCE

BASIC CONCEPTS

MULTIPLE CHOICE QUESTIONS
(Including Competency-based MCQs)

CASE-BASED QUESTIONS

ASSERTION-REASON QUESTIONS



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01 CHEMICAL REACTIONS AND EQUATIONS

BASIC CONCEPTS

1. Chemical reaction is a process in which one or more substances react to form some other new substances with different properties.
2. Chemical equation is the shorthand notation of actually occurring chemical reaction in terms of the symbols, formulae and the ratio of the number of various reactants and products involved.
3. A chemical equation is said to be balanced when the number of atoms of each element on the reactant side is equal to the number of atoms of corresponding elements on the product side. Equations must always be balanced according to law of conservation of mass.
4. A complete balanced chemical equation represents the reactants, products and the conditions under which a reaction occurs.
5. Chemical reactions can be classified into combination, decomposition, displacement and double displacement reactions.
6. A reaction in which two or more substances combine to form a new single substance is called a combination reaction.

$$\underset{\text{Quick lime}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2(aq)}$$

7. In decomposition reaction, a single substance decomposes to give two or more simpler substances. The reaction in which decomposition occurs by applying heat is known as thermal decomposition.

$$\underset{\text{Limestone}}{CaCO_3(s)} \xrightarrow{\text{Heat}} \underset{\text{Quick lime}}{CaO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

The reaction in which decomposition occurs by applying electricity is known as electric decomposition.

$$2H_2O(l) \xrightarrow{\text{Electricity}} 2H_2(g) + O_2(g)$$

The reaction in which decomposition occurs in the presence of sunlight is called photo decomposition.

$$\underset{\text{Silver bromide}}{2AgBr(s)} \xrightarrow{\text{Sunlight}} \underset{\text{Silver}}{2Ag(s)} + \underset{\text{Bromine}}{Br_2(g)}$$

8. In displacement reaction one atom or a group of atoms of a compound is replaced by another atom or group of atoms.

$$\underset{\text{Iron}}{Fe(s)} + \underset{\text{Copper sulphate}}{CuSO_4(aq)} \longrightarrow \underset{\text{Iron sulphate}}{FeSO_4(aq)} + \underset{\text{Copper}}{Cu(s)}$$

9. The reactions in which two compounds exchange their ions to form two new compounds are called double displacement reactions.

$$\underset{\text{Sodium sulphate}}{Na_2SO_4(aq)} + \underset{\text{Barium chloride}}{BaCl_2(aq)} \longrightarrow \underset{\text{Barium sulphate}}{BaSO_4(s)} + \underset{\text{Sodium chloride}}{2NaCl(aq)}$$

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10. Reactions in which heat is given out along with the products are called exothermic reactions.

11. Reactions in which heat is absorbed are known as endothermic reactions.

12. Precipitation reactions produce insoluble salts.

13. Redox (Oxidation-Reduction) Reactions:

(i) **Oxidation** is a process which involves gain of oxygen or loss of hydrogen.

(ii) **Reduction** is a process which involves gain of hydrogen or loss of oxygen.

(iii) **Redox reactions** are those reactions in which oxidation and reduction take place simultaneously.

(iv) **Oxidising agent** is a substance which gives oxygen or gains hydrogen.
Alternatively, oxidising agent is the substance which oxidises other substances and reduces itself.

(v) **Reducing agent** is a substance which gives hydrogen or gains oxygen.
Alternatively, reducing agent is the substance which reduces other substances and oxidises itself.

14. Corrosion: The process of slowly eating up of the metals due to attack of atmospheric gases such as oxygen, carbon dioxide, hydrogen sulphide, water vapour, etc. on the surface of the metals so as to convert the metal into oxide, sulphide, carbonate, etc. is known as corrosion.

$$\underset{\text{Iron}}{2Fe(s)} + \frac{3}{2}\underset{\text{(From air)}}{O_2(g)} + x\underset{\text{Moisture}}{H_2O(l)} \longrightarrow \underset{\substack{\text{Hydrated ferric oxide}\\ \text{(Rust)}}}{Fe_2O_3.xH_2O(s)}$$

$$\underset{\text{Silver}}{2Ag(s)} + \underset{\substack{\text{Hydrogen sulphide}\\ \text{(From air)}}}{H_2S(g)} \longrightarrow \underset{\substack{\text{Silver sulphide}\\ \text{(Black)}}}{Ag_2S(s)} + \underset{\text{Hydrogen gas}}{H_2(g)}$$

$$\underbrace{2Cu(s)}_{\text{Copper}} + \underbrace{CO_2(g) + O_2(g) + H_2O(l)}_{\text{From moist air}} \longrightarrow \underbrace{CuCO_3.Cu(OH)_2}_{\substack{\text{Basic copper carbonate}\\ \text{(Green)}}}$$

15. Methods to Prevent Corrosion:

- Painting
- Oiling and greasing
- Plastic coating
- Chromium plating
- **Galvanising (zinc plating):** This method allows a coating of a more reactive metal (zinc) over the surface of iron or steel so that they can be protected against rusting.
- **Alloying:** This method changes the properties of the metal.

16. Rancidity: We have often noticed that a food containing oil or fat, if left for a long time, develops a bad taste and smell. This is because the oils and fats present in such foods get oxidised with the passage of time. The products (compounds) formed as a result of this oxidation are volatile and have bad smell. Due to this reason, the taste of the food also changes.

The oxidation of oils or fats in a food resulting into a bad taste and smell is called rancidity.

17. Methods to Prevent Rancidity:

(i) **By adding anti-oxidants:** Anti-oxidant is a substance (or chemical) which prevents oxidation. In the food industry, a number of special types of substances are added before packing which slow down the process of oxidation. BHA (Butylated Hydroxy Anisole) is one of the example of antioxidants.

(ii) **Vacuum packing:** In a number of cases, after packing the food, the container is evacuated before sealing so that no air/oxygen is available to bring about the oxidation of the food.

(iii) **Replacing air by nitrogen:** In some food-stuffs, the air present around them is replaced by nitrogen in the packet containing the food-stuff. Thus, oxidation of the food-stuff is

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prevented. For example, the plastic bags containing chips are flushed with nitrogen to prevent them from oxidation.

(*iv*) **Refrigeration of the food-stuff:** When the food is kept in a refrigerator, the oxidation of fats and oils in it is slowed down due to low temperature, so the development of rancidity due to oxidation is retarded.

MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. In which of the following equations, the mass is not same on both the sides?

(*a*) Word equation (*b*) Skeletal equation

(*c*) Balanced equation (*d*) Both (*a*) and (*b*)

2. Which among the following statement(s) is (are) true? Exposure of silver chloride to sunlight for a long duration turns grey due to [*NCERT Exemplar*]

(*i*) the formation of silver by decomposition of silver chloride

(*ii*) sublimation of silver chloride

(*iii*) decomposition of chlorine gas from silver chloride

(*iv*) oxidation of silver chloride

(*a*) (*i*) only (*b*) (*i*) and (*iii*)

(*c*) (*ii*) and (*iii*) (*d*) (*iv*) only

3. Three beakers labelled as A, B and C each containing 25 mL of water were taken. A small amount of NaOH, anhydrous $CuSO_4$ and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statements(s) is (are) correct? [*NCERT Exemplar*]

(*i*) In beakers A and B, exothermic process has occurred.

(*ii*) In beakers A and B, endothermic process has occurred.

(*iii*) In beaker C exothermic process has occurred.

(*iv*) In beaker C endothermic process has occurred.

(*a*) (*i*) only (*b*) (*ii*) only

(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iii*)

4. Corrosion of metals can be prevented

(*a*) by coating the metal surface with a paint.

(*b*) by applying film of grease and oil on the surface of the metal.

(*c*) by covering the surface of the metal with another metal which is more electropositive.

(*d*) all of these.

5. Identify the chemical equation which represents a complete balanced equation for the reaction of barium chloride with sodium sulphate to produce barium sulphate and sodium chloride.

(*a*) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + NaCl(aq)$

(*b*) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow 2BaSO_4(s) + 2NaCl(aq)$

(*c*) $2BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow 2BaSO_4(s) + NaCl(aq)$

(*d*) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$

6. Which of the following is not a physical change? [*NCERT Exemplar*]

(*a*) Boiling of water to give water vapour

(*b*) Melting of ice to give water

(*c*) Dissolution of salt in water

(*d*) Combustion of Liquefied Petroleum Gas (LPG)

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7. Which among the following is (are) double displacement reaction(s)? [*NCERT Exemplar*]

(*i*) $Pb + CuCl_2 \longrightarrow PbCl_2 + Cu$

(*ii*) $Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2NaCl$

(*iii*) $C + O_2 \longrightarrow CO_2$

(*iv*) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(*a*) (*i*) and (*iv*) (*b*) (*ii*) only

(*c*) (*i*) and (*ii*) (*d*) (*iii*) and (*iv*)

8. Which of the following reactions represents a combination reaction?

(*a*) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2\ (aq)$

(*b*) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

(*c*) $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$

(*d*) $2FeSO_4(s) \longrightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

9. Which of the following observation help(s) us to determine that a chemical change has taken place?

(*a*) Change in temperature. (*b*) Change in colour.

(*c*) Evolution of a gas. (*d*) All of these.

10. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified potassium permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation? [*NCERT Exemplar*]

(*a*) $KMnO_4$ is an oxidising agent, it oxidises $FeSO_4$

(*b*) $FeSO_4$ acts as an oxidising agent and oxidises $KMnO_4$

(*c*) The colour disappears due to dilution; no reaction is involved

(*d*) $KMnO_4$ is an unstable compound and decomposes in presence of $FeSO_4$ to a colourless compound.

11. Which of the following is (are) an endothermic processes?

(*i*) Dilution of sulphuric acid. **(*ii*) Sublimation of dry ice.**

(*iii*) Condensation of water vapours. **(*iv*) Evaporation of water.** [*NCERT Exemplar*]

(*a*) (*i*) and (*iii*) (*b*) (*ii*) only

(*c*) (*iii*) only (*d*) (*ii*) and (*iv*)

12. Which of the following are combination reactions? [*NCERT Exemplar*]

(*i*) $2KClO_3 \longrightarrow 2KCl + 3O_2$ **(*ii*) $MgO + H_2O \longrightarrow Mg(OH)_2$**

(*iii*) $4Al + 3O_2 \longrightarrow 2Al_2O_3$ **(*iv*) $Zn + FeSO_4 \longrightarrow ZnSO_4 + Fe$**

(*a*) (*i*) and(*iii*) (*b*) (*iii*) and (*iv*)

(*c*) (*ii*) and (*iv*) (*d*) (*ii*) and (*iii*)

13. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature? [*NCERT Exemplar*]

(*a*) $2H_2(l) + O_2(l) \longrightarrow 2H_2O(g)$ (*b*) $2H_2(g) + O_2(l) \longrightarrow 2H_2O(l)$

(*c*) $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$ (*d*) $2H_2(g) + O_2(g) \longrightarrow 2H_2O(g)$

14. Which of the following are exothermic processes?

(*i*) Reaction of water with quick lime

(*ii*) Dilution of an acid

(*iii*) Evaporation of water

(*iv*) Sublimation of camphor (crystals) [*NCERT Exemplar*]

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iv*) (*d*) (*iii*) and (*iv*)

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15. Which one of the following processes involve chemical reactions? [*NCERT Exemplar*]

(*a*) Storing of oxygen gas under pressure in a gas cylinder

(*b*) Liquefaction of air

(*c*) Keeping petrol in a china dish in the open

(*d*) Heating copper wire in presence of air at high temperature

16. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate? [*NCERT Exemplar*]

(*a*) Lead sulphate (insoluble) (*b*) Lead acetate

(*c*) Ammonium nitrate (*d*) Potassium sulphate

17. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed? [*NCERT Exemplar*]

(*i*) It is an endothermic reaction

(*ii*) It is an exothermic reaction

(*iii*) The pH of the resulting solution will be more than seven

(*iv*) The pH of the resulting solution will be less than seven

(*a*) (*i*) and(*ii*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iv*) (*d*) (*iii*) and (*iv*)

18. What happens when dilute hydrochloric acid is added to iron filings?

(*a*) Hydrogen gas and iron (II) chloride are produced.

(*b*) Chlorine gas and ferric hydroxide are produced.

(*c*) Heat is absorbed, *i.e.*, test tubes becomes cold.

(*d*) Iron salt and water are produced.

19. The following reaction is used for preparation of oxygen gas in the laboratory:

$$2KClO_3(s) \xrightarrow[\text{Catalyst}]{\text{Heat}} 2KCl(s) + 3O_2(g)$$

Which of the following statements is correct about the reaction? [*NCERT Exemplar*]

(*a*) It is a decomposition reaction and endothermic in nature.

(*b*) It is a combination reaction.

(*c*) It is a decomposition reaction and is accompanied by release of heat.

(*d*) It is a photo chemical decomposition reaction and exothermic in nature.

20. The following reaction is an example of a

$$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$$

(*i*) displacement reaction **(*ii*) combination reaction**

(*iii*) redox reaction **(*iv*) neutralisation reaction**

[*NCERT Exemplar*]

(*a*) (*i*) and (*iv*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iii*) (*d*) (*iii*) and (*iv*)

21. Chemically rust is

(*a*) ferric sulphate (*b*) ferric oxide

(*c*) hydrated ferrous oxide (*d*) hydrated ferric oxide

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22. The chemical formula of lead sulphate is

(*a*) Pb_2SO_4 (*b*) $Pb(SO_4)_2$ (*c*) $PbSO_4$ (*d*) $Pb_2(SO_4)_3$

23. Both CO_2 and H_2 gases are

(*a*) heavier than air (*b*) acidic in nature

(*c*) colourless (*d*) soluble in water

24. Which of the following gases can be used for storage of fresh sample of an oil for a long time?

(*a*) Carbon dioxide or oxygen (*b*) Nitrogen or helium

(*c*) Helium or oxygen (*d*) Nitrogen or oxygen

25. The electrolytic decomposition of water gives H_2 and O_2 in the ratio of

(*a*) 2 : 1 by volume (*b*) 1 : 2 by volume

(*c*) 8 : 1 by mass (*d*) 1 : 2 by mass

26. In the decomposition of lead (II) nitrate to give lead (II) oxide, nitrogen dioxide and oxygen gas, the coefficient of nitrogen dioxide (in the balanced equation) is

(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

27. Fatty foods become rancid due to the process of

(*a*) reduction (*b*) corrosion

(*c*) oxidation (*d*) hydrogenation

28. We store silver chloride in a dark coloured bottle because it

(*a*) is a white solid (*b*) undergoes redox reaction

(*c*) decomposes by sunlight (*d*) none of the above

29. Silver article turns black when kept in the open for a few days due to formation of

(*a*) H_2S (*b*) AgS (*c*) $AgSO_4$ (*d*) Ag_2S

30. When crystals of lead nitrate are heated strongly in a dry test tube

(*a*) crystals immediately melt (*b*) a brown residue is left

(*c*) white fumes appear in the tube (*d*) a yellow residue is left

31. Dilute hydrochloric acid is added to granulated zinc taken in a test tube. The following observations are recorded. Point out the correct observation.

(*a*) The surface of metal becomes shining

(*b*) The reaction mixture turns milky

(*c*) Odour of a pungent smelling gas is recorded

(*d*) A colourless and odourless gas is evolved

32. When carbon dioxide is passed through lime water,

(*a*) calcium hydroxide is formed (*b*) white precipitate of CaO is formed

(*c*) lime water turns milky (*d*) colour of lime water disappears.

33. When a magnesium ribbon is burnt in air, the ash formed is

(*a*) black (*b*) white (*c*) yellow (*d*) pink

34. In which of the following, heat energy will be evolved?

(*a*) Burning of L.P.G.

(*b*) Dissolution of NH_4Cl in water

(*c*) Electrolysis of water

(*d*) Decomposition of AgBr in the presence of sunlight

35. Rancidity can be prevented by

(*a*) adding antioxidants (*b*) storing food away from light

(*c*) keeping food in refrigerator (*d*) all of these

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36. The reaction of H_2 gas with oxygen gas to form water is an example of

(*a*) combination reaction (*b*) redox reaction

(*c*) exothermic reaction (*d*) all of these reactions

37. The reaction in which two compounds exchange their ions to form two new compounds is called

(*a*) displacement reaction (*b*) combination reaction

(*c*) double displacement reaction (*d*) redox reaction

38. On immersing an iron nail in $CuSO_4$ solution for few minutes, you will observe

(*a*) no reaction takes place

(*b*) the colour of solution changes to green

(*c*) the surface of iron nails acquire a black coating

(*d*) the colour of solution fades away

39. An element X on exposure to moist air turns reddish-brown and a new compound Y is formed. The substance X and Y are

(*a*) X = Fe, Y = Fe_2O_3 (*b*) X = Ag, Y = Ag_2S

(*c*) X = Cu, Y = CuO (*d*) X = Al, Y = Al_2O_3

40. Which of the following is termed as oxidizing agent?

(*a*) Which gives oxygen (*b*) Which removes oxygen

(*c*) Which gives hydrogen (*d*) All of the above

41. Which of the following termed as reducing agent?

(*a*) Which gives oxygen (*b*) Which removes oxygen

(*c*) Which removes hydrogen (*d*) All of the above

42. Which of the following does show oxidation reaction?

(*a*) Gain of oxygen (*b*) Loss of oxygen

(*c*) Gain of hydrogen (*d*) None of the above

43. Which of the following does show reduction reaction?

(*a*) Gain of oxygen (*b*) Loss of oxygen

(*c*) Loss of hydrogen (*d*) None of the above

44. Which of the reaction is used in black and white photography?

(*a*) Combination reaction (*b*) Decomposition reaction

(*c*) Displacement reaction (*d*) Oxidation reaction

45. In which of the following heat is evolved?

(*a*) Combination reaction (*b*) Decomposition reaction

(*c*) Displacement reaction (*d*) Double displacement reaction

46. In which of the following heat is absorbed generally?

(*a*) Combination reaction (*b*) Decomposition reaction

(*c*) Displacement reaction (*d*) Double displacement reaction

47. Which of the following is termed as endothermic reaction?

(*a*) Reaction in which heat is evolved (*b*) Reaction in which heat is absorbed

(*c*) Reaction in which there is loss of oxygen (*d*) Reaction in which there is gain of hydrogen

48. Which of the following is termed as exothermic reaction?

(*a*) Reaction in which heat is evolved (*b*) Reaction in which heat is absorbed

(*c*) Reaction in which there is loss of oxygen (*d*) Reaction in which there is gain of hydrogen

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49. What is the name of reaction which decomposes after supply of heat?

(*a*) Combination reaction (*b*) Thermal decomposition

(*c*) Displacement reaction (*d*) Redox reaction

50. What is the name of reaction in which both oxidation and reduction takes place?

(*a*) Combination reaction (*b*) Thermal decomposition

(*c*) Displacement reaction (*d*) Redox reaction

51. What is the name of substance which does get deposited over iron because of moisture present in air?

(*a*) Sulphide (*b*) Rust (*c*) Carbonate (*d*) Oxygen

52. Why magnesium ribbon is cleaned before burning?

(*a*) To remove dust (*b*) To remove magnesium oxide

(*c*) To remove magnesium (*d*) All of the above

53. On the basis of evolution or absorption of heat, chemical reactions can be divided into how many types?

(*a*) Two (*b*) Three (*c*) Four (*d*) One

54. Which of the following gas is produced when carbon is burnt in air?

(*a*) Carbon dioxide (*b*) Sulphur dioxide

(*c*) Oxygen (*d*) Hydrogen

55. What happens when hydrogen reacts with oxygen?

(*a*) Carbon dioxide is formed (*b*) Water is formed

(*c*) Hydrogen carbonate is formed (*d*) All of the above

56. Which of the following product is formed when calcium oxide reacts with water?

(*a*) Slaked lime (*b*) Carbon dioxide

(*c*) Calcium oxide (*d*) Oxygen gas

57. What is the another name of quick lime?

(*a*) Calcium hydroxide (*b*) Calcium oxide

(*c*) Carbon dioxide (*d*) Sodium oxide

58. What is the chemical name for slaked lime?

(*a*) Calcium carbonate (*b*) Calcium oxide

(*c*) Calcium hydroxide (*d*) Carbon monoxide

59. Heating of ferrous sulphate gives which of the following product?

(*a*) Ferric oxide (*b*) Sulphur dioxide

(*c*) Sulphur trioxide (*d*) All of the above

60. In which of the following category will you put the reaction of heating of ferrous sulphate?

(*a*) Decomposition reaction (*b*) Combination reaction

(*c*) Displacement reaction (*d*) All of the above

61. In which of the following category will you put the reaction of heating of calcium carbonate?

(*a*) Decomposition reaction (*b*) Thermal decomposition reaction

(*c*) Endothermic reaction (*d*) All of the above

62. Which of the following product is formed after heating of limestone?

(*a*) Calcium oxide (*b*) Calcium carbonate

(*c*) Hydrogen gas (*d*) All of the above

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63. What happens when silver chloride is put under sunlight?

(*a*) Silver metal and chlorine gas are formed
(*b*) Silver metal and hydrogen gas are formed
(*c*) Only silver metal is formed
(*d*) Only hydrogen gas is formed

64. Which of the following is formed when lead nitrate is put under thermal decomposition?

(*a*) Lead oxide
(*b*) Nitrogen dioxide
(*c*) Oxygen gas
(*d*) All of the above

65. What happens when carbon dioxide is passed through lime water?

(*a*) Lime water turns milky because of formation of calcium carbonate
(*b*) Lime water turns milky because of formation of water
(*c*) Lime water turns red because of formation of permanganate
(*d*) Lime water turns red because of formation of copper sulphate

66. What happens when silver bromide is exposed to sunlight?

(*a*) Hydrogen gas is formed
(*b*) Bromine gas is formed
(*c*) Chlorine gas is formed
(*d*) Iodine gas is formed

67. Which metal is displaced when lead is put in the solution of copper chloride?

(*a*) Lead
(*b*) Copper
(*c*) Chlorine
(*d*) All of the above.

68. Which of the following is formed when lead metal reacts with the solution of copper chloride?

(*a*) No reaction takes place
(*b*) Chlorine gas
(*c*) Lead chloride
(*d*) Copper-lead complex

69. Which metal is displaced when zinc metal is put in the solution of copper sulphate?

(*a*) Copper
(*b*) Zinc
(*c*) Sulphate
(*d*) All of the above

70. What happens when sodium sulphate solution is mixed with the solution of barium chloride?

(*a*) Barium sulphate is formed
(*b*) Sodium sulphate is formed
(*c*) Sulphur dioxide gas is formed
(*d*) No reaction takes place

71. What happens when copper metal is dipped in the solution of zinc sulphate?

(*a*) Copper sulphate is formed
(*b*) Oxygen gas is formed
(*c*) Zinc metal is separated
(*d*) No reaction takes place

72. What happens when zinc metal is dipped in the solution of copper sulphate?

(*a*) Zinc sulphate is formed
(*b*) Zinc oxide is formed
(*c*) Zinc sulphide is formed
(*d*) No reaction takes place

73. Why are articles made of iron painted to prevent rust?

(*a*) Paint makes articles made of iron beautiful
(*b*) Paint prevents iron articles to come in contact with moisture present in air.
(*c*) Paint prevents iron articles from getting sticky
(*d*) All of the above

74. Which of the following is termed as rancidity?

(*a*) Reduction of oxygen present in food
(*b*) Oxidation of oil present in food
(*c*) Oxidation of sugar present in food
(*d*) All of the above

75. How rancidity can be prevented?

(*a*) By adding antioxidants in food
(*b*) By adding more oxygen to food
(*c*) By keeping food items in open
(*d*) All of the above

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76. Balanced equation of $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ is

(*a*) $Fe + 4H_2O \rightarrow Fe_3O_4 + H_2$ (*b*) $Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

(*c*) $3Fe + H_2O \rightarrow Fe_3O_4 + 4H_2$ (*d*) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

77. The formula of quick lime and the compound formed when it reacts with water respectively are

(*a*) CaO, $CaCO_3$ (*b*) CaO, $Ca(OH)_2$

(*c*) $Ca(OH)_2$, $CaCO_3$ (*d*) $CaCO_3$, $Ca(OH)_2$

78. A solution of which of the following compounds is used for whitewashing?

(*a*) Slaked lime (*b*) Quick Lime

(*c*) Blue vitriol (*d*) Limestone

79. Electrolysis of water is

(*a*) Combination reaction (*b*) Decomposition reaction

(*c*) Displacement reaction (*d*) None

80. Example of displacement reaction is

(*a*) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

(*b*) $C(s) + O_2(g) \rightarrow CO_2(g)$

(*c*) $AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2(g)$

(*d*) $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

81. Lead nitrate $Pb(NO_3)_2$ on heating forms solid Lead oxide (PbO) and Nitrogen dioxide gas. What is the colour of lead oxide and nitrogen dioxide?

(*a*) White, Colourless (*b*) White, Brown

(*c*) Yellow, Brown (*d*) Yellow, Colourless

82. Silver chloride on exposure to sunlight decomposes into silver and chlorine gas. This property is used in

(*a*) Heat production as enormous energy is released.

(*b*) Silver extraction as earth contains silver mainly in silver chloride form.

(*c*) Photography as grey silver formed produces an image imprint.

(*d*) None

83. Quick lime is used in whitewashing because

(*a*) it is cheap

(*b*) it forms slaked lime with water which has a nice colour.

(*c*) it forms slaked lime with water which reacts with atmospheric carbon dioxide to form limestone.

(*d*) None

84. Example of a double displacement reaction will be

(*a*) Metal with a salt (*b*) Metal with an acid

(*c*) Metal with metal (*d*) Salt with a salt

85. Ferrous sulphate solution is green while ferric oxide formed by its decomposition is

(*a*) red (*b*) white

(*c*) brown (*d*) yellow

86. Corrosion or rusting of iron metal is

(*a*) Oxidation of iron (*b*) Reduction of iron

(*c*) Displacement of iron (*d*) None

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87. To facilitate the electrolysis of water we add a few drops of acids like sulphuric acid because

(*a*) It acts as a catalyst

(*b*) It prevents the decomposition of electrodes used.

(*c*) It makes the water a good conductor of electricity

(*d*) None

88. Fried foods are packed with which gas to prevent oxidation of fat?

(*a*) Oxygen (*b*) Nitrogen

(*c*) Any of the above (*d*) None

89. Which of the following statements about the given reaction are correct?

$3Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)$

(*i*) Iron metal is getting oxidised

(*ii*) Water is getting reduced

(*iii*) Water is acting as reducing agent

(*iv*) Water is acting as oxidising agent

(*a*) (*i*), (*ii*) and (*iii*) (*b*) (*iii*) and (*iv*)

(*c*) (*i*), (*ii*) and (*iv*) (*d*) (*ii*) and (*iv*)

90. Which of the following is a displacement reaction?

(*a*) $MgCO_3 \rightarrow MgO + CO_2$,

(*b*) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

(*c*) $2H_2 + O_2 \rightarrow 2H_2O$

(*d*) $2Pb\ (NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

91. A substance 'X' is used in white-washing and is obtained by heating limestone in the absence of air. The substance 'X' is

(*a*) $CaOCl_2$ (*b*) $Ca(OH)_2$ (*c*) CaO (*d*) $CaCO_3$

92. Select the oxidising agent for the following reaction:

$H_2S + I_2 \rightarrow 2HI + S$

(*a*) I_2 (*b*) H_2S (*c*) HI (*d*) S

93. A substance added to food containing fats and oils is called:

(*a*) Oxidant (*b*) Rancid (*c*) Coolant (*d*) Antioxidant

94. The condition produced by aerial oxidation of fats and oils in foods marked by unpleasant smell and taste is called:

(*a*) antioxidation (*b*) reduction

(*c*) rancidity (*d*) corrosion

95. When SO_2 gas is passed through saturated solution of H_2S, which of the following reaction occurs?

(*a*) $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$

(*b*) $SO_2 + 2H_2S \rightarrow H_2O + 3S$

(*c*) $SO_2 + H_2S \rightarrow H_2O + S$

(*d*) $SO_2 + H_2O \rightarrow SO_3 + H_2$

96. What are the products formed when iron filings are heated with dilute hydrochloric acid?

(*a*) Fe (III) chloride and water

(*b*) Fe (II) chloride and water

(*c*) Fe (II) chloride and hydrogen gas

(*d*) Fe (III) chloride and hydrogen gas

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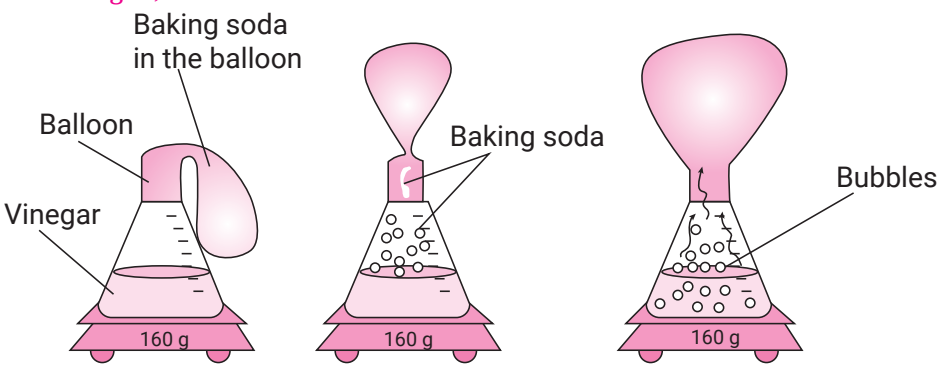
97. A student poured 100 mL of water in a bottle and added 40 mL vinegar to it. A balloon was filled with 20 g baking soda and was fixed at the mouth of the bottle. Slowly the shape of the balloon changed, as shown below:



The student claims that a chemical change happened when the two substances were mixed. Is the claim made by the student correct? ***[CBSE Question Bank]***

(*a*) Yes, as a new substance was formed in the form of a gas.

(*b*) No, as the formation of bubbles in the mixture shows a physical change.

(*c*) Yes, as the mass remains the same throughout the experiment.

(*d*) No, as the change in the shape and size of the balloon shows a physical change.

98. A student performs an experiment to form aluminium chloride from aluminium and chlorine. Which options gives the balanced chemical equation of the reaction? ***[CBSE Question Bank]***

(*a*) $3Al + 3Cl_2 \rightarrow 3AlCl_3$ (*b*) $2Al + Cl_2 \rightarrow 2AlCl$

(*c*) $2Al + 3Cl_2 \rightarrow 2AlCl_3$ (*d*) $Al + Cl_2 \rightarrow AlCl_2$

99. A researcher adds barium hydroxide to hydrochloric acid to form a white coloured barium chloride. Which option gives the balanced chemical equation of the reaction?

[CBSE Question Bank]

(*a*) $HCl + 2Ba(OH) \rightarrow 2BaCl_2 + 2H_2O + O_2$

(*b*) $2HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2H_2O$

(*c*) $2HCl + Ba(OH)_2 \rightarrow BaH_2 + 2HCl + O_2$

(*d*) $2HCl + Ba(OH)_2 \rightarrow BaH_2 + 2HCl + O_2$

100. A student writes a balanced chemical equation as ***[CBSE Question Bank]***

$Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$

Which option gives the number of atoms on the LHS and RHS of the chemical equation?

	Element	Number of Atoms in Reactants (LHS)	Number of Atoms in Products (RHS)
	Pb	1	1
(*a*)	Cu	1/2	1/2
	Cl	2	2
(*b*)	Pb	1	1
	Cu	1	1
	Cl	1/2	1/2
(*c*)	Pb	1	1
	Cu	1	1
	Cl	1	1
(*d*)	Pb	1	1
	Cu	1	1
	Cl	2	2

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101. A student learns that some products are formed as a result of combining two compounds while some products are formed as a result of dissociation of two compounds. Two reactions are:

Reaction P – $CaO + SO_3 \rightarrow CaSO_4$
Reaction Q – $ZnCO_3 \rightarrow ZnO + CO_2$

Which reaction is an example of a combination reaction and a decomposition reaction? ***[CBSE Question Bank]***

(*a*) Both the reactions are examples of a decomposition reaction.
(*b*) P is an example of a decomposition reaction while reaction Q is an example of a combination reaction.
(*c*) Reaction P is an example of a combination reaction while reaction Q is an example of a decomposition reaction.
(*d*) Both the reactions are examples of combination reaction.

102. A student adds lead and silver to two different test tubes containing an equal amount of copper sulphate solution. The student observes that the colour of the solution in the test tube with lead changes. What explains the change in the colour of the solution? ***[CBSE Question Bank]***

(*a*) A displacement reaction takes place as lead replaces copper from the solution.
(*b*) Decomposition reaction takes place as copper dissociates from sulphate in the solution.
(*c*) A double displacement reaction takes place as copper dissociates from sulphate and lead combines with sulphate in the solution.
(*d*) A combination reaction takes place as lead combines with sulphate in the solution.

103. The chemical reaction between potassium chloride and silver nitrate is given by the chemical equation. What can be inferred from the chemical equation? ***[CBSE Question Bank]***

$KCl + AgNO_3 \rightarrow AgCl + KNO_3$

(*a*) Silver nitrate and potassium undergo a combination reaction to form silver chloride and potassium nitrate.
(*b*) Silver nitrate and potassium undergo a decomposition reaction to form silver chloride and potassium nitrate.
(*c*) Silver nitrate and potassium undergo a displacement reaction to form silver chloride and potassium nitrate.
(*d*) Silver nitrate and potassium chloride undergo double displacement reaction to form silver chloride and potassium nitrate.

104. The reaction between iron oxide and hydrogen is given below:

$Fe_3O_4 + 4H_2 \rightarrow 3Fe + 4H_2O$

Which option shows the compounds undergoing oxidation and reduction?

[CBSE Question Bank]

	Oxidation	Reduction
(*a*)	$4H_2$	Fe_3O_4
(*b*)	Fe_3O_4	$4H_2O$
(*c*)	$4H_2O$	Fe_3O_4
(*d*)	3Fe	$4H_2$

105. A student notices that the bread kept out has a green coloured coating over it after a few days. What explains the reason for the student's observation? ***[CBSE Question Bank]***

(*a*) The oils in the bread reduces and cause the change in the colour of the bread.
(*b*) Bread comes in contact with atmospheric moisture and corrodes.
(*c*) The oils in the bread oxidises and causes rancidity.
(*d*) Comes in contact with the atmospheric nitrogen and a layer deposits over it.

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106. Calcium oxide reacts vigorously with water to produce slaked lime.

$CaO\,(s) + H_2O\,(l) \rightarrow Ca(OH)_2\,(aq)$ **[*CBSE 2020* (31/1/1)]**

This reaction can be classified as:

(A) Combination reaction

(B) Exothermic reaction

(C) Endothermic reaction

(D) Oxidation reaction

Which of the following is a correct option ?

(*a*) (A) and (C) (*b*) (C) and (D)

(*c*) (A), (C) and (D) (*d*) (A) and (B)

107. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate or copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of a : **[*CBSE 2020* (31/1/1)]**

(*a*) Combination reaction

(*b*) Displacement reaction

(*c*) Decomposition reaction

(*d*) Double displacement reaction

108. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution: **[*CBSE 2020* (31/1/1)]**

(A) exchange of atoms takes place

(B) exchange of ions takes place

(C) a precipitate is produced

(D) an insoluble salt is produced

The correct option is:

(*a*) (B) and (D) (*b*) (A) and (C)

(*c*) only (B) (*d*) (B), (C) and (D)

109. Identify '*x*', '*y*' and '*z*' in the following reaction: **[*CBSE 2020* (31/2/1)]**

$2KClO_3\,(x) \xrightarrow{(y)} 2KCl\,(x) + O_2\,(z)$

(*a*) x = gas; y = reaction condition, z = gas

(*b*) x = solid; y = liquid; z = gas

(*c*) x = number of moles of $KClO_3$; y = reaction condition; z = no. of molecules of oxygen.

(*d*) x = physical state of $KClO_3$ and KCl; y = reaction condition; z = physical state of O_2.

110. In which of the following the identity of initial substance remains unchanged? **[*CBSE 2020* (31/3/1)]**

(*a*) Curdling of milk

(*b*) Formation of crystals by process of crystallisation

(*c*) Fermentation of grapes

(*d*) Digestion of food

Answers

1. (*d*)	**2.** (*a*)	**3.** (*c*)	**4.** (*d*)	**5.** (*d*)	**6.** (*d*)	**7.** (*b*)
8. (*a*)	**9.** (*d*)	**10.** (*a*)	**11.** (*d*)	**12.** (*d*)	**13.** (*d*)	**14.** (*a*)
15. (*d*)	**16.** (*b*)	**17.** (*b*)	**18.** (*a*)	**19.** (*a*)	**20.** (*c*)	**21.** (*d*)
22. (*c*)	**23.** (*c*)	**24.** (*b*)	**25.** (*a*)	**26.** (*d*)	**27.** (*c*)	**28.** (*c*)
29. (*d*)	**30.** (*d*)	**31.** (*d*)	**32.** (*c*)	**33.** (*b*)	**34.** (*a*)	**35.** (*d*)

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36. (*d*)	**37.** (*c*)	**38.** (*b*)	**39.** (*a*)	**40.** (*a*)	**41.** (*b*)	**42.** (*a*)
43. (*b*)	**44.** (*b*)	**45.** (*a*)	**46.** (*b*)	**47.** (*b*)	**48.** (*a*)	**49.** (*b*)
50. (*d*)	**51.** (*b*)	**52.** (*b*)	**53.** (*a*)	**54.** (*a*)	**55.** (*b*)	**56.** (*a*)
57. (*b*)	**58.** (*c*)	**59.** (*d*)	**60.** (*a*)	**61.** (*d*)	**62.** (*a*)	**63.** (*a*)
64. (*d*)	**65.** (*a*)	**66.** (*b*)	**67.** (*b*)	**68.** (*c*)	**69.** (*a*)	**70.** (*a*)
71. (*d*)	**72.** (*a*)	**73.** (*b*)	**74.** (*b*)	**75.** (*a*)	**76.** (*d*)	**77.** (*b*)
78. (*b*)	**79.** (*b*)	**80.** (*a*)	**81.** (*c*)	**82.** (*c*)	**83.** (*c*)	**84.** (*d*)
85. (*c*)	**86.** (*a*)	**87.** (*c*)	**88.** (*b*)	**89.** (*c*)	**90.** (*b*)	**91.** (*c*)
92. (*a*)	**93.** (*d*)	**94.** (*c*)	**95.** (*a*)	**96.** (*c*)	**97.** (*a*)	**98.** (*c*)
99. (*b*)	**100.** (*d*)	**101.** (*c*)	**102.** (*a*)	**103.** (*d*)	**104.** (*a*)	**105.** (*c*)
106. (*d*)	**107.** (*d*)	**108.** (*d*)	**109.** (*d*)	**110.** (*b*)		

CASE-BASED QUESTIONS

Question numbers 1 to 4 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).

A chemical equation is a representation of chemical change in terms of symbols and formulae of reactants and products. A word-equation shows change of reactants to products through an arrow placed between them. The substances which react are written on the left hand side of the arrow and are termed as reactants while the substances produced as a result of reaction are called products and are written on the right hand side of the arrow. The arrowhead points towards the products and shows the direction of the reaction. A chemical equation in which the number of atoms of each element on reactant side is equal to that on the product side is called a balanced chemical equation.

(*i*) In which of the following equations, the mass is not same on both the sides?

(*a*) Word equation (*b*) Skeletal equation

(*c*) Balanced equation (*d*) Both (*a*) and (*b*)

(*ii*) The word aqueous (*aq*) represent _____ in a chemical reaction.

(*a*) solution (*b*) solid

(*c*) gas (*d*) all of these

(*iii*) Among the following, the correct balanced equation is

(*a*) $3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

(*b*) $Zn + HCl \longrightarrow ZnCl_2 + H_2$

(*c*) $N_2 + H_2 \longrightarrow NH_3$

(*d*) $N_2 + O_2 \longrightarrow NO$

(*iv*) Which of the following represents the limitation of chemical equations?

(*a*) It fails to provide the information regarding actual concentrations of the reactants taken and the products formed in the chemical reaction.

(*b*) Time taken for the completion of the chemical change is not provided by the chemical equation.

(*c*) It does not tell whether the reaction is feasible or not.

(*d*) All of the above

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(v) Consider the following reactions.

$H_2 + Cl_2 \rightarrow 2HCl$

$2H_2 + O_2 \rightarrow 2H_2O$

Which option identifies the reactants and products of the reactions? [*CBSE Question Bank*]

	Reactants	Products
(a)	$2H_2$, O_2 and H_2O	H_2, Cl_2 and HCl
(b)	HCl and $2H_2O$	H_2, Cl_2, $2H_2$ and O_2
(c)	H_2, Cl_2 , $2H_2$ and O_2	HCl and $2H_2O$
(d)	H_2, Cl_2 and HCl	$2H_2$, O_2 and H_2O

2. Read the following and answer any four questions from (i) to (v).

A chemical reaction is a representation of chemical change in terms of symbols and formulae of reactants and products. There are various types of chemical reactions like combination, decomposition, displacement, double displacement, oxidation and reduction reactions. Reactions in which heat is released along with the formation of products are called exothermic chemical reactions. All combustion reactions are exothermic reactions.

(i) The chemical reaction in which a single substance breaks down into two or more simpler substances upon heating is known as

(a) thermal decomposition reaction (b) photo decomposition reaction

(c) electric decomposition reaction (d) both (a) and (c)

(ii) The massive force that pushes the rocket forward through space is generated due to the

(a) combination reaction (b) decomposition reaction

(c) displacement reaction (d) double displacement reaction

(iii) A white salt on heating decomposes to give brown fumes and yellow residue is left behind. The yellow residue left is of

(a) lead nitrate (b) nitrogen oxide

(c) lead oxide (d) oxygen gas

(iv) Which of the following reactions represents a combination reaction?

(a) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$

(b) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

(c) $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$

(d) $2FeSO_4(s) \longrightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

(v) Complete the following statements by choosing correct type of reaction for X and Y.

Statement 1: The heating of lead nitrate is an example of 'X' reaction.

Statement 2: The burning of magnesium is an example of 'Y' reaction.

(a)

X	Y
Combination	Decomposition

(b)

X	Y
Decomposition	Combination

(c)

X	Y
Combination	Displacement

(d)

X	Y
Displacement	Decomposition

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3. Read the following and answer any four questions from (*i*) to (*v*).

Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.

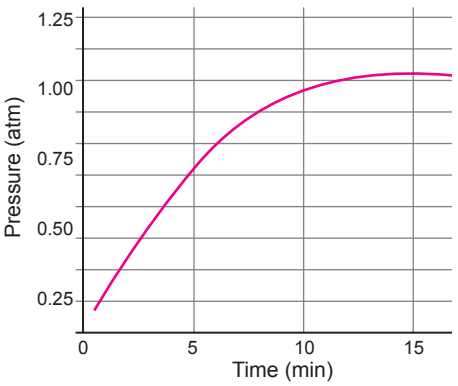
[CBSE Question Bank]

(*i*) The substance not likely to contain $CaCO_3$ is

(*a*) dolomite (*b*) a marble statue

(*c*) calcined gypsum (*d*) sea shells

(*ii*) A student added 10 g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place?



(*a*) 15-20 min

(*b*) 10-15 min

(*c*) 5-10 min

(*d*) 0-5 min

(*iii*) Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process.

(*a*) Respiration (*b*) Photosynthesis

(*c*) Transpiration (*d*) Photolysis

(*iv*) Marble statues are corroded or stained when they repeatedly come into contact with polluted rain water. Identify the main reason.

(*a*) decomposition of calcium carbonate to calcium oxide

(*b*) polluted water is basic in nature hence it reacts with calcium carbonate

(*c*) polluted water is acidic in nature hence it reacts with calcium carbonate

(*d*) calcium carbonate dissolves in water to give calcium hydroxide.

(*v*) Calcium oxide can be reduced to calcium, by heating with sodium metal. Which compound would act as an oxidizing agent in the above process?

(*a*) Sodium (*b*) Sodium oxide

(*c*) Calcium (*d*) Calcium oxide

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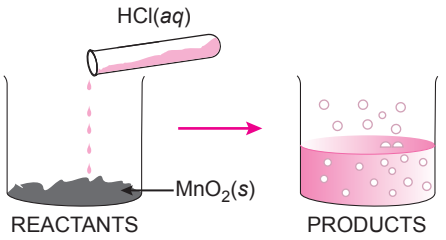
4. Read the following and answer any four questions from (*i*) to (*v*).

The reaction between MnO_2 with HCl is depicted in the following diagram. It was observed that a gas with bleaching abilities was released.



[*CBSE Question Bank*]

(*i*) The chemical reaction between MnO_2 and HCl is an example of:

(*a*) displacement reaction
(*b*) combination reaction
(*c*) redox reaction
(*d*) decomposition reaction.

(*ii*) Chlorine gas reacts with _____ to form bleaching powder.

(*a*) dry $Ca(OH)_2$
(*b*) dil. solution of $Ca(OH)_2$
(*c*) conc. solution of $Ca(OH)_2$
(*d*) dry CaO

(*iii*) Identify the correct statement from the following:

(*a*) MnO_2 is getting reduced whereas HCl is getting oxidized
(*b*) MnO_2 is getting oxidized whereas HCl is getting reduced.
(*c*) MnO_2 and HCl both are getting reduced.
(*d*) MnO_2 and HCl both are getting oxidized.

(*iv*) In the above discussed reaction, what is the nature of MnO_2?

(*a*) Acidic oxide (*b*) Basic oxide
(*c*) Neutral oxide (*d*) Amphoteric oxide

(*v*) What will happen if we take dry HCl gas instead of aqueous solution of HCl?

(*a*) Reaction will occur faster. (*b*) Reaction will not occur.
(*c*) Reaction rate will be slow. (*d*) Reaction rate will remain the same.

Answers

1. (*i*)—(*d*)

In both word and skeletal equation, the mass is not same on both the sides.

(*ii*)—(*a*)

Aqueous represents that the compound is present as a solution in water.

(*iii*)—(*a*)

In this equation, the atoms of each element on both the sides is same.

(*iv*)—(*d*)

(*v*)—(*c*)

The substances which react are written on the left hand side of the arrow and are termed as reactants while the substances produced as a result of reaction are called products and are written on the right hand side of the arrow.

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2. (*i*)—(*a*)

The chemical reaction in which a single substance breaks down into two or more simpler substances upon heating is known as thermal decomposition reaction.

(*ii*)—(*b*)

The massive force that pushes the rocket forward through space is generated due to the decomposition reaction. Hydrogen peroxide decomposes and provides it with a considerable reaction force thrust.

(*iii*)—(*c*)

Lead nitrate decomposes to give brown fumes of nitrogen dioxide gas and yellow residue of lead oxide is left behind.

(*iv*)—(*a*)

A reaction in which two or more reactants combine to form a single product is known as a combination reaction.

(*v*)—(*b*)

Heating of lead nitrate to form nitrogen dioxide and lead oxide is an example of thermal decomposition reaction and the burning of magnesium ribbon in the air to form magnesium oxide is an example of combination reaction.

3. (*i*)—(*c*)

In calcined gypsum, or hemihydrate ($CaSO_4.0.5H_2O$), $CaCO_3$ is not present.

(*ii*)—(*d*)

0-5 min, during this time interval, maximum increase in pressure was observed. So, maximum decomposition takes place.

(*iii*)—(*b*)

In the heating of calcium carbonate, carbon dioxide gas is produced which is used in photosynthesis.

(*iv*)—(*c*)

(*v*)—(*d*)

Calcium oxide is getting reduced to carbon so it is an oxidising agent.

4. (*i*)—(*c*)

In this reaction, MnO_2 is getting reduced whereas HCl is getting oxidised.

(*ii*)—(*a*)

$$\underset{\text{(Dry)}}{Ca(OH)_2} + Cl_2 \longrightarrow \underset{\text{(Bleaching powder)}}{CaOCl_2} + H_2O$$

(*iii*)—(*a*)

MnO_2 is getting reduced to $MnCl_2$ whereas HCl is getting oxidised to Cl_2.

$MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$

(*iv*)—(*b*)

Basic oxide as it is an oxide of a metal.

(*v*)—(*b*)

Reaction will not occur as the ions are not produced.

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ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (*A*) : Decomposition of vegetable matter into compost is an example of exothermic reactions.

Reason (*R*) : Exothermic reaction are those reactions in which heat is evolved.

2. Assertion (*A*) : When HCl is added to zinc granules, a chemical reaction occurs.

Reason (*R*) : Evolution of a gas and change in colour indicate that the chemical reaction is taking place.

3. Assertion (*A*) : Calcium carbonate when heated gives calcium oxide and water.

Reason (*R*) : On heating calcium carbonate, decomposition reaction takes place.

4. Assertion (*A*) : Brown fumes are produced when lead nitrate is heated.

Reason (*R*) : Nitrogen dioxide gas is produced as a by product due to the decomposition of lead nitrate.

5. Assertion (*A*) : White silver chloride turns grey in sunlight.

Reason (*R*) : Decomposition of silver chloride in presence of sunlight takes place to form silver metal and chlorine gas.

6. Assertion (*A*) : Following is a balanced chemical equation for the action of steam on iron:

$$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$$

Reason (*R*) : The law of conservation of mass holds good for a chemical equation.

[CBSE 2020 (31/4/1)]

7. Assertion (*A*) : The reaction

$$MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$$

is an example of a redox reaction.

Reason (*R*) : In this reaction, HCl is reduced to Cl_2 whereas MnO_2 is oxidised to $MnCl_2$.

[CBSE 2020 (31/4/2)]

8. Assertion (*A*) : After white washing the walls, a shiny white finish on walls is obtained after two to three days.

Reason (*R*) : Calcium oxide reacts with carbon dioxide to form calcium hydrogen carbonate which gives shiny white finish. ***[CBSE Sample Paper 2021]***

Answers

1. (*a*) **2.** (*b*) **3.** (*d*) **4.** (*a*) **5.** (*a*) **6.** (*a*) **7.** (*c*)
8. (*c*)

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02 ACIDS, BASES AND SALTS

BASIC CONCEPTS

1. Acids taste sour, bases taste bitter, and the compounds (salts) formed when acids react with bases taste salty. Some salts have very unpleasant taste and may be poisonous also.
2. The acids produced by plants and animals (exception hydrochloric acid) are known as organic acids. The acids prepared from minerals present in the earth's crust are known as mineral acids.
3. **Indicator:** An indicator is a special chemical that changes its colour to indicate the presence of a chemical substance. It is used to confirm the presence of an acid, a base or a neutral solution. Indicators show different colours in acidic and basic medium. These are dyes or mixtures of dyes which are used to indicate the presence of acids and bases. Some examples are litmus solution, methyl orange, phenolphthalein and universal indicator. There are some substances whose odour changes in acidic or basic medium. These are called **olfactory indicators**.
4. Metals react with acids to give a salt and hydrogen gas, although there are exceptions to this. When a base reacts with a metal, alongwith the evolution of hydrogen gas a salt is formed which has its negative ion composed of the metal and oxygen.

$$\text{Metal} + \text{Acid} \longrightarrow \text{Salt} + \text{Hydrogen gas}$$

$$Zn + H_2SO_4(\text{dil}) \longrightarrow \underset{\text{Zinc sulphate}}{ZnSO_4} + H_2$$

$$Zn + 2NaOH \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + H_2$$

5. When a metal carbonate or metal hydrogencarbonate (bicarbonate) reacts with an acid, it gives out a corresponding salt, carbon dioxide and water.

$$Na_2CO_3(s) + 2HCl(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$

$$NaHCO_3(s) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l) + CO_2(g)$$

When the carbon dioxide gas evolved is passed through lime water, it turns milky due to the formation of calcium carbonate.

$$\underset{\text{Lime water}}{Ca(OH)_2(aq)} + CO_2(g) \longrightarrow \underset{\text{(White)}}{CaCO_3(s)} + H_2O(l)$$

On passing excess carbon dioxide the milkiness disappears and the solution becomes colourless due to the formation of soluble calcium hydrogencarbonate.

$$CaCO_3(s) + H_2O(l) + CO_2(g) \longrightarrow \underset{\text{(Soluble in water)}}{Ca(HCO_3)_2(aq)}$$

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6. When acids dissolve in water, the hydrogen is released into the solution as $H^+(aq)$ or H_3O^+ ions. It is $H^+(aq)$ or H_3O^+ ions that make a solution acidic. Formation of $OH^-(aq)$ ions in solution is responsible for the basic nature of a substance.

Ions present in some common Acids and Bases

Acidic solution	Formula	Ions present
Dilute hydrochloric acid	HCl	H^+ and Cl^-
Dilute nitric acid	HNO_3	H^+ and NO_3^-
Dilute sulphuric acid	H_2SO_4	H^+ and SO_4^{2-}

Alkaline solution	Formula	Ions present
Sodium hydroxide	NaOH	Na^+ and OH^-
Potassium hydroxide	KOH	K^+ and OH^-
Calcium hydroxide	$Ca(OH)_2$	Ca^{2+} and OH^-

7. Pure water is a neutral liquid. This is because water contains exactly the same numbers of H^+ and OH^- ions. Acid solution contains more hydrogen ions (H^+) than water. Alkaline solutions have a greater concentration of hydroxide ions (OH^-) than water.

Water and neutral solutions	Equal concentrations of H^+ and OH^-.
Acid solutions	Greater concentration of H^+ than water.
Alkaline solutions	Greater concentration of OH^- than water.

8. **pH Scale:** A scale for measuring hydrogen ion concentration in a solution is called pH scale. Higher the hydrogen ion concentration, lower is the pH value.

pH of a solution is defined as the negative logarithm (to the base 10) of the hydrogen ion concentration in the solution.

Role of pH in Everyday Life:

(*a*) Human blood, tears and saliva have a pH range of 7.0 to 7.8. Survival of living organisms is possible only within this range of pH.

(*b*) For gardening and farming, the best crops are usually obtained with neutral or acidic soil (pH—6.5 to 7.0). Below pH 6.5 the soil is not suitable for normal growth of plants, particularly vegetables.

(*c*) HCl produced in the stomach is important for digestion. Hyperacidity (increase in the amount of acid during indigestion) causes pain and irritation. The excess acid is neutralised by the intake of antacids such as magnesium hydoxide (milk of magnesia).

(*d*) When the pH inside the mouth becomes lower than 5.5, it causes tooth decay. Toothpastes are generally basic. They neutralise the excess acid and prevent tooth decay.

(*e*) Stings of insects such as bees, ants and wasps cause pain and irritation. They contain methanoic acid.

9. The process of dissolving an acid or a base in water is an highly exothermic process. It is known as dilution.

The acid must always be added slowly to water with constant stirring. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns. The glass container may also break due to excessive local heating.

10. All bases react with acids to form salts and water. This process is known as neutralisation. During neutralisation the $H^+(aq)$ ions of an acid combine with OH^- ions of a base to form water while the negative ion of the acid and positive ion of the base combine to form a salt.

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11. pH of Salts:

(*a*) The salt of a **strong acid** and a **strong base** gives a **neutral** solution (pH = 7)

(*b*) The salt of a **strong acid** and a **weak base** gives an **acidic** solution (pH < 7).

(*c*) The salt of a **weak acid** and a **strong base** gives a **basic** solution (pH > 7).

12. Water of crystallisation: The fixed number of water molecules chemically attached to each formula unit of a salt in its crystalline form is called water of crystallisation. The salt which contain water of crystallisation are called hydrated salts. e.g., $CuSO_4.5H_2O$.

13. Common Salt

Chemical Name: Sodium Chloride

Chemical Formula: NaCl

Preparation: Sodium chloride can be prepared in the laboratory by combination reaction of sodium hydroxide and hydrochloric acid.

$$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

Uses: (*i*) It is used as a raw material for making a large number of useful chemicals in industry.

(*ii*) It is used in cooking food.

14. Caustic Soda

Chemical Name: Sodium Hydroxide

Chemical Formula: NaOH

Preparation: When electricity is passed through a concentrated solution of sodium chloride (brine), it decomposes to form sodium hydroxide, chlorine and hydrogen. It is also known as 'chlor-alkali' process because of the products formed, 'chlor' for Cl_2 and 'alkali' for NaOH.

$$2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$$

Chlorine gas is produced at the anode and hydrogen gas is produced at the cathode. Sodium hydroxide solution is formed near the cathode.

Uses: It is used

(*i*) in detergents and soaps to remove grease.

(*ii*) in paper making.

(*iii*) in rayon and acetate fibres.

(*iv*) in the manufacture of bleach (household bleaches, bleaching fabric).

(*v*) in purifying bauxite to extract aluminium.

15. Uses of Hydrogen

(*i*) It is used in making margarine: Margarines are made from vegetable oils. The oils are liquids which are too runny to spread on bread. The problem has been solved by reacting hydrogen with the natural oil molecules. This makes the oil thicker.

(*ii*) Hydrogen is used as a fuel: Hydrogen reacts explosively with the oxygen in air. When a lighted split pops in hydrogen, it reacts with oxygen to make water (steam).

$$2H_2(g) + O_2(g) \xrightarrow{\text{Catalyst}} 2H_2O(g)$$

Hydrogen has played a big part in space travel. It can be used as rocket fuel. The liquid hydrogen stored in tanks is ready to react with liquid oxygen. It has also been used inside space-craft to power fuel cells.

(*iii*) It is used in the manufacture of ammonia for fertilisers.

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$

(*iv*) Hydrogen directly combines with chlorine: This reaction is used for the manufacture of hydrochloric acid (HCl).

$$H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$$

Hydrochloric acid has many uses in industry. It is used for cleaning steel, ammonium chloride medicines and cosmetics.

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16. Uses of Chlorine

(*i*) It is used in killing bacteria in drinking water and swimming pools.
(*ii*) It is used in the manufacture of bleach to kill bacteria and to whiten paper.
(*iii*) It forms hydrochloric acid which has many uses in industry.
(*iv*) It is used in CFCs (chloro-fluorocarbons), PVC (polyvinyl chloride), bleaching fabric.

17. Washing Soda

Chemical Name: Sodium carbonate decahydrate.

Chemical Formula: $Na_2CO_3.10H_2O$

Preparation: Washing soda is obtained by recrystallisation of sodium carbonate. Sodium carbonate is recrystallised by dissolving in water.

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

Uses: (*i*) Softening hard water.
(*ii*) Used in paper, paints and textiles industries.
(*iii*) Manufacture of glass, borax and caustic soda.
(*iv*) Used in laundry for washing clothes.

18. Baking Soda

Chemical Name: Sodium hydrogencarbonate.

Chemical Formula: $NaHCO_3$

Preparation: Sodium hydrogencarbonate is produced on a large scale by reacting a cold and concentrated solution of sodium chloride (brine) with ammonia and carbon dioxide.

$$NaCl + NH_3 + CO_2 + H_2O \longrightarrow NaHCO_3 + NH_4Cl$$

Uses: (*i*) Preparation of baking powder.
(*ii*) Manufacture of soda water.
(*iii*) Remove acidity of stomach.
(*iv*) Used in fire extinguishers.

19. Bleaching Powder

Chemical Name: Calcium oxychloride.

Chemical Formula: $CaOCl_2$

Preparation: It is prepared by passing chlorine gas over dry slaked lime.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

Uses: (*i*) Used for bleaching cotton textile.
(*ii*) As disinfecting drinking water to make it germs free.
(*iii*) As an oxidising agent in chemical industries.
(*iv*) Used in manufacturing of chloroform.

20. Plaster of Paris

Chemical Name: Calcium sulphate hemihydrate

Chemical Formula: $CaSO_4.\frac{1}{2}H_2O$

Preparation: It is prepared by heating gypsum at 373K.

$$\underset{\text{Gypsum}}{CaSO_4.2H_2O} \xrightarrow{373\,K} CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O$$

Uses: (*i*) Making statues, models, toys, etc.
(*ii*) Making chalk for writing on blackboards.
(*iii*) Making fireproof materials.
(*iv*) It is used for setting fractured bones in the right position.

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MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. Calcium carbonate is the chemical formula of

(*a*) limestone (*b*) chalk
(*c*) marble (*d*) all (*a*), (*b*) and (*c*)

2. On adding dilute HCl to copper oxide in a beaker, the solution turns blue-green due to formation of

(*a*) copper(II) hydroxide (*b*) copper nitrate
(*c*) copper (II) chloride (*d*) copper sulphate

3. Human body works within the pH range of

(*a*) 7.0 to 7.8 (*b*) 4.5 to 5.6
(*c*) 13.0 to 14.0 (*d*) 1.2 to 2.2

4. A basic solution could have a pH of

(*a*) 1 (*b*) 11
(*c*) 7 (*d*) 2

5. Which of the following gives the correct increasing order of acidic strength? [*NCERT Exemplar*]

(*a*) Water < Acetic acid < Hydrochloric acid
(*b*) Water < Hydrochloric acid < Acetic acid
(*c*) Acetic acid < Water < Hydrochloric acid
(*d*) Hydrochloric acid < Water < Acetic acid

6. Fruit juices, such as orange juice, contain

(*a*) boric acid (*b*) citric acid
(*c*) sulphuric acid (*d*) nitric acid

7. Common salt, besides being used in kitchen, can also be used as the raw material for making

(*i*) washing soda **(*ii*) bleaching powder**
(*iii*) baking soda **(*iv*) slaked lime** [*NCERT Exemplar*]

(*a*) (*i*) and (*ii*) (*b*) (*i*), (*ii*) and (*iv*)
(*c*) (*i*) and (*iii*) (*d*) (*i*), (*iii*) and (*iv*)

8. Which of the following salts does not contain water of crystallisation? [*NCERT Exemplar*]

(*a*) Blue vitriol
(*b*) Baking soda
(*c*) Washing soda
(*d*) Gypsum

9. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue? [*NCERT Exemplar*]

(*a*) Lemon juice
(*b*) Vinegar
(*c*) Common salt
(*d*) An antacid

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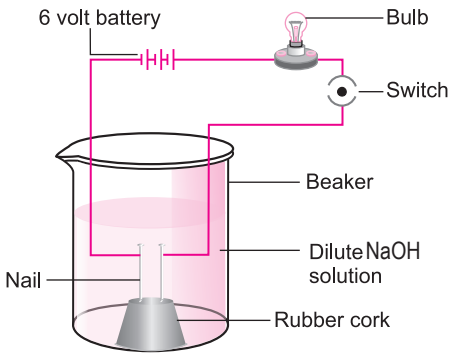
10. In an attempt to demonstrate electrical conductivity through an electrolyte, the alongside apparatus was set up. Which among the following statement(s) is(are) correct? ***[NCERT Exemplar]***



(*i*) Bulb will not glow because electrolyte is not acidic

(*ii*) Bulb will glow because NaOH is a strong base and furnishes ions for conduction.

(*iii*) Bulb will not glow because circuit is incomplete.

(*iv*) Bulb will not glow because it depends upon the type of electrolytic solution.

(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iv*)

(*c*) (*ii*) only (*d*) (*iv*) only

11. Which of the following solutions will turn phenolphthalein pink?

(*a*) HCl(*aq*) (*b*) $CO_2(aq)$

(*c*) KOH(*aq*) (*d*) $H_2SO_4(aq)$

12. Identify the correct representation of reaction occurring during chlor-alkali process. ***[NCERT Exemplar]***

(*a*) $2NaCl(l) + 2H_2O(l) \longrightarrow 2NaOH(l) + Cl_2(g) + H_2(g)$

(*b*) $2NaCl(aq) + 2H_2O(aq) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

(*c*) $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(aq) + H_2(aq)$

(*d*) $2NaCl\,(aq) + 2H_2O\,(l) \longrightarrow 2NaOH\,(aq) + Cl_2(g) + H_2(g)$

13. Which of the following statements is true for acids? ***[NCERT Exemplar]***

(*a*) Bitter and change red litmus to blue (*b*) Sour and change red litmus to blue

(*c*) Sour and change blue litmus to red (*d*) Bitter and change blue litmus to red

14. The acid having highest hydrogen ion concentration is one with

(*a*) pH = 2.5 (*b*) pH = 1.8

(*c*) pH = 7 (*d*) pH = 10

15. The pH of the gastric juices released during digestion is: ***[NCERT Exemplar]***

(*a*) less than 7 (*b*) more than 7

(*c*) equal to 7 (*d*) equal to 0

16. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done? ***[NCERT Exemplar]***

(*a*) Wash the hand with saline solution.

(*b*) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogencarbonate.

(*c*) After washing with plenty of water, apply solution of sodium hydroxide on the hand.

(*d*) Neutralise the acid with a strong alkali.

17. Sodium hydrogencarbonate when added to acetic acid evolves a gas. Which of the following statements is true about the gas evolved? ***[NCERT Exemplar]***

(*i*) It turns lime water milky.

(ii) It extinguishes a burning splinter.

(*iii*) It dissolves in a solution of sodium hydroxide.

(*iv*) It has a pungent odour.

(*a*) (*i*) and (*ii*) (*b*) (*i*), (*ii*) and (*iii*)

(*c*) (*ii*), (*iii*) and (*iv*) (*d*) (*i*) and (*iv*)

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18. Which solution will change blue litmus to red?

(*a*) NaOH(*aq*) (*b*) $H_2SO_4(aq)$

(*c*) KCl(*aq*) (*d*) $NH_4OH(aq)$

19. Which is a soluble base in water?

(*a*) $Cu(OH)_2$ (*b*) $Fe(OH)_3$

(*c*) $Zn(OH)_2$ (*d*) KOH

20. In general, salts

(*a*) are ionic compounds. (*b*) contain hydrogen ions.

(*c*) contain hydroxide ions. (*d*) turn blue litmus red.

21. Which of the following properties is closely related to acids?

(*a*) Contain the hydroxide ion (*b*) Bitter taste

(*c*) Salty taste (*d*) Sour taste

22. A base can be prepared by the reaction between

(*a*) an active non-metal and water. (*b*) a gas and water.

(*c*) a sulphide and water. (*d*) an active metal and water.

23. Which of the following is (are) true when HCl(*g*) is passed through water? [*NCERT Exemplar*]

(*i*) It does not ionise in the solution as it is a covalent compound.

(*ii*) It ionises in the solution.

(*iii*) It gives both hydrogen and hydroxyl ion in the solution.

(*iv*) It forms hydronium ion in the solution due to the combination of hydrogen ion with water molecule.

(*a*) (*i*) only (*b*) (*iii*) only

(*c*) (*ii*) and (*iv*) (*d*) (*iii*) and (*iv*)

24. What happens when a solution of an acid is mixed with a solution of a base in a test tube?

(*i*) Temperature of the solution decreases

(*ii*) Temperature of the solution increases

(*iii*) Temperature of the solution remains the same

(*iv*) Salt formation takes place [*NCERT Exemplar*]

(*a*) (*i*) and (*iv*) (*b*) (*i*) and (*iii*)

(*c*) (*ii*) only (*d*) (*ii*) and (*iv*)

25. When hydrogen chloride gas is prepared on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

(*a*) absorb the evolved gas (*b*) moisten the gas

(*c*) absorb moisture from the gas (*d*) absorb Cl^- ions from the evolved gas

26. What is formed when zinc reacts with sodium hydroxide?

(*a*) Zinc hydroxide and sodium (*b*) Sodium zincate and hydrogen gas

(*c*) Sodium zinc-oxide and hydrogen gas (*d*) Sodium zincate and water

27. Tomato is a natural source of which acid?

(*a*) Acetic acid (*b*) Citric acid

(*c*) Tartaric acid (*d*) Oxalic acid

28. Brine is an

(*a*) aqueous solution of sodium hydroxide

(*b*) aqueous solution of sodium carbonate

(*c*) aqueous solution of sodium chloride

(*d*) aqueous solution of sodium bicarbonate

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29. **$Na_2CO_3.10H_2O$ is**

(*a*) washing soda (*b*) baking soda

(*c*) bleaching powder (*d*) tartaric acid

30. **At what temperature is gypsum heated to form Plaster of Paris?**

(*a*) 90°C (*b*) 100°C

(*c*) 110°C (*d*) 120°C

31. **How many water molecules does hydrated calcium sulphate contain?**

(*a*) 5 (*b*) 10

(*c*) 7 (*d*) 2

32. **Sodium carbonate is a basic salt because it is a salt of**

(*a*) strong acid and strong base (*b*) weak acid and weak base

(*c*) strong acid and weak base (*d*) weak acid and strong base

33. **Alkalis are**

(*a*) acids, which are soluble in water (*b*) acids, which are insoluble in water

(*c*) bases, which are insoluble in water (*d*) bases, which are soluble in water

34. **Which of the following statements is correct about an aqueous solution of an acid and or a base?**

(*i*) Higher the pH, stronger the acid **(*ii*) Higher the pH, weaker the acid**

(*iii*) Lower the pH, stronger the base **(*iv*) Lower the pH, weaker the base**

[*NCERT Exemplar*]

(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

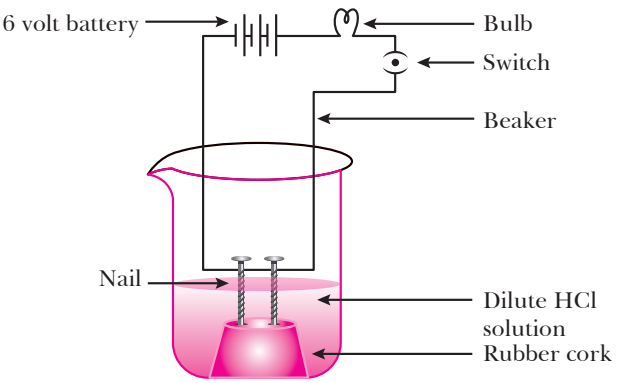
35. **The apparatus given in the adjoining figure was set up to demonstrate electrical conductivity. Which of the following statement(s) is (are) correct?**

(*i*) Bulb will not glow because electrolyte is not acidic.

(*ii*) Bulb will glow because HCl is a strong acid and furnishes ions for conduction.

(*iii*) Bulb will not glow because circuit is incomplete.

(*iv*) Bulb will not glow because it depends upon the type of electrolytic solution.



(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iv*)

(*c*) (*ii*) only (*d*) (*iv*) only

36. **Lime water reacts with chlorine to give**

(*a*) bleaching powder (*b*) baking powder

(*c*) baking soda (*d*) washing soda

37. **Nettle sting is a natural source of which acid?**

(*a*) Methanoic acid (*b*) Lactic acid

(*c*) Citric acid (*d*) Tartaric acid

38. **Tooth enamel is made up of**

(*a*) calcium phosphate (*b*) calcium carbonate

(*c*) calcium oxide (*d*) potassium

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39. Rain is called acid rain when its:

(*a*) pH falls below 7 (*b*) pH falls below 6

(*c*) pH falls below 5.6 (*d*) pH is above 7

40. Sodium hydroxide is a

(*a*) weak base (*b*) weak acid

(*c*) strong base (*d*) strong acid

41. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change? [*NCERT Exemplar*]

(*a*) Baking powder (*b*) Lime

(*c*) Ammonium hydroxide solution (*d*) Hydrochloric acid

42. When copper oxide and dilute hydrochloric acid react, colour changes to

(*a*) white (*b*) bluish-green

(*c*) blue-black (*d*) black

43. Sodium hydroxide is used

(*a*) as an antacid (*b*) in manufacture of soap

(*c*) as a cleansing agent (*d*) in alkaline batteries

44. Sodium hydroxide turns phenolphthalein solution

(*a*) pink (*b*) yellow

(*c*) colourless (*d*) orange

45. Chemical formula of washing soda is

(*a*) $Na_2CO_3.7H_2O$ (*b*) $Na_2CO_3.5H_2O$

(*c*) $Na_2CO_3.2H_2O$ (*d*) $Na_2CO_3.10H_2O$

46. Which of the following is not a acidic salt?

(*a*) $CuSO_4$ (*b*) NH_4Cl

(*c*) $FeCl_3$ (*d*) CH_3COONa

47. A solution of NaCl

(*i*) will turn red litmus blue **(*ii*) will turn pH paper green**

(*iii*) will turn blue litmus red **(*iv*) will not affect litmus**

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iii*)

(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

48. Many salts absorbs water from atmosphere. This property is called

(*a*) deliquescence (*b*) efflorescence

(*c*) hydration (*d*) addition

49. An aqueous solution with pH = 1 is

(*a*) strongly acidic (*b*) strongly basic

(*c*) neutral (*d*) weakly acidic

50. $CaOCl_2$ will liberate Cl_2 gas in presence of

(*i*) CO_2 **(*ii*) HCl**

(*iii*) CO **(*iv*) NO**

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

51. Egg shell is made up of

(*a*) $CaCO_3$ (*b*) CaO

(*c*) $Ca(OH)_2$ (*d*) $CaCl_2$

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52. Curd cannot be stored in

(*i*) Brass vessel **(*ii*) Copper vessel**

(*iii*) Steel **(*iv*) Bronze**

(*a*) (*i*), (*ii*), (*iii*) (*b*) (*ii*), (*iii*), (*iv*)

(*c*) (*i*), (*ii*), (*iv*) (*d*) (*i*), (*iii*), (*iv*)

53. Sodium carbonate is a basic salt because it is a salt of **[*NCERT Exemplar*]**

(*a*) strong acid and strong base. (*b*) weak acid and weak base.

(*c*) strong acid and weak base. (*d*) weak acid and strong base.

54. Calcium phosphate is present in tooth enamel. Its nature is **[*NCERT Exemplar*]**

(*a*) basic (*b*) acidic

(*c*) neutral (*d*) amphoteric

55. Which one of the following can be used as an acid-base indicator by a visually impaired (blind) student? **[*NCERT Exemplar*]**

(*a*) Litmus (*b*) Turmeric

(*c*) Vanilla essence (*d*) Petunia leaves

56. Which of the following is used for dissolution of gold ? **[*NCERT Exemplar*]**

(*a*) Hydrochloric acid (*b*) Sulphuric acid

(*c*) Nitric acid (*d*) Aqua regia

57. Which of the following are present in a dilute aqueous solution of hydrochloric acid? **[*NCERT Exemplar*]**

(*a*) $H_3O^+ + Cl^-$ (*b*) $H_3O^+ + OH^-$

(*c*) $Cl^- + OH^-$ (*d*) unionised HCl

58. $NaHCO_3$, formed by reaction of

(*a*) $NaOH + H_2CO_3$ (*b*) $NaCl + H_2CO_3$

(*c*) $Na_2CO_3 + HCl$ (*d*) $NaOH + Na_2CO_3$

59. pH of H_2O is

(*a*) 7 (*b*) 8 (*c*) 9 (*d*) 10

60. Ag_2S reacts with H_2SO_4 to form

(*a*) $AgSO_4$ (*b*) $Ag_2SO_4 + H_2S$

(*c*) $Ag_2O + H_2S$ (*d*) $AgOH + H_2S$

61. Lime water reacts with chlorine to form

(*a*) $CaCl_2$ (*b*) $CaOCl_2$

(*c*) $Ca(ClO_3)_2$ (*d*) CaO_2Cl_2

62. NaOH is obtained by electrolysis of

(*a*) Aq. solution of NaCl (*b*) Aq. Na_2CO_3

(*c*) Aq. $NaHCO_3$ (*d*) Molten NaCl

63. The chemical name of bleaching powder is

(*a*) calcium hypo oxychloride (*b*) calcium oxychloride

(*c*) calcium chloride (*d*) calcium chloro oxide

64. The ratio of the water molecule in Plaster of Paris and Gypsum is

(*a*) 3:1 (*b*) 1:3 (*c*) 1:4 (*d*) 4:3

65. Baking powder is

(*a*) sodium carbonate + sodium tartarate (*b*) sodium bicarbonate + sodium tartarate

(*c*) sodium bicarbonate + tartaric acid (*d*) sodium carbonate + sodium benzoate

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66. Gastric juice contains HCl which is one example of

(*a*) inorganic acid (*b*) organic acid
(*c*) soft organic acid (*d*) strong inorganic acid

67. When milk of magnesia reacts with acetic acid it produces

(*a*) basic salt (*b*) acidic salt
(*c*) neutral salt (*d*) complex salt

68. Which of the following phenomena will occur when a small amount of acid is added to water?

(*i*) dilution (*ii*) neutralisation
(*iii*) salt formation (*iv*) ionization **[*NCERT Exemplar*]**

(*a*) (*i*) and (*iii*) (*b*) (*i*) and (*iv*)
(*c*) (*ii*) and (*iii*) (*d*) (*ii*) and (*iv*)

69. Brine is used for industrial production of

(*a*) NaOH (*b*) KOH
(*c*) bleaching powder (*d*) none of the above

70. When base reacts with the non-metal oxide

(*a*) it neutralizes each other (*b*) it creates fire
(*c*) it produces acidic salts (*d*) it produces basic salts

71. Corrosive effect on the skin is caused by

(*a*) acids and bases (*b*) bases and salts
(*c*) water (*d*) mercury

72. The acid used for the manufacture of fertilizers and explosives is

(*a*) nitric acid (*b*) sulphuric acid
(*c*) phosphoric acid (*d*) hydrochloric acid

73. Which acid is found in bee sting?

(*a*) Citric acid (*b*) Formic acid (*c*) Tartaric acid (*d*) Nitric acid

74. Rubbing of which does give relief from pain in the case of bee sting?

(*a*) Dilute hydrochloric acid (*b*) Dilute nitric acid
(*c*) Tooth paste (*d*) Alkali

75. Which statement is correct?

(*a*) Organic acids are obtained from natural sources.
(*b*) Inorganic acids are prepared in laboratory.
(*c*) Bee sting contains formic acid.
(*d*) All of the above.

76. What happens when acid is mixed with water?

(*a*) Heat is evolved (*b*) Heat is absorbed
(*c*) Concentration of acid increases (*d*) All of the above

77. What happens when an alkali is mixed with water?

(*a*) Heat is evolved (*b*) Heat is absorbed
(*c*) Concentration of acid increases (*d*) All of the above

78. Which of the following is alkali?

(*a*) Sodium hydroxide (*b*) Calcium carbonate
(*c*) Copper carbonate (*d*) Carbonic acid

79. Which of the following is called alkali?

(*a*) Water soluble base (*b*) Water insoluble base
(*c*) Carbonate of metals (*d*) Oxides of metals

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80. What happens when an acid react with base?

(*a*) Acid neutralizes base (*b*) Water is formed

(*c*) A salt is formed (*d*) All of the above

81. Which of the following is an olfactory indicator?

(*a*) Turmeric (*b*) Onion

(*c*) Litmus (*d*) All of the above

82. What happens when a base is added to vanilla?

(*a*) Colour of vanilla changes into red (*b*) Vanilla becomes colourless

(*c*) Vanilla loses its smell (*d*) Nothing happens

83. What happens when an acid is added to vanilla?

(*a*) Colour of vanilla changes into red (*b*) Vanilla becomes colourless

(*c*) Vanilla loses its smell (*d*) Nothing happens

84. What is the original colour of phenolphthalein solution which is an indicator?

(*a*) Colourless (*b*) Red (*c*) Pink (*d*) Violet

85. Phenolphthalein exhibits which colour with a base?

(*a*) Remains colourless (*b*) Pink

(*c*) Red (*d*) Green

86. Phenolphthalein exhibits which colour with an acid?

(*a*) Remains colourless (*b*) Pink

(*c*) Red (*d*) Green

87. Methyl orange which is an indicator turns into which colour with an acid?

(*a*) Red (*b*) Yellow (*c*) Pink (*d*) No colour

88. Methyl orange which is an indicator turns into which colour with a base?

(*a*) Red (*b*) Yellow (*c*) Pink (*d*) No colour

89. What the original colour of methyl orange solution which is an indicator?

(*a*) Yellow (*b*) Orange (*c*) Pink (*d*) Red

90. Which of the following compound is formed when zinc reacts with hydrochloric acid?

(*a*) Zinc sulphate (*b*) Zinc chloride

(*c*) Zinc carbonate (*d*) Zinc hydroxide

91. Which of the following compound is formed when zinc reacts with sodium hydroxide?

(*a*) Zinc hydroxide (*b*) Sodium zincate

(*c*) Zinc hydrogenate (*d*) No reaction takes place

92. Which of the following gas is formed when an acid reacts with metal carbonate?

(*a*) Carbon monoxide (*b*) Carbonic acid gas

(*c*) Carbon dioxide gas (*d*) Hydrochloric acid gas

93. What happens when hydrogen carbonate reacts with an acid?

(*a*) Carbon monoxide (*b*) Carbonic acid gas

(*c*) Carbon dioxide gas (*d*) Hydrochloric acid gas

94. What happens when carbon dioxide gas is passed through lime water?

(*a*) Lime water turns milky (*b*) Lime water turns colourless

(*c*) Lime water turns bluish (*d*) Lime water turns black

95. What happens when excess of carbon dioxide gas is passed through lime water?

(*a*) Lime water first turns milky and then colourless

(*b*) Lime water turns bluish

(*c*) Lime water turns milky

(*d*) Lime water turns blackish

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96. What is the nature of non-metallic oxides?

(*a*) Basic (*b*) Acidic

(*c*) Neutral (*d*) None of the above

97. A basic solution is added to a test tube. A blue and red litmus paper is dipped into the basic solution. What will happen to both litmus papers? [*CBSE Question Bank*]

(*a*) Blue litmus paper: changes colour; red litmus paper: no colour change

(*b*) Blue litmus paper: changes colour; red litmus paper: changes colour

(*c*) Blue litmus paper: no colour change; red litmus paper: changes colour

(*d*) Blue litmus paper: no colour change; red litmus paper: no colour change

98. A solution of pH 2 is filled in two separate beakers. A few drops of methyl orange and phenolphthalein are added into separate solutions. How will the colour of the indicators change? [*CBSE Question Bank*]

(*a*) Methyl orange: red; phenolphthalein: pink

(*b*) Methyl orange: orange; phenolphthalein: colourless

(*c*) Methyl orange: red; phenolphthalein: colourless

(*d*) Methyl orange: orange; phenolphthalein: pink

99. When dilute sulphuric acid is added to a solid X, a gas Y is formed along with the formation of the salt of the solid. What could be X and Y? [*CBSE Question Bank*]

(*a*) X: carbon; Y: hydrogen (*b*) X: zinc; Y: hydrogen

(*c*) X: zinc; Y: oxygen (*d*) X: copper; Y: oxygen

100. When a base reacts with a metal, it forms a salt and hydrogen gas is released. By what method the presence of hydrogen can be detected? [*CBSE Question Bank*]

(*a*) By methyl orange (*b*) By water

(*c*) By litmus paper (*d*) By a burning candle

101. A student did an activity in which he added sodium bicarbonate to hydrochloric acid. It forms the carbon dioxide gas. The gas released is passed through lime water. What change will be observed in lime water? [*CBSE Question Bank*]

(*a*) The colour of solution becomes red. (*b*) White precipitate is formed.

(*c*) The solution becomes colourless. (*d*) Bubbles are formed.

102. A metal carbonate reacts with a solution X which forms a salt, water, and a gas Y. What are X and Y? [*CBSE Question Bank*]

(*a*) X: sodium hydroxide; Y: carbon dioxide

(*b*) X: sodium hydroxide; Y: hydrogen

(*c*) X: hydrochloric acid; Y: carbon dioxide

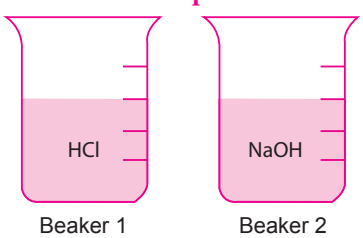
(*d*) X: hydrochloric acid; Y: hydrogen

103. Which equation for the reaction between hydrochloric acid and sodium hydroxide is correct? [*CBSE Question Bank*]

(*a*) $HCl + NaOH \rightarrow NaCl + H_2O$ (*b*) $2HCl + NaOH \rightarrow 2NaCl + H_2O$

(*c*) $2HCl + NaOH \rightarrow NaCl + 2H_2O$ (*d*) $HCl + 2NaOH \rightarrow Na_2Cl + H_2O$

104. A student placed 10 mL HCl and NaOH in two separate beakers as shown. [*CBSE Question Bank*]



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In beaker 1, 4 mL of NaOH is added whereas in beaker 2, 4 mL of HCl is added. The student notes the possible changes in pH in both solutions.

	Change in pH (Beaker 1)	Change in pH (Beaker 2)
A	increase	increase
B	reduce	increase
C	increase	reduce
D	reduce	reduce

Which change in pH is correct?

(*a*) A (*b*) B (*c*) C (*d*) D

105. The equation shows the reaction of metal oxide with acid. ***[CBSE Question Bank]***

Metal oxide + Acid → X + Water

What is X?

(*a*) Salt (*b*) Hydrogen (*c*) Carbon dioxide (*d*) Base

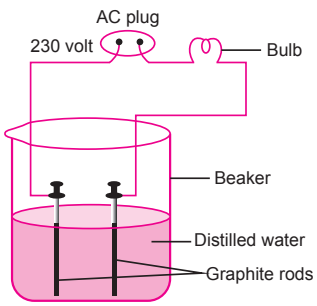
106. An oxide of element P is added to an acid where it forms salt and water. The table shows the possible value of pH and the type of element before the reaction. ***[CBSE Question Bank]***

S.N.	pH	Type of Element
A	Less than 7	Metal
B	Less than 7	Non-metal
C	Greater than 7	Metal
D	Greater than 7	Non-metal

Which option is correct?

(*a*) A (*b*) D (*c*) C (*d*) B

107. A student makes an arrangement to test the electrical conductivity of distilled water as shown.



The student observes that the bulb does not glow. What could be the reason the bulb does not glow? ***[CBSE Question Bank]***

(*a*) The water never conducts electricity.

(*b*) The bulb needs DC source to glow.

(*c*) The graphite is bad conductor of electricity.

(*d*) The distilled water does not have ions present in it.

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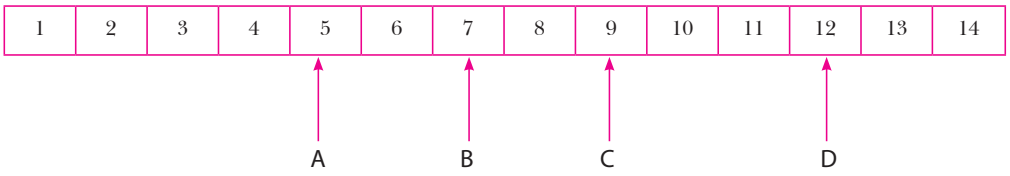
108. The pH values of four solutions on a pH scale are shown below. *[CBSE Question Bank]*

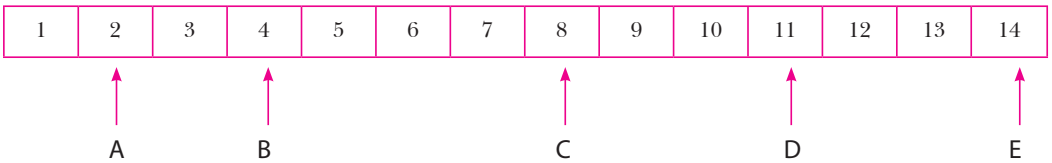


Which solutions are alkaline in nature?

(*a*) A and B (*b*) A and D

(*c*) C and D (*d*) B and C

109. Five solutions are labelled on a pH scale. *[CBSE Question Bank]*



Which classification is correct?

	Strongest Acid	Strongest Base
(*a*)	A	E
(*b*)	B	E
(*c*)	A	C
(*d*)	B	C

110. A student learns that plants grow best when the pH of the soil is slightly acidic. Which range of pH is most suited for plant growth? *[CBSE Question Bank]*

(*a*) 11 – 14 (*b*) 5.5 – 7 (*c*) 1 – 3 (*d*) 7 – 9

111. A sting from insect A has pH of 6. The table shows the pH of four substances.

Substance	pH
Hydrochloric acid	1
Vinegar	5
Sodium hydrogen carbonate	8
Sodium hydroxide	14

Which substance is used to treat the sting? *[CBSE Question Bank]*

(*a*) Vinegar (*b*) Sodium hydroxide

(*c*) Sodium hydrogen carbonate (*d*) Hydrochloric acid

112. The equation shows the reaction of hydrochloric acid with sodium hydroxide.

$HCl + NaOH \rightarrow NaCl + H_2O$

If the pH of the salt is 7, what are the positive and negative radicals in the salt?

[CBSE Question Bank]

(*a*) Na - negative radical; Cl - negative radical

(*b*) Na - positive radical; Cl - negative radical

(*c*) Na - positive radical; Cl - positive radical

(*d*) Na - negative radical; Cl - positive radical

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113. A scientist in a chemistry lab wants to make salt of pH 5.5 using acid and base. The table shows the acid and base present in the lab. ***[CBSE Question Bank]***

1	HCl
2	NaOH
3	H_2CO_3
4	NH_4OH
5	CH_3COOH

Which of the acid and base he should use for the reaction?

(*a*) CH_3COOH and NaOH (*b*) HCl and NaOH

(*c*) HCl and NH_4OH (*d*) H_2CO_3 and NaOH

114. A student learns that when sodium chloride reacts with water, it forms sodium hydroxide. Which type of reaction results in the formation of sodium hydroxide? ***[CBSE Question Bank]***

(*a*) Neutralization reaction (*b*) Displacement reaction

(*c*) Combination reaction (*d*) Decomposition reaction

115. Which of the following is the best possible application of calcium oxychloride?

[CBSE Question Bank]

(*a*) To make the water soft (*b*) To reduce the pH of water

(*c*) To disinfect the water (*d*) To change the state of water

116. The chemical reaction shows the reactants for the formation of baking soda.

$NaCl + H_2O + CO_2 + NH_3 \rightarrow X + Y$

What are X and Y? ***[CBSE Question Bank]***

(*a*) X: NH_3Cl; Y: $NaHCO_3$ (*b*) X: NH_4Cl; Y: $NaHCO_3$

(*c*) X: HCl; Y: $NaHCO_3$ (*d*) X: NH_4Cl; Y: $NaHCO_2$

117. What is the use of washing soda? ***[CBSE Question Bank]***

(*a*) To lower the temperature of the water

(*b*) To change the state of water

(*c*) To make the water alkaline

(*d*) To remove the permanent hardness of water

118. Washing soda is obtained from the recrystallization of sodium carbonate. How is sodium carbonate obtained from baking soda? ***[CBSE Question Bank]***

(*a*) By heating the baking soda (*b*) By reacting the baking soda with base

(*c*) By reacting the baking soda with acid (*d*) By adding water to baking soda

119. When water of crystallization is removed from copper sulphate solution, how does the colour of the salt change? ***[CBSE Question Bank]***

(*a*) From white to blue (*b*) From white to red

(*c*) From blue to red (*d*) From blue to white

120. The chemical formula for plaster of Paris is: ***[CBSE 2020 (31/1/1)]***

(*a*) $CaSO_4.2H_2O$ (*b*) $CaSO_4.H_2O$

(*c*) $CaSO_4.\frac{1}{2}H_2O$ (*d*) $2CaSO_4.H_2O$

121. A visually challenged student, has to perform a lab test to detect the presence of acid in a given solution. The acid-base indicator preferred by him will be: ***[CBSE 2020 (31/2/1)]***

(*a*) Blue litmus (*b*) Clove oil

(*c*) Red cabbage extract (*d*) Hibiscus extract

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Answers

1. (*d*)	**2.** (*c*)	**3.** (*a*)	**4.** (*b*)	**5.** (*a*)	**6.** (*b*)	**7.** (*c*)
8. (*b*)	**9.** (*d*)	**10.** (*c*)	**11.** (*c*)	**12.** (*d*)	**13.** (*c*)	**14.** (*b*)
15. (*a*)	**16.** (*b*)	**17.** (*b*)	**18.** (*b*)	**19.** (*d*)	**20.** (*a*)	**21.** (*d*)
22. (*d*)	**23.** (*c*)	**24.** (*d*)	**25.** (*c*)	**26.** (*b*)	**27.** (*d*)	**28.** (*c*)
29. (*a*)	**30.** (*b*)	**31.** (*d*)	**32.** (*d*)	**33.** (*d*)	**34.** (*d*)	**35.** (*c*)
36. (*a*)	**37.** (*a*)	**38.** (*a*)	**39.** (*c*)	**40.** (*c*)	**41.** (*d*)	**42.** (*b*)
43. (*b*)	**44.** (*a*)	**45.** (*d*)	**46.** (*d*)	**47.** (*d*)	**48.** (*a*)	**49.** (*a*)
50. (*a*)	**51.** (*a*)	**52.** (*c*)	**53.** (*d*)	**54.** (*a*)	**55.** (*c*)	**56.** (*d*)
57. (*a*)	**58.** (*a*)	**59.** (*a*)	**60.** (*b*)	**61.** (*b*)	**62.** (*a*)	**63.** (*b*)
64. (*c*)	**65.** (*c*)	**66.** (*d*)	**67.** (*c*)	**68.** (*b*)	**69.** (*a*)	**70.** (*a*)
71. (*a*)	**72.** (*a*)	**73.** (*b*)	**74.** (*c*)	**75.** (*d*)	**76.** (*a*)	**77.** (*a*)
78. (*a*)	**79.** (*a*)	**80.** (*d*)	**81.** (*b*)	**82.** (*c*)	**83.** (*d*)	**84.** (*a*)
85. (*b*)	**86.** (*a*)	**87.** (*a*)	**88.** (*b*)	**89.** (*b*)	**90.** (*b*)	**91.** (*b*)
92. (*c*)	**93.** (*c*)	**94.** (*a*)	**95.** (*a*)	**96.** (*b*)	**97.** (*c*)	**98.** (*c*)
99. (*b*)	**100.** (*d*)	**101.** (*b*)	**102.** (*c*)	**103.** (*a*)	**104.** (*c*)	**105.** (*a*)
106. (*c*)	**107.** (*d*)	**108.** (*c*)	**109.** (*a*)	**110.** (*b*)	**111.** (*c*)	**112.** (*b*)
113. (*c*)	**114.** (*d*)	**115.** (*c*)	**116.** (*b*)	**117.** (*d*)	**118.** (*a*)	**119.** (*d*)
120. (*c*)	**121.** (*b*)					

CASE-BASED QUESTIONS

Question numbers 1 to 4 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).

In everyday life, pH plays an important role on daily basis like in gardening and farming, the best crops are usually obtained with neutral or slightly acidic soil (pH 6.5 to 7.0), tooth decay starts when the pH of mouth is lower than 5.5. Bee-sting leaves an acid which causes pain and irritation etc.

(*i*) During indigestion, which acid is produced by the stomach that causes irritation and pain?

(*a*) Hydrochloric acid (*b*) Sulphuric acid
(*c*) Nitric acid (*d*) Phosphoric acid

(*ii*) Rain is called an acid rain when the pH is

(*a*) above 8.5 (*b*) below 6.5
(*c*) below 5.6 (*d*) between 7-8

(*iii*) The basic salt that gives relief on the stung area is

(*a*) washing soda (*b*) caustic soda
(*c*) baking soda (*d*) bleaching powder

(*iv*) Which of the following type of medicines is used for the treatment of hyperacidity in the stomach?

(*a*) Antiseptic (*b*) Antibiotic
(*c*) Analgesic (*d*) Antacid

(*v*) Which of the following substance(s) is added by farmers if the soil is acidic?

(*a*) Common salt (*b*) Slaked lime
(*c*) Vinegar (*d*) Limestone

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2. Read the following and answer any four questions from (*i*) to (*v*).

Sodium chloride is used as one of the raw materials in the production of baking soda. Baking soda is commonly used to make crispy *pakoras*, etc., in the kitchen. It is also added for faster cooking. It is also used in the preparation of effervescent drinks and fruit salts.

(*i*) The chemical name of baking soda is

(*a*) sodium hydrogen carbonate
(*b*) sodium hydroxide
(*c*) sodium carbonate decahydrate
(*d*) calcium oxychloride

(*ii*) Which of the following statements is correct regarding properties of baking soda?

(*a*) It is a yellow crystalline substance.
(*b*) It is non-corrosive in nature.
(*c*) It reacts with acids evolving hydrogen gas.
(*d*) All are correct

(*iii*) The temperature above which sodium bicarbonate decomposes to give sodium carbonate is

(*a*) 283 K (*b*) 309 K
(*c*) 373 K (*d*) 575 K

(*iv*) Baking powder is a mixture of

(*a*) sodium carbonate and ethanoic acid
(*b*) sodium hydrogen carbonate and ethanoic acid
(*c*) sodium carbonate and tartaric acid
(*d*) sodium hydrogen carbonate and tartaric acid

(*v*) The chemical formula of baking soda is

(*a*) $NaHCO_3$ (*b*) NaOH
(*c*) $Na_2CO_3.10H_2O$ (*d*) $CaOCl_2$

3. Read the following and answer any four questions from (*i*) to (*v*).

Acids, bases and salts are three main categories of chemical compounds. These have certain definite properties which distinguish one class from the other.

The acids are sour in taste while bases are bitter in taste. Tasting a substance is not a good way of finding out if it is an acid or a base. Acids and bases can be better distinguished with the help of indicators. Indicators are substances that undergo a change of colour with a change of acidic, neutral or basic medium. Many of these indicators are derived from natural substances such as extracts from flower petals and barrier. Litmus, a purple dye is extracted from the lichen plant. Some indicators are prepared artificially. For example, methyl orange and phenolphthalein. Given below is a table of indicators and their colour change in acidic and basic medium.

Indicator	Colour in Acid	Colour in Alkali
Litmus	Red	Blue
Methyl orange	Pinkish red	Yellow
Phenolphtalein	Colourless	Pink

(*i*) Which of the following is an example of natural indicator?

(*a*) Turmeric (*b*) Methyl orange
(*c*) Phenolphthalein (*d*) Methyl red

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(ii) An aqueous solution turns blue litmus solution red. Excess addition of which solution would reverse the change?

(a) HCl (b) H_2SO_4

(c) NaOH (d) HNO_3

(iii) Universal indicators impart _____ colour in neutral solution.

(a) Red (b) Yellow

(c) Green (d) Blue

(iv) An aqueous solution 'A' turns phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A', the pink colour disappears. Which of the following statement is true for solution 'A' and 'B'? [*CBSE* 2020 (31/3/1)]

(a) A is strongly basic and B is a weak base.

(b) A is strongly acidic and B is a weak acid.

(c) A has pH greater than 7 and B has pH less than 7.

(d) A has pH less than 7 and B has pH greater than 7.

(v) If 10 mL of H_2SO_4 is mixed with 10 mL of $Mg(OH)_2$ of the same concentration, the resultant solution will give the following colour with universal indicator: [*CBSE* 2020 (31/5/1)]

(a) Red (b) Yellow

(c) Green (d) Blue

4. Read the following and answer any four questions from (i) to (v). [*CBSE Question Bank*]

Frothing in Yamuna

The primary reason behind the formation of the toxic foam is high phosphate content in the wastewater because of detergents used in dyeing industries, dhobi ghats and households. Yamuna's pollution level is so bad that parts of it have been labelled 'dead' as there is no oxygen in it for aquatic life to survive.

(i) Predict the pH value of the water of river Yamuna if the reason for froth is high content of detergents dissolved in it.

(a) 10-11 (b) 5-7

(c) 2-5 (d) 7

(ii) Which of the following statements is correct for the water with detergents dissolved in it?

(a) low concentration of hydroxide ion (OH^-) and high concentration of hydronium ion (H_3O^+)

(b) high concentration of hydroxide ion (OH^-) and low concentration of hydronium ion (H_3O^+)

(c) high concentration of hydroxide ion (OH^-) as well as hydronium ion (H_3O^+)

(d) equal concentration of both hydroxide ion (OH^-) and hydronium ion (H_3O^+).

(iii) The table provides the pH value of four solutions P, Q, R and S

Solution	pH value
P	2
Q	9
R	5
S	11

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Which of the following correctly represents the solutions in increasing order of their hydronium ion concentration?

(*a*) P > Q > R > S (*b*) P > S > Q > R

(*c*) S < Q < R < P (*d*) S < P < Q < R

(*iv*) High content of phosphate ion in river Yamuna may lead to:

(*a*) decreased level of dissolved oxygen and increased growth of algae

(*b*) decreased level of dissolved oxygen and no effect of growth of algae

(*c*) increased level of dissolved oxygen and increased growth of algae

(*d*) decreased level of dissolved oxygen and decreased growth of algae

(*v*) If a sample of water containing detergents is provided to you, which of the following methods will you adopt to neutralize it?

(*a*) Treating the water with baking soda (*b*) Treating the water with vinegar

(*c*) Treating the water with caustic soda (*d*) Treating the water with washing soda

Answers

1. (*i*)—(*a*)

Secretion of too much hydrochloric acid in stomach causes several unpleasant symptoms.

(*ii*)—(*c*)

Normal rain has pH of about 5.6; it is slightly acidic because of CO_2 dissolves into it forming weak carbonic acid. Acid rain usually has a pH between 4.2 and 4.4.

(*iii*)—(*c*)

Use of a mild base like baking soda on the stung area gives relief.

(*iv*)—(*d*)

Antacids neutralize the excess acid in the stomach and this helps in getting rid of the pain caused by it.

(*v*)—(*b*)

Slaked lime is $Ca(OH)_2$. It is basic so neutralises the acidic soil.

2. (*i*)—(*a*)

Th chemical formula of baking soda is $NaHCO_3$, hence the chemical name is sodium hydrogen carbonate.

(*ii*)—(*b*)

Baking soda is a white crystalline substance which is sparingly soluble in water, it is non-corrosive in nature and it reacts with acids and evolves carbon dioxide.

(*iii*)—(*c*)

On heating, sodium bicarbonate decomposes to sodium carbonate above 100°C (373K).

(*iv*)—(*d*)

(*v*)—(*a*)

3. (*i*)—(*a*)

(*ii*)—(*c*)

Blue litmus turns red, it means the solution is acidic. Excess addition of a base would reverse the change.

(*iii*)—(*c*)

After adding a universal indicator, yellow to red indicate an acidic solution, blue to violet indicate alkali and green colour indicates that a solution is neutral.

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(*iv*)—(*c*)

'A' turns phenolphthalein pink so it is basic in nature and its pH is greater than 7. On adding 'B' to 'A', pink colour disappears it means it is acidic in nature so its pH is less than 7.

(*v*)—(*c*)

Both the acid and base are strong so they neutralise each other and the colour of neutral solution on universal indicator is green.

4. (*i*)—(*a*)

Detergents are basic so the pH is greater than 7.

(*ii*)—(*b*)

Detergents are basic so concentration of high hydroxide ion (OH^-) and low concentration of hydronium ion (H_3O^+).

(*iii*)—(*c*)

Lower the pH, higher is the hydronium ion concentration.

(*iv*)—(*a*)

(*v*)—(*b*)

The nature of detergents is basic so to neutralise them, vinegar (acid) is used.

ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (*A*) : The acid must always be added to water with constant stirring.
Reason (*R*) : Mixing of an acid with water decreases the concentration of H^+ ions per unit volume.

2. Assertion (*A*) : Copper sulphate crystals are wet because it contains water of crystallisation.
Reason (*R*) : Water of crystallisation is the fixed number of molecules of water present in one formula unit of salt.

3. Assertion (*A*) : The aqueous solutions of glucose and alcohol do not show acidic character.
Reason (*R*) : Aqueous solutions of glucose and alcohol do not give H^+ ions.

4. Assertion (*A*) : HCl gas does not change the colour of dry blue litmus paper.
Reason (*R*) : HCl gas dissolves in the water present in wet litmus paper to form H^+ ions.

5. Assertion (*A*) : Weak acids have low electrical conductivity.
Reason (*R*) : Strong acids and weak acids have equal concentration of hydrogen ions in their solutions.

6. Assertion (*A*) : Pure water is neither acidic nor basic.
Reason (*R*) : The pH of a solution is inversely proportional to the concentration of hydrogen ions in it.

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7. Assertion (*A*) : During electrolysis of concentrated aqueous solution of sodium chloride, hydrogen is produced at anode and chlorine gas is produced at cathode.

Reason (*R*) : Ions get attracted to oppositely charged electrodes.

8. Assertion (*A*) : Soaps would change the colour of red litmus to blue.

Reason (*R*) : Soaps are acidic in nature.

Answers

1. (*b*) **2.** (*d*) **3.** (*a*) **4.** (*b*) **5.** (*c*) **6.** (*b*) **7.** (*d*)
8. (*c*)

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03 METALS AND NON-METALS

BASIC CONCEPTS

1. Metals are malleable, ductile and good conductor of heat and electricity. They possess high melting point and boiling point.

   Examples: Cu, Al, Mg, Ag, Au, etc

   Exceptions among metals:

   (*a*) All metals are solid but mercury is a liquid at room temperature.

   (*b*) Metals have high melting and boiling points, but gallium and caesium have very low melting points. These two metals will melt if you keep them on your palm.

   (*c*) Alkali metals (Li, Na, K) are soft and can be easily cut with a knife. They have low densities and low melting points.

2. Non-metals are non-malleable, non-ductile and bad conductor of heat and electricity. They possess low melting point and boiling point.

   Examples: C, S, P, N, O, etc.

   Exceptions among non-metals:

   (*a*) Non-metals are generally solids or gases except bromine which is liquid.

   (*b*) Iodine is a lustrous non-metal.

   (*c*) Diamond is the hardest natural known substance.

   (*d*) Graphite is a good conductor of electricity.

3. **Metalloids:** They show both characteristics, metallic as well as non-metallic.

   Examples: Si, Ge, As, Sb and Te.

4. **Differences between chemical properties of metals and non-metals:**

Metals	Non-metals
(*i*) **Metals lose electrons and form +ve ions.** $Na \rightarrow Na^+ + e^-$ Metals are electropositive elements.	(*i*) **Non-metals gain electrons and form –ve ions.** $Cl + e^- \rightarrow Cl^-$ Non-metals are electronegative elements.
(*ii*) **Metals combine with oxygen** and form basic oxides. $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$	(*ii*) **Non-metals combine with oxygen** and form acidic oxides or neutral oxides. $C(s) + O_2(g) \rightarrow CO_2(g)$
(*iii*) **Basic oxides + Water → Bases** $Na_2O(s) + H_2O(l) \rightarrow \underset{\text{Sodium hydroxide}}{2NaOH(aq)}$ In litmus test, the bases formed turn red litmus paper blue.	(*iii*) **Acidic oxides + Water → Acids** $CO_2(g) + H_2O(l) \rightarrow \underset{\text{Carbonic acid}}{H_2CO_3(aq)}$ In litmus test, the acids formed turn blue litmus red.

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(iv)	(*a*) Oxidation: K and Na catch fire in oxygen. To prevent oxidation they are kept immersed in kerosene. (*b*) The surfaces of metals like Mg, Al, Zn, Pb, etc., are covered with a thin layer of their oxides. So, no further oxidation takes place. (*c*) Magnesium on heating burns forming magnesium oxide. (*d*) Copper on heating becomes coated with black coloured copper-oxide (CuO). (*e*) Silver and gold do not react with oxygen.	***(iv)***	(*a*) CO_2 and SO_2 are acidic oxides (turn blue litmus red). (*b*) Carbon monoxide (CO), water (H_2O) and nitrous oxide (N_2O) are neutral oxides (no action on litmus). (*c*) A jet of hydrogen gas burns in air with a pale blue flame. Steam produced can be condensed to water. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$
(v)	**Reaction with Water:** (*a*) Na and K react violently with **cold water**. Evolved H_2 gas catches fire. $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$ $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ (*b*) Magnesium reacts with **hot water.** $Mg(s) + 2H_2O(l) \xrightarrow[\text{(Hot)}]{} Mg(OH)_2(aq) + H_2(g)$ (*c*) Al, Zn and Fe react with **steam**. $2Al(s) + 3H_2O(g) \rightarrow Al_2O_3(s) + 3H_2(g)$ $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$ $Zn(s) + H_2O(g) \rightarrow ZnO(s) + H_2(g)$ (*d*) Lead(Pb), Copper(Cu), Silver(Ag) and Gold (Au) **do not react** with water.	***(v)***	Non-metals do not react with water to evolve hydrogen gas.
(vi)	**Reactions with Acids:** (*a*) Metals react with dil. HCl and H_2SO_4 to liberate H_2 gas. Metal + dil. Acid $\rightarrow$ Salt + Hydrogen (*b*) When metals react with dilute HNO_3, H_2 gas is not evolved but H_2O (water) is formed. Metal + dil. Nitric acid $\rightarrow$ Metal salt + Water + Oxides of nitrogen. (**Exceptions:** Mg and Mn evolve H_2 gas with dil. HNO_3)	***(vi)***	Non-metals do not displace H_2 from acids because non-metals are electron acceptor, and they cannot supply electron to hydrogen.
(vii)	**Reaction with Chlorine:** Metals react with Cl_2 to form ionic metal chloride. Metals are electron donor Chlorine is electron acceptor $Ca \rightarrow Ca^{2+} + 2e^-$ $2Cl + 2e^- \rightarrow 2Cl^-$ $Ca^{2+} + 2Cl^- \rightarrow CaCl_2$	***(vii)***	Non-metals react with Cl_2 to form covalent chloride. $P_4(s) + 6Cl_2(g) \rightarrow 4PCl_3(g)$

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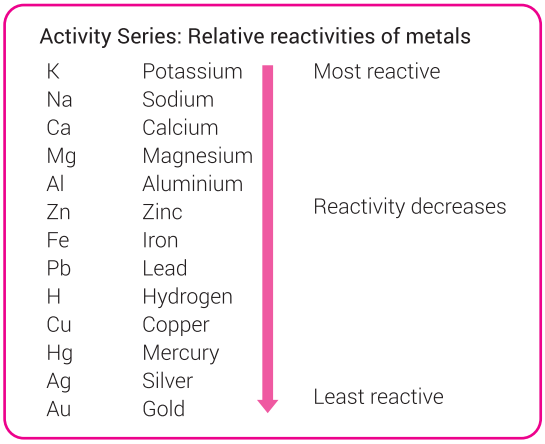
(*viii*) Reaction with Hydrogen: Hydrogen can share or lose electrons. But active metals like Na, K and Ca can force hydrogen atom to accept the electrons to form hydrides. $2Na(s) + H_2(g) \rightarrow 2NaH(s)$ $Ca(s) + H_2(g) \rightarrow CaH_2(s)$	**(*viii*)** Hydrides of non-metals are stable compounds and are formed by sharing electrons. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $H_2(g) + S(s) \rightarrow H_2S(g)$

5. **Reactivity series of metals:** The reactivity series is a list of metals arranged in the order of their decreasing activities.



6. **Ionic compounds:** Ionic compounds are those compounds which are formed by the transfer of electrons from a metal to a non-metal. For example, NaCl.

Properties:

(*i*) Physical nature: Ionic compounds are hard and solid due to strong force of attraction between oppositely charged ions.

(*ii*) Melting point and boiling point: As more amount of energy is required to break strong bonds. So, they have high melting point and boiling point.

(*iii*) Solubility: These are soluble in water (polar solvent) but insoluble in organic solvent.

(*iv*) Conduction of electricity: They conduct electricity in solution or molten state as ions move towards opposite electrodes.

MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. **Which of the following metals does not burn on heating?**
   (*a*) Magnesium (*b*) Copper
   (*c*) Lithium (*d*) Sodium

2. **Four metals Al, Zn, Cu and Fe are added in different test tubes containing dilute hydrochloric acid. No bubbles are seen in the case of**
   (*a*) Al (*b*) Zn
   (*c*) Cu (*d*) Fe

3. **Na^+ has**
   (*a*) 11 protons, 10 electrons (*b*) 10 protons, 11 electrons
   (*c*) 12 protons, 11 electrons (*d*) 11 protons, 12 electrons

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4. Which of the following property is generally not shown by metals? [*NCERT Exemplar*]

(*a*) Electrical conduction (*b*) Sonorous in nature

(*c*) Dullness (*d*) Ductility

5. The ability of metals to be drawn into thin wire is known as [*NCERT Exemplar*]

(*a*) ductility (*b*) malleability

(*c*) sonorousity (*d*) conductivity

6. Which one of the following metals do not react with cold as well as hot water? [*NCERT Exemplar*]

(*a*) Na (*b*) Ca (*c*) Mg (*d*) Fe

7. What happens when calcium is treated with water? [*NCERT Exemplar*]

(*i*) It does not react with water.

(*ii*) It reacts violently with water.

(*iii*) It reacts less violently with water.

(*iv*) Bubble of hydrogen gas formed stick to the surface of calcium.

(*a*) (*i*) and (*iv*) (*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*ii*) (*d*) (*iii*) and (*iv*)

8. Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg)? [*NCERT Exemplar*]

(*a*) H_2SO_4 (*b*) HCl

(*c*) HNO_3 (*d*) All of these

9. The composition of aqua regia is: [*NCERT Exemplar*]

(*a*) Dil. HCl : Conc. HNO_3 (*b*) Conc. HCl : Dil. HNO_3

3 : 1 3 : 1

(*c*) Conc. HCl : Conc. HNO_3 (*d*) Dil. HCl : Dil. HNO_3

3 : 1 3 : 1

10. Generally, metals are solid in nature. Which one of the following metals is found in liquid state at room temperature?

(*a*) Na (*b*) Fe (*c*) Cr (*d*) Hg

11. Generally, non-metals are not lustrous. Which of the following non-metal is lustrous? [*NCERT Exemplar*]

(*a*) Sulphur (*b*) Oxygen

(*c*) Nitrogen (*d*) Iodine

12. Which one of the following four metals would be displaced from the solution of its salts by other three metals? [*NCERT Exemplar*]

(*a*) Mg (*b*) Ag

(*c*) Zn (*d*) Cu

13. 2 mL each of concentrated HCl, HNO_3 and a mixture of concentrated HCl and concentrated HNO_3 in the ratio of 3 : 1 were taken in test tubes labelled as *A*, *B* and *C*. A small piece of metal was put in each test tube. No change occurred in test tubes A and B but the metal got dissolved in test tube C respectively. The metal could be: [*NCERT Exemplar*]

(*a*) Al (*b*) Au

(*c*) Cu (*d*) Pt

14. Which among the following statements is incorrect for magnesium metal? [*NCERT Exemplar*]

(*a*) It burns in oxygen with a dazzling white flame.

(*b*) It reacts with cold water to form magnesium oxide and evolves hydrogen gas.

(*c*) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas.

(*d*) It reacts with steam to form magnesium hydroxide and evolves hydrogen gas.

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15. Reaction between X and Y, forms compound Z. X loses electron and Y gains electron. Which of the following properties is not shown by Z? *[NCERT Exemplar]*

(*a*) Has high melting point (*b*) Has low melting point

(*c*) Conducts electricity in molten state (*d*) Occurs as solid

16. Although metals form basic oxides, which of the following metals form an amphoteric oxide? *[NCERT Exemplar]*

(*a*) Na (*b*) Ca (*c*) Al (*d*) Cu

17. Generally, non-metals are not conductors of electricity. Which of the following is a good conductor of electricity? *[NCERT Exemplar]*

(*a*) Diamond (*b*) Graphite

(*c*) Sulphur (*d*) Fullerene

18. Electrical wires have a coating of an insulating material. The material, generally used is: *[NCERT Exemplar]*

(*a*) Sulphur (*b*) Graphite

(*c*) PVC (*d*) All can be used

19. Which of the following non-metals is a liquid? *[NCERT Exemplar]*

(*a*) Carbon (*b*) Bromine

(*c*) Phosphorus (*d*) Sulphur

20. Which of the following can undergo a chemical reaction? *[NCERT Exemplar]*

(*a*) $MgSO_4$ + Fe (*b*) $ZnSO_4$ + Fe

(*c*) $MgSO_4$ + Pb (*d*) $CuSO_4$ + Fe

21. The most abundant metal in the earth's crust is

(*a*) Iron (*b*) Aluminium

(*c*) Calcium (*d*) Sodium

22. The poorest conductor of heat among metals is

(*a*) Lead (*b*) Mercury

(*c*) Calcium (*d*) Sodium

23. Which property of metals is used for making bells and strings of musical instruments like Sitar and Violin?

(*a*) Sonorous (*b*) Malleability

(*c*) Ductility (*d*) Conductivity

24. $Al_2O_3 + 2NaOH \rightarrow \ldots\ldots + H_2O$

(*a*) $Al(OH)_3$ (*b*) Na_2O

(*c*) $NaAlO_2$ (*d*) Al_2NaO_2

25. Which of the following pairs will give displacement reactions?

(*a*) $FeSO_4$ solution and Copper metal (*b*) $AgNO_3$ solution and Copper metal

(*c*) $CuSO_4$ solution and Silver metal (*d*) NaCl solution and Copper metal

26. Non-metals form covalent chlorides because

(*a*) they can give electrons to chlorine

(*b*) they can share electrons with chlorine

(*c*) they can give electrons to chlorine atoms to form chloride ions

(*d*) they cannot share electrons with chlorine atoms

27. Which of the following are not ionic compounds?

(*i*) KCl **(*ii*) HCl**

(*iii*) CCl_4 **(*iv*) NaCl**

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*)

(*c*) (*iii*) and (*iv*) (*d*) (*i*) and (*iii*)

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28. Which of the following non-metal is lustrous?

(*a*) Sulphur (*b*) Oxygen
(*c*) Nitrogen (*d*) Iodine

29. Example of an amphoteric oxide is:

(*a*) Na_2O (*b*) K_2O (*c*) Al_2O_3 (*d*) MgO

30. Which one among the following is an acidic oxide?

(a) Na_2O (*b*) CO (*c*) CO_2 (*d*) Al_2O_3

31. The atomic number of an element 'X' is 12. Which inert gas is nearest to X?

(*a*) He (*b*) Ar
(*c*) Ne (*d*) Kr

32. An element X is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following.

(*a*) Mg (*b*) Na (*c*) P (*d*) Ca

33. Reaction between X and Y forms compound Z. X loses electron and Y gains electron. Which of the following properties is not shown by Z?

(*a*) Has high melting point
(*b*) Has low melting point
(*c*) Conducts electricity in molten state
(*d*) Occurs as solid

34. The electronic configurations of three elements X, Y and Z are X — 2, 8; Y — 2, 8, 7 and Z — 2, 8, 2. Which of the following is correct?

(*a*) X is a metal (*b*) Y is a metal
(*c*) Z is a non-metal (*d*) Y is a non-metal and Z is a metal

35. The lightest liquid metal is

(*a*) Hg (*b*) Ga (*c*) Cs (*d*) Fr

36. The most abundant element in the universe is

(*a*) Hydrogen (*b*) Helium
(*c*) Carbon (*d*) Oxygen

37. An element 'X' is yellow coloured solid, insoluble in water but soluble in carbon disulphide. It has low melting point 114.5°C. It boils at 445°C and it burns with pale blue flame forming pungent smelling gas 'Y' which turns moist blue litmus red and finally colourless. 'X' and 'Y' are

(*a*) C, CO_2 (*b*) N, NO_2
(*c*) S, SO_2 (*d*) I_2, I_2O_5

38. Which of the following oxide(s) of iron would be obtained on prolonged reaction of iron with steam? ***[NCERT Exemplar]***

(*a*) FeO (*b*) Fe_2O_3
(*c*) Fe_3O_4 (*d*) Fe_2O_3 and Fe_3O_4

39. Which of the following metals exist in their native state in nature ? ***[NCERT Exemplar]***

(*i*) Cu (*ii*) Au (*iii*) Zn (*iv*) Ag

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*)
(*c*) (*ii*) and (*iv*) (*d*) (*iii*) and (*iv*)

40. An element 'X' reacts with O_2 to give a compound with a high melting point. This compound is also soluble in water. The element 'X' is likely to be: ***[CBSE 2020 (31/1/2)]***

(*a*) iron (*b*) calcium
(*c*) carbon (*d*) silicon

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41. An aluminium strip is kept immersed in freshly prepared ferrous sulphate solution taken in a test tube, the change observed is that

(*a*) Green solution becomes colourless

(*b*) Lower end of test tube become slightly warm

(*c*) A colourless gas with the smell of burning sulphur is observed

(*d*) Light green solution changes to blue.

42. Aluminium is used for making cooking utensils. Which of the following properties of aluminium are responsible for the same?

(*i*) Good thermal conductivity **(*ii*) Good electrical conductivity**

(*iii*) Ductility **(*iv*) High melting point**

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iii*)

(*c*) (*ii*) and (*iii*) (*d*) (*i*) and (*iv*)

43. Which one of the following properties is not generally exhibited by ionic compounds?

(*a*) Solubility in water (*b*) Electrical conductivity in solid state

(*c*) High melting and boiling points (*d*) Electrical conductivity in molten state

44. Which of the following metals catch fire on reaction with air?

(*a*) Magnesium (*b*) Manganese

(*c*) Potassium (*d*) Calcium

45. When MgO is dissolved in water, $Mg(OH)_2$ is obtained. The solution thus obtained is _____ in nature.

(*a*) amphoteric (*b*) alkaline

(*c*) neutral (*d*) acidic

46. Which of the following metals do not react even with steam?

(*a*) Silver (*b*) Iron

(*c*) Calcium (*d*) Sodium

47. Identify the non-metal which exists in a liquid state in room temperature 25°C.

(*a*) Aluminium (*b*) Mercury

(*c*) Iodine (*d*) Bromine

48. Which of the following pairs of compounds undergo displacement reaction when they react with each other?

(*a*) Cu and $AgNO_3$ solution (*b*) Ag and $FeSO_4$ solution

(*c*) Cu and NaCl solution (*d*) Mg and NaCl solution

49. A reaction in which a more reactive metal replaces a less reactive metal from its salt solution is called a/an _____ reaction.

(*a*) combination (*b*) displacement

(*c*) double displacement (*d*) addition

50. Metals, except Al and Zn, react with oxygen to form _____ oxides.

(*a*) acidic (*b*) neutral

(*c*) amphoteric (*d*) basic

51. When sulphur reacts with oxygen, the oxide formed is _____ in nature.

(*a*) alkaline (*b*) neutral

(*c*) basic (*d*) acidic

52. Metals like zinc and aluminium react with sodium hydroxide to produce ____ gas.

(*a*) hydrogen (*b*) hydrogen sulphide

(*c*) oxygen (*d*) sulphur dioxide

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53. When zinc reacts with dilute sulphuric acid, a salt is formed with the release of a gas. The gas produced during this puts off a burning candle with a pop sound. The gas evolved during this reaction is:

(*a*) sulphur dioxide (*b*) oxygen
(*c*) hydrogen (*d*) hydrogen sulphide

54. The property by which metals can be beaten into sheets is known as _____.

(*a*) ductility (*b*) sonority (*c*) lusture (*d*) malleability

55. The property of metal by which it can be drawn into wires is called _____.

(*a*) sonority (*b*) malleability (*c*) ductility (*d*) lusture

56. Which of the following can be beaten into thin sheets?

(*a*) Zinc (*b*) Phosphorus (*c*) Sulphur (*d*) Oxygen

57. A substance is said to be sonorous if it _____.

(*a*) conducts heat (*b*) conducts electricity
(*c*) conducts water through metal pipes (*d*) produces a ringing sound when beaten

58. Pick the odd one from the following elements.

(*a*) Gold (*b*) Potassium (*c*) Carbon (*d*) Platinum

59. Which of the following statements is false?

(*a*) Carbon is the most malleable metal. (*b*) Copper is a good conductor of electricity.
(*c*) Aluminium is a good conductor of heat. (*d*) Bromine is the only liquid non-metal.

60. What is the property that makes metals shine called?

(*a*) Malleability (*b*) Ductility (*c*) Sonorous (*d*) Lustre

61. Which of the following is a non-metal but is lustrous?

(*a*) Carbon (*b*) Mercury (*c*) Iodine (*d*) Fluorine

62. An incomplete chemical equation of the reaction between iron and oxygen is given below:

$4Fe\ (s) + 3O_2(g) \rightarrow$

Which option shows the products formed during the reaction? ***[CBSE Question Bank]***

(*a*) $3Fe_4O_2(s)$ (*b*) $12FeO(s)$
(*c*) $4FeO_3(s)$ (*d*) $2Fe_2O_3(s)$

63. A student writes two incomplete chemical reactions. ***[CBSE Question Bank]***

X – $P_4(s) + 5O_2(g) \rightarrow$

Y – $2Mg(s) + O_2(g) \rightarrow$

Which option completes the reactions to form a balanced chemical equation?

(*a*) X - $P_5O_4(s)$; Y-$(MgO)_2(s)$ (*b*) X - $4PO_{10}(s)$; Y- $4MgO(s)$
(*c*) X - $P_4O_{10}(s)$; Y - $2MgO(s)$ (*d*) X - $5P_4O_2(s)$; Y- $Mg_2O_2(s)$

64. A student studying the chemical properties of metals finds incomplete chemical reactions in his book, as shown:

$MgO + HNO_3 \rightarrow$

Which option completes the reaction? ***[CBSE Question Bank]***

(*a*) $MgO + HNO_3 \rightarrow Mg + NO_2 + O_2$ (*b*) $MgO + HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$
(*c*) $MgO + HNO_3 \rightarrow Mg(OH)_2 + 2NO_2$ (*d*) $MgO + HNO_3 \rightarrow Mg_3N_2 + 4H_2O$

65. When hydrochloric acid is added to barium hydroxide, a white-colored compound is formed. Which option gives the complete chemical reaction? ***[CBSE Question Bank]***

(*a*) $2HCl + Ba(OH)_2 \rightarrow BaH_2 + 2HCl + O_2$
(*b*) $2HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2HOH$
(*c*) $HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2HOH$
(*d*) $HCl + 2Ba(OH) \rightarrow 2BaCl_2 + 2HOH + O_2$

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66. When calcium oxide is added to water, it completely dissolves in water without forming bubbles. What products are formed in this reaction? *[CBSE Question Bank]*

(*a*) Ca and H_2O_2 (*b*) CaH_2

(*c*) $Ca(OH)_2$ (*d*) Ca and H_2

67. A student adds some metallic ash in water taken in a test tube. The ash gets completely dissolved in water and the solution changes colour. What should the student do next to test the chemical properties of the product formed? *[CBSE Question Bank]*

(*a*) Test the acidity using a blue litmus paper.

(*b*) Test the basicity using a red litmus paper.

(*c*) Measure the temperature change using a thermometer.

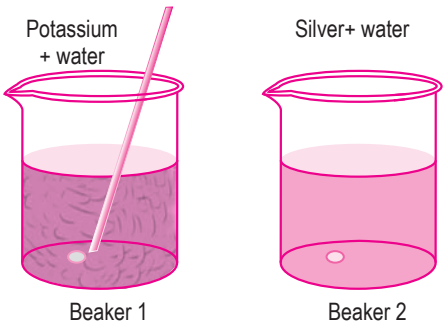
(*d*) Evaporate the solution to get crystals.

68. What happens when a pellet of sodium is dropped in water? *[CBSE Question Bank]*

(*a*) It catches fire and forms oxide. (*b*) It absorbs heat and forms hydroxide.

(*c*) It catches fire and forms hydroxide. (*d*) It absorbs heat and forms oxide.

69. A student drops pieces of potassium and silver in beakers containing water. The image given below shows the reaction.



What are the products formed in each beaker? *[CBSE Question Bank]*

(*a*) Beaker 1: K_2O and H_2O; Beaker 2: No reaction takes place

(*b*) Beaker 1: KOH and H_2O; Beaker 2: Ag_2O and H_2O

(*c*) Beaker 1: K_2O and H_2O; Beaker 2: AgO and H_2O

(*d*) Beaker 1: KOH and H_2O; Beaker 2: No reaction takes place

70. Which product is formed in the chemical reaction between a small strip of magnesium and nitric acid? *[CBSE Question Bank]*

(*a*) $MgNO_3$ and H_2O

(*b*) $Mg(NO_3)_2$ and H_2O

(*c*) $Mg(NO_3)_2$ and H_2

(*d*) $MgNO_3$ and $2H_2$

71. The chemical reaction between a piece of copper and nitric acid is given by the chemical equations,

$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + H_2$

$H_2 + HNO_3 \rightarrow H_2O + NO_2$

What can be inferred from the chemical equation? *[CBSE Question Bank]*

(*a*) Nitrate reacts with hydrogen to form NO_2 and H_2O.

(*b*) Hydrogen gas gets oxidized by HNO_3 to form water.

(*c*) Gas reacts with oxygen in the air to form water.

(*d*) Copper causes the oxidation of HNO_3 to form NO_2.

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Answers

1. (*b*)	**2.** (*c*)	**3.** (*a*)	**4.** (*c*)	**5.** (*a*)	**6.** (*d*)	**7.** (*d*)
8. (*c*)	**9.** (*c*)	**10.** (*d*)	**11.** (*d*)	**12.** (*b*)	**13.** (*b*)	**14.** (*b*)
15. (*b*)	**16.** (*c*)	**17.** (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*d*)	**21.** (*b*)
22. (*a*)	**23.** (*a*)	**24.** (*c*)	**25.** (*b*)	**26.** (*b*)	**27.** (*b*)	**28.** (*d*)
29. (*c*)	**30.** (*c*)	**31.** (*c*)	**32.** (*b*)	**33.** (*b*)	**34.** (*d*)	**35.** (*a*)
36. (*a*)	**37.** (*c*)	**38.** (*c*)	**39.** (*c*)	**40.** (*b*)	**41.** (*a*)	**42.** (*d*)
43. (*b*)	**44.** (*c*)	**45.** (*b*)	**46.** (*a*)	**47.** (*d*)	**48.** (*a*)	**49.** (*b*)
50. (*d*)	**51.** (*d*)	**52.** (*a*)	**53.** (*c*)	**54.** (*d*)	**55.** (*c*)	**56.** (*a*)
57. (*d*)	**58.** (*c*)	**59.** (*a*)	**60.** (*d*)	**61.** (*c*)	**62.** (*d*)	**63.** (*c*)
64. (*b*)	**65.** (*b*)	**66.** (*c*)	**67.** (*b*)	**68.** (*c*)	**69.** (*d*)	**70.** (*c*)
71. (*b*)						

CASE-BASED QUESTIONS

Question numbers 1 to 2 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).

Metals are elements that exhibit a variety of physical properties such as those of malleability, ductility, conductivity of heat and electricity, lustre, etc. Due to such properties, metals find usage in purpose such as cooking utensils, machinery, modes of transportation, construction, etc., in our daily life. Metals such as gold and silver have been used in making jewellery since ancient times. Non-metals have been found to exist in all the three states— solid, liquid and gaseous. They are non-malleable, non-ductile and are brittle in nature. Non-metals have very low tensile strength and are easily broken up.

(*i*) Which of the following metal(s) will have very low melting point?

(*a*) Gallium (*b*) Caesium
(*c*) Copper (*d*) Both (*a*) and (*b*)

(*ii*) The metal which is known as strategic metal is

(*a*) zirconium (*b*) titanium
(*c*) manganese (*d*) all of these

(*iii*) Metals can be given different shapes according to our needs because

(*a*) they are malleable and ductile (*b*) they are sonorous
(*c*) they are generally hard (*d*) they have a shining surface

(*iv*) Which of the following non-metal is a good conductor of electricity?

(*a*) Oxygen (*b*) Nitrogen
(*c*) Graphite (*d*) Bromine

(*v*) Metals produce a metallic sound. This property of metal is called

(*a*) malleability (*b*) sonority
(*c*) conductivity (*d*) ductility

2. Read the following and answer any four questions from (*i*) to (*v*).

Metals react with non-metals by losing or gaining electrons. They have a give-and-take relation between them. Ionic compounds are usually solid and hard in nature. They are generally soluble in water and insoluble in organic solvents like petrol, kerosene, etc. The melting and boiling points of electrovalent compounds are high. In order to change the physical state of the electrovalent compounds (from solid to liquid to gas), a high temperature is needed to overcome the attractive forces.

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(*i*) Which of the following properties is not generally exhibited by ionic compounds?

(*a*) Electrical conductivity in molten state (*b*) Electrical conductivity in solid state

(*c*) High melting and boiling points (*d*) Solubility in water

(*ii*) Electrovalent compounds are usually solid and hard in nature. This is due to

(*a*) strong forces of attraction between the oppositely charged ions

(*b*) weak forces of attraction between the oppositely charged ions

(*c*) strong forces of attraction between the similarly charged ions

(*d*) weak forces of attraction between the similarly charged ions

(*iii*) Transfer of one or more valence electrons from a metal to non-metal takes place in case of

(*a*) chemical bonding (*b*) molecular bonding

(*c*) ionic bonding (*d*) covalent bonding

(*iv*) Calcium oxide is formed by losing of electrons to oxygen atoms, the number of valence electrons calcium has is

(*a*) three (*b*) one

(*c*) four (*d*) two

(*v*) The atomic number of four elements A, B, C, D are 6, 8, 10 and 12 respectively. The two elements which can react to form ionic compounds are:

(*a*) A and B (*b*) C and D

(*c*) B and D (*d*) A and C

Answers

1. (*i*)—(*d*)

Metals generally have high melting and boiling points. For example, the melting point of copper is 1083° C. But, gallium and caesium have very low melting point, they will melt on keeping on hand.

(*ii*)—(*d*)

Some metals such as titanium, chromium, manganese, zirconium, etc., are classified as strategic metals. That is, they are essential for the country's economy and its defence. These metals and their alloys are used in atomic energy, space science projects, jet engines, etc.

(*iii*)—(*a*)

Metals can be given different shapes according to our needs because of their malleability (*i.e.*, ability to convert into thin sheets by hammering) and ductility (*i.e.*, ability to drawn into thin wire).

(*iv*)—(*c*)

Except graphite (which is an allotropic form of carbon), all non-metals are bad conductors of heat and electricity. Since graphite is a good conductor of electricity, it is used for making electrodes.

(*v*)—(*b*)

The metals that produce a sound on striking a hard surface are said to be sonorous and the property is called sonority.

2. (*i*)—(*b*)

The cations and anions are held together by electrostatic forces of attraction in the solid state; they are, therefore not free to move. Hence, electrovalent compounds in the solid state do not conduct electricity.

(*ii*)—(*a*)

Electrovalent compounds are usually solid and hard in nature. This is due to the strong forces of attraction between the oppositely charged ions.

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(*iii*)—(*c*)

Transfer of one or more valence electrons from a metal to non-metal takes place in case of ionic bonding and the compounds formed are called ionic compounds.

(*iv*)—(*d*)

The atomic number of calcium is 20 having electronic configuration: K L M
2, 8, 2

Thus it has 2 valence electrons in its valence shell (outermost shell).

(*v*)—(*c*)

The electronic configuration of B atom is 2, 6 and of D atom is 2, 8, 2. Therefore, D has 2 electrons in its valence shell, so it will lose 2 electrons to B and both will attain inert gas configuration.

ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (*A*) : Hydrogen gas is not evolved when a metal reacts with nitric acid.
Reason (*R*) : Nitric acid is a strong oxidising agent.

2. Assertion (*A*) : Zinc becomes dull in moist air.
Reason (*R*) : Zinc is coated by a thin film of its basic carbonate in moist air.

3. Assertion (*A*) : Aluminium is used in making food wrappers.
Reason (*R*) : Aluminium is highly malleable and has high melting point.

4. Assertion (*A*) : Zinc oxide is amphoteric in nature.
Reason (*R*) : Zinc oxide reacts with both acids and bases.

5. Assertion (*A*) : Magnesium chloride is an ionic compound.
Reason (*R*) : Metals and non-metals react by mutual transfer of electrons.

6. Assertion (*A*) : Zinc can easily displace copper on reacting with a solution of copper sulphate.
Reason (*R*) : Copper is more reactive metal as compared to Zinc.

7. Assertion (*A*) : $MgCl_2$ is a covalent compound.
Reason (*R*) : $MgCl_2$ is a good conductor of electricity in molten state.

Answers

1. (*a*) **2.** (*a*) **3.** (*a*) **4.** (*a*) **5.** (*a*) **6.** (*c*) **7.** (*d*)

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04 LIFE PROCESSES

BASIC CONCEPTS

1. **Food or nourishment** or nutrients provide energy for life activities of plants and animals. Green plants and blue-green algae manufacture their own food in the form of simple sugars that is stored in cells as starch.
2. **Organisms** like bacteria, fungi and animals do not synthesise their own food. They depend on plants for their food.
3. **Nutrition** is a physiological process in which living organisms obtain nutrients. These nutrients are essential for their life activities.
4. **Nutrients** are inorganic (minerals and water) and organic, *e.g.*, carbohydrates, fats, proteins and vitamins. These are essential for growth and energy for various metabolic activities in living organisms.
5. **Autotrophic nutrition** occurs in green plants. They manufacture their own food (sugar/starch) using CO_2 and H_2O in the presence of sunlight and chlorophyll by the process of photosynthesis. They are called autotrophs, because they can prepare their own food.
6. **Photosynthetic organisms** are green plants which possess chlorophyll (green pigment) in their cells (in chloroplasts or plastids). *Euglena* (protozoan) also possesses chloroplasts under some specific conditions. These organisms synthesise their own food from inorganic compounds like CO_2 and H_2O.
7. **Chemosynthetic organisms** manufacture carbohydrate by oxidation of inorganic substances like H_2O, CO_2, CH_4, NH_3, nitrates, etc. They are called chemoautotrophs, *e.g.*, some nitrifying bacteria, sulphur bacteria, etc.
8. **Heterotrophs** are those organisms which cannot manufacture their own food and thus depend on organic substances of plant and animal sources. Heterotrophic organisms include animals and fungi.
9. **Saprophytic organisms** (non-green plants) are those which absorb their organic nutrition from dead and decaying organisms. Such animals are called saprophytes. Holozoic nutrition is found in most animals. They take solid substances through mouth. *e.g.*, Man and *Amoeba*.
10. **Differences Between Breathing and Respiration**

S. No.	Breathing	Respiration
1.	It is a constant process where you breathe in and out constantly.	It is a process where the body breaks down the oxygen.
2.	It is a physical process.	It is a chemical process.
3.	It takes in oxygen.	It takes out oxygen.
4.	It is an exchange of gases between cells.	It takes place in a cell.
5.	It has two process—ventilation and gas exchange.	It has one process—oxidation.
6.	It can be controlled.	It cannot be controlled.

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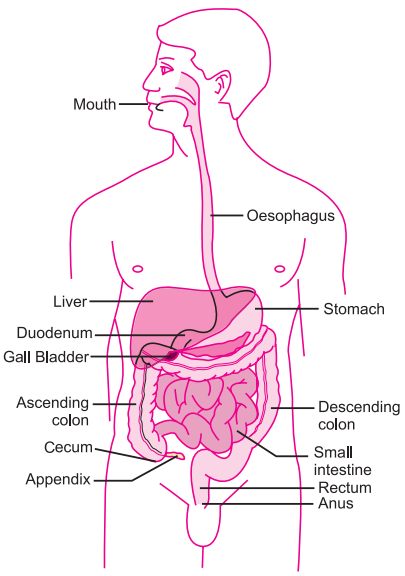
11. **Parasitic organisms** (plants and animals) live in the body or on the body of other organisms, called host and absorb their nutrition from them (total parasites).
12. **Partial parasites** in plants manufacture their own food with the help of chlorophyll present in their cells, but suck water and minerals from the body of the host. e.g., *Cuscuta*—(amar-bel)
13. **Photosynthesis** is a complex process involving light reaction and dark reaction in cells of green leaves. Light reaction occurs in chloroplast (grana of chloroplast) cells in presence of sunlight, water and CO_2, forming hydrogen and $NADPH_2$ and O_2 is released.
14. **Dark reaction** occurs in the absence of light in stroma of chloroplast.
15. **Photolysis** is the splitting of water into H^+ and OH^- ions by the use of some trapped light energy in chlorophyll.
16. **Photophosphorylation** is the formation of ATP from ADP with the help of energy of the excited chlorophyll molecule. It is an electron transport system.
17. **Nutrition** in *Amoeba* is holozoic.
18. **Pseudopodia** are finger-like projections of the body of *Amoeba* (protozoan) by which they engulf their food.
19. **Nutrition** in grasshopper is holozoic.
20. **Digestive system** of human consists of alimentary canal and its associated glands. The glands which are associated with the human digestive system are salivary glands, liver and pancreas.
21. **Saliva** is alkaline containing salivary amylase enzyme. Salivary amylase digests starch into maltose sugar.
22. **Gastric glands** are present in the wall of stomach secreting gastric juice. It contains pepsin (an enzyme for digesting the proteins), hydrochloric acid (HCl) and mucus.
23. **Intestinal glands** secrete intestinal juice containing enzymes lipase, trypsin, maltase, lactase and invertase.
24. **Pancreatic juice** secreted by pancreas contain enzyme amylase for digesting starch, trypsin for digesting proteins and lipase for digesting fats. Bile is secreted from liver and stored in gall bladder. It has no enzymes. Bile salts help in emulsification of fats in small intestine.
25. **Bile pigments** give colour to urine and faeces.
26. **Cellulose** digestion does not occur in humans.
27. **Human digestive system**



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28. Summary of enzymes involved in digestion

S. No.	Location	Enzyme	Function
1.	Mouth	Salivary amylase	Breaks down starch
2.	Stomach	Pepsin	Digests proteins
3.	Small Intestine	• Bile juice (secreted by liver) • Pancreatic juice (secreted by pancreas) (contains trypsin and lipase) • intestinal juice (contains many enzymes)	• Makes food alkaline and emulsified fat • digests proteins and emulsified fats • digests proteins, carbohydrates and fats

29. **Respiration** is the production of bio-energy in the form of ATP in living organisms.

30. Breakdown of complex high energy food molecules into simple low energy food molecules (CO_2 + H_2O) and release of energy.

31. **Respiration** is an energy releasing process, associated with all living organisms.

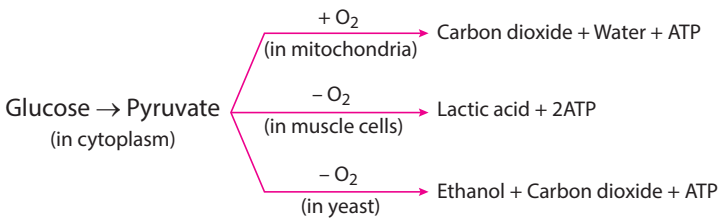
32. **Breathing** occurs only in animals and not in plants.

33. **Aerobic respiration:** It occurs in the presence of oxygen in most animals and plant, yielding very high energy. In aerobic respiration, the glucose is completely broken down into carbon dioxide and water by oxidation. It produces considerable amount of energy for use by the organism.

34. **Anaerobic respiration:** It occurs in the absence of oxygen. Food substances like glucose are not completely oxidised liberating less energy in tissue cells. It occurs in bacteria, yeast, fungi and internal animal parasites, etc.

35. **Fermentation** is a kind of anaerobic respiration. It is done by bacteria, yeast cell and alcohol or organic acids are produced. Wine and acetic acid (vinegar) are produced by fermentation of molasses and fruit juices, etc.

36. Summary of types of respiration



37. Differences Between Aerobic Respiration and Anaerobic Respiration

S.No.	Aerobic Respiration	Anaerobic Respiration
1.	It occurs in all living organisms, plants, animals and microbes.	It occurs only in some bacteria, fungi, germinating seeds, animal tissues, etc.
2.	Oxygen is used.	Oxygen is not required.
3.	Complete oxidation of food (glucose) occurs.	Incomplete oxidation of food occurs.
4.	Oxidation of one molecule of glucose produces CO_2, water and 38 ATP molecules.	Oxidation of one molecule of glucose produces carbon dioxide, alcohol and 2 ATP molecules.

38. **In animal's respiration** exchange of O_2 and CO_2 occurs by

(i) **Skin** (earthworms, aquatic insects, frogs, etc.)

(ii) **Air tubes or trachea** in grasshopper. Spiracles are tiny pores opening into air tubes, found on the lateral sides of body and open into trachea.

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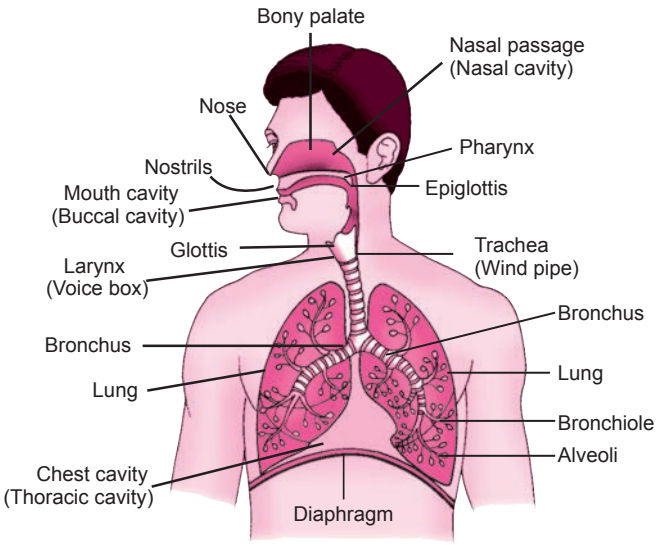
(*iii*) **Gills** are filamentous structures, found in fishes on lateral sides of head (pharynx) in pouches. These are found in 4, 5 or more pairs.

(*iv*) **Lungs** are found in most vertebrates except fishes. These are hollow bag-like (frog) or solid and spongy structures as found in man (mammals).

39. **Respiratory system** in man includes a pair of nostrils (external and internal), pharynx, larynx, trachea or wind pipe, two bronchi that enter into right and left lungs and each divide and re-divide to form bronchioles → alveolar ducts → atrium into which open alveoli.
40. **Alveoli** are tiny thin-walled balloon–like structures surrounded by blood capillaries.
41. **Larynx** is a box-like sound producing organ present at the tip of wind pipe. It is supported by cartilages. Sound is produced by vibrations of a pair of true vocal cords or ligaments.
42. **Epiglottis** guards opening of wind-pipe during swallowing of food.
43. **Pleura** is a pair of thin membranes covering each lung. In between these membranes is present the pleural cavity containing pleural fluid.
44. **Adam's apple** is an anterior elevation of larynx visible in the neck of an adult male person.
45. **Diaphragm** is a dome-shaped musculo-fibrous partition in between thorax and abdomen, just below the lungs. Its contraction and relaxation helps in breathing.
46. **Intercostal muscles** are externally and internally placed in between the ribs. Their rhythmic contraction helps in respiration, increases and decreases the volume of chest cavity (thoracic cavity).
47. **Inspiration:** Mechanism by which air moves into the lungs.
48. **Expiration:** Mechanism by which air is forced out of the lungs.
49. **Exchange** of gases (oxygen and carbon dioxide) occurs in the lungs in between the capillary blood and air present in the alveoli of lungs by diffusion.
50. **Exchange** of gases occurs due to concentration difference of gases in blood and alveolar air. Gases diffuses from higher concentration to lower concentration.
51. **Haemoglobin** is a respiratory pigment found in red blood cells of man and has high affinity for oxygen.
52. **Oxygen** with haemoglobin forms oxyhaemoglobin which dissociates into oxygen and haemoglobin present in cells.
53. CO_2 is transported from cells to lungs alveoli from where it is expelled outside the body.
54. **Breathing** is involuntary, its rate is controlled by respiratory centre located in brain (pons and medulla).
55. **Respiratory system of humans**



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56. **Blood** is a fluid connective tissue.
57. **Blood** is composed of slightly pale transparent plasma in which cells are suspended.
58. **Blood corpuscles** are of two types: Red blood corpuscles (erythrocytes), white blood corpuscles (leucocytes), and platelets (Thrombocytes).
59. **Plasma** contains about 90 percent water, plasma proteins, mineral salts, nutrient materials, nitrogenous waste products, hormones, enzymes and gases, etc.
60. **Red blood corpuscles** of human are spherical, biconcave and non-nucleated. Life span is of 120 days. They contain haemoglobin. They carry O_2 and also some CO_2.
61. **Human heart** has four chambers *i.e.* 2 auricles and 2 ventricles.
62. **Right auricle** is larger and receives deoxygenated blood.
63. **Aorta** arises from left ventricle and distributes oxygenated blood to entire body.
64. **Pulmonary aorta** arises from right ventricle carrying deoxygenated blood to lungs.
65. **Blood circulation** is closed in human and flows in definite channels.
66. **Chordae tendinae** are cord-like structures connecting the valves with the inner wall of ventricles (papillary muscles).
67. **Cardiac cycle** or heart cycle or heart beat is composed of a systole and a diastole.
68. **Systole** is contraction of heart chambers.
69. **Diastole** is relaxation of heart chambers. Both systole and diastole occur alternately. Heart beat of an adult is 72 to 80 per minute.
70. **Differences Between Arteries and Veins**

S.No.	Characteristics	Arteries	Veins
1.	Direction of blood flow	Blood flows from heart to body organs.	Blood flows from body organs to the heart
2.	Nature of blood	Oxygenated, except pulmonary arteries.	Deoxygenated, except pulmonary veins.
3.	Pressure and speed	Blood flows under high pressure with a high speed.	Blood flows under low pressure and with a low speed.
4.	Wall	Wall is thick, more elastic and non-collapsible.	Wall is thin, less elastic and is collapsible.
5.	Lumen	Narrow	Wide
6.	Position	Mostly located in deeper part of the body.	Mostly located close to the skin.
7.	Valves	Internal valves are absent.	Have internal semilunar valves to prevent a back flow of blood.
8.	Colour	Appear pink in colour.	Appear dark red in colour.
9.	Blood Volume	About 15% of blood at any given time.	About 64% of blood at any given time.
10.	After death	Become empty.	Contain blood.

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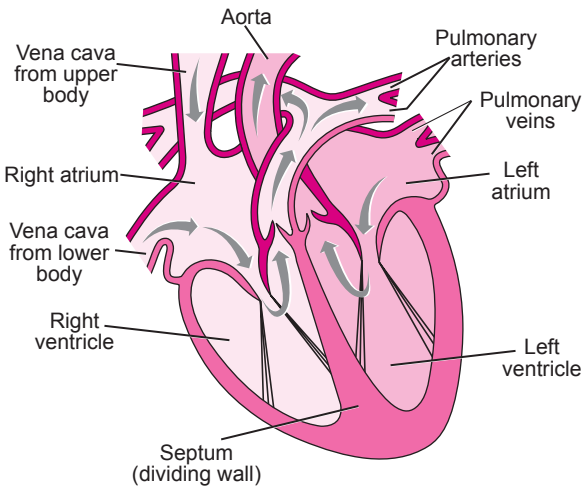
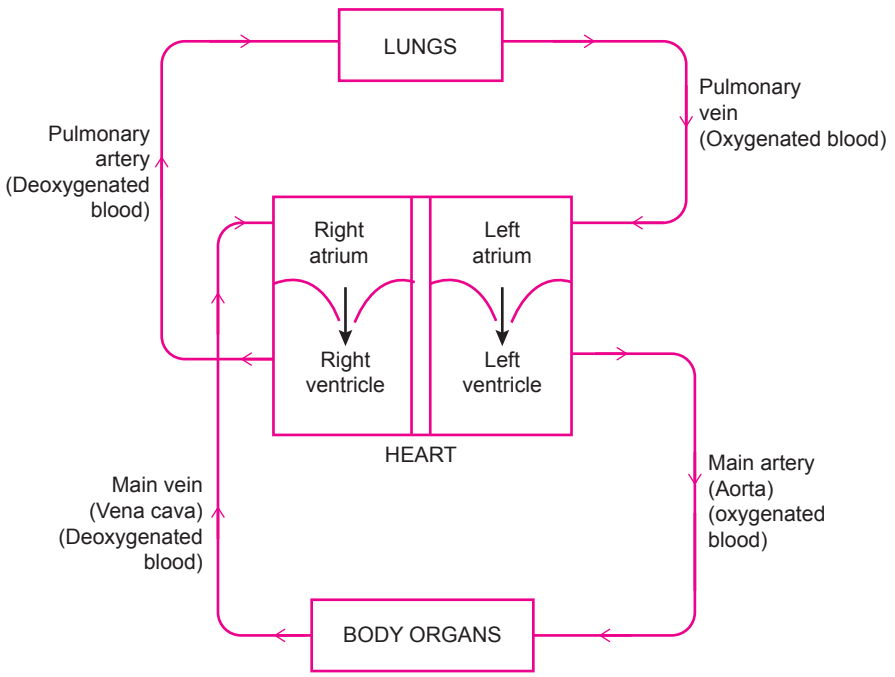
71. Internal structure of heart



72. Process of double circulation



73. **Arteries** are thick-walled elastic vessels carrying oxygenated blood from the heart to various parts of the body. (Exception: Pulmonary artery, as it carries deoxygenated blood)

74. **Veins** are thin-walled vessels with large lumen that bring deoxygenated blood back from entire body to the heart. (Exception: Pulmonary vein, as it carries oxygenated blood)

75. **Capillaries** are formed of single layer of cells and are permeable to gases, digested food, etc.

76. **Lymph** is like blood plasma, but colourless and contains less protein.

77. **Lymph nodes** are found in lymph vessels and are formed of lymphatic tissue.

78. **Lymph** is filtered in lymph nodes from micro-organisms, phagocytes and damaged cells.

79. **Lymphocytes,** antibodies and antitoxins are produced in lymph nodes.

80. **Excretion** is the process of elimination of harmful metabolic wastes from the body.

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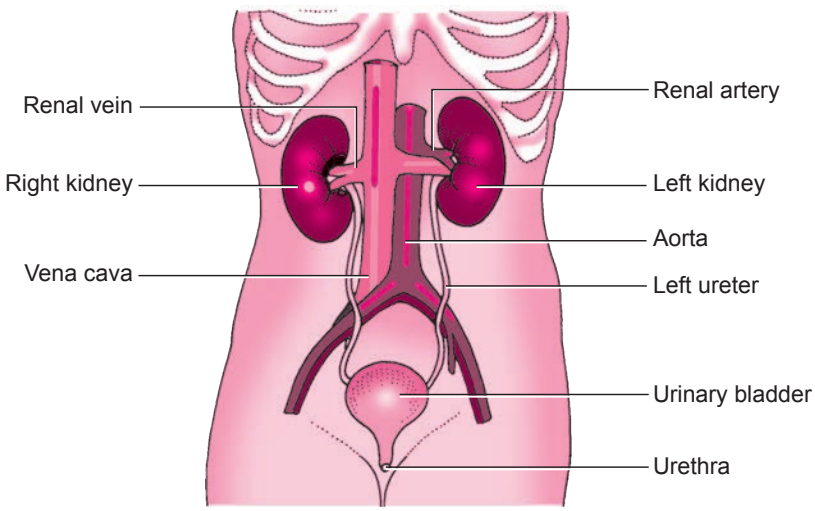
81. **Kidney** is the excretory organ for the elimination of excess water, salts, urea, etc., not needed by the body or harmful to the body.
82. **Nitrogenous excretory wastes** are ammonia, uric acid and urea.
83. **Excretory organs in humans** are a pair of kidneys located in the upper back part of abdomen.
84. **Kidney** is bean-shaped. Inner depression of kidney is hilum or hilus.
85. **Ureter** arises from the hilus. Artery and Vein enter and arises from the hilus part.
86. Kidney has two regions, outer cortex and inner medulla.
87. Functional unit of kidney is **nephron** or **uriniferous tubule**.
88. A nephron has a coiled or convoluted urinary tubule consists of proximal and distal convoluted tubule and U-shaped loop of Henle.
89. A double-walled cup, called Bowman's capsule with enclosed blood capillaries network together constitute the glomerulus.
90. **Glomerulus** is formed of the capillaries of afferent renal arteriole and efferent renal arteriole (branches of renal artery).
91. **Blood** enters glomerulus through afferent renal arteriole and leaves through efferent renal arteriole. Diameter of afferent renal arteriole is more than that of efferent renal arteriole. Blood flows slowly under great pressure in the efferent renal arteriole.
92. **Ultrafiltration,** *i.e.*, filtration of blood occurs in Bowman's capsule. Filtrate contains water, urea, glucose, amino acids, sodium, potassium, uric acid and creatinine, etc.
93. **Selective reabsorption** occurs in the entire long uriniferous tubule. Most of the water, glucose, amino acids and salts are reabsorbed. Besides, sodium and chloride ions, etc., are also reabsorbed.
94. **Tubular secretion** of ammonia, potassium, creatinine, hydrogen ions and hippuric acid, etc., occurs in proximal convoluted tubule.
95. **Osmoregulation** is the maintenance of optimum concentration of water and salts in the body fluids.
96. **Isotonic:** Concentration of body fluid and that of surrounding medium is equal.
97. **Hypotonic:** Body fluid concentration is lower than that of surrounding medium.
98. **Hypertonic:** Body fluid concentration is higher than that of surrounding medium.
99. **Human Excretory System**



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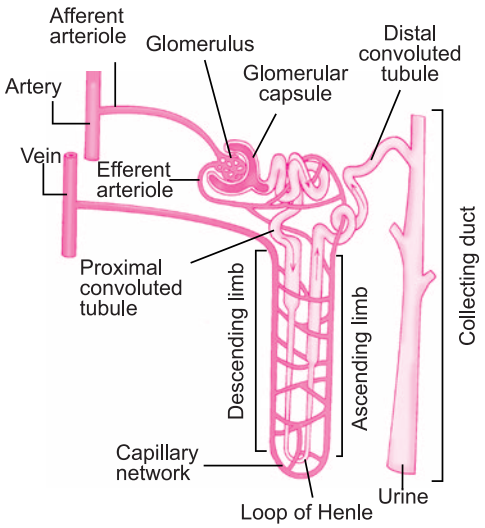
100. A single nephron and its blood supply



MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. The green colour of plants is due to the presence of

(*a*) chlorophyll (*b*) carotene
(*c*) xanthophyll (*d*) starch

2. During respiration exchange of gases take place in [*NCERT Exemplar*]

(*a*) trachea and larynx (*b*) alveoli of lungs
(*c*) alveoli and throat (*d*) throat and larynx

3. The correct sequence of anaerobic reactions in yeast is [*NCERT Exemplar*]

(*a*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate $\xrightarrow{\text{Mitochondria}}$ Ethanol + Carbon dioxide
(*b*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate $\xrightarrow{\text{Cytoplasm}}$ Lactic acid
(*c*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate $\xrightarrow{\text{Mitochondria}}$ Lactic acid
(*d*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate $\xrightarrow{\text{Cytoplasm}}$ Ethanol + Carbon dioxide

4. In which of the following vertebrate group/groups, heart does not pump oxygenated blood to different parts of the body? [*NCERT Exemplar*]

(*a*) Pisces and amphibians (*b*) Amphibians and reptiles
(*c*) Amphibians only (*d*) Pisces only

5. Blood from superior vena cava flows into

(*a*) right atrium (*b*) right ventricle (*c*) left atrium (*d*) left ventricle

6. Which is the first enzyme to mix with food in the digestive tract? [*NCERT Exemplar*]

(*a*) Pepsin (*b*) Cellulase (*c*) Amylase (*d*) Trypsin

7. In which part of the alimentary canal food is finally digested? [*NCERT Exemplar*]

(*a*) Stomach (*b*) Mouth cavity (*c*) Large intestine (*d*) Small intestine

8. When air is blown from mouth into a test-tube containing lime water, the lime water turned milky due to the presence of [*NCERT Exemplar*]

(*a*) oxygen (*b*) carbon dioxide
(*c*) nitrogen (*d*) water vapour

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9. Choose the correct path of urine in our body. [*NCERT Exemplar*]

(*a*) Kidney → ureter → urethra → urinary bladder

(*b*) Kidney → urinary bladder → urethra → ureter

(*c*) Kidney → ureter → urinary bladder → urethra

(*d*) Urinary bladder → kidney → ureter → urethra

10. The internal (cellular) energy reserve in autotrophs is [*NCERT Exemplar*]

(*a*) glycogen (*b*) protein (*c*) starch (*d*) fatty acid

11. Which is the correct sequence of parts in human alimentary canal? [*NCERT Exemplar*]

(*a*) Mouth → stomach → small intestine → oesophagus → large intestine

(*b*) Mouth → oesophagus → stomach → large intestine → small intestine

(*c*) Mouth → stomach → oesophagus → small intestine → large intestine

(*d*) Mouth → oesophagus → stomach → small intestine → large intestine

12. If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected? [*NCERT Exemplar*]

(*a*) Proteins breaking down into amino acids

(*b*) Starch breaking down into sugars

(*c*) Fats breaking down into fatty acids and glycerol

(*d*) Absorption of vitamins

13. A few drops of iodine solution were added to rice water. The solution turned blue-black in colour. This indicates that rice water contains [*NCERT Exemplar*]

(*a*) complex proteins (*b*) simple proteins (*c*) fats (*d*) starch

14. Which of the following is most appropriate for aerobic respiration? [*NCERT Exemplar*]

(*a*) Glucose $\xrightarrow{\text{Mitochondria}}$ Pyruvate $\xrightarrow{\text{Cytoplasm}}$ $CO_2 + H_2O$ + Energy

(*b*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate $\xrightarrow{\text{Mitochondria}}$ $CO_2 + H_2O$ + Energy

(*c*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate + Energy $\xrightarrow{\text{Mitochondria}}$ $CO_2 + H_2O$

(*d*) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate + Energy $\xrightarrow{\text{Mitochondria}}$ $CO_2 + H_2O$ + Energy

15. Single circulation, *i.e.*, blood flows through the heart only once during one cycle of passage through the body, is exhibited by [*NCERT Exemplar*]

(*a*) *Labeo*, Chameleon, Salamander (*b*) Hippocampus, Exocoetus, *Anabas*

(*c*) *Hyla, Rana, Draco* (*d*) Whale, Dolphin, Turtle

16. Lack of oxygen in muscles often leads to cramps among cricketers. This results due to [*NCERT Exemplar*]

(*a*) conversion of pyruvate to ethanol (*b*) conversion of pyruvate to glucose

(*c*) non conversion of glucose to pyruvate (*d*) conversion of pyruvate to lactic acid

17. The opening and closing of the stomatal pore depends upon [*NCERT Exemplar*]

(*a*) oxygen (*b*) temperature

(*c*) water in guard cells (*d*) concentration of CO_2 in stomata

18. The inner lining of stomach is protected by one of the following from hydrochloric acid. Choose the correct one. [*NCERT Exemplar*]

(*a*) Pepsin (*b*) Mucus (*c*) Salivary amylase (*d*) Bile

19. Rings of cartilage present in the throat ensure that

(*a*) air is filtered (*b*) air is at room temperature

(*c*) air passage does not collapse (*d*) air is free of microbes

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20. Which of the following organisms absorbs nutrition with haustoria?

(*a*) A carnivore (*b*) A herbivore (*c*) A parasite (*d*) A saprophyte

21. The process by which *Amoeba* obtains food is called

(*a*) phagocytosis (*b*) assimilation (*c*) diffusion (*d*) absorption

22. Which of the following is not a digestive enzyme contained in the pancreatic juice?

***(i)* Lipase** ***(ii)* Hydrochloric acid**

***(iii)* Mucus** ***(iv)* Trypsin**

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iv*) (*c*) (*ii*) and (*iii*) (*d*) (*i*) and (*iii*)

23. The enzymes pepsin and trypsin are secreted respectively by

(*a*) stomach and pancreas (*b*) salivary gland and stomach

(*c*) liver and pancreas (*d*) liver and salivary gland

24. Among the following choose the correct option which includes the organisms that have a holozoic mode of nutrition:

(*a*) *Plasmodium* and *Amoeba* (*b*) Parakeet and *Amoeba*

(*c*) *Paramecium* and *Plasmodium* (*d*) *Paramecium* and Parasite

25. Raw materials required in the autotrophic mode of nutrition involves:

***(i)* Carbon dioxide and water** ***(ii)* Chlorophyll**

***(iii)* Nitrogen** ***(iv)* Sunlight**

(*a*) (*i*), (*ii*) and (*iii*) (*b*) (*i*) and (*ii*) (*c*) (*i*), (*ii*) and (*iv*) (*d*) All (*i*), (*ii*), (*iii*) and (*iv*)

26. The enzymes in pancreatic juice help in the digestion of

(*a*) fats and carbohydrates (*b*) proteins and fats

(*c*) proteins and carbohydrates (*d*) proteins, fats and carbohydrates

27. Which of the following help in protecting the inner lining of the stomach from the harmful effect of hydrochloric acid?

(*a*) Mucus (*b*) Pepsin (*c*) Trypsin (*d*) Bile

28. Sometimes we get painful cramps in our leg muscles after running for a long time due to the accumulation of

(*a*) hydrochloric acid (*b*) fat (*c*) carbon dioxide (*d*) lactic acid

29. The vein which brings clean blood from the lungs into the heart is known as

(*a*) pulmonary vein (*b*) hepatic vein

(*c*) superior vena cava (*d*) pulmonary artery

30. Movement of the synthesized products from the leaves to the roots and other parts of a plant's body takes place through the phloem. This process is known as

(*a*) translocation (*b*) transpiration (*c*) transportation (*d*) excretion

31. During deficiency of oxygen in tissues of human beings, pyruvic acid is converted into lactic acid in the **[*NCERT Exemplar*]**

(*a*) cytoplasm (*b*) chloroplast (*c*) mitochondria (*d*) golgi body

32. Which among the following procedures is used for cleaning the blood of a person by separating the waste substance from it?

(*a*) Kidney transplant (*b*) Blood transfusion

(*c*) Dialysis (*d*) Hydrolysis

33. The excretory unit of the human excretory system is known as

(*a*) nephridia (*b*) neuron (*c*) nephron (*d*) kidneys

34. Plants use the energy stored in ATP to accomplish the process of transportation of

(*a*) water and minerals (*b*) oxygen

(*c*) water, minerals and food (*d*) food

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35. Which among the following is necessary to carry out the blood coagulation in a cut or wound?

(*a*) White blood cells (*b*) Blood plasma (*c*) Platelets (*d*) Red blood cells

36. Arteries and veins are connected by a network of extremely narrow tubes called

(*a*) sieve tubes (*b*) capillaries (*c*) vena cava (*d*) valves

37. Which of the following are energy foods?

(*a*) Carbohydrates and fats (*b*) Proteins and mineral salts

(*c*) Vitamins and minerals (*d*) Water and roughage

38. In which mode of nutrition an organism derives its food from the body of another living organism without killing it?

(*a*) Saprotrophic nutrition (*b*) Parasitic nutrition

(*c*) Holozoic nutrition (*d*) Autotrophic nutrition

39. The mode of nutrition found in fungi is

(*a*) parasitic nutrition (*b*) holozoic nutrition

(*c*) autotrophic nutrition (*d*) saprotrophic nutrition

40. Roots of the plants absorb water from the soil through the process of

(*a*) diffusion (*b*) transpiration (*c*) osmosis (*d*) none of these

41. The site of photosynthesis in the cells of a leaf is

(*a*) chloroplast (*b*) mitochondria (*c*) cytoplasm (*d*) protoplasm

42. In *Amoeba*, food is digested in the

(*a*) food vacuole (*b*) mitochondria (*c*) pseudopodia (*d*) chloroplast

43. Which region of the alimentary canal absorbs the digested food?

(*a*) Stomach (*b*) Small intestine (*c*) Large intestine (*d*) Liver

44. The contraction and expansion movement of the walls of the food pipe is called

(*a*) translocation (*b*) transpiration

(*c*) peristaltic movement (*d*) digestion

45. The exit of unabsorbed food material is regulated by

(*a*) liver (*b*) anus (*c*) small intestine (*d*) anal sphincter

46. What are the products obtained by anaerobic respiration in plants?

(*a*) Lactic acid + Energy (*b*) Carbon dioxide + Water + Energy

(*c*) Ethanol + Carbon dioxide + Energy (*d*) Pyruvate

47. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in

(*a*) cytoplasm (*b*) mitochondria (*c*) chloroplast (*d*) nucleus

48. Glycolysis process occurs in which part of the cell?

(*a*) Cytoplasm (*b*) Nucleus (*c*) Mitochondria (*d*) Chloroplast

49. Name the substances whose build up in the muscles during vigorous physical exercise may cause cramps?

(*a*) Ethanol + Carbon dioxide + Energy (*b*) Lactic acid + Energy

(*c*) Carbon dioxide + Water + Energy (*d*) Pyruvate

50. Name the pores in a leaf through which respiratory exchange of gases takes place.

(*a*) Lenticels (*b*) Vacuoles (*c*) Xylem (*d*) Stomata

51. The respiratory pigment in human beings is

(*a*) carotene (*b*) chlorophyll (*c*) haemoglobin (*d*) mitochondria

52. Which plant tissue transports water and minerals from the roots to the leaf?

(*a*) Xylem (*b*) Phloem (*c*) Parenchyma (*d*) Collenchyma

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53. A blood vessel which pumps the blood from the heart to the entire body is called

(*a*) artery (*b*) capillary (*c*) vein (*d*) haemoglobin

54. Name a circulatory fluid in the human body other than blood.

(*a*) Platelets (*b*) RBC (*c*) Lymph (*d*) Plasma

55. Name the tube which connects the kidneys to the urinary bladder.

(*a*) Urethra (*b*) Nephron (*c*) Tubule (*d*) Ureter

56. Which part of nephron allows the selective reabsorption of useful substances like glucose, amino acids, salts and water into the blood capillaries?

(*a*) Tubule (*b*) Glomerulus (*c*) Bowman's capsule (*d*) Ureter

57. Where is the dirty blood in our body filtered?

(*a*) Heart (*b*) Lungs (*c*) Ureter (*d*) Kidneys

58. Autotrophic organisms include

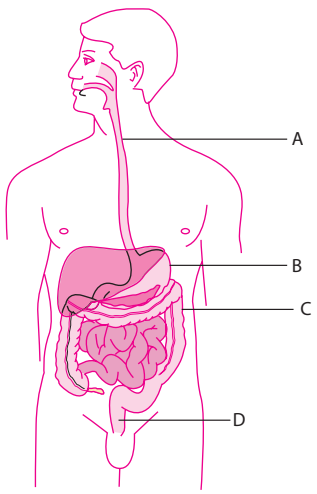
(*a*) bacteria and virus (*b*) bacteria and fungi

(*c*) green plants and some bacteria (*d*) green plants and all bacteria

59. Which of the following are chiefly digested in the stomach?

(*a*) Carbohydrates (*b*) Proteins (*c*) Lipids (*d*) Fats

60. From the given picture of the digestive system, identify the part labelled as gastric gland.



(*a*) A (*b*) B (*c*) C (*d*) D

61. Large intestine in man mainly carries out

(*a*) absorption of water (*b*) assimilation

(*c*) digestion of fats (*d*) digestion of carbohydrates

62. The part of the digestive system where no digestion takes place is

(*a*) ileum (*b*) stomach (*c*) mouth (*d*) oesophagus

63. The fermentation of glucose by yeast normally yields

(*a*) alcohol, CO_2 and 36 ATP (*b*) CO_2, H_2O and 36 ATP

(*c*) alcohol, CO_2 and 2 ATP (*d*) lactic acid, CO_2 and 2 ATP

64. A large quantity of one of the following is removed from our body by lungs?

(*a*) CO_2 and H_2O (*b*) CO_2 only (*c*) H_2O only (*d*) Ammonia

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65. In respiration, air passes through

(*a*) Pharynx → nasal cavity → larynx → trachea bronchi → bronchioles

(*b*) Nasal cavity → pharynx → larynx → trachea → bronchi → bronchioles

(*c*) Larynx → nasal cavity → pharynx → trachea

(*d*) Larynx → pharynx → trachea → lungs

66. A biochemical compound that readily combines with oxygen and distributes it throughout the human body is

(*a*) water (*b*) urea (*c*) haemoglobin (*d*) acetylcholine

67. The process in which loss of water takes place in the form of water vapour through stomata is called

(*a*) transportation (*b*) transpiration (*c*) guttation (*d*) translocation

68. In a closed circulatory system, blood is completely enclosed within

(*a*) vessels (*b*) heart (*c*) skeleton (*d*) sinuses

69. Normal blood pressure (systolic/diastolic) is

(*a*) 120/80 mm of Hg (*b*) 160/80 mm of Hg

(*c*) 120 60 mm of Hg (*d*) 180/80 mm of Hg

70. Blood pressure is measured by an instrument called

(*a*) barometer (*b*) sphygmomanometer (*c*) photometer (*d*) manometer

71. Which of the following statements is not correct?

(*a*) Deoxygenated blood is poured into right atrium of heart.

(*b*) The excretory units of flatworms are flame cells.

(*c*) Human kidney has about 1 million nephridia.

(*d*) Tracheids and vessels are non-living conducting tissues.

72. The chlorophyll in photosynthesis is used for

(*a*) absorbing light (*b*) breaking down water molecule

(*c*) no function (*d*) reduction of CO_2

73. Proteins after digestion are converted into

(*a*) carbohydrates (*b*) small globules (*c*) amino acids (*d*) starch

74. Carbohydrates in the plants are stored in the form of

(*a*) glycogen (*b*) starch (*c*) glucose (*d*) maltose

75. Opening and closing of pores is a function performed by

(*a*) stomata (*b*) chlorophyll (*c*) chloroplast (*d*) guard cells

76. Which element is used in the synthesis of proteins?

(*a*) Hydrogen (*b*) Oxygen (*c*) Nitrogen (*d*) Carbon dioxide

77. Temporary finger like extensions on *Amoeba* are called

(*a*) cell membrane (*b*) cell wall (*c*) pseudopodia (*d*) cilia

78. Bile juice is secreted by

(*a*) stomach (*b*) pancreas (*c*) small intestine (*d*) liver

79. Which of these juices is secreted by pancreas?

(*a*) Trypsin (*b*) Pepsin (*c*) Bile juice (*d*) Both (*a*) and (*b*)

80. Lipase acts on

(*a*) amino acids (*b*) fats (*c*) carbohydrates (*d*) all of these

81. Blood consist of what fluid medium?

(*a*) Lymph (*b*) Platelets (*c*) Plasma (*d*) All of these

82. One cell-thick vessels are called

(*a*) arteries (*b*) veins (*c*) capillaries (*d*) pulmonary artery

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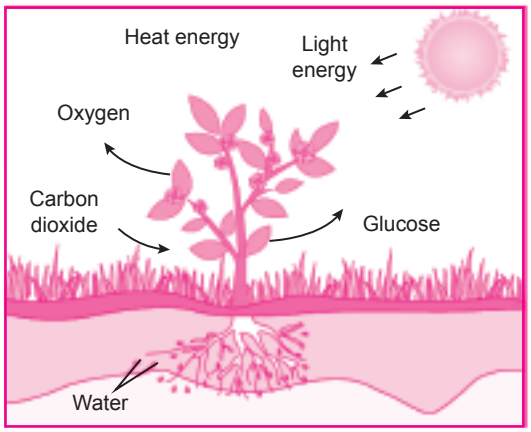
83. The image shows the process of making food by a plant.

Which statement can be concluded from the image?



(*a*) Plants absorb CO_2 from air and H_2O from the soil as raw materials and convert them into glucose.

(*b*) Plants absorb O_2 from air and minerals from the soil as raw materials and convert them into heat energy.

(*c*) Plants absorb O_2 from air and glucose from the soil as raw materials and convert them into light energy.

(*d*) Plants absorb CO_2 from the soil and H_2O from air as raw materials and convert them into glucose.

84. A student sets up an experiment to study the importance of nutrition in plants. The student takes 2 pots, pot 1 and pot 2 each with the same healthy plant. Both the pots were placed in the garden and watered properly. Pot 1 was kept as such, while pot 2 was kept in an air tight glass box with caustic soda. Caustic soda absorbs carbon dioxide present in the surrounding. After 2 days, the student observes that the plant kept in the garden is healthy while the plant placed in container shed leaves and droops. What is the likely reason for this observation?

(*a*) Absence of oxygen for survival

(*b*) Absorption of light by caustic soda restricting growth

(*c*) Inability to perform photosynthesis

(*d*) Lack of nutrients in the soil

85. Which of the equation show correct conversion of CO_2 and H_2O into carbohydrates in plants?

(*a*) $6CO_2 + 12H_2O \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} C_6H_{12}O_6 + C_6H_{12}O_6 + 6O_2 + 6H_2O$ (Glucose)

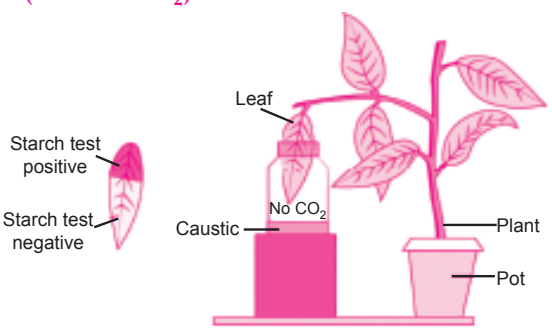
(*b*) $6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 12H_2O$ (Glucose)

(*c*) $6CO_2 + 12H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$ (Glucose)

(*d*) $6CO_2 + 6H_2O \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} C_6H_{12}O_6 + C_6H_{12}O_6 + 6O_2 + 12H_2O$ (Glucose)

86. A student sets up an experiment to study the photosynthesis in plants. The student destarched a potted plant by keeping it in a dark room for 3 days. Half of the portion of destarched leaf was placed in a bottle containing caustic potash (absorbs CO_2) as shown.

The student then places the plant in light and tests the leaf after 5 hours for the presence of starch. The portions inside the bottle shows negative starch test by reflecting no change in colour when react with iodine, however, other upper portions of the leaf gave positive starch test showing blue-black colour with iodine. What can be evaluated from this experiment?



(*a*) Lack of carbon dioxide increases amount of starch in plant.

(*b*) Carbon dioxide is necessary for preparing carbohydrate.

(*c*) Carbon dioxide is directly linked with the colour of leaf.

(*d*) Lack of carbon dioxide slows the process of photosynthesis.

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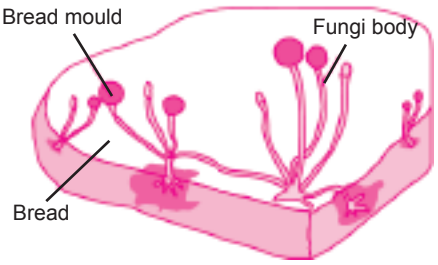
87. The image shows the bread moulds on a bread. How these fungi obtain nutrition?



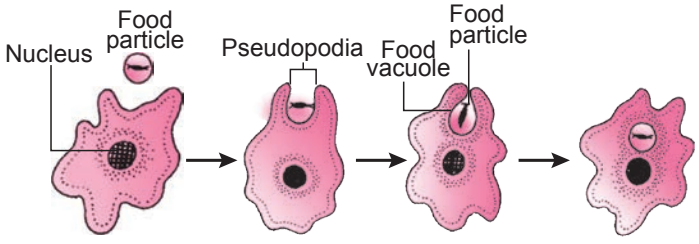
(*a*) By using nutrients from the bread to prepare their own food.

(*b*) By allowing other organisms to grow on the bread and then consuming them.

(*c*) By breaking down the nutrients of bread and then absorbing them.

(*d*) By eating the bread on which it is growing.

88. The image shows how *Amoeba* obtains nutrition.



How this process is advantageous for *Amoeba*?

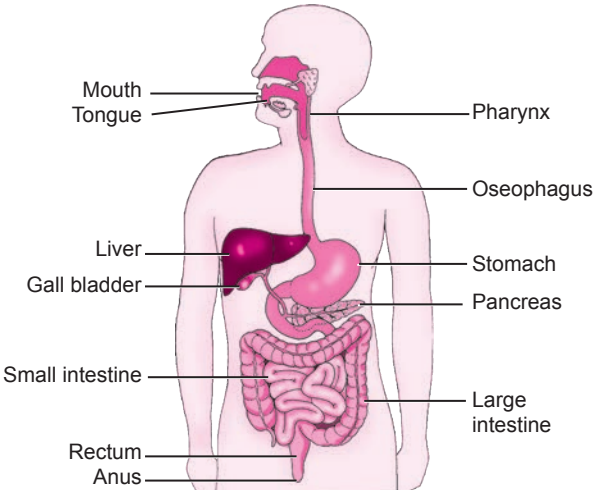
(*a*) Capturing of food takes less time.

(*b*) More amount of food can be consumed.

(*c*) Complex food can be digested easily.

(*d*) Fast distribution of nutrition within the body.

89. The image shows the human digestive system.



Digestion of food starts from which organ of the digestive system?

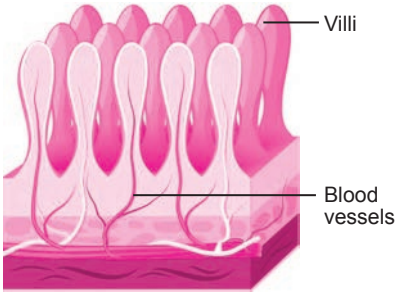
(*a*) Mouth due to the presence of saliva.

(*b*) Pancreas that releases juices for fat breakdown.

(*c*) Oesophagus that moves the food in gut.

(*d*) Stomach which helps in mixing food with digestive juices.

90. The image shows a cross section of small intestine.



What will be the likely happen if the number of villi increases in the intestine?

(*a*) Increase in the absorption of food.

(*b*) Fast breakdown of larger food particles into smaller ones.

(*c*) Increase in flow of blood in the small intestine.

(*d*) Fast elimination of waste from the body.

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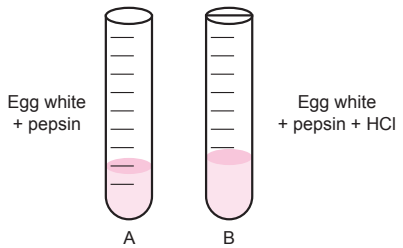
91. An incomplete equation for the digestion of starch using saliva is shown as:
Saliva + Starch (in test tube) →
What will be the likely outcome of this?

(*a*) Saliva will breakdown starch into simple protein molecules.
(*b*) Saliva will convert starch into complex fat molecules.
(*c*) Saliva will breakdown starch into simple sugar molecules.
(*d*) Saliva will convert starch into complex sugar molecules.

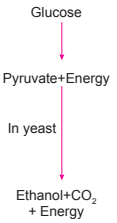
92. A student sets up an experiment to study the role of enzymes in digestion of food.



In which test tube, the digestion of protein will occur?

(*a*) Test tubes A as pepsin will breakdown protein into simple molecules.
(*b*) Test tube B as HCl will breakdown protein into simple molecules.
(*c*) Test tube A as pepsin will breakdown into simple molecules.
(*d*) Test tube B as HCl will activate pepsin for breakdown of protein into simple molecules.

93. The image shows the flow diagram for the breakdown of glucose in yeast. Under which condition these types of products are obtained?



(*a*) In the presence of carbon dioxide
(*b*) In the absence of oxygen
(*c*) In the presence of oxygen
(*d*) In the absence of carbon dioxide

94. Which pathway will occur in the cell of an athlete who is performing 100 m sprint?

(*a*) Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate $\xrightarrow{\text{Absence of oxygen}}$ Ethanol + CO_2 + Energy

(*b*) Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate $\xrightarrow[\text{(in human muscle cells)}]{\text{Lack of oxygen}}$ Lactic acid + Energy

(*c*) Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate
- $\xrightarrow[\text{(in human muscle cells)}]{\text{Lack of oxygen}}$ Lactic acid + Energy
- $\xrightarrow[\text{(in mitochondria)}]{\text{Prsence of oxygen}}$ CO_2 + Water + Energy

(*d*) Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate
- $\xrightarrow[\text{(in human muscle cells)}]{\text{Lack of oxygen}}$ Lactic acid + Energy
- $\xrightarrow{\text{Absence of oxygen}}$ Ethanol + CO_2 + Energy

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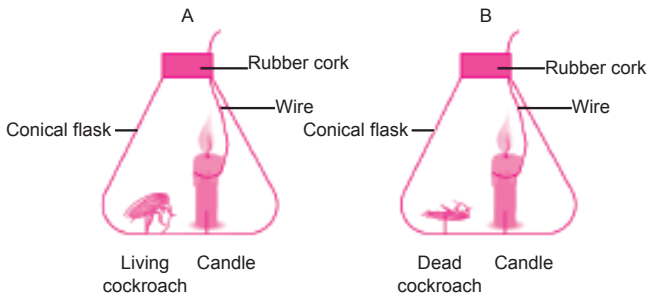
95. A student setup an experiment to study the human respiratory system. In the experiment, the student places candle and a living cockroach in the flask A, while a candle and a dead cockroach in flask B. The burning of candle needs oxygen.

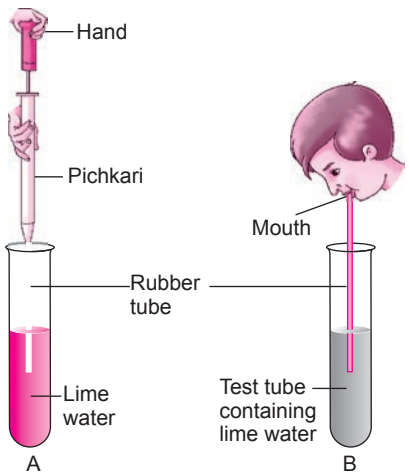


After 10 minutes, the student observes that the candle in flask A extinguish faster while candle in flask B keeps burning for a longer time. What can be evaluated from this experiment?

(*a*) Water vapours produced by living beings prevents burning of candle.
(*b*) Living beings consumes oxygen during respiration.
(*c*) Burning of candle decreases the life span of cockroach.
(*d*) Candle produces high amount of carbon dioxide.

96. A student sets up an experiment to study human respiration using lime water, test tube and a straw. Lime water is colourless in the absence of CO_2 and is milky in its presence. The student fills a freshly prepared limewater in a test tube and blows air through straw into the limewater. It was observed that the solution turns cloudy as shown.

What can be evaluated from this observation?



(*a*) Oxygen is exhaled during respiration.
(*b*) Water vapours are produced during respiration.
(*c*) Carbon dioxide is exhaled during respiration.
(*d*) Glucose is produced during respiration.

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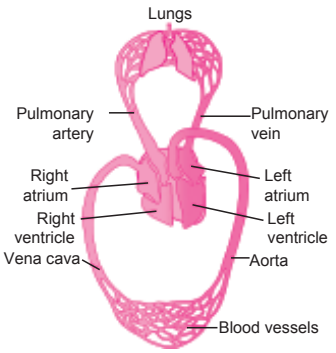
97. The image shows the transport of gases in body through heart and lungs.



Which option correctly shows the transport of oxygen to the cell?

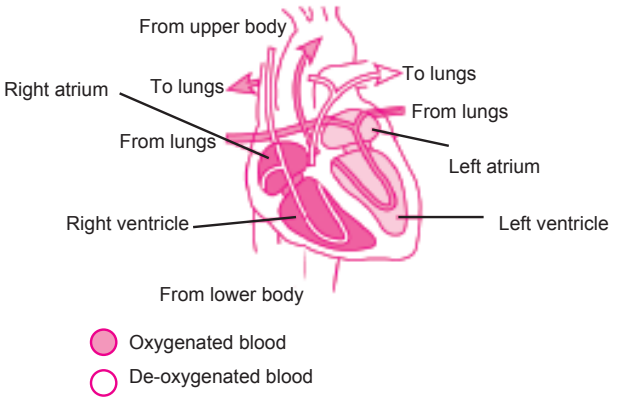
(*a*) Lungs → pulmonary vein → left atrium → left ventricle → aorta → body cells.

(*b*) Lungs → pulmonary artery → right atrium → right ventricle → vena cava → body cells.

(*c*) Lungs → pulmonary artery → left atrium → left ventricle → vena cava → body cells.

(*d*) Lungs → pulmonary vein → right atrium → right ventricle → aorta → body cells.

98. The image shows oxygenated and de-oxygenated blood in the human heart.



What is the direction of deoxygenated blood from right ventricle of the heart?

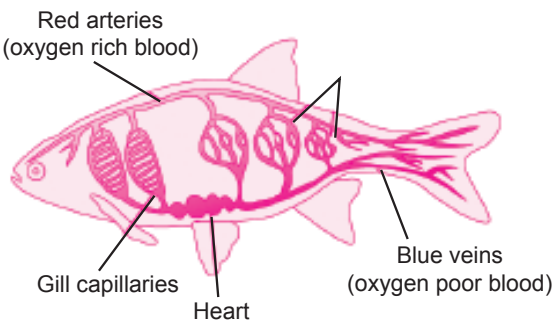
(*a*) towards the lungs.

(*b*) towards the left atrium of heart.

(*c*) towards the upper body.

(*d*) towards the lower body.

99. The image shows the circulation of blood in fishes.



Which option correctly traces the pathway of blood flow in fish body?

(*a*) Capillaries → heart → oxygenated blood → body cells → deoxygenated blood → heart → gills.

(*b*) Gill capillaries → oxygenated blood → body cells → deoxygenated blood → heart → gills.

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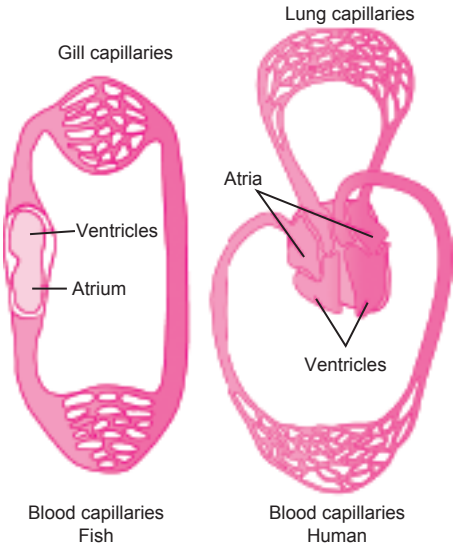
(*c*) Gill capillaries → oxygenated blood → heart → body cells → deoxygenated blood → heart → gills.

(*d*) Gill capillaries → oxygenated blood → heart → body cells → deoxygenated blood → gills.

100. The image shows the circulation of blood in fishes and humans.



How is the circulation of blood in fish different from that in humans?

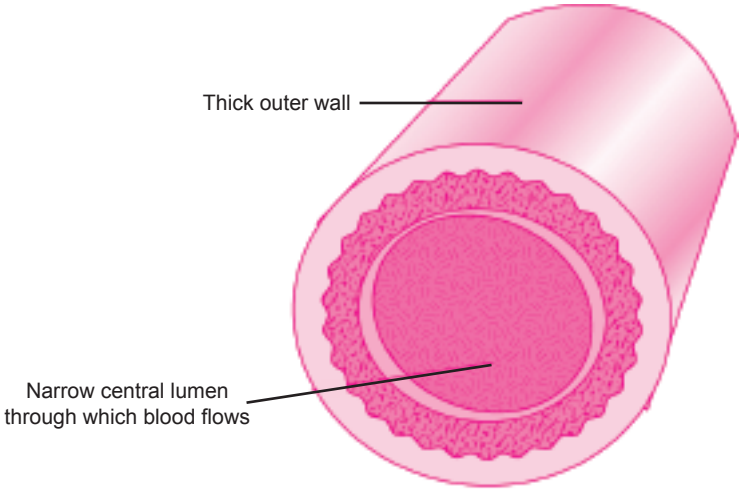
(*a*) The flow of blood in fish is unidirectional.

(*b*) The heart of fish has more chambers compared to that of a human.

(*c*) The blood goes through heart only once in fishes.

(*d*) The heart in fish is bigger in size.

101. The image shows the structure of an artery.



Which statement supports the likely reason for thick walls in arteries?

(*a*) To sustain the high-pressure blood from the heart.

(*b*) To carry large amount of blood.

(*c*) To ensure blood flows in only one direction.

(*d*) To allow easy exchange of gases with cells.

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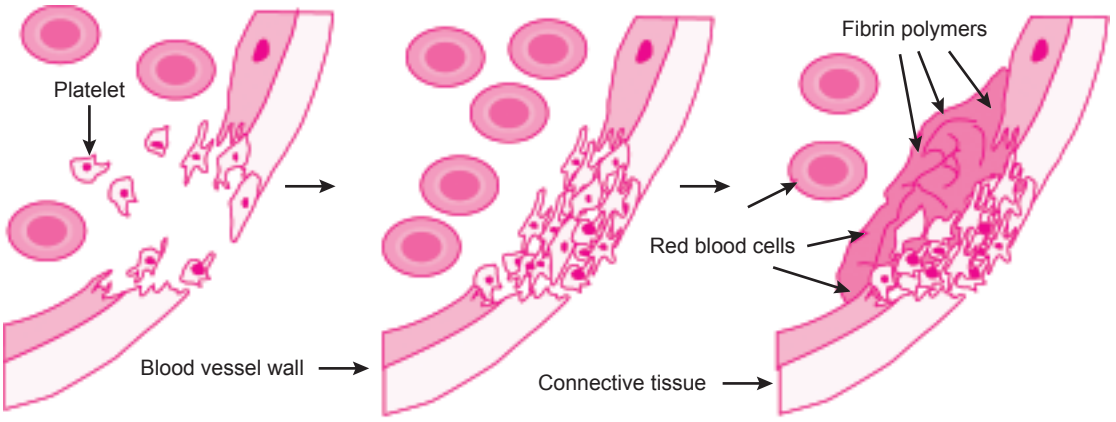
102. The image shows the healing of a wound.



Based on the image, what explains the process?

(*a*) Platelets form clot by plugging the site of injury.

(*b*) Red blood cells and platelets migrate to site of injury and secrete substance that forms new vessel.

(*c*) Platelets uses component of broken vessel to form clot.

(*d*) Red blood cells divide and replace the broken vessel at the site of injury.

103. How water is taken up from soil to the xylem tissue of the plant roots?

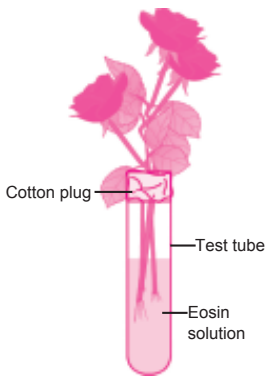
(*a*) Roots act as a suction pump for taking water.

(*b*) Soil expels the water with pressure to the xylem.

(*c*) Xylem attracts water molecules.

(*d*) Difference in the ion concentration creates a gradient for water movement.

104. A student performs an experiment using a Balsam plant with intact stem, leaves, roots and flowers. The plant was kept in a test tube containing eosin solution (a pink colour dye). The test tube mouth was covered using cotton plug as shown.



The student kept the plant undisturbed in the lab. After 2-3 hours, a transverse section of stem was obtained using sharp scissors and studied under microscope. The studies reveal the presence of pink colour in the vessels of xylem. What does this observation explain?

(*a*) Most portion of the plant stem is occupied by xylem.

(*b*) Water moves through xylem in the plant.

(*c*) Eosin solution gets stored in the xylem.

(*d*) Xylem reacts with eosin and gives colour.

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105. The loss of water from the leaves of the plant is transpiration. How this process is advantageous for the plant?

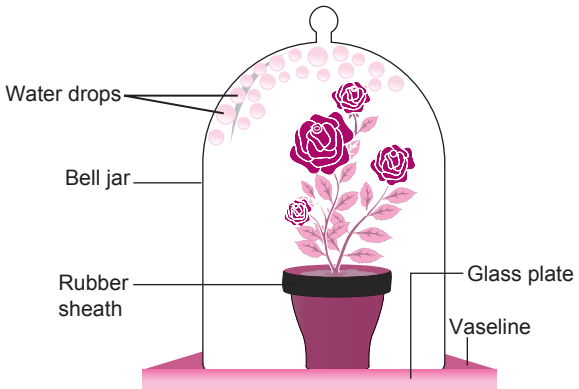
(*a*) It helps maintain a constant level of water in the soil around the plant.

(*b*) It helps the plant to maintain temperature in hot sunny days.

(*c*) It helps in the downward movement of the water.

(*d*) It acts as a driving force for distribution of food in plant's body.

106. A student setup an experiment using a well-watered plant. The plant's roots and soil were covered with a rubber sheet. The plant was then kept in a glass bell jar and sealed with vaseline at the bottom part to prevent the flow of air. The student keeps the apparatus in the light and observes water drops inside the jar after 2 hours as shown in the image.



What can be evaluated about transpiration from this experiment?

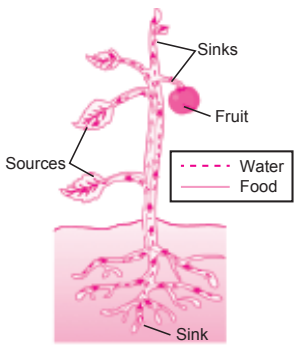
(*a*) Plant leaves give off water in form of vapours.

(*b*) Plant absorbs water from environment thus extra water appears on the inside of jar.

(*c*) Heat from the outside warms the jar which melts the vaseline into vapours.

(*d*) Covered roots and stem of the plant decreases the temperature of jar resulting in condensation of moisture into vapours.

107. The image shows the transport of food material inside plant body with the help of phloem.



How is food transported from phloem to the tissues according to plants need?

(*a*) Food is transported in only direction like water in the plant body through xylem.

(*b*) Food is transported along with the water in plant's body.

(*c*) Food is transported from a region with low concentration to higher concentration.

(*d*) Food is transported from a region where it is produced to other parts of the plants.

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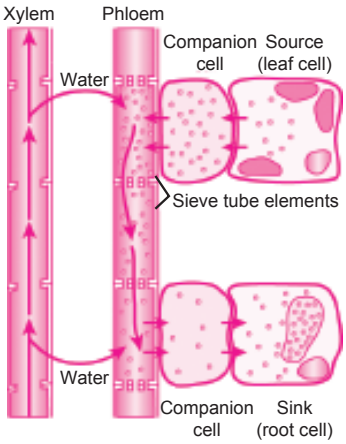
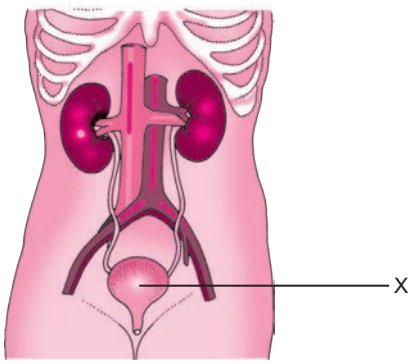
108. The image shows the movement of sucrose into phloem against the concentration gradient which also leads to the movement of water due to osmotic difference. This osmotic pressure allows movement of material in plant body.



How the movement of sucrose into phloem takes place initially?

(*a*) With the help of ADP molecules
(*b*) With the help of transpiration
(*c*) With the help of ATP molecules
(*d*) With the help of water gradient

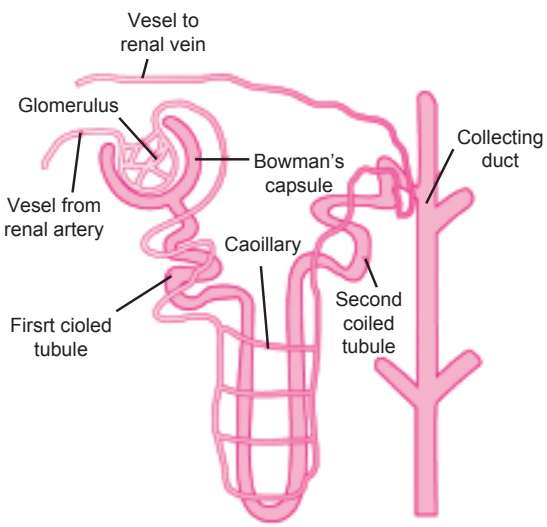
109. The image shows the excretory system in humans.



What is the importance of the labelled part in excretory system?

(*a*) It filters waste from the blood.
(*b*) It carries urine from kidney to outside.
(*c*) It stores the urine till urination.
(*d*) It produces urine.

110. The image shows the structure of a nephron.



Nephron is a unit of filtration in kidneys that filters waste material. It selectively reabsorbs or excretes water with the help of capillaries that surround it. What is the likely benefit of this?

(*a*) It helps to keep the output of urine constant throughout the day.
(*b*) It helps to uptake and store excess amount of water in the body for later use.
(*c*) It makes the process of filtration at Bowman's capsule easier.
(*d*) It maintains the concentration of urine based on the amount of water present in the body.

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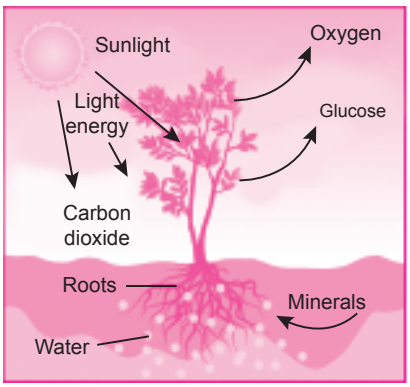
111. The image shows the process of photosynthesis in plants.

Based on the image, which component is excreted by plants during photosynthesis?



(*a*) Glucose
(*b*) Light energy
(*c*) Carbon dioxide
(*d*) Oxygen

112. A plant gets rid of excess water through transpiration. Which is a method used by plants to get rid of solid waste products?

(*a*) Dropping down of fruits
(*b*) Expansion of roots into the soil
(*c*) Shedding of yellow leaves
(*d*) Shortening of stem

113. Anaerobic process **[*CBSE* 2020 (31/4/1)]**

(*a*) takes place in yeast during fermentation.
(*b*) takes place in the presence of oxygen.
(*c*) produces only energy in the muscles of human beings.
(*d*) produces ethanol, oxygen and energy.

114. Most of the digestion and absorption of the food takes place in the **[*CBSE* 2020 (31/4/1)]**

(*a*) small intestine (*b*) liver (*c*) stomach (*d*) large intestine

115. In the excretory system of human beings, some substances in the initial filtrate such as glucose, amino acids, salts and water are selectively reabsorbed in **[*CBSE* 2020 (31/4/2)]**

(*a*) Urethra (*b*) Nephron (*c*) Ureter (*d*) Urinary bladder

116. Pseudopodia are **[*CBSE* 2020 (31/4/2)]**

(*a*) small hair-like structures present on unicellular organisms.
(*b*) false feet developed in some unicellular organisms.
(*c*) long, tube-like structures coming out of the mouth.
(*d*) suckers which are attached to the walls of the intestines.

117. Which of the following statements about the autotrophs is incorrect? **[*NCERT Exemplar*]**

(*a*) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll
(*b*) They store carbohydrates in the form of starch
(*c*) They convert carbon dioxide and water into carbohydrates in the absence of sunlight
(*d*) They constitute the first trophic level in food chains

118. In which of the following groups of organisms, food material is broken down outside the body and absorbed? **[*NCERT Exemplar*]**

(*a*) Mushroom, green plants, Amoeba (*b*) Yeast, mushroom, bread mould
(*c*) *Paramecium*, Amoeba, Cuscuta (*d*) Cuscuta, lice, tapeworm

119. Select the correct statement

(*a*) Heterotrophs do not synthesise their own food
(*b*) Heterotrophs utilise solar energy for photosynthesis
(*c*) Heterotrophs synthesise their own food
(*d*) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates

120. Which part of alimentary canal receives bile from the liver? **[*NCERT Exemplar*]**

(*a*) Stomach (*b*) Small intestine (*c*) Large intestine (*d*) Oesophagus

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121. Choose the function of the pancreatic juice from the following [*NCERT Exemplar*]

(*a*) trypsin digests proteins and lipase carbohydrates

(*b*) trypsin digests emulsified fats and lipase proteins

(*c*) trypsin and lipase digest fats

(*d*) trypsin digests proteins and lipase emulsified fats

122. Which of the following statement(s) is (are) true about respiration? [*NCERT Exemplar*]

(*i*) During inhalation, ribs move inward and diaphragm is raised

(*ii*) In the alveoli, exchange of gases takes place *i.e.*, oxygen from alveolar air diffuses into blood and carbon dioxide from blood into alveolar air

(*iii*) Haemoglobin has greater affinity for carbon dioxide than oxygen

(*iv*) Alveoli increase surface area for exchange of gases

(*a*) (*i*) and (*iv*) (*b*) (*ii*) and (*iii*) (*c*) (*i*) and (*iii*) (*d*) (*ii*) and (*iv*)

123. Which is the correct sequence of air passage during inhalation? [*NCERT Exemplar*]

(*a*) Nostrils → larynx → pharynx → trachea → lungs

(*b*) Nasal passage → trachea → pharynx → larynx → alveoli

(*c*) larynx → nostrils → pharynx → lungs

(*d*) Nostrils → pharynx → larynx → trachea → alveoli

124. Which of the following statement (s) is (are) true about heart? [*NCERT Exemplar*]

(*i*) Left atrium receives oxygenated blood from different parts of body while right atrium receives deoxygenated blood from lungs

(*ii*) Left ventricle pumps oxygenated blood to different body parts while right ventricle pumps deoxygenated blood to lungs

(*iii*) Left atrium transfers oxygenated blood to right ventricle which sends it to different body parts

(*iv*) Right atrium receives deoxygenated blood from different parts of the body while left ventricle pumps oxygenated blood to different parts of the body

(*a*) (*i*) (*b*) (*ii*) (*c*) (*ii*) and (*iv*) (*d*) (*i*) and (*iii*)

125. What prevents backflow of blood inside the heart during contraction? [*NCERT Exemplar*]

(*a*) Valves in heart (*b*) Thick muscular walls of ventricles

(*c*) Thin walls of atria (*d*) All of the above

126. Choose the correct statement that describes arteries. [*NCERT Exemplar*]

(*a*) They have thick elastic walls, blood flows under high pressure; collect blood from different organs and bring it back to the heart

(*b*) They have thin walls with valves inside, blood flows under low pressure and carry blood away from the heart to various organs of the body

(*c*) They have thick elastic walls, blood flows under low pressure; carry blood from the heart to various organs of the body

(*d*) They have thick elastic walls without valves inside, blood flows under high pressure and carry blood away from the heart to different parts of the body.

127. The filtration units of kidneys are called [*NCERT Exemplar*]

(*a*) ureter (*b*) urethra (*c*) neurons (*d*) nephrons

128. Oxygen liberated during photosynthesis comes from [*NCERT Exemplar*]

(*a*) water (*b*) chlorophyll (*c*) carbon dioxide (*d*) glucose

129. The blood leaving the tissues becomes richer in [*NCERT Exemplar*]

(*a*) carbon dioxide (*b*) water (*c*) heamoglobin (*d*) oxygen

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130. Which of the following is an incorrect statement? [*NCERT Exemplar*]

(*a*) Organisms grow with time

(*b*) Organisms must repair and maintain their structure

(*c*) Movement of molecules does not take place among cells

(*d*) Energy is essential for life processes

131. Which of the following equations is the summary of photosynthesis? [*NCERT Exemplar*]

(*a*) $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

(*b*) $6CO_2 + H_2O + \text{Sunlight} \rightarrow C_6H_{12}O_6 + O_2 + 6H_2O$

(*c*) $6CO_2 + 12H_2O + \text{Chlorophyll} + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

(*d*) $6CO_2 + 12H_2O + \text{Chlorophyll} + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6CO_2 + 6H_2O$

132. Choose the event that does not occur in photosynthesis [*NCERT Exemplar*]

(*a*) Absorption of light energy by chlorophyll

(*b*) Reduction of carbon dioxide to carbohydrates

(*c*) Oxidation of carbon to carbon dioxide

(*d*) Conversion of light energy to chemical energy

133. Choose the forms in which most plants absorb nitrogen [*NCERT Exemplar*]

(*i*) Proteins **(*ii*) Nitrates and Nitrites**

(*iii*) Urea **(*iv*) Atmospheric nitrogen**

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*) (*c*) (*iii*) and (*iv*) (*d*) (*i*) and (*iv*)

134. Which of the following statement(s) is (are) correct? [*NCERT Exemplar*]

(*i*) Pyruvate can be converted into ethanol and carbon dioxide by yeast

(*ii*) Fermentation takes place in aerobic bacteria

(*iii*) Fermentation takes place in mitochondria

(*iv*) Fermentation is a form of anaerobic respiration

(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iv*) (*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iii*)

Answers

1. (*a*)	**2.** (*b*)	**3.** (*d*)	**4.** (*d*)	**5.** (*a*)	**6.** (*c*)	**7.** (*d*)	**8.** (*b*)
9. (*c*)	**10.** (*c*)	**11.** (*d*)	**12.** (*b*)	**13.** (*d*)	**14.** (*d*)	**15.** (*b*)	**16.** (*d*)
17. (*c*)	**18.** (*b*)	**19.** (*c*)	**20.** (*c*)	**21.** (*a*)	**22.** (*c*)	**23.** (*a*)	**24.** (*b*)
25. (*c*)	**26.** (*d*)	**27.** (*a*)	**28.** (*d*)	**29.** (*a*)	**30.** (*a*)	**31.** (*a*)	**32.** (*c*)
33. (*c*)	**34.** (*d*)	**35.** (*c*)	**36.** (*b*)	**37.** (*a*)	**38.** (*b*)	**39.** (*d*)	**40.** (*c*)
41. (*a*)	**42.** (*a*)	**43.** (*b*)	**44.** (*c*)	**45.** (*d*)	**46.** (*c*)	**47.** (*b*)	**48.** (*a*)
49. (*b*)	**50.** (*d*)	**51.** (*c*)	**52.** (*a*)	**53.** (*a*)	**54.** (*c*)	**55.** (*d*)	**56.** (*a*)
57. (*d*)	**58.** (*d*)	**59.** (*b*)	**60.** (*b*)	**61.** (*a*)	**62.** (*d*)	**63.** (*c*)	**64.** (*b*)
65. (*b*)	**66.** (*c*)	**67.** (*b*)	**68.** (*a*)	**69.** (*a*)	**70.** (*b*)	**71.** (*c*)	**72.** (*a*)
73. (*c*)	**74.** (*b*)	**75.** (*d*)	**76.** (*c*)	**77.** (*c*)	**78.** (*d*)	**79.** (*b*)	**80.** (*b*)
81. (*c*)	**82.** (*c*)	**83.** (*a*)	**84.** (*c*)	**85.** (*c*)	**86.** (*b*)	**87.** (*c*)	**88.** (*d*)
89. (*a*)	**90.** (*a*)	**91.** (*c*)	**92.** (*d*)	**93.** (*b*)	**94.** (*c*)	**95.** (*b*)	**96.** (*c*)
97. (*a*)	**98.** (*a*)	**99.** (*b*)	**100.** (*c*)	**101.** (*a*)	**102.** (*a*)	**103.** (*d*)	**104.** (*b*)
105. (*b*)	**106.** (*a*)	**107.** (*d*)	**108.** (*c*)	**109.** (*c*)	**110.** (*d*)	**111.** (*d*)	**112.** (*c*)
113. (*a*)	**114.** (*a*)	**115.** (*b*)	**116.** (*b*)	**117.** (*c*)	**118.** (*b*)	**119.** (*a*)	**120.** (*b*)
121. (*d*)	**122.** (*d*)	**123.** (*d*)	**124.** (*c*)	**125.** (*a*)	**126.** (*d*)	**127.** (*d*)	**128.** (*a*)
129. (*a*)	**130.** (*c*)	**131.** (*c*)	**132.** (*c*)	**133.** (*b*)	**134.** (*c*)		

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CASE-BASED QUESTIONS

Question numbers 1 to 5 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).

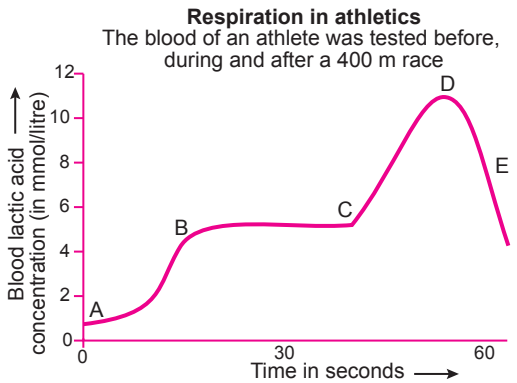
All living cells require energy for various activities. This energy is available by the breakdown of simple carbohydrates either using oxygen or without using oxygen. ***[CBSE Sample Paper 2021]***

(*i*) Energy in the case of higher plants and animals is obtained by

(*a*) breathing (*b*) tissue respiration

(*c*) organ respiration (*d*) digestion of food

(*ii*) The graph below represents the blood lactic acid concentration of an athlete during a race of 400 m and shows a peak at point D.

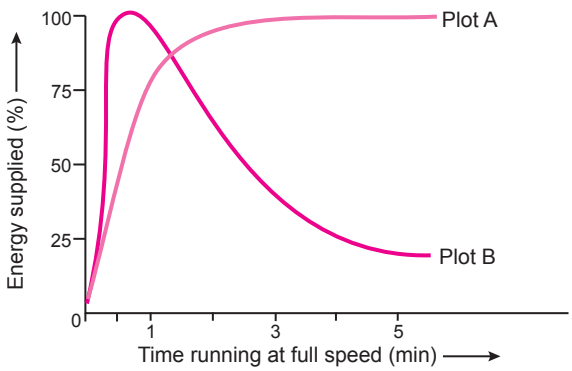


Lactic acid production has occurred in the athlete while running in the 400 m race. Which of the following processes explains this event?

(*a*) Aerobic respiration (*b*) Anaerobic respiration

(*c*) Fermentation (*d*) Breathing

(*iii*) Study the graph below that represents the amount of energy supplied with respect to the time while an athlete is running at full speed.



Choose the correct combination of plots and justification provided in the following table.

	Plot A	Plot B	Justification
(*a*)	Aerobic	Anaerobic	Amount of energy is low and inconsistent in aerobic and high in anaerobic
(*b*)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic

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(*c*)	Anaerobic	Aerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
(*d*)	Anaerobic	Aerobic	Amount of energy is high and inconsistent in anaerobic and low in aerobic

(*iv*) The characteristic processes observed in anaerobic respiration are

I. presence of oxygen **II. release of carbon dioxide**

III. release of energy **IV. release of lactic acid**

(*a*) I, II only (*b*) I, II, III only

(*c*) II, III, IV only (*d*) IV only

(*v*) Study the table below and select the row that has the incorrect information.

		Aerobic	Anaerobic
(*a*)	Location	Cytoplasm	Mitochondria
(*b*)	End product	CO_2 and H_2O	Ethanol and CO_2
(*c*)	Amount of ATP	High	Low
(*d*)	Oxygen	Needed	Not needed

2. Read the following and answer any four questions from (*i*) to (*v*).

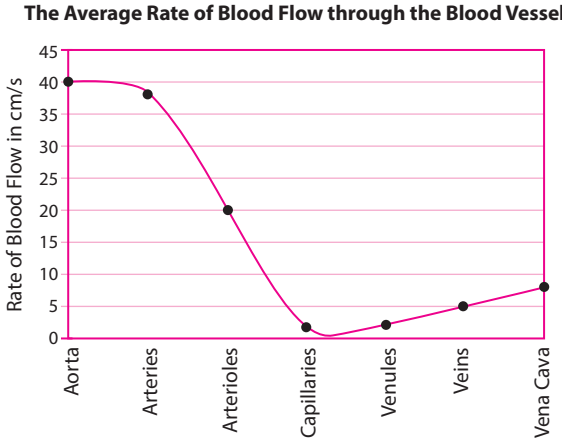
Blood transports food, oxygen and waste materials in our bodies. It has plasma as the fluid medium. A pumping organ (heart) is required to push the blood around the body. The blood flows through the chambers of heart in a specific manner and direction. While flowing throughout the body, blood exerts a pressure against the wall of the blood vessels through which it travels.

(*i*) Oxygenated blood from lungs enters left atrium through

(*a*) vena cava (*b*) pulmonary artery

(*c*) pulmonary vein (*d*) aorta

(*ii*) The given graph indicates the average rate of blood flow in the different blood vessels.



The rate of blood flow in the capillaries is very low because capillaries are

(*a*) very narrow and have high resistance

(*b*) much wide and have low resistance

(*c*) very narrow and have low resistance

(*d*) much wide and have high resistance

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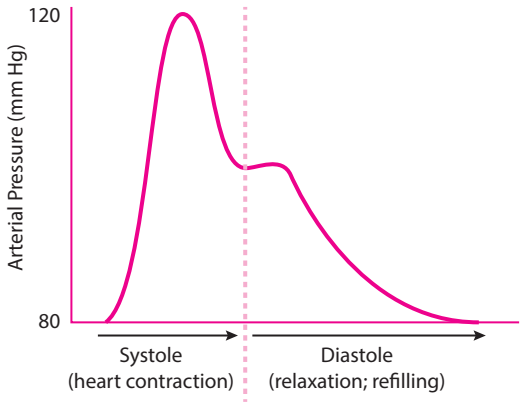
(*iii*) Study the graph below that represents changes in pressure within large arteries during a single cardiac cycle of contraction and relaxation.



Choose the correct combination of plots provided in the following table.

	Blood pressure category	**Systolic (mmHg)**	**Diastolic (mmHg)**
(*a*)	Normal	120	80
(*b*)	Normal	80	120
(*c*)	Hypertension	120	80
(*d*)	Hypertension	70	60

(*iv*) Which of the following statement(s) is (are) true about human heart?

I. It is a hollow muscular organ.
II. It is four-chambered having three auricles and one ventricle.
III. It has different chambers to prevent the oxygen-rich blood from mixing with the blood containing carbon dioxide.
IV. Arteries always carry blood away from the heart.

(*a*) I and II (*b*) II and III
(*c*) I, II and III (*d*) I, III and IV

(*v*) Study the table below and select the row that has the correct information.

	Bodily fluid	**Contents**
(*a*)	Blood	Plasma + RBCs + WBCs + Platelets
(*b*)	Plasma	Blood – RBCs
(*c*)	Lymph	Plasma + RBCs
(*d*)	Serum	Plasma + RBCs + WBCs

3. Read the following and answer any four questions from (*i*) to (*v*).

Nitrogenous materials formed due to metabolic activities are needed to be removed. The biological process involved in the removal of these harmful metabolic wastes from the body is called excretion. Different organisms use varied strategies to do this. Many unicellular organisms remove these wastes by simple diffusion from the body surface into the surrounding water while complex multicellular organisms use specialised organs to perform the same function.

(*i*) The excretory system of human beings include

(*a*) a pair of kidneys, a pair of ureters, a urinary bladder and a urethra
(*b*) a pair of kidneys, a pair of urinary bladders, a ureter, and a urethra
(*c*) a pair of kidneys, a pair of ureters, a pair of urinary bladders and a urethra
(*d*) a kidney, a ureter, a urinary bladder and a urethra

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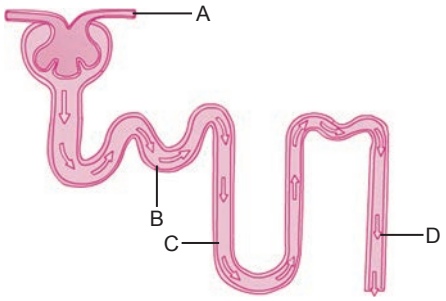
(ii) **The given figure represents the structure of a nephron.**

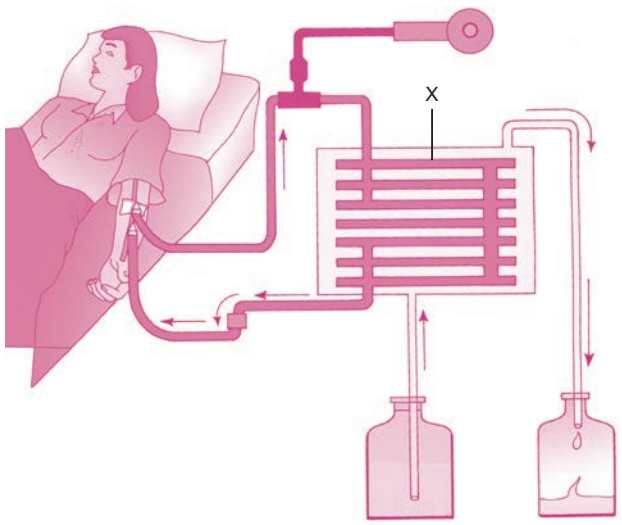


Which section of the nephron is responsible for concentrating the solute in the filtrate?

(*a*) A (*b*) B

(*c*) C (*d*) D

(iii)



Study the picture given above and choose the correct combination of information provided in the following table.

	X	Process used	Function
(*a*)	Dialyser	Diffusion	To remove the excess wastes and fluid from the blood
(*b*)	Blood thinner	Clotting	To remove the clots from the blood
(*c*)	Dialysate	Osmosis	To add fluid to the blood
(*d*)	Dialysing pump	Filtration	To draw blood from the body and send it to dialyser

(iv) **Which of the following statement(s) is (are) true about excretion in human beings?**

I. Kidneys are the primary excretory organs.

II. The bladder is muscular, so it is under nervous control.

III. Each kidney has large number of filtration units called nephrons.

IV. Urine is stored in the urethra until the urge of passing it out.

(*a*) I and II only

(*b*) I and III only

(*c*) I, II and III only

(*d*) I and IV only

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(v) Study the table below and select the row that has the incorrect information.

	Excretory organ	Substances excreted
(a)	Kidneys	Nitrogenous wastes
(b)	Lungs	Urea
(c)	Skin	Sweat
(d)	Oil glands	Sebum

4. Read the following and answer any four questions from (i) to (v).

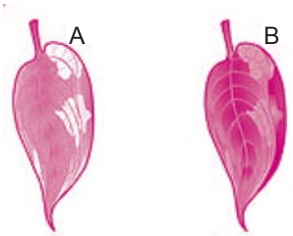
Energy is needed to maintain a state of order in our body. The source of energy and materials is the food we eat. Some organisms use simple food materials obtained from inorganic sources and other organisms utilise complex substances. These complex substances have to be broken down into simpler ones before they can be used for the upkeep and growth of the body.

(i) All non-green organisms fall under the category of

(a) autotrophs (b) heterotrophs

(c) saprotrophs (d) chemotrophs

(ii) The diagram below is an experiment conducted to study a factor necessary for photosynthesis.



The test performed on the leaf and the solution used for the test are respectively

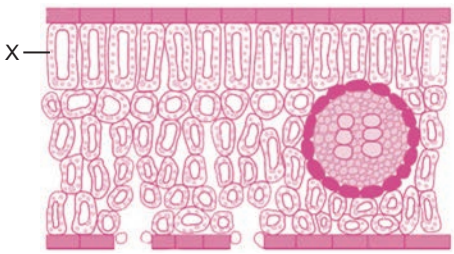
(a) starch test and potassium iodide

(b) chlorophyll test and ethyl alcohol

(c) photosynthesis test and potassium iodide

(d) starch test and ethyl alcohol

(iii) The diagram given below represents the cross-section of a leaf.



Identify "X" and choose the correct combination of information provided in the following table.

	X	Description	Function
(a)	Chlorophyll	A green coloured pigment	Essential for photosynthesis
(b)	Chloroplast	A cell organelle	Conducts photosynthesis
(c)	Vascular bundle	Vascular tissue	Transportation in plants
(d)	Chloroplast	A green coloured pigment	Essential for photosynthesis

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(*iv*) Which of the following statement(s) is (are) true about stomata?

I. These are the tiny pores present on the surface of the leaves.

II. Through these, massive amounts of gaseous exchange take place.

III. Plants open these pores when carbon dioxide is not required for photosynthesis.

IV. Guard cells operate the opening and closing of these pores.

(*a*) I and II only

(*b*) I and III only

(*c*) I, II and III only

(*d*) I, II and IV only

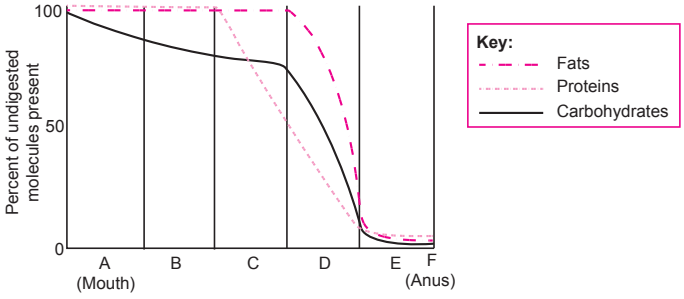
(*v*) Study the table below and select the row that has the incorrect information.

	Organism	Type of heterotrophic nutrition
(*a*)	*Amoeba*	Holozoic
(*b*)	Mushroom	Saprophytic
(*c*)	Lice	Parasitic
(*d*)	Lion	Parasitic

5. Read the following and answer any four questions from (*i*) to (*v*).

In humans, the process of nutrition takes place through a long tube extending from the mouth to the anus along with various accessory organs and organ systems. Complex foods should be converted to smaller ones and should be moved in a regulated manner along the tube. Some parts of nervous and circulatory systems also play a significant role in this process. A combination of enzymes, glands, hormones and blood take part in completion of this task.

(*i*) The graph given below shows the extent to which carbohydrates, proteins and fats are chemically digested as food passes through the human digestive tract. The letters represent the sequential structures that make up the digestive tract.



Proteins are digested in both

(*a*) A and B

(*b*) B and C

(*c*) C and D

(*d*) A and D

(*ii*) The ascending order of gastrointestinal tract of humans is

(*a*) mouth, oesophagus, stomach, small intestine, large intestine and anus

(*b*) mouth, oesophagus, small intestine, stomach, large intestine and anus

(*c*) mouth, pharynx, small intestine, large intestine and anus

(*d*) oesophagus, large intestine, stomach, small intestine and anus

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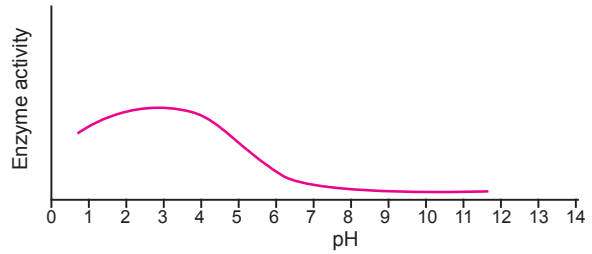
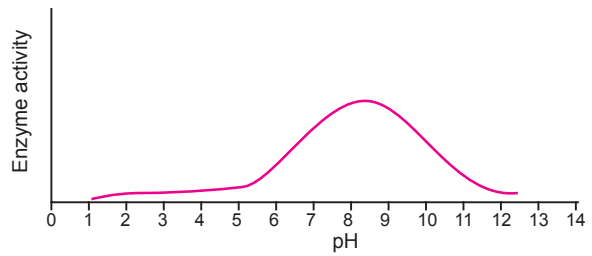
(*iii*) The two graphs below show the relative activities of two enzymes in solutions of varying pH. Which of the following choices correctly identifies the enzymes?

1.



2.



Choose the correct combination of enzymes provided in the following table.

	Enzyme–1	**Enzyme–2**
(*a*)	Chymotrypsin	Pepsin
(*b*)	Pepsin	Carboxypeptidase
(*c*)	Lactase	Aminopeptidase
(*d*)	Enteropeptidase	Amylase

(*iv*) Which of the following statement(s) is (are) false about the functions of the pancreas?

I. Produces hormones that regulate blood sugar levels

II. Produces enzymes that break down carbohydrates, proteins, lipids and nucleic acids

III. Produces bile

IV. Produces sodium bicarbonate, a base that neutralises acids

(*a*) I and II only (*b*) I and III only

(*c*) III only (*d*) II and IV only

(*v*) Study the table below and select the row that has the incorrect information.

	Digestive enzyme	**Function**
(*a*)	Trypsin	Hydrolyses specific peptide bonds
(*b*)	Lactase	Hydrolyses lactose to glucose and galactose
(*c*)	Pancreatic amylase	Hydrolyses starch to maltose
(*d*)	Lipase	Emulsifies fats

Answers

1. (*i*)—(*b*)

Higher plants and animals obtained their energy by cellular respiration/internal respiration/tissue respiration.

(*ii*)—(*b*)

Lactic acid is a chemical byproduct of anaerobic respiration - the process by which cells produce energy without oxygen.

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(*iii*)—(*b*)

Energy produced during aerobic respiration is more as compared to anaerobic respiration. Hence plot A represent aerobic respiration and plot B anaerobic respiration.

(*iv*)—(*c*)

Anaerobic respiration takes place in the absence of oxygen, the end products may be ethyl alcohol and carbon dioxide or lactic acid. Energy is also produced but in less amount due to incomplete oxidation of food.

(*v*)—(*a*)

In both aerobic and anaerobic respiration, the breakdown of glucose into pyruvate takes place in cytoplasm, and only in case of aerobic respiration the conversion of pyruvate into $CO_2 + H_2O$ and energy takes place in mitochondria.

2. (*i*)—(*c*)

Blood enters the right atrium and passes through the right ventricle. The right ventricle pumps the blood to the lungs where it becomes oxygenated and this oxygenated blood is brought back to the heart via pulmonary veins towards the left atrium.

(*ii*)—(*a*)

The diameter of capillaries is very narrow and they have high resistance. Therefore, blood flows more slowly through them.

(*iii*)—(*a*)

The normal systolic pressure is about 120 mm of Hg and diastolic pressure is 80 mm of Hg. Hypertension is high blood pressure.

(*iv*)—(*d*)

Human heart is a hollow muscular organ. It is four-chambered—two auricles and two ventricles. There is a complete separation of oxygenated and deoxygenated blood. Arteries are the vessels which carry blood away from the heart to various organs of the body.

(*v*)—(*a*)

Blood is the bodily fluid that circulates in blood vessels. It is composed of blood cells which include RBCs, WBCs and platelets, which are suspended in blood plasma.

3. (*i*)—(*a*)

The excretory system of human beings includes a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

(*ii*)—(*c*)

In the given diagram, A is renal artery; B is proximal convoluted tubule; C is loop of Henle and D is collecting tubule. The proximal convoluted tubule does not alter solute concentration and the distal convoluted tubule decreases solute concentration in the filtrate. It is the loop of Henle (descending and ascending limbs), which is responsible for concentrating or diluting the tubular fluid by the process called counter current mechanism.

(*iii*)—(*a*)

The given picture represents the process of haemodialysis where "X" is denoting the dialyser. A dialyser is often referred to as an "artificial kidney." Its function is to remove the excess wastes and fluid from the blood when the patient's kidneys can no longer perform that task. During this passage, the waste products from the blood pass into dialysing fluid by diffusion.

(*iv*)—(*c*)

Urine is stored in the urinary bladder until the pressure of the expanded bladder leads to the urge to pass it out through the urethra.

(*v*)—(*b*)

Lungs remove carbon dioxide from the blood.

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4. (*i*)—(*b*)

All non-green organisms fall under the category of heterotrophs as they depend on other organisms to obtain food.

(*ii*)—(*a*)

The given diagram indicates that starch test has been performed on the leaf and potassium iodide is used for the test. Potassium iodide turns the starchy areas in leaf blue-black.

(*iii*)—(*b*)

In the given diagram "X" represents the chloroplast, *i.e.*, the cell organelle that contains chlorophyll.

(*iv*)—(*d*)

Since large amounts of water can also be lost through the stomata, the plant closes these pores when it does not need carbon dioxide for photosynthesis.

(*v*)—(*d*)

Lion shows holozoic type of nutrition. In such type of nutrition, the digestion of food follows the ingestion of food. Thus, digestion takes place inside the body of the organism while parasitic nutrition is a mode of heterotrophic nutrition where an organism lives on the body surface or inside the body of another organism. The parasite obtains nutrition directly from the body of the host.

5. (*i*)—(*c*)

Here, A represents mouth, B represents oesophagus, C represents stomach, D represents small intestine and E represents large intestine. The digestion of protein begins in the stomach and is completed in the small intestine.

(*ii*)—(*a*)

The hollow organs that make up the gastrointestinal tract (GI tract) include the mouth, oesophagus, stomach, small intestine and large intestine that contains the rectum and anus.

(*iii*)—(*b*)

The first graph shows maximal activity at a very acidic pH, implying that this is an enzyme acting in the stomach. The second graph shows maximal activity around pH 8.5, implying that this is an enzyme acting in the duodenum. The only choice that matches the first graph with a stomach enzyme, *i.e.*, pepsin and the second with a duodenal enzyme, *i.e.*, carboxypeptidase.

(*iv*)—(*c*)

Bile is produced continuously by the liver and stored temporarily in the gall bladder.

(*v*)—(*d*)

Lipase is involved in the digestion of fats and not in emulsification of fats. Emulsification is assisted by the action of the bile salts.

ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (*A*) : Plants lack excretory organs.

Reason (*R*) : Plants usually absorb essential nutrients.

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2. Assertion (*A*) : In anaerobic respiration, one of the end product is alcohol.
Reason (*R*) : There is an incomplete breakdown of glucose.

3. Assertion (*A*) : In plants there is no need of specialised respiratory organs.
Reason (*R*) : Plants do not have great demands of gaseous exchange.

4. Assertion (*A*) : Bile is essential for digestion of lipids.
Reason (*R*) : Bile juice contains enzymes.

5. Assertion (*A*) : Carbohydrate digestion mainly takes place in small intestine.
Reason (*R*) : Pancreatic juice contains the enzyme lactase.

6. Assertion (*A*) : The walls of the ventricle are thicker than the walls of the auricles.
Reason (*R*) : The ventricles have to pump blood to long distances and various organs.

7. Assertion (*A*) : Pulmonary circulation includes flow of oxygenated blood from right ventricle to the lungs.
Reason (*R*) : The main purpose of this circulation is purification of blood.

8. Assertion (*A*) : Photosynthesis is considered as an endothermic reaction.
Reason (*R*) : Energy gets released in the process of photosynthesis.

9. Assertion (*A*): The concentration of harmful substances is more in human being.
Reason (*R*) : Humans are at the apex of the food chain.

10. Assertion (*A*): Green plants of the ecosystem are the transducers.
Reason (*R*) : Producers trap the radiant energy of the sun and change it into chemical energy.

Answers

1. (*b*) **2.** (*a*) **3.** (*a*) **4.** (*c*) **5.** (*c*) **6.** (*a*) **7.** (*d*) **8.** (*c*)
9. (*a*) **10.** (*a*)

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LIGHT–REFLECTION AND REFRACTION

05

BASIC CONCEPTS

Reflection

1. There are two theories of the nature of light—wave theory and particle theory. According to wave theory, light is a form of energy which is propagated as electromagnetic waves (or non-mechanical waves). It does not require any medium for its propagation, *i.e.*, solid, liquid or gas. The speed of light in vacuum is 3×10^8 m/s. The speed of light in vacuum is greater than the speed of light in medium. According to particle theory, light consists of particles which travel in straight line. These particles are called photons.
2. **Reflection of Light:**

   When light rays fall on a body, then three things may happen to the light rays:

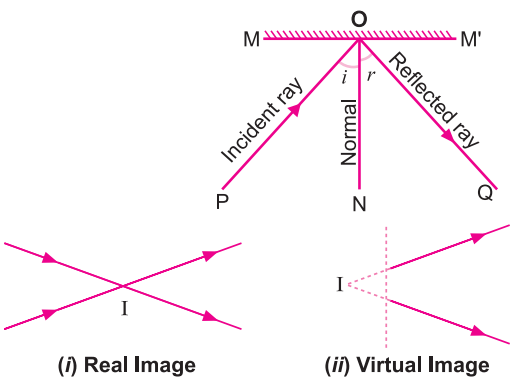
   (*i*) A part of light rays may be absorbed.

   (*ii*) A part of light rays may come back to the same medium, which gives the phenomenon of reflection of light.

   (*iii*) A part of light rays may be transmitted, which gives the phenomenon of refraction. When most of the light rays after interacting with a boundary separating the two media return back in the same medium, the phenomenon is termed as reflection of light.
3. **Laws of Reflection:** When light undergoes reflection from a smooth polished surface, it obeys two laws, which are known as the laws of reflection of light.

   Ist law: The incident ray, the reflected ray and the normal at the point of incidence all lie in the same plane.

   IInd law: The angle of incidence is equal to the angle of reflection.



(*i*) Real Image (*ii*) Virtual Image

4. **Image:** When a number of rays, starting from a point after reflection or refraction, meet at another point, the second point is called the image of the first point. The images are of two types:

   (*i*) Real image (*ii*) Virtual image.
5. **Real Image:** If two or more light rays after reflection or refraction, actually meet at a point, the image formed is known as the real image of an object. A real image is inverted and obtained on the screen. For example: The images of actor and actress in a movie screen is the real image.
6. **Virtual Image:** If the rays do not actually meet but appear to meet when produced backwards, the image is said to be a virtual image. A virtual image cannot be obtained on the screen. The virtual image is erect.
7. **Mirror:** A plane or curved glass surface which is silver polished on one side is called a mirror. Mirrors are of two types: (i) Plane mirror (ii) Spherical mirror.

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8. **Image Formation by Plane Mirror:** The image formed by the plane mirror is:
   - virtual and erect
   - the same size as the object
   - distance of object from the mirror = distance of image from the mirror
   - laterally inverted
   - angle of incidence = angle of reflection.

9. **Spherical mirror:** A part of hollow sphere whose inner or outer surface has been polished or silvered is known as spherical mirror. It is of two types:

   (*i*) Concave (*ii*) Convex

   (*i*) Concave mirror: In a concave mirror, the polishing or silvering is done on the outer surface. Here the reflecting surface faces inward.

   (*ii*) Convex mirror: In a convex mirror, polishing is done on the inner surface. Here the reflecting surface faces outward.

10. **Important Terms Related to Spherical Mirrors:**

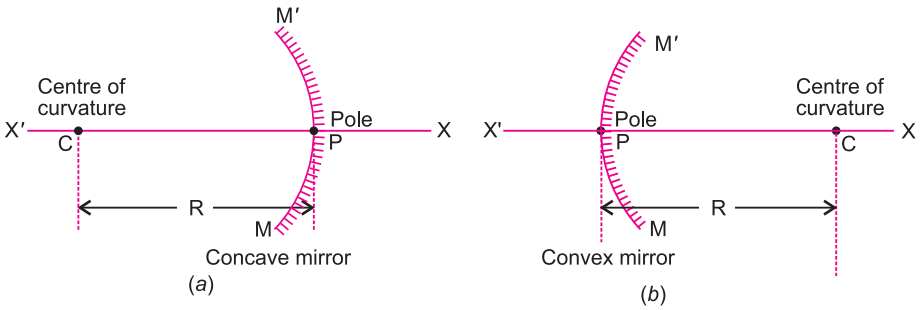
Pole: The midpoint or centre of the reflecting surface of a spherical mirror is called pole of the mirror.

Centre of curvature: It is the centre of the hollow sphere of which the mirror is a part.

Radius of curvature: It is the radius of that sphere of which the mirror is a part. *PC* is the radius of curvature.

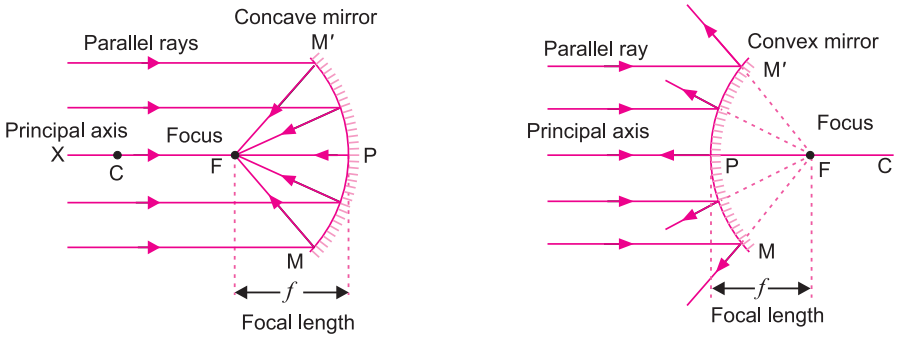
Principal axis: The line joining the pole and the centre of curvature is called the principal axis of the mirror. It extends on both sides of the mirror.

Principal section: Principal section M'PM of a mirror is its vertical section by a plane passing through the principal axis of the mirror.



11. **Principal Focus and Focal Length of Spherical Mirrors:**

(*i*) Concave mirror: *The principal focus of a concave mirror is a point on the principal axis at which all the incident rays parallel to principal axis meet after reflection from the concave mirror.* Principal focus of a mirror is denoted by *F*.



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(*ii*) Convex mirror: *The principal focus of a convex mirror is the point on the principal axis from which all the incident rays parallel to principal axis appear to come after reflection from the convex mirror.*

The principal focus of concave mirror is real. But the principal focus of convex mirror is virtual.

The distance of principal focus from the pole of mirror is called the focal length of mirror.

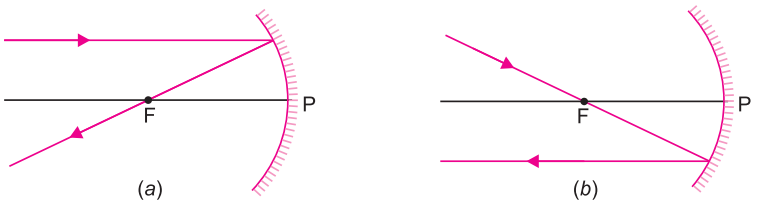
12. Relation between Radius of Curvature and Focal Length of a Spherical Mirror:

$$\text{Focal length} = \frac{\text{Radius of curvature}}{2} \text{ or } f = \frac{R}{2}$$

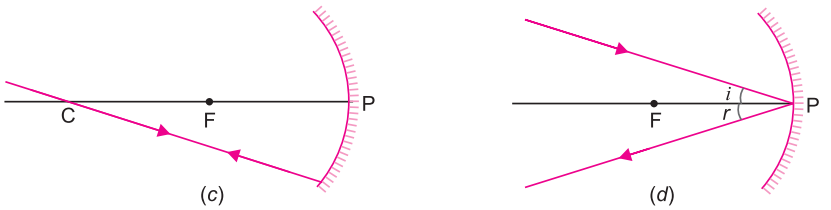
the focal length of a spherical mirror is half of its radius of curvature.

13. Rules for Obtaining Images Formed by Concave Mirrors:

1. A ray of light incident parallel to the principal axis after reflection passes through the principal focus [Fig. (*a*)]. (By definition of focus).
2. An incident ray of light which passes through the principal focus after reflection becomes parallel to the principal axis [Fig. (*b*)] (By principle of reversibility).



3. A ray of light which passes through the centre of curvature after reflection retraces its path back [Fig. (*c*)] (as for $\angle i = 0$, then $\angle r = 0$).
4. A ray of light incident at the pole and making an angle with the principal axis, after reflection goes on the other side of the principal axis making the same angle with it [Fig. (*d*)]. (Laws of reflection, $\angle i = \angle r$).



Formation of Images by a Concave Mirror:

Case I. When the object is between P and F:

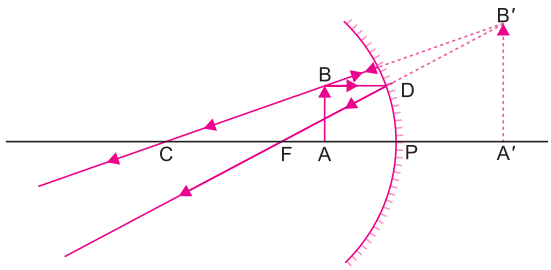
The image formed is

(*i*) behind the mirror,

(*ii*) virtual,

(*iii*) erect, and

(*iv*) magnified.



Case II. When the object is at F:

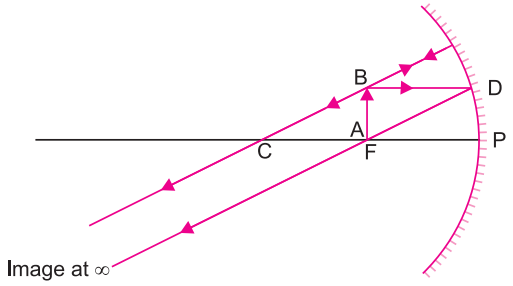
The image formed is

(*i*) at infinity,

(*ii*) real,

(*iii*) inverted, and

(*iv*) highly magnified.



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Case III. When the object is between F and C:

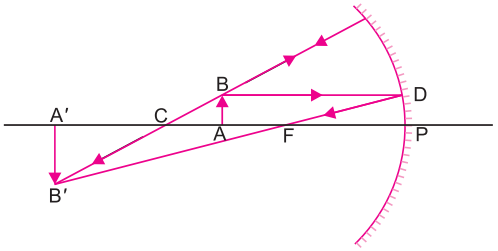
The image formed is

(*i*) beyond C,

(*ii*) real,

(*iii*) inverted, and

(*iv*) magnified.



Case IV. When the object is at C:

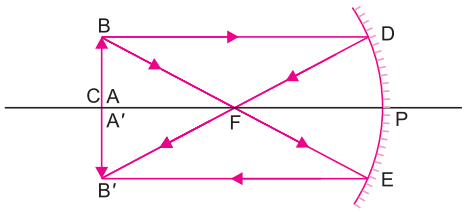
The image formed is

(*i*) at C,

(*ii*) real,

(*iii*) inverted, and

(*iv*) same size as the object.



Case V. When the object is beyond C:

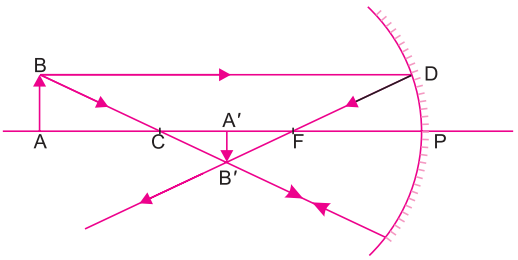
The image formed is

(*i*) between F and C,

(*ii*) real,

(*iii*) inverted, and

(*iv*) diminished.



Case VI. When the object is at infinity:

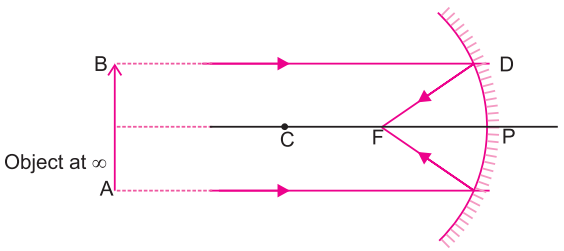
The image formed is

(*i*) at F,

(*ii*) real,

(*iii*) inverted, and

(*iv*) highly diminished.



Summary of Formation of Different Types of Images by a Concave Mirror

	Position of the object	Position of the image	Size of the image	Nature of the image
1.	Between the pole P and focus F	Behind the mirror	Magnified	Virtual and erect
2.	At F	At infinity	Infinitely large or highly magnified	Real and inverted
3.	Between C and F	Beyond C	Magnified or Enlarged	Real and inverted
4.	At centre of curvature, C	At C	Same size	Real and inverted
5.	Beyond the centre of curvature C	Between F and C	Diminished	Real and inverted
6.	At infinity	At the focus F	Highly diminished	Real and inverted

14. Rules for Obtaining Images Formed by Convex Mirror

1. A ray of light incident parallel to the principal axis after reflection appears to come from the principal focus [Fig. (*a*)]. (By definition of focus).

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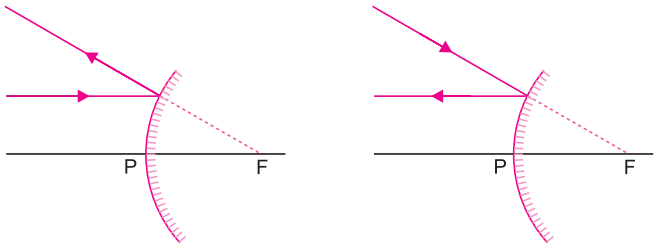
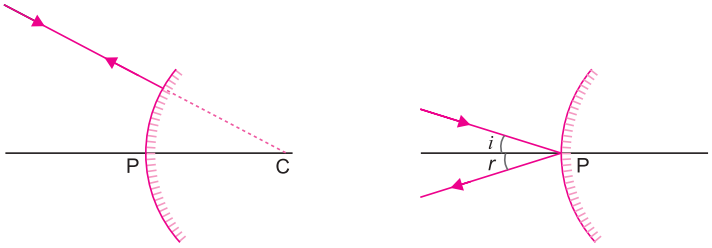
2. A ray of light directed towards the principal focus after reflection becomes parallel to the principal axis [Fig. (*b*)]. (By principle of reversibility).



(*a*) (*b*)

3. A ray of light directed towards the centre of curvature after reflection retraces its path back [Fig. (*c*)]. (as for , $\angle i = 0$ then $\angle r = 0$).

4. A ray of light incident at the pole and making an angle with the principal axis, after reflection goes on the other side of the principal axis making the same angle with it [Fig. (*d*)] (Laws of reflection, $\angle i = \angle r$).



(*c*) (*d*)

Formation of Images by Convex Mirror:

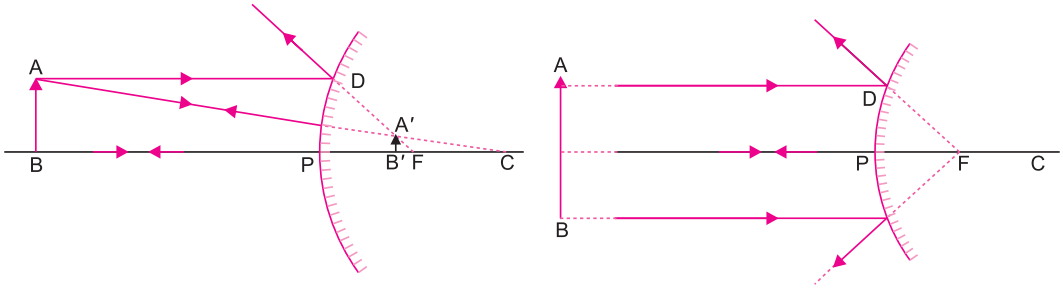
Case 1: When the object is between the mirror and infinity.

The image formed is

(*i*) between the pole and the focus
(*ii*) virtual
(*iii*) erect, and
(*iv*) diminished

Case 2: When the object is at infinity. The image formed is

(*i*) at F
(*ii*) virtual
(*iii*) erect, and
(*iv*) highly diminished



Summary of Image Formation by Convex Mirror:

	Position of the object	Position of the image	Size of the image	Nature of the image
1.	Between infinity and the pole P	Between P and F, behind the mirror	Diminished	Virtual and erect
2.	At infinity (∞)	At the focus F, behind the mirror	Highly diminished, point-sized	Virtual and erect

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15. Sign Convention for Spherical Mirrors:

According to the new cartesian sign convention:

(*i*) The object is always taken on the left side of the mirror.

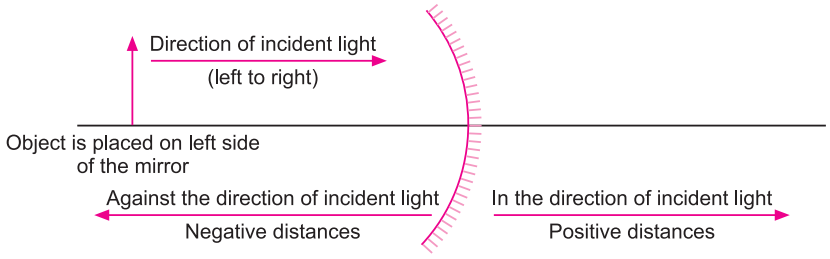
(*ii*) All the distances are measured from pole of the mirror.

(*iii*) Distances measured in the same direction as that of incident light are taken as positive.

(*iv*) Distances measured against the direction of incident light are taken as negative.

(*v*) Distances measured upward and perpendicular to the principal axis are taken as positive.

(*vi*) Distances measured downward and perpendicular to the principal axis are taken as negative.



u = object distance, v = image distance, f = focal length

h = height of the object, h' = height of the image

	Type of mirror	Position of object	u	v	f	h	h'
	Concave	Between P & F	– ve	+ ve	– ve	+ ve	+ ve
	Concave	Between F & C	– ve	– ve	– ve	+ ve	– ve
	Concave	At C	– ve	– ve	– ve	+ ve	– ve
	Concave	Beyond C	– ve	– ve	– ve	+ ve	– ve
	Convex	In front of it	– ve	+ ve	+ ve	+ ve	+ ve

16. Mirror Formula:

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

where v = distance of image from mirror

u = distance of object from mirror

f = focal length of the mirror.

17. Linear Magnification: The ratio of height of image to the height of object is known as linear magnification.

$$\text{Magnification} = \frac{\text{height of image}}{\text{height of object}} \text{ or } m = \frac{h'}{h}$$

where h' = height of image

and h = height of object.

It is also defined as the ratio of the image distance to the object distance, with a minus sign. Thus,

Magnification, $m = -\frac{v}{u}$

where v = image distance, u = object distance.

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Key Points:

1. *Object distance (u) is always negative.*
2. *If v is positive, then the image will be virtual and erect. But if v is negative, then image is real and inverted.*
3. *For convex mirror, v is always positive. For concave mirror, v is only positive when the object is placed between pole and principal focus. Otherwise v is negative.*
4. *If value of linear magnification 'm' is positive, then the image is virtual and erect. But if value of 'm' is negative then the image is real and inverted.*
5. *If value of 'm' > 1, then image is enlarged. If value of 'm' = 1, then image is of same size as that of object. If value of 'm' < 1 then image is diminished.*
6. *Convex mirror always gives a diminished virtual image but concave mirror gives a magnified virtual image.*
7. *Focal length of convex mirror is positive and that of concave mirror is negative.*

18. Applications of Mirrors:

(A) Uses of Plane Mirror:

(*i*) Plane mirrors are generally used as a looking glass in daily life.

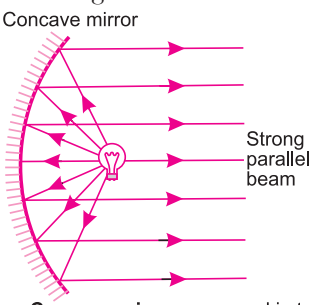
(*ii*) In optical instruments such as periscope, kaleidoscope, etc., plane mirrors are used as reflectors.

(*iii*) Plane mirrors are also used at the blind turns on the road to guide drivers.

(B) Uses of Concave Mirrors:

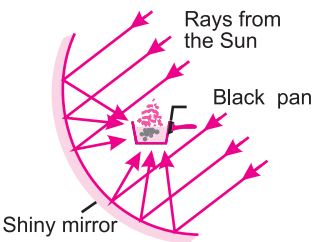
(*i*) Concave mirrors are used by doctors to focus a parallel beam of light on the patient's organs like teeth, throat, ear etc, for the examination of these parts.

(*ii*) We know that when an object is placed between the pole and the focus of a concave mirror, a magnified, erect and virtual image is obtained. This property of concave mirror is utilised for using them as shaving mirrors.



Concave mirrors are used in torches and searchlights to give a strong, parallel beam.

(*iii*) Concave mirrors are also used as reflectors in headlights of automobiles and in search-lights which are meant for throwing light to large distances. The source of light is placed just at the focus of the concave mirror and a parallel beam of light is obtained by reflection.



(*iv*) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces.

(C) Uses of Convex Mirrors:

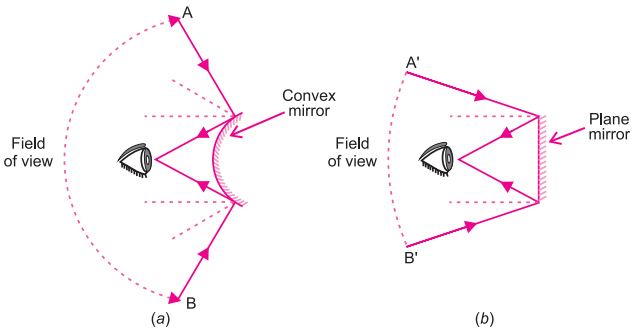
(*i*) As a rear view mirror in vehicles: Convex mirrors are used as rear view mirrors in vehicles (cars, trucks, buses, etc.) to see traffic at the backside. This is due to the following reasons:

(*a*) Convex mirrors always form an erect and diminished image.

(*b*) They have a wider field of view as they are curved outwards.

For this purpose, plane mirrors may also be used. But a convex mirror is preferred because the field of view is wider than that of a plane mirror.

(*ii*) As a reflector in street lamps: The light incident on the lamp is reflected by the convex mirror and reflected light spreads in the form of a divergent beam. Therefore, light spreads over a larger area.



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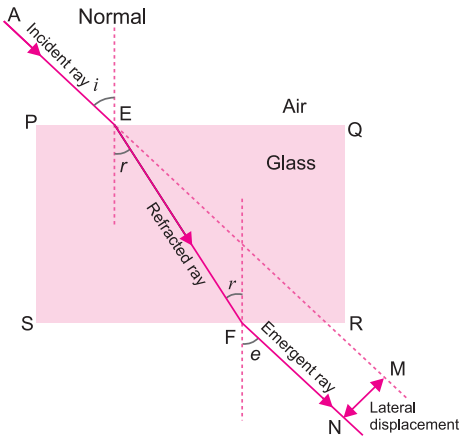
Refraction

1. **Refraction of Light:** The bending of light when it passes from one medium to another, is called refraction of light.



Rules for refraction through a rectangular glass slab:

(*i*) The angle of emergence is equal to the angle of incidence.

(*ii*) The final emergent ray is parallel to the incident ray.

(*iii*) The final emergent ray is laterally displaced with respect to incident ray.

(*iv*) The lateral displacement increases with an increase in the thickness of the glass slab as well as with an increase in the angle of incidence.

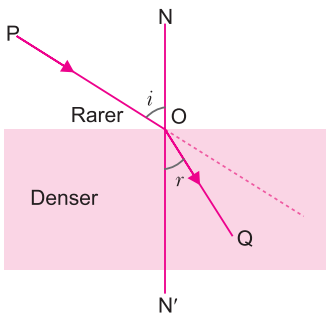
2. **Cause of Refraction:** The speed of light is different in different media. When a light ray goes from one medium to another, its speed changes. This change causes the refraction of light.

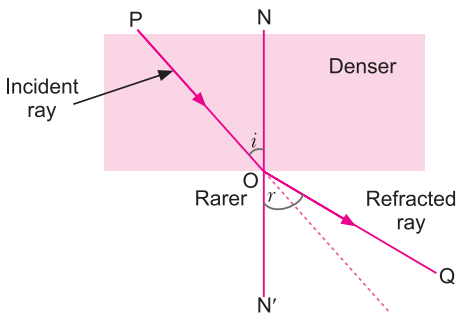
3. **Optically Rarer and Denser Medium:** A medium in which the speed of light is more is known as optically rarer medium and a medium in which the speed of light is less is known as optically denser medium.

It has been found that:

(*i*) When a ray of light goes from a rarer medium to a denser, it bends towards the normal.

(*ii*) When a ray of light goes from a denser medium to a rarer medium, it bends away from the normal.





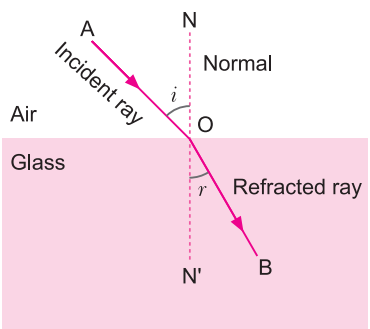
4. **Laws of Refraction of Light:**

First law: The incident ray, the refracted ray, and the normal at the point of incidence all lie in the same plane.

Second law: The ratio of sine of angle of incidence to the sine of angle of refraction is a constant for a given pair of media.

i.e., $\frac{\sin i}{\sin r}$ = a constant

This constant is known as refractive index. This law is also known as Snell's law of refraction.



5. **Refractive Index:** Refractive index of a medium is defined as the ratio of the speed of light in vacuum to the speed of light in the medium.

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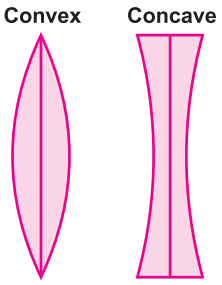
Refractive index, $n = \dfrac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}} = \dfrac{c}{v}$

It is a ratio and has no unit.

- The refractive index depends on the nature of the material of the medium and on the colour or wavelength of the light used.
- A substance having higher refractive index is optically denser than another substance having lower refractive index.



6. Lens: A lens is a transparent glass bound by two spherical surfaces, whose working is based on the refraction of light rays when they pass through it.

Lenses are of two types: Convex lens and concave lens.

Convex lens: It is thick at the centre but thinner at the edges.

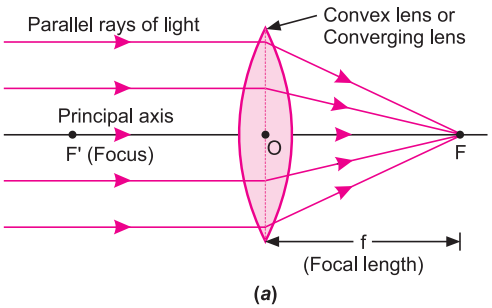
Concave lens: It is thin in the middle but thicker at the edges.

7. Some Terms Related to Lenses:

(*i*) Optical centre: The centre point of a lens is known as its optical centre (O).

(*ii*) Principal axis: A line passing through the optical centre of the lens and perpendicular to both the faces of the lens is known as principal axis. In the **Fig. (*a*)** FF′ is the principal axis.

(*iii*) Converging lens: The light rays after bending from the convex lens meet at a point on the principal axis hence it is called converging lens.

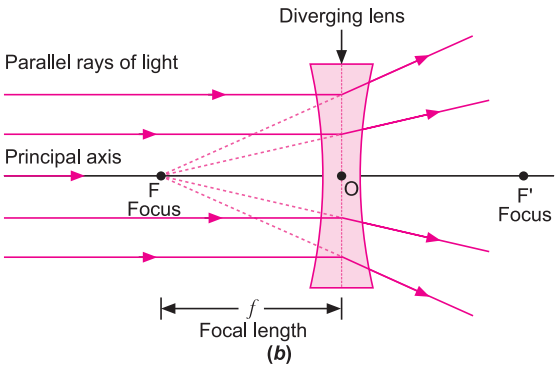


(*a*)

(*iv*) Diverging lens: A concave lens diverges a parallel beam of light, so it is diverging lens. The diverging action of the concave lens is shown in **Fig. (*b*)**.

(*v*) Principal focus of a convex lens: The principal focus of a convex lens is a point on its principal axis to which light rays parallel to principal axis converge after passing through the lens.

The point F is the principal focus for the light rays coming from the left side. If the incident light rays fall on the convex lens from the right hand side, they will converge to a point F' on the left side of the lens. Thus, F' is the second focus of the convex lens.



(*b*)

(*vi*) Principal focus of a concave lens: The principal focus of a concave lens is a point on its principal axis from which light rays originally parallel to the axis, appear to diverge after passing through the concave lens. In the figure, the parallel rays of light appear to be diverging from point F after refraction. So, *F* is the principal focus of the concave lens for the light rays coming from the left side. If the parallel rays of light come from the right side, then they will appear to diverge from point F' which is the second focus of the concave lens.

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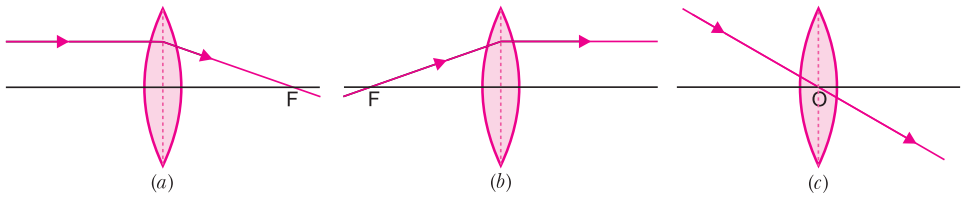
Focal length of a concave lens: The focal length of a lens is the distance between optical centre and principal focus of the lens. In the figure, the distance OF is the focal length of the convex lens.

8. Rules for Obtaining Images Formed by Convex Lenses:

(*i*) **Rule 1:** A ray of light proceeding parallel to the principal axis after refraction through a convex lens passes through the principal focus, shown in **Fig. (*a*)**.

(*ii*) **Rule 2:** A ray of light passing through the principal focus of a convex lens after refraction becomes parallel to the principal axis, shown in **Fig. (*b*)**.

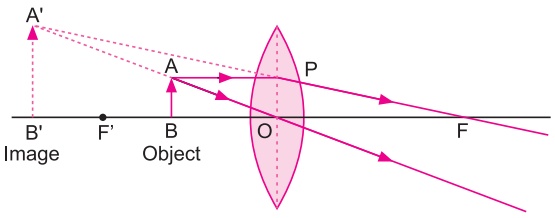
(*iii*) **Rule 3:** A ray of light passing through the optical centre of a convex lens emerges without suffering any deviation, as shown in **Fig. (*c*)**.



9. Image Formation by a Convex Lens:

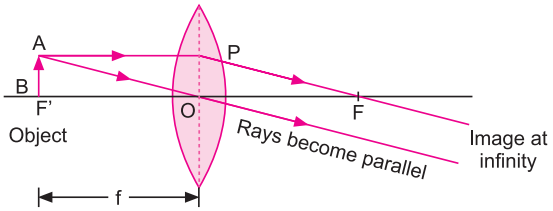
Case 1. When the object is placed between optical centre (O) and focus (F'):

Image	Use
Appears to be the same side of the lens	Magnifying glass
Virtual	
Erect	
Magnified	



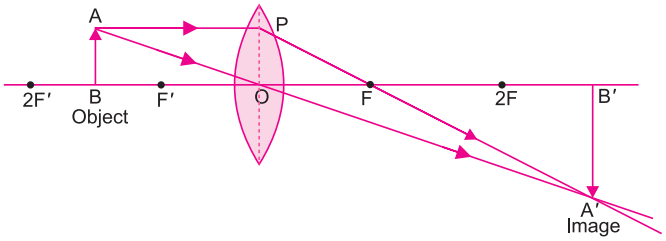
Case 2. When the object is placed at the focus of a convex lens:

Image	Use
At infinity	Searchlight
Real	Spotlight
Inverted	
Highly magnified	



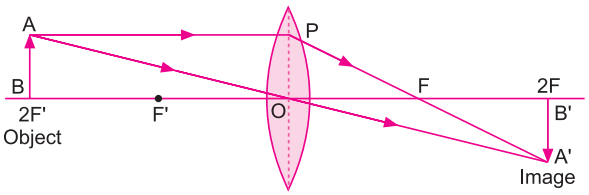
Case 3. When the object is placed between F' and 2 F'

Image	Use
Beyond 2F	Projector
Real	Enlarger
Inverted	
Magnified	



Case 4. When the object is at 2F':

Image	Use
At 2F	Terrestrial
Real	telescope
Inverted	
Same size as the object	



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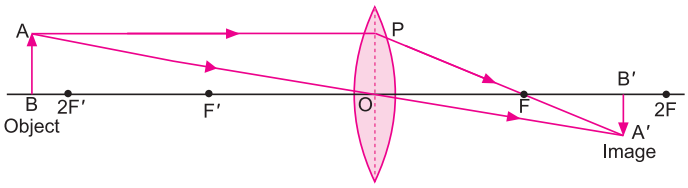
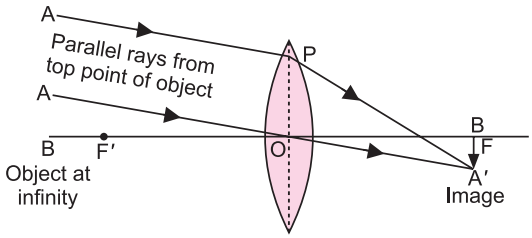
Case 5. When the object is beyond 2F′:

Image	Use
Between F and 2F	Camera
Real	
Inverted	
Smaller than the object	



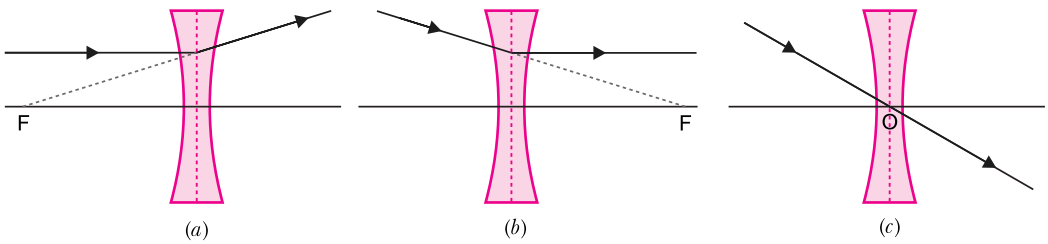
Case 6. When the object is at infinity:

Image	Use
At F	Astronomical
Real	telescope
Inverted	
Highly diminished	



10. Rules for Obtaining Images Formed by Concave Lenses:

Rule (*i*): A ray of light proceeding close and parallel to the principal axis after refraction through a concave lens appears to diverge from the principal focus as shown in **Fig. (*a*)**.



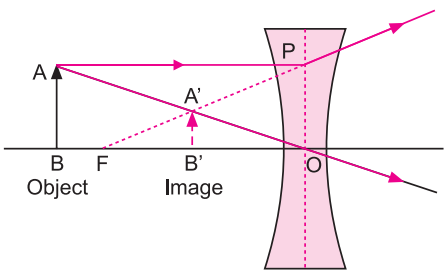
Rule (*ii*): A ray of light directed towards the principal focus of a concave lens after refraction becomes parallel to the principal axis as shown in **Fig. (*b*)**.

Rule (*iii*): A ray of light passing through the optical centre of a concave lens emerges without suffering any deviation as shown in **Fig. (c)**.

Formation of images by a concave lens:

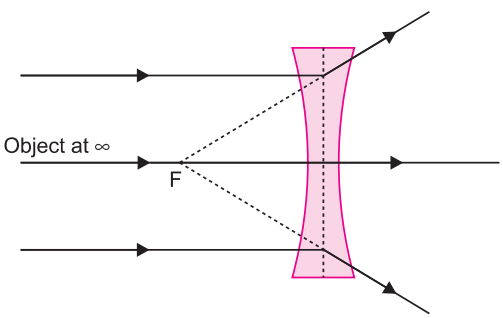
(*i*) When the object is placed between the lens and infinity

Image	Use
Between F and O	Spectacles
Virtual	
Erect	
Diminished	



(*ii*) When object is placed at infinity

Image
At F
Virtual
Erect
Highly Diminished



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11. Sign Convention for Lenses:

According to new Cartesian Sign Convention:

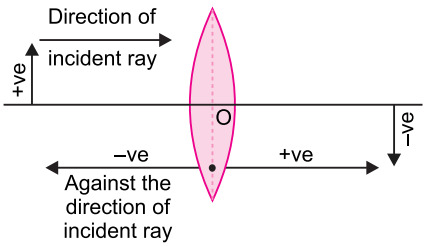
(*i*) All the distances are measured from the optical centre of the lens.

(*ii*) The distances measured in the same direction as that of incident light are taken as positive.

(*iii*) The distances measured against the direction of incident light are taken as negative.

(*iv*) The distances measured upward and perpendicular to the principal axis are taken as positive.

(*v*) The distances measured downward and perpendicular to the principal axis are taken as negative.



12. Lens Formula: A formula which gives us the relationship between the image distance (v), object distance (u), and focal length (f) of a lens is known as the lens formula, which is written as

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

This lens formula is applicable for both types of spherical lenses, convex lenses as well as concave lenses.

13. Magnification Produced by Lenses: The linear magnification is the ratio of the height of the image to the height of the object. Thus,

$$\text{Magnification} = \frac{\text{Height of image}}{\text{Height of object}} \text{ or } m = \frac{h'}{h}$$

where h' = Height of image

and h = Height of object.

In terms of image distance (v) and object distance (u), the linear magnification produced by a lens is equal to the ratio of image distance to the object distance.

$$\text{Magnification} = \frac{\text{Image distance}}{\text{Object distance}} \text{ or } m = \frac{v}{u}$$

where v = image distance

u = object distance.

If m is positive, then the image is erect and when m is negative the image is inverted.

Key Points:

1. *While solving numerical problems, use the formula,* $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ *and substitute the values of the known quantities with their proper signs. The unknown quantity is obtained with its proper sign after calculation. Do not give any sign to the unknown quantity.*
2. *Magnification is –ve for a real image and +ve for a virtual image.*
3. *Focal length of a convex lens is +ve and that of a concave lens is –ve.*
4. *For convex and concave lenses; u is always negative.*
5. *v is always negative for concave lens.*
6. *If* $m = 1$*; size of image is equal to the size of the object.*
   If $m > 1$*; the image is larger in size as compared to the object.*
   If $m < 1$*; the image is smaller in size as compared to the object.*

14. Power of a Lens:

The power of a lens is a measure of the degree of convergence or divergence of light rays falling on it. In other words, the power of a lens is defined as the reciprocal of its focal length in metres.

$$\text{Thus, power of a lens} = \frac{1}{\text{Focal length of the lens (in metres)}} \text{ or } P = \frac{1}{f},$$

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where, P = Power of the lens

and f = Focal length of the lens (in metres).

The SI unit of the power of a lens is dioptre, which is denoted by the letter D.

15. The power of a lens is one dioptre if its focal length is one metre. The power of lens is two dioptre if its focal length is $\frac{1}{2}$ m or 50 cm. The power of a converging (convex) lens is taken as positive while that of a diverging (concave) lens is taken as negative.

Power of a combination of lenses: If a number of lenses are placed in contact, then the power of the combination of lenses is equal to the algebraic sum of the powers of individual lenses.

$P = P_1 + P_2 + P_3 + \ldots\ldots$

Focal length of the combination of two lenses of focal lengths f_1 and f_2 respectively placed in close contact is given by

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2},$$

where F is the focal length of combination

$$\frac{1}{F} > \frac{1}{f_1} \text{ and } \frac{1}{F} > \frac{1}{F_2}$$

i.e., $F < f_1$ and $F < f_2$

Thus, the resultant focal length will be less than smallest individual focal length.

Total magnification in combination of lenses is given by

$m = m_1 \times m_2 \times m_3 \ldots$

IMPORTANT FORMULAE

1. Focal length, $f = \frac{R}{2}$

2. Mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

3. Magnification produced by mirror, $m = \frac{h'}{h} = \frac{-v}{u}$

4. **Snell's law of refraction:** For light ray going from medium 'a' to medium 'b'

$$\frac{\sin i}{\sin r} = \frac{n_b}{n_a} = {}_a n_b = \frac{v_a}{v_b} = \frac{\lambda_a}{\lambda_b}$$

5. Absolute refractive index of a medium,

$$n = \frac{\text{Speed of light in vaccum}}{\text{Speed of light in medium}} = \frac{c}{v}$$

6. If C is critical angle, then refractive index $n = \frac{1}{\sin C}$

7. Lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

8. Magnification produced by lens $m = \frac{h'}{h} = \frac{v}{u}$

9. Power of a lens, $P = \frac{1}{f(\text{in m})} = \frac{100}{f(\text{in cm})}$

10. Power of combination of lenses $P = P_1 + P_2 + P_3 + \ldots$

11. Total magnification of combination of lenses $m = m_1 \times m_2 \times m_3 \ldots$

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MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. A ray of light travelling in air falls obliquely on the surface of a calm pond. It will

(*a*) go into the water without deviating from its path
(*b*) deviate away from the normal
(*c*) deviate towards the normal
(*d*) turn back on its original path

2. The diameter of the reflecting surface of spherical mirror is called its

(*a*) aperture
(*b*) focal length
(*c*) radius of curvature
(*d*) none of these

3. Choose the incorrect statement.

(*a*) The height of the object is taken to be positive as the object is usually placed above the principal axis.
(*b*) The height of the image should be taken as positive for both virtual and real image.
(*c*) A negative sign in the value of the magnification indicates that the image is real.
(*d*) A positive sign in the value of the magnification indicates that the image is virtual.

4. If the magnification of a lens has a positive value, the image is

(*a*) real
(*b*) virtual and erect
(*c*) inverted
(*d*) none of these

5. An object is placed at the centre of curvature of a concave mirror. The distance between the image and the pole is

(*a*) equal to f
(*b*) greater than f but less than $2f$
(*c*) equal to $2f$
(*d*) greater than $2f$

6. If the magnification of a lens has a negative value, the image is

(*a*) real and inverted
(*b*) virtual
(*c*) erect
(*d*) none of these

7. The focal length, $f = \frac{R}{2}$ is valid

(*a*) for convex mirror but not for concave mirror.
(*b*) for concave mirror but not for convex mirror.
(*c*) for both convex and concave mirrors.
(*d*) neither for convex mirror nor for concave mirror.

8. The image of the distant object is obtained on a screen by using a concave mirror. The focal length of the mirror can be determined by measuring the distance between

(*a*) the object and the mirror
(*b*) the object and the screen
(*c*) the mirror and the screen
(*d*) the mirror and the screen as well as that between the object and the screen

9. Which of the following can make a parallel beam of light when light from a point source is incident on it?

(*a*) Concave mirror as well as convex lens
(*b*) Convex mirror as well as concave lens
(*c*) Two plane mirrors placed at 90° to each other
(*d*) Concave mirror as well as concave lens

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10. Under which of the following conditions a concave mirror can form a real image larger than the actual object?

(*a*) When the object is kept at a distance equal to its radius of curvature

(*b*) When object is kept at a distance less than its focal length

(*c*) When object is placed between the focus and centre of curvature

(*d*) When object is kept at a distance greater than its radius of curvature

11. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?

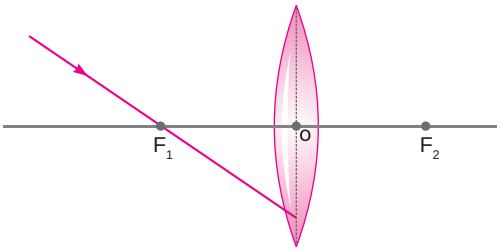
(*a*) 15 cm in front of the mirror

(*b*) 30 cm in front of the mirror

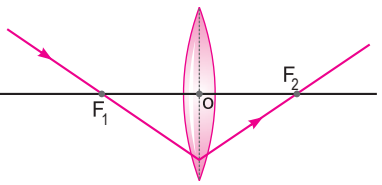
(*c*) between 15 cm and 30 cm in front of the mirror

(*d*) more than 30 cm in front of the mirror

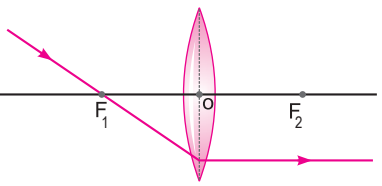
12. Which one of the following ray diagrams is correct for the ray of light incident on a lens as shown in figure? [*NCERT Exemplar*]



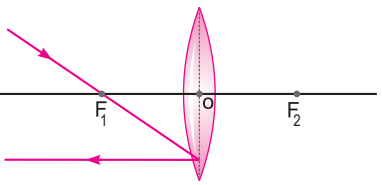
(*a*)



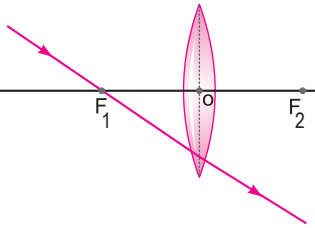
(*b*)



(*c*)



(*d*)



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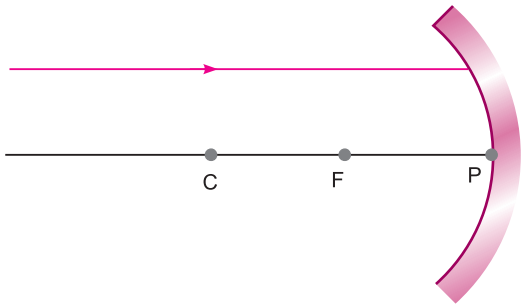
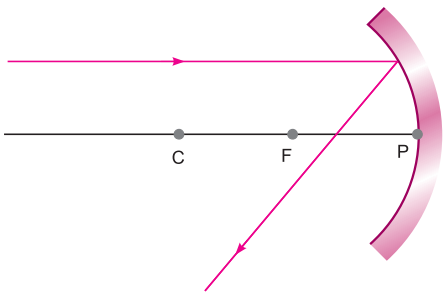
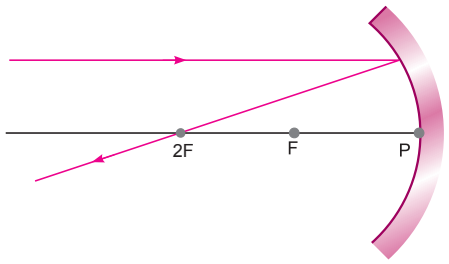
13. Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in Figure? [*NCERT Exemplar*]



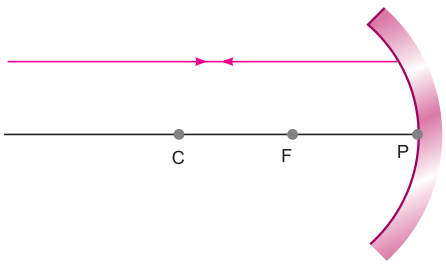
(*a*)



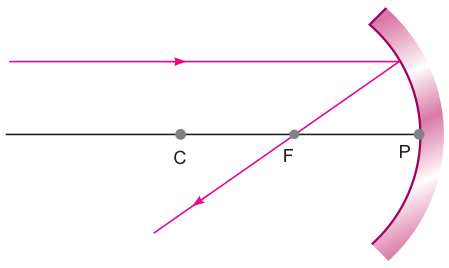
(*b*)



(*c*)



(*d*)



14. You are given water, mustard oil, glycerine and kerosene. In which of these media a ray of light incident obliquely at same angle would bend the most? [*NCERT Exemplar*]

(*a*) Kerosene (*b*) Water

(*c*) Mustard oil (*d*) Glycerine

15. A child is standing in front of a magic mirror. He finds the image of his head bigger, the middle portion of his body to be of same size and that of the legs smaller. Which of the following is the order of combinations for the magic mirror from the top? [*NCERT Exemplar*]

(*a*) Plane, convex and concave

(*b*) Convex, concave and plane

(*c*) Concave, plane and convex

(*d*) Convex, plane and concave

16. Two lenses of power +2.50 D and –3.75 D are combined to form a compound lens. Its focal length in cm will be

(*a*) 40 (*b*) –40 (*c*) 80 (*d*) –80

17. A man runs towards the plane mirror at 2 ms^{-1}. The relative speed of his image with respect to him will be

(*a*) 2 ms^{-1} (*b*) 4 ms^{-1} (*c*) 8 ms^{-1} (*d*) 10 ms^{-1}

18. An object is placed 20 cm in front of a plane mirror. The mirror is moved 2 cm towards the object. The distance between the positions of the original and final images seen in the mirror is

(*a*) 2 cm (*b*) 4 cm (*c*) 10 cm (*d*) 22 cm

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19. A ray of light that strikes a plane mirror PQ at an angle of incidence of 30°, is reflected from the plane mirror and then strikes a second plane mirror QR placed at right angles to the first mirror. The angle of reflection at the second mirror is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

20. Which position of the object will produce a magnified virtual image, if a concave mirror of focal length 15 cm is being used?

(*a*) 10 cm (*b*) 20 cm (*c*) 30 cm (*d*) 35 cm

21. A concave mirror produces a magnification of +4. The object is placed

(*a*) At the focus

(*b*) Between focus and centre of curvature

(*c*) Between focus and pole

(*d*) Beyond the centre of curvature

22. Two big mirrors A and B are fitted side by side on a wall. A man is standing at such a distance from the wall that he can see the erect image of his face in both the mirrors. When the man starts walking towards the mirrors, he finds that the size of his face in mirror A goes on increasing but that in mirror B remains the same

(*a*) Mirror A is concave and mirror B is convex

(*b*) Mirror A is plane and mirror B is concave

(*c*) Mirror A is concave and mirror B is plane

(*d*) Mirror A is convex and mirror B is concave

23. A ray of light is travelling in a direction perpendicular to the boundary of a parallel glass slab. The ray of light

(*a*) Is refracted towards the normal (*b*) Is refracted away from the normal

(*c*) Is reflected along the same path (*d*) Does not get refracted

24. A ray of light passes from a medium X to another medium Y. No refraction of light occurs if the ray of light hits the boundary of medium Y at an angle of

(*a*) 120° (*b*) 90° (*c*) 45° (*d*) 0°

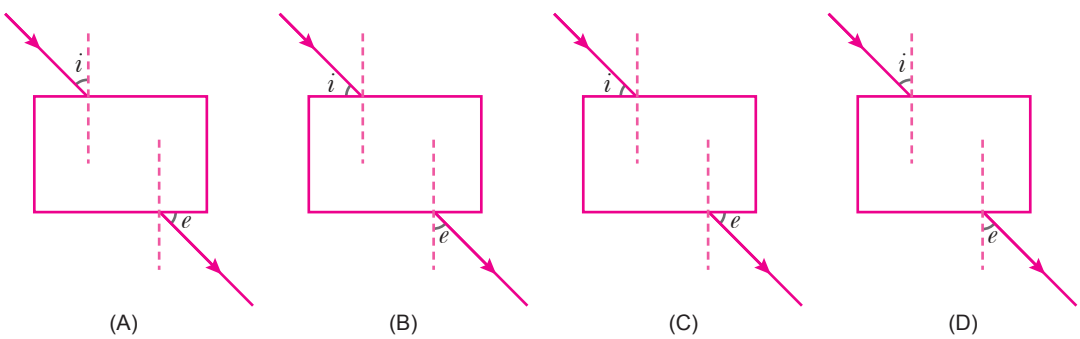
25. A lens of focal length 12 cm forms an erect image, three times the size of the object. The distance between the object and image is

(*a*) 8 cm (*b*) 16 cm (*c*) 24 cm (*d*) 36 cm

26. If an object is placed 21 cm from a converging lens, the image formed is slightly smaller than the object. If the object is placed at a distance of 19 cm from the lens, the image formed is slightly larger than the object. The approximate focal length of the lens is

(*a*) 20 cm (*b*) 18 cm (*c*) 10 cm (*d*) 5 cm

27. A student does the experiment on tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. He can get a correct measure of the angle of incidence and the angle of emergence by following the labelling indicated in figure



(*a*) A (*b*) B (*c*) C (*d*) D

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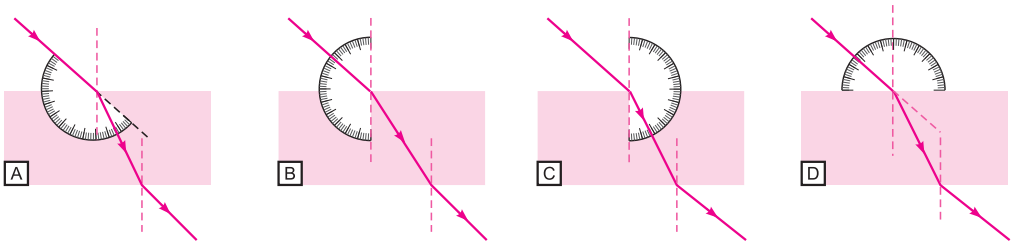
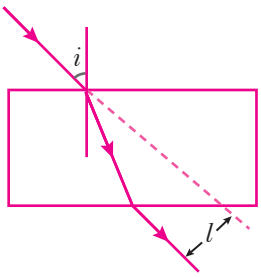
28. A student traces the path of a ray of light passing through a rectangular slab.



For measuring the angle of incidence, he must position the protractor in the manner shown in the figure

(*a*) A (*b*) B (*c*) C (*d*) D

29. A student traces the path of a ray of light passing through a rectangular slab for three different values of angle of incidence ($\angle i$) namely 30°, 45° and 60°. He extends the direction of incident ray by a dotted line and measures the perpendicular distance 'l' between the extended incident ray and the emergent ray.



He will observe that

(*a*) 'l' keeps on increasing with increase in angle of incidence

(*b*) 'l' keeps on decreasing with increase in angle of incidence

(*c*) 'l' remains the same for all three angles of incidence

(*d*) 'l' is the maximum for $\angle i = 45°$ and is less than this value for $\angle i = 30°$ and $\angle i = 60°$.

30. Focal length of plane mirror is

(*a*) At infinity (*b*) Zero

(*c*) Negative (*d*) None of these

31. Image formed by plane mirror is

(*a*) Real and erect (*b*) Real and inverted

(*c*) Virtual and erect (*d*) Virtual and inverted

32. A concave mirror gives real, inverted and same size image if the object is placed

(*a*) At F (*b*) At infinity (*c*) At C (*d*) Beyond C

33. In optics, an object which has higher refractive index is called

(*a*) Optically rarer (*b*) Optically denser (*c*) Optical density (*d*) Refractive index

34. Convex lens forms a real, point sized image at focus, the object is placed

(*a*) At focus (*b*) Between F and 2F (*c*) At infinity (*d*) At 2F

35. The unit of power of lens is

(*a*) Metre (*b*) Centimetre (*c*) Dioptre (*d*) M^{-1}

36. The radius of curvature of a mirror is 20cm the focal length is

(*a*) 20 cm (*b*) 10 cm (*c*) 40 cm (*d*) 5 cm

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37. An object is placed at a distance of 0.25 m in front of a plane mirror. The distance between the object and image will be

(*a*) 0.25 m (*b*) 1.0 m (*c*) 0.5 m (*d*) 0.125 m

38. The angle of incidence for a ray of light having zero reflection angle is

(*a*) 0° (*b*) 30° (*c*) 45° (*d*) 90°

39. For a real object, which of the following can produce a real image?

(*a*) Plane mirror (*b*) Concave mirror (*c*) Concave lens (*d*) Convex mirror

40. Which of the following mirror is used by a dentist to examine a small cavity?

(*a*) Convex mirror (*b*) Plane mirror

(*c*) Concave mirror (*d*) Combination of convex and concave mirror

41. An object at a distance of + 15 cm is slowly moved towards the pole of a convex mirror. The image will get

(*a*) shortened and real (*b*) enlarged and real

(*c*) enlarged and virtual (*d*) diminished and virtual

42. A concave mirror of radius 30 cm is placed in water. Its focal length in air and water differ by

(*a*) 15 (*b*) 20 (*c*) 30 (*d*) 0

43. A concave mirror of focal length 20 cm forms an image having twice the size of object. For the virtual position of image, the position of object will be at

(*a*) 25 cm (*b*) 40 cm (*c*) 10 cm (*d*) At infinity

44. The image formed by concave mirror is real, inverted and of the same size as that of the object. The position of object should be

(*a*) at the focus (*b*) at the centre of curvature

(*c*) between focus and centre of curvature (*d*) beyond centre of curvature

45. The nature of the image formed by concave mirror when the object is placed between the focus (F) and centre of curvature (C) of the mirror observed by us is

(*a*) real, inverted and diminished (*b*) virtual, erect and smaller in size

(*c*) real, inverted and enlarged (*d*) virtual, upright and enlarged

46. The nature of image formed by a convex mirror when the object distance from the mirror is less than the distance between pole and focal point (F) of the mirror would be

(*a*) real, inverted and diminished in size

(*b*) real, inverted and enlarged in size

(*c*) virtual, upright and diminished in size

(*d*) virtual, upright and enlarged in size

47. The angle of incidence *i* and angle of refraction *r* are equal in a transparent slab when the value of *i* is

(*a*) 0° (*b*) 45°

(*c*) 90° (*d*) depend on the material of the slab

48. The refractive index of transparent medium is greater than one because

(*a*) Speed of light in vacuum < speed of light in transparent medium

(*b*) Speed of light in vacuum > speed of light in transparent medium

(*c*) Speed flight in vacuum = speed of light in transparent medium

(*d*) Frequency of light wave changes when it moves from rarer to denser medium

49. You are given three media A, B and C of refractive index 1.33, 1.65 and 1.46. The medium in which the light will travel fastest is

(*a*) A (*b*) B (*c*) C (*d*) equal in all three media

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50. Light from the Sun falling on a convex lens will converge at a point called

(*a*) centre of curvature (*b*) focus

(*c*) radius of curvature (*d*) optical centre

51. A divergent lens will produce

(*a*) always real image (*b*) always virtual image

(*c*) both real and virtual image (*d*) none of these

52. When an object moves closer to convex lens, the image formed by it shift

(*a*) away from the lens

(*b*) towards the lens

(*c*) first towards and then away from the lens

(*d*) first away and then towards the lens

53. When object moves closer to a concave lens, the image formed by it shift

(*a*) away from the lens on the same side of object

(*b*) towards the lens

(*c*) away from the lens on the other side of lens

(*d*) first towards and then away from the lens

54. A magnified real image is formed by a convex lens when the object is at

(*a*) F (*b*) between F and 2F

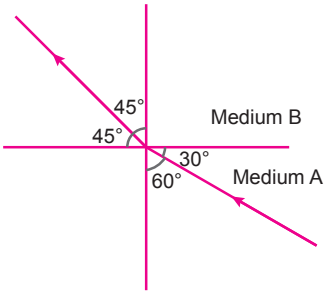
(*c*) 2F (*d*) (*a*) and (*b*) both

55. A 10 mm long awl pin is placed vertically in front of a concave mirror. A 5 mm long image of the awl pin is formed at 30 cm in front of the mirror. The focal length of this mirror is [*NCERT Exemplar*]

(*a*) – 30 cm (*b*) – 20 cm

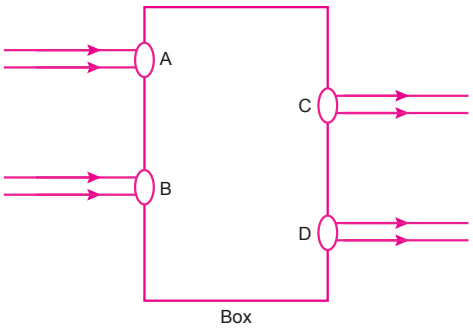
(*c*) – 40 cm (*d*) – 60 cm

56. Figure shows a ray of light as it travels from medium A to medium B. Refractive index of the medium B relative to medium A is [*NCERT Exemplar*]



(*a*) $\frac{\sqrt{3}}{\sqrt{2}}$ (*b*) $\frac{\sqrt{2}}{\sqrt{3}}$ (*c*) $\frac{1}{\sqrt{2}}$ (*d*) $\sqrt{2}$

57. Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in the figure. Which of the following could be inside the box? [*NCERT Exemplar*]



(*a*) A rectangular glass slab

(*b*) A convex lens .

(*c*) A concave lens

(*d*) A prism

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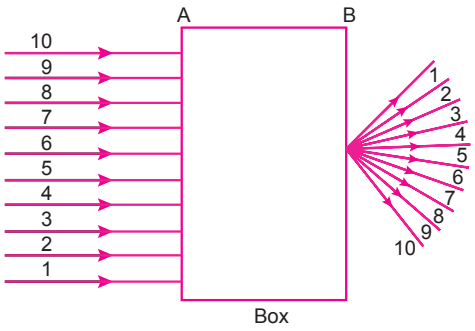
58. A beam of light is incident through the holes on side A and emerges out of the hole on the other face of the box as shown in the figure. Which of the following could be inside the box? *[NCERT Exemplar]*



(*a*) Concave lens
(*b*) Rectangular glass slab
(*c*) Prism
(*d*) Convex lens

59. Which of the following statements is/are true? *[NCERT Exemplar]*

(*a*) A convex lens has 4 dioptre power having a focal length 0.25 m
(*b*) A convex lens has -4 dioptre power having a focal length 0.25 m
(*c*) A concave lens has 4 dioptre power having a focal length 0.25 m
(*d*) A concave lens has – 4 dioptre having a focal length 0.25 m

60. Magnification produced by a rear view mirror fitted in vehicles *[NCERT Exemplar]*

(*a*) is less than one
(*b*) is more than one
(*c*) is equal to one
(*d*) can be more than or less than one depending upon the position of the object in front of it.

61. A full length image of a distant tall building can definitely be seen by using *[NCERT Exemplar]*

(*a*) a concave mirror
(*b*) a convex mirror
(*c*) a plane mirror
(*d*) both concave as well as plane mirror

62. In torches, search lights and headlights of vehicles the bulb is placed *[NCERT Exemplar]*

(*a*) between the pole and the focus of the reflector
(*b*) very near to the focus of the reflector
(*c*) between the focus and centre of curvature of the reflector
(*d*) at the centre of curvature of the reflector

63. The laws of reflection hold good for *[NCERT Exemplar]*

(*a*) plane mirror only
(*b*) concave mirror only
(*c*) convex mirror only
(*d*) all mirrors irrespective of their shape

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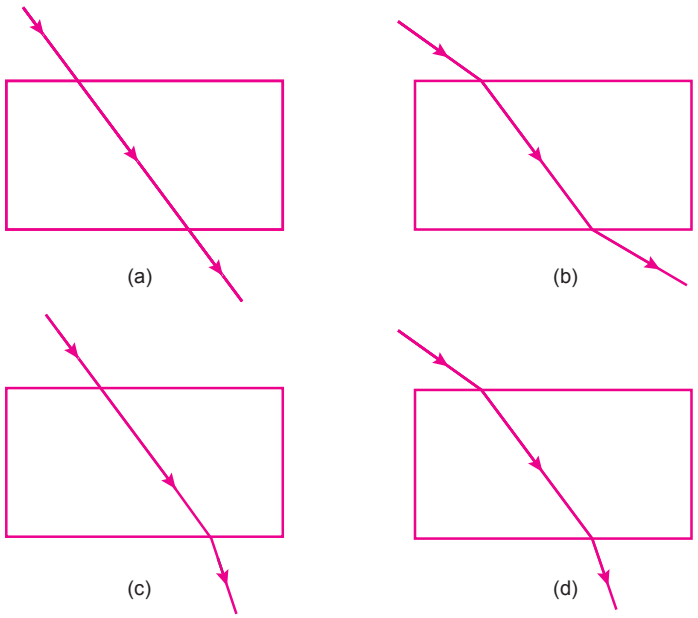
64. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students are shown as A, B, C and D in figure. Which one of them is correct?
[*NCERT Exemplar*]



(*a*) A (*b*) B (*c*) C (*d*) D

65. In which of the following, the image of an object placed at infinity will be highly diminished and point sized?
[*NCERT Exemplar*]

(*a*) Concave mirror only
(*b*) Convex mirror only
(*c*) Convex lens only
(*d*) Concave mirror, convex mirror, concave lens and convex lens.

66. When light falls on a smooth polished surface, most of it

(*a*) is reflected in the same direction (*b*) is reflected in different directions
(*c*) is scattered (*d*) is refracted into the second medium

67. Image formed by reflection from a plane mirror is

(*a*) real and inverted (*b*) virtual and erect
(*c*) real and erect (*d*) virtual and inverted

68. If an incident ray passes through the focus, the reflected ray will

(*a*) pass through the pole (*b*) be parallel to the principal axis
(*c*) retrace its path (*d*) pass through the centre of curvature

69. Focal length of a concave mirror is

(*a*) negative (*b*) positive
(*c*) depends on the position of object (*d*) depends on the position of image

70. If the power of a lens is – 2 D, what is its focal length?

(*a*) +50 cm (*b*) –100 cm
(*c*) –50 cm (*d*) +100 cm

71. When the object is placed between f and 2f of a convex lens, the image formed is

(*a*) at f (*b*) at 2f
(*c*) beyond 2f (*d*) between O and f

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72. If the image is formed in front of the mirror, then the image distance will be

(*a*) positive or negative depending on the size of the object
(*b*) neither positive nor negative
(*c*) positive
(*d*) negative

73. A ray of light is travelling from a rarer medium to a denser medium. While entering the denser medium at the point of incidence, it

(*a*) goes straight into the second medium (*b*) bends towards the normal
(*c*) bends away from the normal (*d*) does not enter at all

74. Monochromatic light of frequency 5×10^{14} Hz travelling in vacuum enters a medium of refractive index 1.5. Its wavelength in the medium is

(*a*) 5000 Å (*b*) 4000 Å (*c*) 5500 Å (*d*) 6000 Å

75. Two thin lenses, one of focal length +60 cm and the other of focal length -20 cm are kept in contact. Their combined focal length is

(*a*) – 30 cm (*b*) + 30 cm (*c*) – 15 cm (*d*) + 30 cm

76. When light travels from one medium to other whose refractive index is different, then which of the given will change?

(*a*) Wavelength and velocity (*b*) Frequency and wavelength
(*c*) Frequency and wavelength (*d*) Frequency, wavelength and velocity

77. The number of images observable between two parallel mirrors is

(*a*) 2 (*b*) 4 (*c*) 6 (*d*) Infinity

78. f = r/2 is valid

(*a*) For convex mirrors but not for concave mirrors
(*b*) For concave mirrors but not for convex mirrors
(*c*) For both convex and concave mirrors
(*d*) Neither for convex mirrors nor for concave mirrors

79. A hole is made in a convex lens, then

(*a*) A hole appears in the image (*b*) Image size decreases
(*c*) Image intensity decreases (*d*) No change

80. Which of the given is not true of an image formed by a plane mirror ?

(*a*) It is erect (*b*) It is virtual
(*c*) It is diminished (*d*) It is at the same distance as the object

81. Two lenses of power +3 and -1 dioptres are placed in contact. The focal length of the combined lens is

(*a*) 100 cm (*b*) 25 cm (*c*) 50 cm (*d*) 30.3 cm

82. The focal length of a concave mirror is 50 cm. To obtain an inverted image two times the size of the object, the object should be placed at

(*a*) 50 cm (*b*) 63 cm (*c*) 72 cm (*d*) 75 cm

83. The focal length of lens depends on

(*a*) The radii of curvature of its surfaces
(*b*) The refractive index of its material
(*c*) The refractive index of the medium surrounding
(*d*) All of these factors

84. A parallel beam of light is incident on a converging lens parallel to its principal axis. As we move away from the lens on the other side on its principal axis, the intensity of light

(*a*) Remains constant (*b*) Continuously increases
(*c*) Continuously decreases (*d*) First increases and then decreases

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85. Using a convex lens, a clear image of candle flame is produced on a screen. How many other clear images can be received on this screen if only the lens is to be shifted ?

(*a*) A large number (*b*) Only one more

(*c*) Two more (*d*) None of these

86. A convex lens of power P is immersed in a water . How will its power change ?

(*a*) Increases

(*b*) Remain unchanged

(*c*) Decreases

(*d*) Increases for red colour and decreases for blue colour

87. Which of the given can produce a virtual image larger in size than the object ?

(*a*) Concave lens (*b*) Convex lens

(*c*) Convex concave lens (*d*) None of these

88. A lens has a power of +0.5D. It is

(*a*) A concave lens of local length 5 m (*b*) A convex lens of focal length 2 m

(*c*) A convex lens of focal length 5 m (*d*) A concave lens of focal length 2 m

89. A diverging lens will produce

(*a*) Always a virtual image (*b*) Real or virtual image

(*c*) Always real image (*d*) None of these

90. Refractive index

(*a*) Depends on the wavelength of light used

(*b*) Is actual property of the substance

(*c*) Depends on the angle of incidence

(*d*) None of these

91. Which of the given is NOT paired correctly?

(*a*) Solar furnace-concave mirror (*b*) Rear -view mirror-convex mirror

(*c*) Magnifying glass -convex lens (*d*) None of these

92. In order to obtain a magnification of, -0.6 (minus 0.6) with a concave mirror, the object must be placed

(*a*) At the focus (*b*) Between pole and focus

(*c*) Between focus and centre of curvature (*d*) Beyond the centre of curvature

93. Which statement is true for the reflection of light? ***[CBSE Question Bank]***

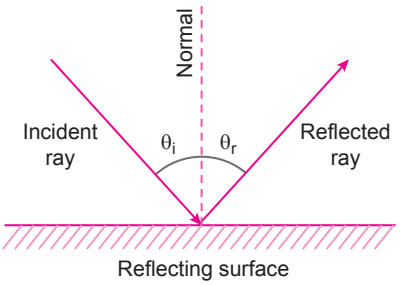
(*a*) The angle of incidence and reflection are equal.

(*b*) The sum of angle of incidence and reflection is always greater than 90°.

(*c*) The reflected light is less bright than the incident light.

(*d*) The beams of incident light after reflection diverges at unequal angles.

94. The image shows reflection of light on a mirror.



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Based on the image, what can be inferred? *[CBSE Question Bank]*

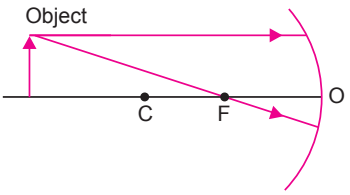
(*a*) The angle between incident ray and normal is greater than the angle between normal and the reflected ray.

(*b*) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

(*c*) The incident ray, reflected ray, and normal at the point of reflection do not lie on a common plane.

(*d*) The angle between incident ray and normal is smaller than the angle between normal and the reflected ray.

95. The image shows the path of incident rays to a concave mirror.



Where would the reflected rays meet for the image formation to take place? *[CBSE Question Bank]*

(*a*) Between F and O

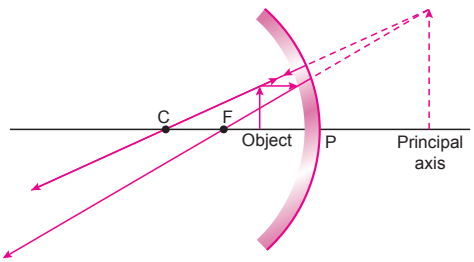
(*b*) Beyond C

(*c*) Between C and F

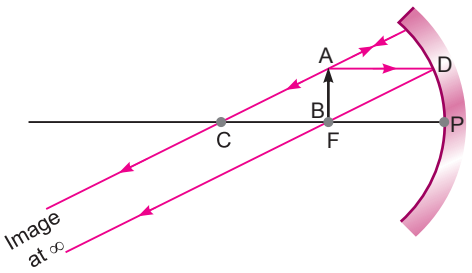
(*d*) Behind the mirror

96. An object is placed near a concave mirror at a distance of one-fourth the radius of curvature of the concave mirror. Which ray diagram shows the incident rays, reflected rays, and the position and nature of the image formed? *[CBSE Question Bank]*

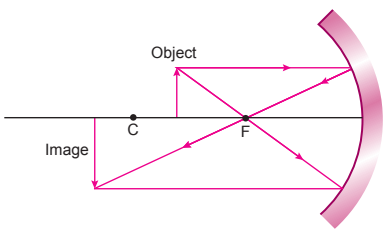
(*a*)



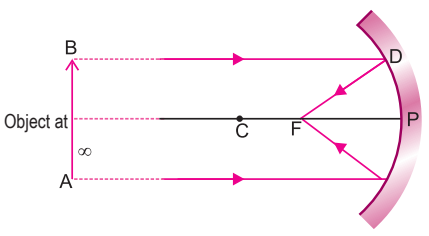
(*b*)



(*c*)

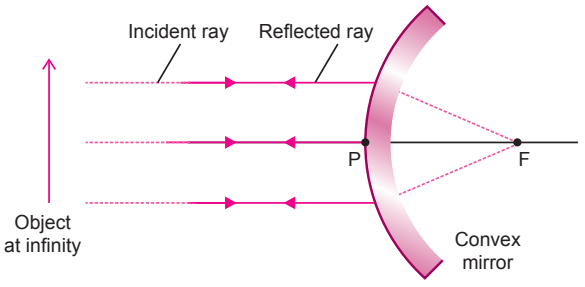


(*d*)



97. Which image represents the path of incident and reflected ray from a convex mirror when an object is placed at infinity? *[CBSE Question Bank]*

(*a*)



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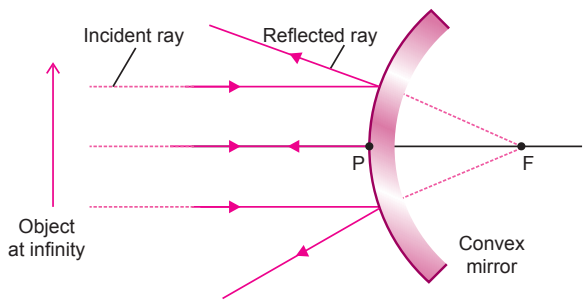
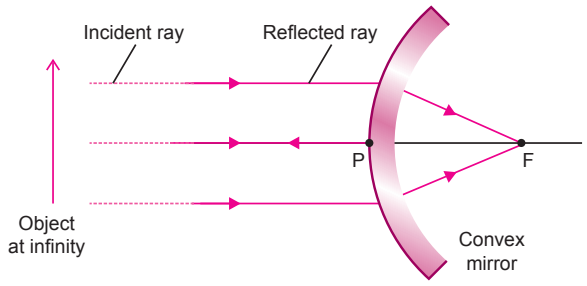
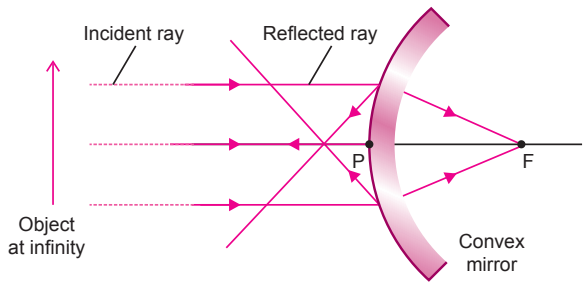
(*b*)



(*c*)



(*d*)



98. A student studies that convex mirror always forms virtual image irrespective of its position. What causes the convex mirror to always form a virtual image? **[*CBSE Question Bank*]**

(*a*) Because the reflected ray never intersect.

(*b*) Because the incident ray traces its path back along the principal axis.

(*c*) Because the incident ray of a convex mirror gets absorbed in the mirror.

(*d*) Because the reflected ray converges at a single point.

99. A student conducts an activity using a concave mirror with focal length of 10 cm. He placed the object 15 cm from the mirror. Where is the image likely to form? **[*CBSE Question Bank*]**

(*a*) At 6 cm in front of the mirror

(*b*) At 6 cm behind the mirror

(*c*) At 30 cm behind the mirror

(*d*) At 30 cm in front of the mirror

100. Rekha placed a juice bottle at a distance of 20 cm in front of a convex mirror which has a focal length of 20 cm. Where is the image likely to form? **[*CBSE Question Bank*]**

(*a*) At a distance of 10 cm in front of the mirror

(*b*) At focus in front of the mirror

(*c*) At a distance of 10 cm behind the mirror

(*d*) At focus behind the mirror

101. Sunil conducts an activity using an object of height 10 cm and a convex mirror of focal length 20 cm. He placed the object at a distance of 20 cm in front of the mirror. What is likely to be height of the image produced? **[*CBSE Question Bank*]**

(*a*) – 5 cm (*b*) 5 cm (*c*) 1 cm (*d*) 20 cm

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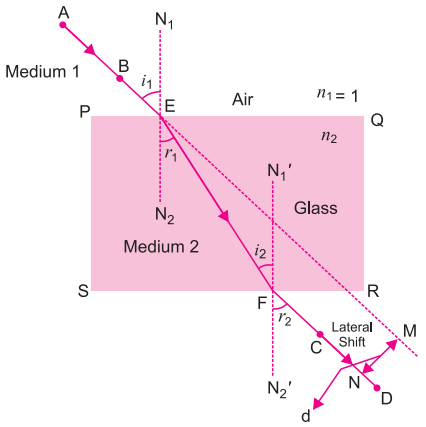
102. The image shows the path of light travelling through a glass slab.



What causes the ray of light to deviate from its original path? ***[CBSE Question Bank]***

(*a*) Change in the temperature of the air

(*b*) Change in the amount of light

(*c*) Change in the direction of wind flow

(*d*) Change in the density of the medium

103. A student studies that speed of light in air is 300000 km/sec whereas that of speed in a glass slab is about 197000 km/ sec. What causes the difference in speed of light in these two media? ***[CBSE Question Bank]***

(*a*) Difference in density (*b*) Difference in amount of light

(*c*) Difference in direction of wind flow (*d*) Difference in temperature

104. The speed of light in air is 3×10^8 ms^{-1}, whereas that of the speed of light in water is 2.26×10^8 ms^{-1}. What is the refractive index of water with respect to air? ***[CBSE Question Bank]***

(*a*) 2.64 (*b*) 1 (*c*) 1.32 (*d*) 0.75

105. Rahul conducts an experiment using an object of height 10 cm and a concave lens with focal length 20 cm. The object is placed at a distance of 25 cm from the lens. Can the image be formed on a screen? ***[CBSE Question Bank]***

(*a*) Yes, as the image formed will be real.

(*b*) No, as the image formed will be inverted.

(*c*) No, as the image formed will be virtual.

(*d*) Yes, as the image formed will be erect.

106. A student conducts an experiment using a convex lens of focal length 20 cm and an object of height 15 cm. He placed the object at 25 cm from the lens. Can the image be formed on a screen? ***[CBSE Question Bank]***

(*a*) Yes, because a real image will be formed.

(*b*) Yes, because an erect image will be formed.

(*c*) No, because an inverted image will be formed.

(*d*) No, because a virtual image will be formed.

107. Rakhi conducts an experiment to produce an image of an object on a screen which is placed at 20 cm from the lens. She uses a convex lens of focal length 15 cm for the experiment.

Where should she place the object in order to produce the sharpest image? ***[CBSE Question Bank]***

(*a*) 20 cm in front of the lens (*b*) 8 cm in front of the lens

(*c*) 15 cm in front of the lens (*d*) 60 cm in front of the lens

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108. An image of an object is produced on a screen which is about 36 cm using a convex lens. The image produced is about 3 times the size of the object. What is the size of the object? ***[CBSE Question Bank]***

(*a*) 12 cm (*b*) –12 cm (*c*) 33 cm (*d*) 39 cm

109. An object of height 10 cm is placed in front of a convex lens having focal length of 12 cm. The object is placed at a distance of 36 cm in front of the lens. How many times is the image likely to be magnified? ***[CBSE Question Bank]***

(*a*) ½ times (*b*) 3 times (*c*) 4 times (*d*) 2 times

110. A student conducts an experiment using a convex lens. He places the object at a distance of 60 cm in front of the lens and observed that the image is formed at a distance of 30 cm behind the lens. What is the power of the lens? ***[CBSE Question Bank]***

(*a*) 0.005 dioptre (*b*) 50 dioptre (*c*) 5 dioptre (*d*) 0.05 dioptre

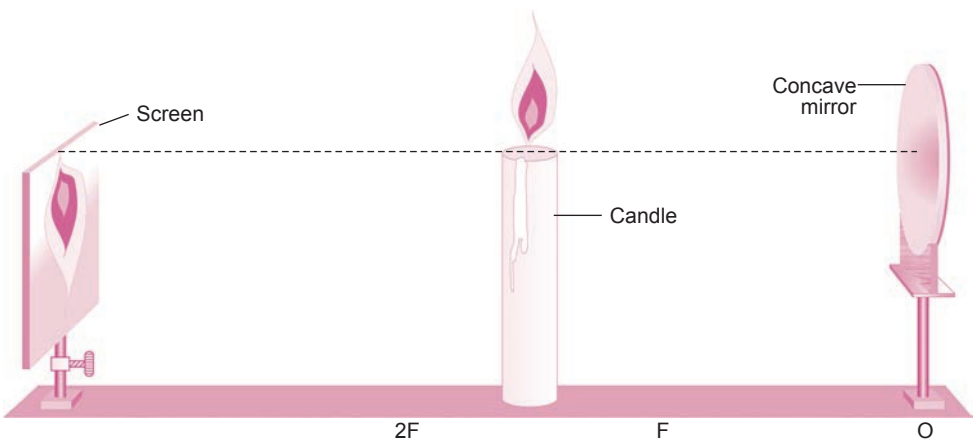
Answers

1. (*c*)	**2.** (*a*)	**3.** (*b*)	**4.** (*b*)	**5.** (*c*)	**6.** (*a*)	**7.** (*c*)	**8.** (*c*)
9. (*a*)	**10.** (*c*)	**11.** (*b*)	**12.** (*b*)	**13.** (*d*)	**14.** (*d*)	**15.** (*c*)	**16.** (*d*)
17. (*b*)	**18.** (*b*)	**19.** (*c*)	**20.** (*a*)	**21.** (*c*)	**22.** (*c*)	**23.** (*d*)	**24.** (*b*)
25. (*b*)	**26.** (*c*)	**27.** (*d*)	**28.** (*b*)	**29.** (*a*)	**30.** (*a*)	**31.** (*c*)	**32.** (*c*)
33. (*b*)	**34.** (*c*)	**35.** (*c*)	**36.** (*b*)	**37.** (*c*)	**38.** (*a*)	**39.** (*b*)	**40.** (*c*)
41. (*d*)	**42.** (*d*)	**43.** (*c*)	**44.** (*b*)	**45.** (*c*)	**46.** (*c*)	**47.** (*a*)	**48.** (*b*)
49. (*a*)	**50.** (*b*)	**51.** (*b*)	**52.** (*a*)	**53.** (*b*)	**54.** (*d*)	**55.** (*b*)	**56.** (*a*)
57. (*a*)	**58.** (*d*)	**59.** (*a*)	**60.** (*a*)	**61.** (*b*)	**62.** (*b*)	**63.** (*d*)	**64.** (*b*)
65. (*d*)	**66.** (*a*)	**67.** (*b*)	**68.** (*b*)	**69.** (*a*)	**70.** (*c*)	**71.** (*c*)	**72.** (*d*)
73. (*b*)	**74.** (*b*)	**75.** (*a*)	**76.** (*a*)	**77.** (*d*)	**78.** (*c*)	**79.** (*c*)	**80.** (*c*)
81. (*c*)	**82.** (*d*)	**83.** (*d*)	**84.** (*d*)	**85.** (*b*)	**86.** (*c*)	**87.** (*b*)	**88.** (*b*)
89. (*a*)	**90.** (*a*)	**91.** (*d*)	**92.** (*d*)	**93.** (*a*)	**94.** (*b*)	**95.** (*c*)	**96.** (*a*)
97. (*b*)	**98.** (*a*)	**99.** (*d*)	**100.** (*c*)	**101.** (*b*)	**102.** (*d*)	**103.** (*a*)	**104.** (*c*)
105. (*c*)	**106.** (*a*)	**107.** (*d*)	**108.** (*a*)	**109.** (*a*)	**110.** (*c*)		

CASE-BASED QUESTIONS

Question numbers 1 to 3 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).



We know that the characteristics of image formed by a concave mirror depend on the position of the object with respect to the mirror.

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When an object is placed between F and infinity, the image formed is real and inverted. But when the object is placed between F and mirror it cannot be obtained on the screen. The image formed in this case is virtual, erect and magnified. Such image may be seen by looking in the mirror directly.

When the object is moved from focus towards infinity, the image moves from infinity towards focus and its size decreases.

When object is placed at $2F$ image of the same size is formed at $2F$, itself. **[*CBSE Question Bank*]**

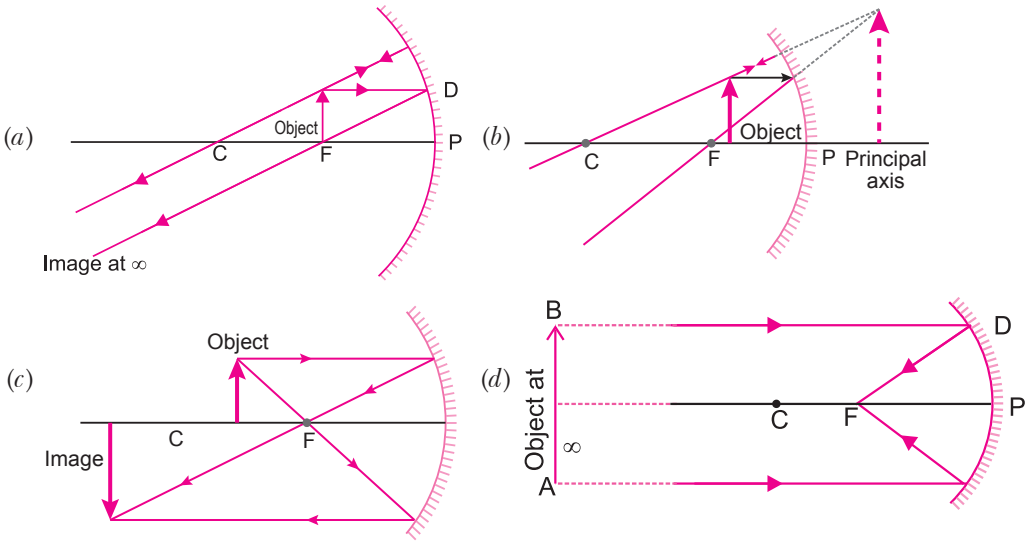
(*i*) If an object is placed 10 cm in front of a concave mirror of focal length 20 cm, the image will be

(*a*) real, erect, magnified
(*b*) real, inverted, diminished
(*c*) virtual, erect and magnified
(*d*) virtual, erect and diminished

(*ii*) The minimum distance between the object and its real image for concave mirror is

(*a*) zero
(*b*) f
(*c*) $2f$
(*d*) $4f$

(*iii*) An object is placed near a concave mirror at a distance of half the radius of curvature of the concave mirror. Which ray diagram shows the incident rays, reflected rays, and the position and nature of the image formed?



(*iv*) An object is placed at the centre of curvature of a concave mirror. The distance between its image and the pole is

(*a*) equal to f
(*b*) equal to $2f$
(*c*) greater than $2f$
(*d*) between f and $2f$

(*v*) A candle flame 3 cm high is placed at a distance of 3 m from a wall. How far from the wall must a concave mirror be placed in order that it may form an image of the flame 9 cm high on the wall?

(*a*) 1.5 m
(*b*) 2.5 m
(*c*) 3 m
(*d*) 4.5 m

2. Read the following and answer any four questions from (*i*) to (*v*).

The image formed by a convex lens depends on the position of the object in front of the lens. When the object is placed anywhere between focus and infinity, the image formed by convex lens is real and inverted. The image is not obtained on the screen when the object is placed between focus and the lens.

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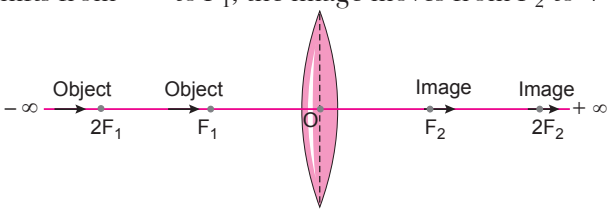
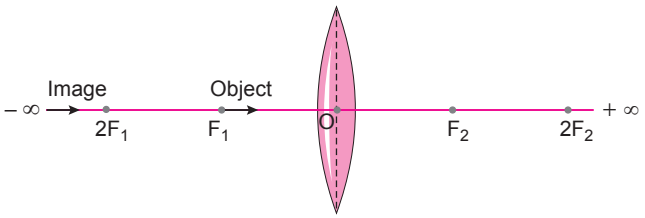
The distance between the optical centre O of the convex lens and the focus point F_1 or F_2 is its focal length.

When the object shifts from $-\infty$ to F_1, the image moves from F_2 to $+\infty$.



When the object shifts from F_1 to O, the image moves from $-\infty$ to O.



A student did an experiment with a convex lens. He put an object at different distances from the lens. In each case he measured the distance of the image from the lens. The results were recorded in the following table.

Object distance (in cm)	25	30	40	60	120
Image distance (in cm)	100	24	60	30	40

Unfortunately his results are written in the wrong order. ***[CBSE Question Bank]***

(*i*) The focal length of this lens is

(*a*) 20 cm (*b*) 25 cm

(*c*) 30 cm (*d*) 35 cm

(*ii*) The image distances in the correct order (in cm) is

(*a*) 24, 30, 40, 60, 100 (*b*) 100, 24, 60, 40, 30

(*c*) 100, 60, 30, 40, 24 (*d*) 100, 60, 40, 30, 24

(*iii*) Which of this object distances gives the biggest image?

(*a*) 30 cm (*b*) 25 cm

(*c*) 40 cm (*d*) 60 cm

(*iv*) The minimum distance between an object and its real image formed by a convex lens is

(*a*) $2f$ (*b*) $3f$

(*c*) $4f$ (*d*) zero

(*v*) A virtual image is formed by convex lens when object is placed

(*a*) at infinity (*b*) between C and F

(*c*) at F (*d*) between F and O

3. Read the following and answer any four questions from (*i*) to (*v*).

If rays parallel to the axis fall on thin lens, they will be focused to a point called the focal point, F. This will not be precisely true for a lens with spherical surfaces. But it will be very nearly true; i.e., parallel rays will be focused to a tiny region that is nearly a point, if the diameter of the lens is small compared to radii of curvature of the two lens surfaces. This condition is satisfied by a thin lens.

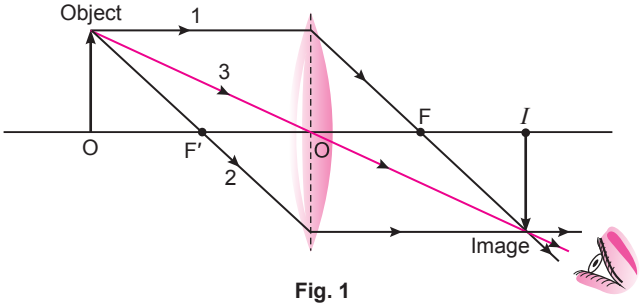


Fig. 1

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By drawing the same three rays we can determine the image position for diverging lens.

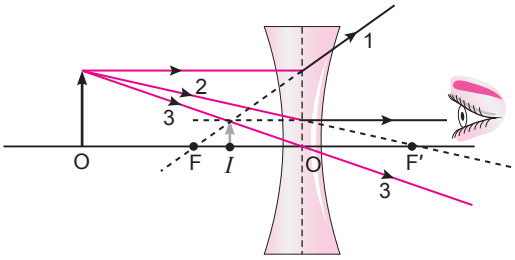

Fig. 2: Finding the image by ray tracing for a diverging lens

To find the image point by drawing rays would be difficult if we had to determine all the refractive angles. So, to find the image point, we need to consider only three rays which shows an arrow as the object and a converging lens forming an image to the right. The three rays are drawn as follows:

(*i*) Ray 1 is drawn parallel to the axis; therefore it is refracted by the lens so that it passes along a line through the focal point F.

(*ii*) Ray 2 is drawn on a line, passing through the other focal point F and emerges from the lens parallel to the axis.

(*iii*) Ray 3 is directed towards the very centre of the lens where the two surfaces are essentially parallel to each other; this ray therefore emerges from the lens at the same angle as it entered.

Any two of these rays will suffice to locate the image point, which is the point where they intersect. In this way, we can find the image point for one point of the object. The image points for all other points on the object can be found similarly to determine complete image of the object.

[CBSE Question Bank]

(*i*) How will the image formed by convex lens be affected if the upper half of the lens is wrapped with the black paper?

(*a*) There will be no effect.

(*b*) The brightness of the image will be reduced.

(*c*) The upper half of the image will be absent.

(*d*) The size of the image is reduced to one-half.

(*ii*) The refractive index of glass with respect to air is $\frac{3}{2}$ and the refractive index of water with respect to air is $\frac{4}{3}$. The refractive index of glass with respect to water will be

(*a*) 1.125 (*b*) 1.225

(*c*) 1.425 (*d*) 1.525

(*iii*) To form an image twice the size of the object, using a convex lens of focal length 20 cm, the object distance must be

(*a*) less than 20 cm (*b*) greater than 40 cm

(*c*) between 20 cm and 40 cm (*d*) none of these

(*iv*) Two thin lenses of power, +3.5 D and – 2.5 D are placed contact, then power and focal length of the lens combination is

(*a*) +1 D, +100 cm (*b*) +2 D, +150 cm

(*c*) +1 D, +200 cm (*d*) +2 D, +100 cm

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(v) Convex lens and concave lens are also known as

(*a*) converging lens and converging lens
(*b*) converging lens and diverging lens
(*c*) diverging lens and converging lens
(*d*) diverging lens and diverging lens

Answers

1. (*i*)—(*c*)

Concave mirror forms erect and enlarged image when held closer to the cavity.

(*ii*)—(*a*)

Concave mirror forms a real and inverted image at 2*F* of the object kept at 2*F*.

(*iii*)—(*a*)

(*iv*)—(*b*)

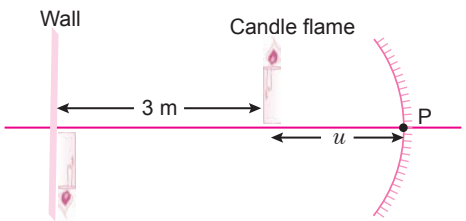
Using mirror formula,

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f} \quad \Rightarrow \quad \frac{1}{v}+\frac{1}{-2f}=\frac{1}{-f}$$

$$\Rightarrow \quad \frac{1}{v}=-\frac{1}{f}+\frac{1}{2f} \quad \Rightarrow \quad \frac{1}{v}=\frac{-2+1}{2f}=-\frac{1}{2f}$$

$$\Rightarrow \quad v=-2f \quad \Rightarrow \quad |v|=2f$$

(*v*)—(*d*)



Clearly, the image distance = $u + 3$

$$m=\frac{-v}{u}=\frac{I}{O}$$

$$\frac{-(u+3)}{u}=\frac{-9}{3}$$

$$u = 1.5 \text{ m}$$

Distance of wall from the mirror = $u + 3 = 1.5 + 3 = 4.5$ m

2. (*i*)—(*a*)

When the object distance equals the image distance, they are at twice the focal length from the lens.

When $2F = 60$ cm

$\Rightarrow \quad F = 30$ cm

When an object is placed at focus ($F = 30$ cm) of a convex lens, the image formed is at infinity. But infinity is not any observation in the given table.

Hence, $F = 30$ cm is not possible.

Now, when $2F = 40$ cm

$\therefore \quad F = 20$ cm

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(*ii*)—(*d*)

When object come closer to the lens up to *F* then image will be formed away from the lens and vice-versa.

(*iii*)—(*b*)

When an object is placed between *F* and 2*F* of a convex lens, we get a real, inverted and magnified image.

(*iv*)—(*c*)

When object is at $2F_1$ then image is formed at $2F_2$ then minimum distance between object and real image is $2f_1 + 2f_2 = 4f \quad (\because f_1 = f_2)$.

(*v*)—(*d*)

When object is placed between *F* and *O* image formed is virtual, erect and magnified.

3. (*i*)—(*b*)

Because less amount of light passes through the lens from object.

(*ii*)—(*a*)

n_{ga} = refractive index of glass with respect to air

$$n_{ga} = \frac{3}{2}$$

Now, $$n_{ag} = \frac{1}{3/2}$$

n_{wa} = refractive index of water w.r.t air

$$= \frac{4}{3}$$

and n_{gw} = refractive index of glass w.r.t water

Then, $n_{wa} \cdot n_{gw} \cdot n_{ag} = 1$

$$n_{gw} = \frac{1 \times 3 \times 3}{4 \times 2} = \frac{9}{8}$$

$$n_{gw} = 1.125$$

(*iii*)—(*c*)

For virtual image, $u < f$ and for real image, u lies between f and $2f$.

(*iv*)—(*a*)

Power of lens 1, $P_1 = +3.5$ D

Power of lens 2, $P_2 = -2.5$ D

So, $P_{net} = P_1 + P_2 = (+3.5 \text{ D} - 2.5 \text{ D}) = +1.0$ D

$P = +1.0$ D

Now, focal length of the combination $= \frac{1}{+1.0 \text{ D}} = \frac{1}{1 \text{ m}}$

$= +1 \text{ m} = +100 \text{ cm}$

$f = +100$ cm

(*v*)—(*b*)

Convex lens is converging in nature and concave lens is diverging in nature.

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ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

1. Assertion (*A*) : The centre of curvature is not a part of the mirror. It lies outside its reflecting surface.
Reason (*R*) : The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a centre.

2. Assertion (*A*) : A ray passing through the centre of curvature of a concave mirror after reflection, is reflected back along the same path.
Reason (*R*) : The incident rays fall on the mirror along the normal to the reflecting surface.

3. Assertion (*A*) : Light does not travel in the same direction in all the media.
Reason (*R*) : The speed of light does not change as it enters from one transparent medium to another.

4. Assertion (*A*) : The emergent ray is parallel to the direction of the incident ray.
Reason (*R*) : The extent of bending of the ray of light at the opposite parallel faces (air-glass interface and glass-air interface) of the rectangular glass slab is equal and opposite.

5. Assertion (*A*) : A ray of light travelling from a rarer medium to a denser medium slows down and bends away from the normal. When it travels from a denser medium to a rarer medium, it speeds up and bends towards the normal.
Reason (*R*) : The speed of light is higher in a rarer medium than a denser medium.

6. Assertion (*A*) : The mirrors used in search lights are concave spherical.
Reason (*R*) : In concave spherical mirror the image formed is always virtual.

7. Assertion (*A*) : Light travels faster in glass than in air.
Reason (*R*) : Glass is denser than air.

8. Assertion (*A*) : For observing traffic at back, the driver mirror is convex mirror.
Reason (*R*) : A convex mirror has much larger field of view than a plane mirror.

9. Assertion (*A*) : Mirror formula can be applied to a plane mirror.
Reason (*R*) : A plane mirror is a spherical mirror of infinite focal length.

10. Assertion (*A*) : It is not possible to see a virtual image by eye.
Reason (*R*) : The rays that seem to emanate from a virtual image do not in fact emanates from the image.

11. Assertion (*A*) : When the object moves with a velocity 2 m/s, its image in the plane mirror moves with a velocity of 4 m/s.
Reason (*R*) : The image formed by a plane mirror is as far behind the mirror as the object is in front of it.

12. Assertion (*A*) : The height of an object is always considered positive.
Reason (*R*) : An object is always placed above the principal axis in the upward direction.

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13. **Assertion (*A*) :** Concave mirrors are used as make-up mirrors.

Reason (*R*) : When the face is held within the focus of a concave mirror, then a diminished image of the face is seen in the concave mirror.

14. **Assertion (*A*) :** Refractive index has no units.

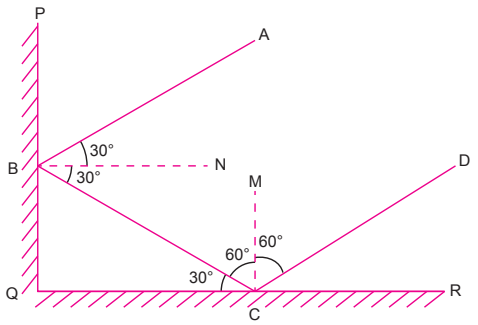
Reason (*R*) : The refractive index is a ratio of two similar quantities.

Answers

1. (*a*) **2.** (*a*) **3.** (*c*) **4.** (*a*) **5.** (*d*) **6.** (*c*) **7.** (*d*) **8.** (*a*)
9. (*a*) **10.** (*d*) **11.** (*a*) **12.** (*a*) **13.** (*c*) **14.** (*a*)

HINTS/SOLUTIONS OF SELECTED MCQs

19.



25. $m = 3, f = 12$ cm,

$v = ?, u = ?$

$m = \frac{v}{u}$

$3 = \frac{v}{u}$

$v = 3u$

using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{3u} - \frac{1}{u} = \frac{1}{12}$

$\frac{-2}{3u} = \frac{1}{12}$

$u = -\frac{24}{3}$ cm

$u = -8$cm

$v = 3u = -8 \times 3$

$= -24$cm

Distance between image and object = 24 – 8 = 16 cm

37. Distance between object and image = 0.25 + 0.25 = 0.5 m

38. For reflecting surface, $\angle i = \angle r$. Thus, angle of incidence is 0°.

42. The focal length of spherical mirror does not depend on the surrounding medium.

43. For virtual image,

$m = -\frac{v}{u} = +2 \Rightarrow v = -2u$

As $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

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$$\therefore \quad \frac{1}{u} + \frac{1}{-2u} = \frac{1}{-20}$$

$$\Rightarrow \quad \frac{1}{2u} = \frac{1}{-20}$$

$$\Rightarrow \quad u = -10 \text{ cm}$$

47. When the incident ray falls normally on the glass slab, it will be refracted without deviation, *i.e.* along the normal in the glass slab. So, $\angle i = \angle r = 0$

48. $\mu = \dfrac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in transparent medium } (v)}$

As $c > v$ so, $\mu > 1$

49. As, ${}^{a}\mu_{m} = \dfrac{v_a}{v_m}$ or $v_m = \dfrac{v_a}{{}^{a}\mu_{m}}$

So, the light will travel faster in a medium having lower refractive index.

55. Given, $h_0 = +10 \text{ mm} = +1 \text{ cm}$

$h_i = -5 \text{ mm} = -0.5 \text{ cm}$

for real image, $v = -30$ cm

Now, magnification, $m = \dfrac{h_i}{h_o} = -\dfrac{v}{u}$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{-30} + \frac{1}{-60} = \frac{-2-1}{60} = -\frac{1}{20}$$

$$\therefore \quad f = -20 \text{ cm}$$

56. Here, $\angle i = 60°$, $\angle r = 45°$

Using Snell's law of refraction, refractive index of medium B with respect to medium A.

$${}^{A}n_{B} = \frac{\sin i}{\sin r} = \frac{\sin 60°}{\sin 45°} = \frac{(\sqrt{3}/2)}{(1/\sqrt{2})} = \frac{\sqrt{3}}{\sqrt{2}}$$

59. Positive sign with power and focal length indicates that the given lens is convex.

Also f = 1/P = 1/4 = 0.25 m

60. Convex mirror is used as rear view mirror and always forms virtual, erect and diminished image. So magnification produced by a rear view mirror is less than one.

74. Velocity of light = 3×10^{8} m/s

Wavelength $(\lambda_1) = \dfrac{3\times10^{8}\text{m/s}}{5\times10^{14}\text{s}^{-1}}$

$\lambda_1 = 6\times10^{-7}$m

$\dfrac{v_1}{v_2} = \dfrac{\lambda_1}{\lambda_2}$ and $v \propto \dfrac{1}{\mu}$

$$\therefore \quad \frac{\mu_2}{\mu_1} = \frac{\lambda_1}{\lambda_2}$$

$$\frac{1.5}{1} = \frac{6\times10^{-7}}{\lambda_2}$$

$$\lambda_2 = \frac{6\times10^{-7}}{1.5}\text{m}$$

$\lambda_2 = 4000$Å

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75. $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

$\frac{1}{f} = \frac{1}{60} + \frac{1}{-20}$

$f = -30\text{cm}$

82. As, $m = -\frac{v}{u}$

Image formed should be two times and inverted, $m = -2$

$-2 = -\frac{v}{u}$

$v = 2u$

Using mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$f = -50$ cm (given)

$\therefore \quad \frac{1}{2u} + \frac{1}{u} = -\frac{1}{50}$

$\frac{3}{2u} = \frac{-1}{50}$

$u = -75$ cm

95. The beam parallel to the principle axis will pass through the focus and the beam passing through the focus will be reflected parallel to the principle axis. These two rays will meet at a point between C and F.

96. The object is placed at a distance $\frac{R}{4}$ or $\frac{F}{2}$ *i.e.*, the object is placed between the pole and the focus of the mirror. The image formed will be magnified, virtual and behind the mirror.

99. Here $f = -10$ cm [$\because$ concave mirror]

$u = -15$ cm, $v = ?$

Using mirror formula

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$

$\frac{1}{v} = \frac{-1}{10} + \frac{1}{15} = \frac{-1}{30}$

$\therefore \ v = -30$ cm

The negative sign indicates that the image is formed in front of the mirror.

100. Here $f = +20$ cm [$\because$ convex mirror]

$u = -20$ cm ; $v = ?$

Using mirror formula

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$

$\frac{1}{v} = \frac{1}{20} + \frac{1}{20} = \frac{1}{10}$

$\therefore v = +10$ cm

The positive sign indicates that the image is formed behind the mirror.

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101. Here $u = -20$ cm $f = +20$ cm [$\because$ convex mirror]

$h_1 = 10$ cm

Using mirror formula

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f} \quad \Rightarrow \frac{1}{v}=\frac{1}{f}-\frac{1}{u}$$

$$\frac{1}{v}=\frac{1}{20}+\frac{1}{20}=\frac{1}{10}$$

$\therefore v = 10$ cm

$$m=\frac{h_2}{h_1}=\frac{-v}{u}$$

$$\frac{h_2}{10}=\frac{-10}{-20} \quad \Rightarrow \quad h_2=+5\text{ cm}$$

104. Speed of light in air, $c = 3 \times 10^8$ m/s

speed of light in water, $v = 2.26 \times 10^8$ m/s

Refractive index of water w.r.t air, $n = \frac{c}{v}$

$$n=\frac{3\times10^8}{2.26\times10^8}=1.32$$

105. Here $f = -20$ cm [$\because$ concave lens]

$u = -25$ cm ; $v = ?$

Using lens formula

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f} \quad \Rightarrow \frac{1}{v}=\frac{1}{f}+\frac{1}{u}$$

$$\frac{1}{v}=-\frac{1}{20}-\frac{1}{25}=\frac{-9}{100}$$

$$\therefore v=\frac{-100}{9}\text{ cm}$$

The negative sign shows that the image is formed in front of the lens and the image is virtual. So, it cannot be obtained on a screen.

106. Here, $f = +20$ cm [$\because$ convex lens]

$u = -25$ cm ; $h_1 = 15$ cm

Using lens formula

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f} \quad \Rightarrow \frac{1}{v}=\frac{1}{f}+\frac{1}{u}$$

$$\frac{1}{v}=\frac{1}{20}-\frac{1}{25}=\frac{1}{100}$$

$v = +100$ cm

$\therefore$ The positive sign indicates that the image is formed behind the lens and the image is real. So, it can be formed on a screen.

107. Here, $v = +20$ cm ; $f = +15$ cm ; $u = ?$

Using lens formula

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f} \quad \Rightarrow \frac{1}{u}=\frac{1}{v}-\frac{1}{f}$$

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$$\frac{1}{u} = \frac{1}{20} - \frac{1}{15} = \frac{-1}{60}$$

$\therefore u = -60$ cm

The negative sign indicates that the object is placed in front of the lens.

108. Here, $h_2 = -36$ cm ; $m = -3$

The height of image and magnification are negative as the image formed is real.

$$m = \frac{h_2}{h_1} \quad \Rightarrow -3 = \frac{-36}{h_1}$$

$h_1 = +12$ cm

109. Here, $f = +12$ cm [$\because$ convex lens]

$u = -36$ cm

Using lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{12} - \frac{1}{36} = \frac{1}{18}$$

$v = 18$ cm

$$m = \frac{v}{u} = \frac{18}{-36} = \frac{-1}{2}$$

The negative sign shows that the image formed is real and inverted.

110. Here, $u = -60$ cm ; $v = +30$ cm [$\because$ convex lens]

Using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{30} + \frac{1}{60} = \frac{1}{20}$$

$f = +20$ cm

Power, $P = \dfrac{100}{f(\text{in cm})} = \dfrac{100}{20} = 5$ D

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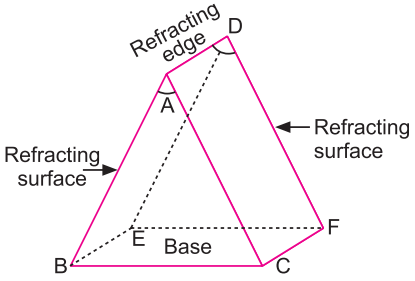
06 THE HUMAN EYE AND THE COLOURFUL WORLD

BASIC CONCEPTS

1. Refraction of light through a prism

A prism is a transparent refracting medium bounded by two plane surfaces inclined at some angle. The plane surface through which light passes is called the refracting surface and the angle between two refracting surfaces is the angle of prism, whereas the line of intersection of the two surfaces is called the refracting edge of the prism. The section of the prism perpendicular to the refracting edge is called the principal section of the prism.



2. Dispersion of Light by a Prism

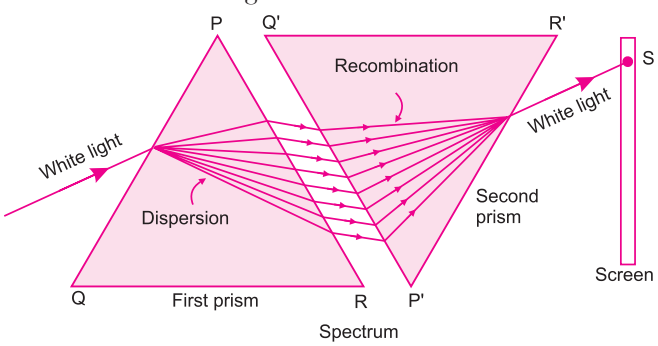
In the year 1665, Newton discovered by his experiment with glass prism that white light (like sunlight) consists of a mixture of seven colours.

The process of splitting up of a white beam into its constituent colours as it passes through a refracting medium is known as dispersion. The different colours obtained constitute the *spectrum* of incident light. The colour band so-obtained, is called spectrum. In case of sunlight, the solar spectrum obtained can be remembered by the word "VIBGYOR" formed by the initial letters of the colours (*e.g.* , **V** for **violet**, **I** for **indigo**, **B** for **blue**, **G** for **Green**, **Y** for **Yellow**, **O** for **Orange** and **R** for **Red**).

Different colours of light have different wavelengths, hence having different refractive index.

3. Prism Combinations

A glass slab acts as a combination of two identical glass prisms. The second prism can be considered to be placed in an inverted position with respect to the first. The first prism splits the white light into its seven colour components. When these colour components fall on the second prism, it recombines to form white light.



4. Rainbow

A rainbow is a natural spectrum appearing in the sky after a rain shower. This is a phenomenon due to combined effect of dispersion, refraction and reflection of sunlight by spherical water droplets of rain.

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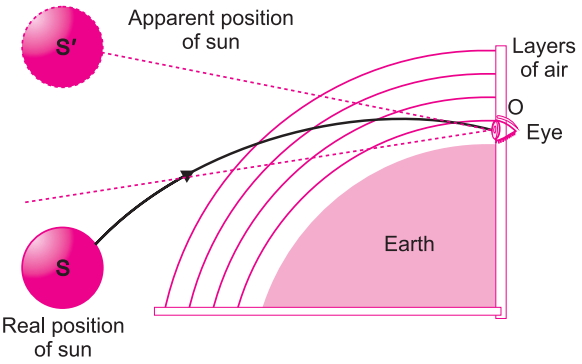
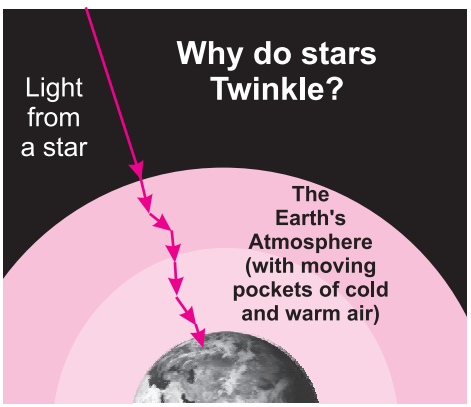
5. Phenomenon due to Atmospheric Refraction

(*i*) Rising and setting of sun appears visible even if below the horizon. *The rising and setting sun becomes visible even if it is below the horizon due to refraction of light from layers of air near the earth's surface and the length of day is increased by nearly 4 minutes due to this phenomenon.*



(*ii*) Twinkling of stars: Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. This apparent position of the star is not stationary, but keeps on changing slightly, as the physical conditions of the earth's atmosphere are not stationary.

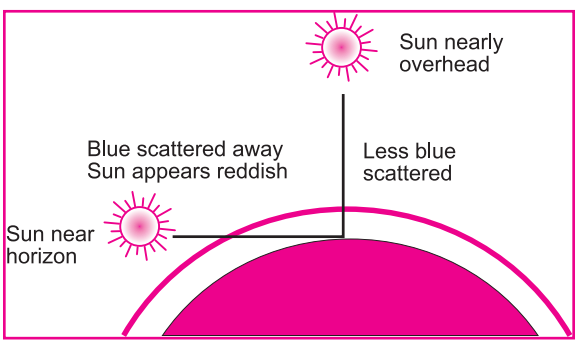


6. Scattering of Light

When light falls on various types of suspended particles, it is deviated from its path in random directions. This phenomenon is called scattering. Thus, the deviation of light from its path randomly in all directions is called the scattering of light.

Phenomenon due to scattering of light

(*i*) Blue Colour of Sky: As the sunlight passes through the atmosphere, the blue colour is preferentially scattered. Some of this scattered light reaches the ground, where we see it as blue skylight.



(*ii*) Red Colour of Sky at Sunset or Sunrise: At sunset or sunrise, the sun's rays pass through a maximum length of atmosphere. Much of the blue and shorter wavelengths has been taken out by scattering. Only the red colour of light reaches the observer. That is why, sunset and sunrise appear red.

(*iii*) White Colour of Clouds: The size of clouds is very large as compared to the wavelength of the incident light, from the sun. They scatter all wavelengths of light nearly uniformly. Hence, clouds appear white.

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(*iv*) **Red Colour of Danger Signal Lights:** When light falls on signal, all colours are scattered much more than red colour. So, the red colour suffering least scattering, remains confined around the signal which in turn illuminates the signal. Thus, signal can be seen from very far off distances.

MULTIPLE CHOICE QUESTIONS

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. We can see a rainbow on a sunny day when you look at the sky through a waterfall or through a water fountain

(*a*) with the Sun in front of you
(*b*) with the Sun behind you
(*c*) with the Sun overhead
(*d*) just after the sunset

2. The time difference between actual sunset and the apparent sunset is about

(*a*) 2 min
(*b*) 3 min
(*c*) 4 min
(*d*) 5 min

3. The sky would appear red instead of blue if

(*a*) atmospheric particles scatter blue light more than red light
(*b*) atmospheric particles scatter all colours equally
(*c*) atmospheric particles scatter red light more than blue light
(*d*) the Sun was much hotter

4. The blue colour of the sky is due to the phenomenon of

(*a*) scattering
(*b*) dispersion
(*c*) internal reflection
(*d*) atmospheric refraction

5. Dispersion of light by glass prism takes place because

(*a*) the lights of different colours have different intensities.
(*b*) the lights of different colours have different speed in a medium.
(*c*) different colours have different frequencies.
(*d*) the lights of different colours have different energies.

6. The colour of light which is deviated the least by a prism in the spectrum of white light is

(*a*) red
(*b*) green
(*c*) violet
(*d*) yellow

7. The colour of light which is deviated the most by a prism in the spectrum of white light is

(*a*) red
(*b*) green
(*c*) violet
(*d*) yellow

8. The clear sky appears blue because [*NCERT Exemplar*]

(*a*) blue light gets absorbed in the atmosphere.
(*b*) ultraviolet radiations are absorbed in the atmosphere.
(*c*) violet and blue lights get scattered more than lights of the other colours by the atmosphere.
(*d*) light of all other colours is scattered more than the violet and blue colour lights by the atmosphere.

9. At noon the Sun appears white because [*NCERT Exemplar*]

(*a*) light is least scattered
(*b*) all colours get scattered equally
(*c*) blue colour is scattered the most
(*d*) red colour is scattered the most

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10. Which of the following phenomena of light are involved in the formation of a rainbow? [*NCERT Exemplar*]

(*a*) Reflection, refraction and dispersion

(*b*) Refraction, dispersion and total internal reflection

(*c*) Refraction, dispersion and internal reflection

(*d*) Dispersion, scattering and total internal reflection

11. Which of the following statements is correct regarding the propagation of light of different colours of white light in air? [*NCERT Exemplar*]

(*a*) Red light moves fastest.

(*b*) Blue light travels faster than green light.

(*c*) All colours of white light move with the same speed.

(*d*) Yellow light moves with the mean speed as that of red and violet lights.

12. The danger signals installed at the top of tall buildings are red in colour. These can be easily seen from a distance because among all other colours, the red light [*NCERT Exemplar*]

(*a*) is scattered the most by smoke or fog

(*b*) is scattered the least by smoke or fog

(*c*) is absorbed the most by smoke or fog

(*d*) moves fastest in air

13. The star appear shifted from their actual position due to the phenomenon of:

(*a*) Diffraction of light

(*b*) Scattering of light

(*c*) Refraction of light

(*d*) Reflection of light

14. Blue colour of the sky is due to the phenomenon of:

(*a*) Reflection of light

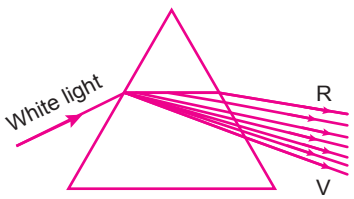
(*b*) Refraction of light

(*c*) Dispersion of light

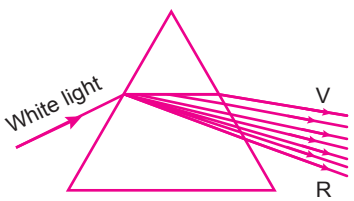
(*d*) Scattering of light

15. Which of the following figures correctly represents the passage of white light through prism?

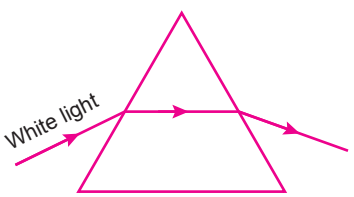
(*a*)



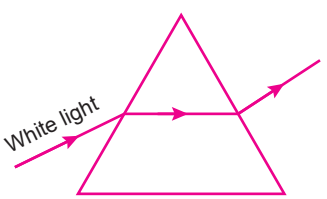
(*b*)



(*c*)



(*d*)



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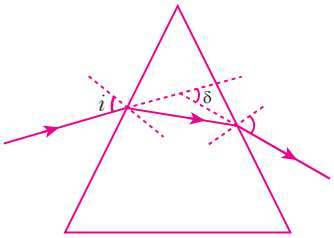
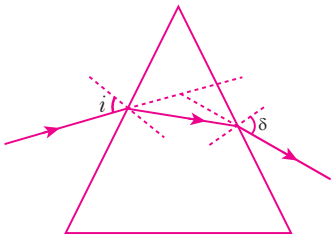
16. Four students studied refractive of light through a glass prism. They traced the ray of light and measured the angle of incidence $\angle i$ and angle of deviation $\angle$D as shown in figure A, B, C and D. Which one is the correct representation.

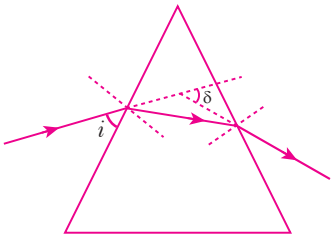
(*a*)



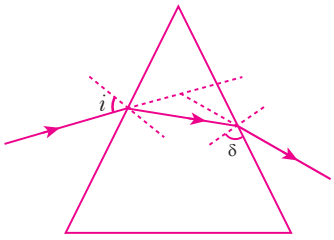
(*b*)



(*c*)

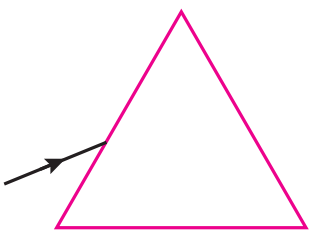


(*d*)

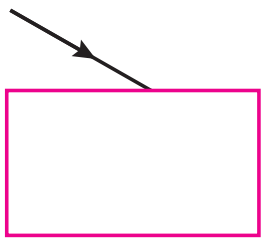


17. In which of the following cases will no dispersion take place when sunlight passes through it?

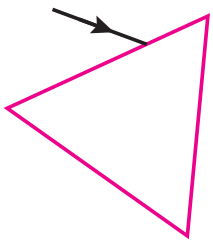
(*a*)



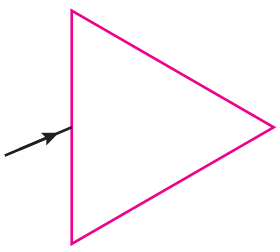
(*b*)



(*c*)



(*d*)



18. Which of the following colours is least scattered by fog, dust or smoke?

(*a*) Violet (*b*) Blue (*c*) Red (*d*) Yellow

19. The coloured light that refracts most while passing through a prism is

(*a*) Yellow (*b*) Violet (*c*) Blue (*d*) Red

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20. When white light enters a prism, it gets split into its constituent colours. This is due to

(*a*) different refractive index for different wavelength of each colour

(*b*) each colours has same velocity in the prism.

(*c*) prism material have high density.

(*d*) Scattering of light

21. The air layer of atmosphere whose temperature is less than the hot layer behave as optically

(*a*) denser medium (*b*) rarer medium

(*c*) inactive medium (*d*) either denser or rarer medium

22. Refraction of light by the earth's atmosphere due to variation in air density is called

(*a*) atmospheric reflection (*b*) atmospheric dispersion

(*c*) atmospheric scattering (*d*) atmospheric refraction

23. The deflection of light by minute particles and molecules of the atmosphere in all direction is called _____ of light.

(*a*) dispersion (*b*) scattering (*c*) interference (*d*) tyndell effect

24. One cannot see through the fog, because

(*a*) refractive index of the fog is very high

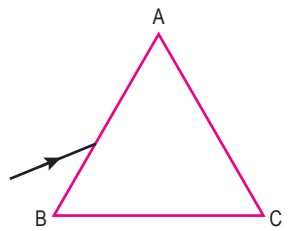
(*b*) light suffers total reflection at droplets

(*c*) fog absorbs light

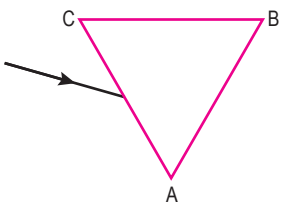
(*d*) light is scattered by the droplets

25. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in figure. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky? ***[NCERT Exemplar]***

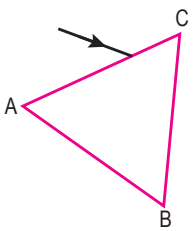
(*a*)



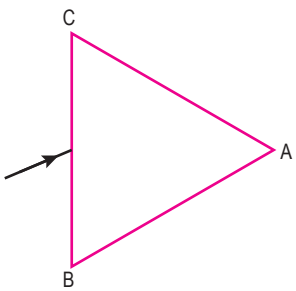
(*b*)



(*c*)



(*d*)



26. Twinkling of stars is due to atmospheric ***[NCERT Exemplar]***

(*a*) dispersion of light by water droplets

(*b*) refraction of light by different layers of varying refractive indices

(*c*) scattering of light by dust particles

(*d*) internal reflection of light by clouds.

27. The bluish colour of water in deep sea is due to ***[NCERT Exemplar]***

(*a*) the presence of algae and other plants found in water

(*b*) reflection of sky in water

(*c*) scattering of light

(*d*) absorption of light by the sea

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28. The splitting of white light into different colours on passing through a prism is called

(*a*) reflection (*b*) refraction

(*c*) dispersion (*d*) deviation

29. Which of the following is a natural phenomenon which is caused by the dispersion of sunlight in the sky?

(*a*) Twinkling of stars

(*b*) Stars seem higher than they actually are

(*c*) Advanced sunrise and delayed sunset

(*d*) Rainbow

30. Name the scientist who was the first to use a glass prism to obtain the spectrum of sunlight.

(*a*) Isaac Newton (*b*) Einstein

(*c*) Kepler (*d*) Hans Christian Oersted

31. Sunlight is a mixture of __ visible colours

(*a*) 5 (*b*) 6

(*c*) 7 (*d*) none

32. The effect of glass prism is only to separate the seven colours of

(*a*) White light (*b*) light from bulb

(*c*) Sunlight (*d*) All

33. The _____ colour is at the top and _____ colour is at the bottom of spectrum.

(*a*) Red, Violet (*b*) Red, Blue

(*c*) Violet, red (*d*) None

34. When Newton colour disc is rotated fast, the different colours _____.

(*a*) Can be separated (*b*) Can be differentiated

(*c*) Cannot be differentiated (*d*) None

35. When a ray passes through a prism _____.

(*a*) It goes undeviated (*b*) It remain parallel to a base

(*c*) It bends towards the base (*d*) None

36. The angle at which the ray gets deviated is called

(*a*) Angle of deviation (*b*) Angle of dispersion

(*c*) Angle of emergence (*d*) refracted angle

37. When a beam of white light passes through the prism

(*a*) velocity of violet rays is greater than that of red rays

(*b*) velocities of violet and red rays are equal to each other

(*c*) velocity of violet rays is smaller than that of red rays

(*d*) velocities of violet and red rays do not change

38. Which of the following is correct for the order of colours present in white light

(*a*) VIBGYOR (*b*) VIYGOBR

(*c*) VBIYORG (*d*) VIGBOYR

39. The angle between two refracting surfaces of prism is called the angle of

(*a*) Prism (*b*) Emergence

(*c*) Deviation (*d*) Incidence

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40. A transparent refracting material which is bounded by two plane refracting surfaces is

(*a*) Prism (*b*) Convex lens

(*c*) Glass slab (*d*) None

41. The broad wavelength range of visible spectrum is-

(*a*) 4000-8000Å (*b*) 2000-4000Å

(*c*) 10000-20000Å (*d*) None of the above

42. For which colour, refractive index of glass is maximum?

(a) Red (*b*) Violet

(*c*) Green (*d*) Yellow

43. Red colour of the sun at the time of sunrise and sunset is because-

(*a*) Red colour is least scattered

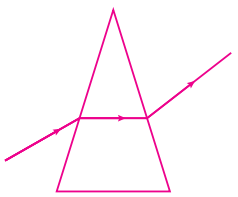
(*b*) Blue colour is least scattered

(*c*) Red colour is scattered the most

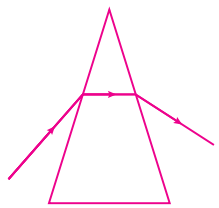
(*d*) All colours are equally scattered

44. Which image shows the deviation of light in a prism? ***[CBSE Question Bank]***

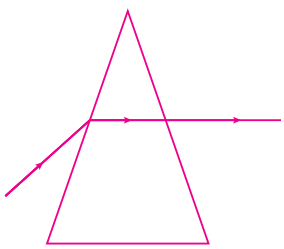
(*a*)



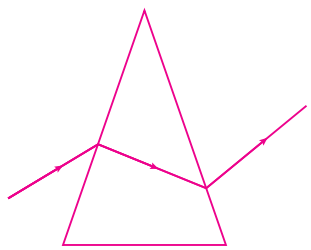
(*b*)



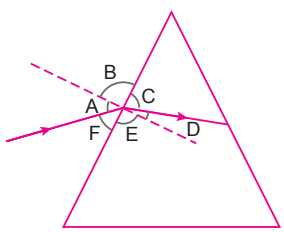
(*c*)



(*d*)



45. The image shows a light ray incident on a glass prism. ***[CBSE Question Bank]***



The various angles are labeled in the image. Which angle shows the angle of incidence and angle of refraction, respectively?

(*a*) A and D (*b*) C and F

(*c*) D and F (*d*) B and E

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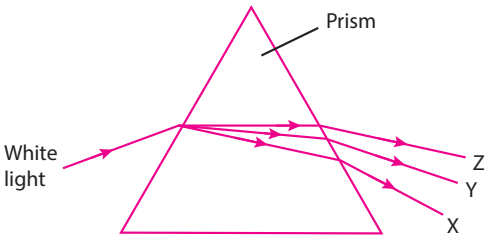
46. The image shows the dispersion of the white light in the prism.



What will be the colours of the X, Y and Z? **[*CBSE Question Bank*]**

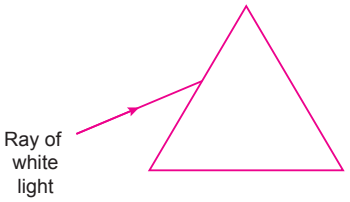
(*a*) X: green; Y: violet; Z: red

(*b*) X: violet; Y: green; Z: red

(*c*) X: red; Y: violet; Z: green

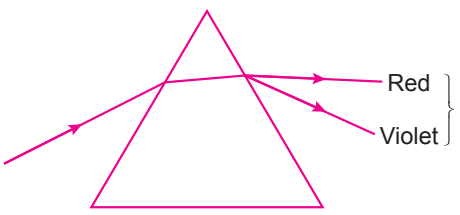
(*d*) X: red; Y: green; Z: violet

47. A ray of light is incident on one face of the prism, as shown.

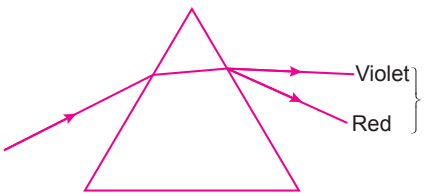


How will the ray of light disperse in the prism? **[*CBSE Question Bank*]**

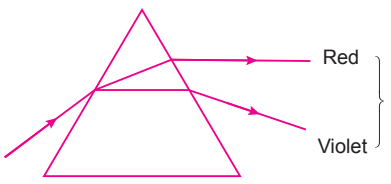
(*a*)



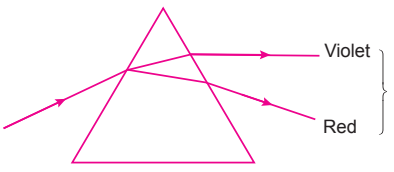
(*b*)



(*c*)



(*d*)



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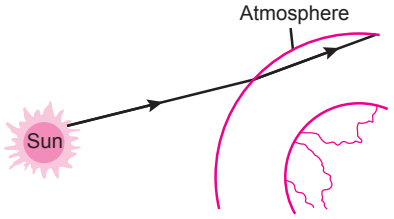
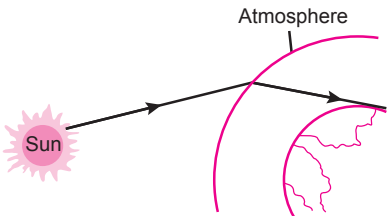
48. The sun appears two minutes before the actual sunrise due to atmospheric refraction. How does sunlight travel from space to atmosphere? ***[CBSE Question Bank]***

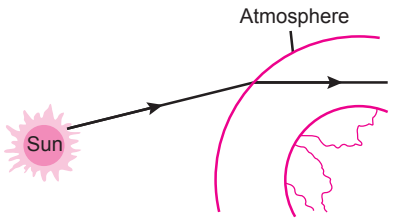
(*a*)



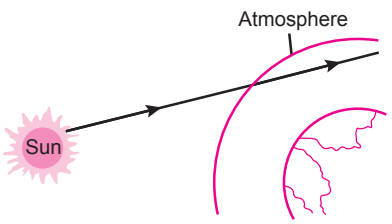
(*b*)



(*c*)



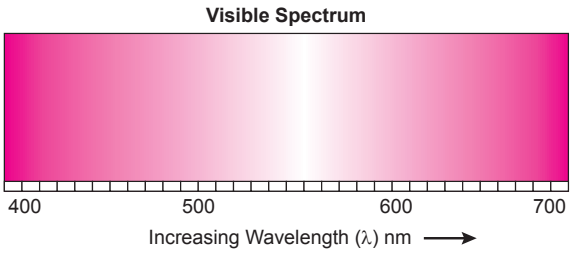
(*d*)



49. Which option justifies that the sun appears red at sunrise and sunset? ***[CBSE Question Bank]***

(*a*) The distance between the sun and earth reduces.
(*b*) The white light disperses into seven colours, only red enters the atmosphere.
(*c*) Red has high wavelength, so it travels longer distance.
(*d*) Red scatters highest by the atmosphere.

50. A student learns that the scattering of sunlight depends on the wavelength of the light and size of particles present in the atmosphere. The student collects the data about the wavelength of the visible lights and size of the particle as shown below: ***[CBSE Question Bank]***



Which particles will scatter blue light?

Particle	Size (m)
P	350
Q	430
R	520
S	650

(*a*) Q and S
(*b*) P and R
(*c*) P and Q
(*d*) R and S

51. The day is longer on the earth by about 4 minutes because

(*a*) the earth is round in shape
(*b*) the earth rotates on its axis
(*c*) the earth has atmosphere
(*d*) the earth revolves around the sun

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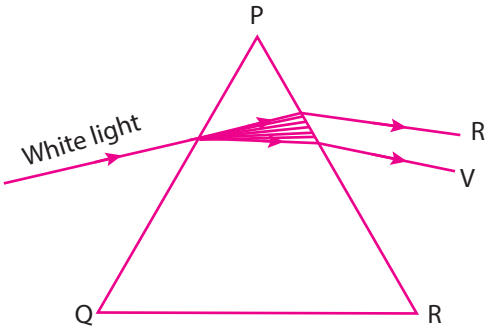
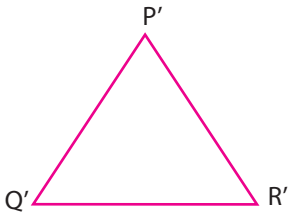
52. Two identical prism *PQR* and *P'Q'R'* are given. White light is passed through *PQR* as shown below.

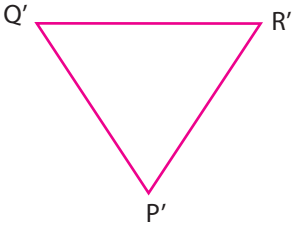


Which of the following position of P'Q'R' will again yield white light?

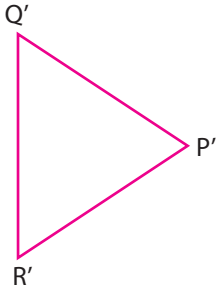
(*a*)



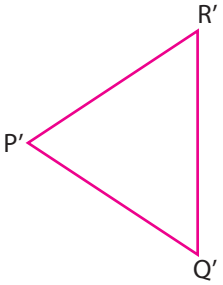
(*b*)



(*c*)



(*d*)



53. White light passes through an equilateral prism then

(*a*) dispersion takes place at first refracting surface and refraction at second refracting surface

(*b*) refraction takes place at first refracting surface and refraction at second refracting surface

(*c*) dispersion takes place at both refracting surfaces

(*d*) refraction takes place at both refracting surfaces

Answers

1. (*b*)	**2.** (*a*)	**3.** (*c*)	**4.** (*a*)	**5.** (*b*)	**6.** (*a*)	**7.** (*c*)	**8.** (*c*)
9. (*a*)	**10.** (*c*)	**11.** (*c*)	**12.** (*b*)	**13.** (*c*)	**14.** (*d*)	**15.** (*a*)	**16.** (*a*)
17. (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*a*)	**21.** (*a*)	**22.** (*d*)	**23.** (*b*)	**24.** (*d*)
25. (*b*)	**26.** (*b*)	**27.** (*c*)	**28.** (*c*)	**29.** (*d*)	**30.** (*a*)	**31.** (*c*)	**32.** (*d*)
33. (*a*)	**34.** (*c*)	**35.** (*c*)	**36.** (*a*)	**37.** (*b*)	**38.** (*b*)	**39.** (*a*)	**40.** (*a*)
41. (*a*)	**42.** (*b*)	**43.** (*a*)	**44.** (*b*)	**45.** (*a*)	**46.** (*b*)	**47.** (*c*)	**48.** (*b*)
49. (*c*)	**50.** (*c*)	**51.** (*c*)	**52.** (*b*)	**53.** (*a*)			

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CASE-BASED QUESTIONS

Question numbers 1 to 2 contain five sub-parts each. You are expected to answer any four sub-parts in these questions.

1. Read the following and answer any four questions from (*i*) to (*v*).

The Earth's atmosphere is a heterogeneous mixture of minute particles. These particles include smoke, tiny water droplets, suspended particles of dust and molecules of air.

When a beam of light strikes such fine particles, the path of the beam becomes visible. The light reaches us after being reflected diffusely by these particles. The phenomenon of scattering of light by the colloidal particle is known as Tyndall effect.

Tyndall effect can also be observed when sunlight passes through a canopy of dense forest. The colour of the scattered particle's light depend upon size of scattering particles.

(*i*) The phenomenon of scattering of light by colloidal particles is called

(*a*) Corona effect (*b*) Tyndall effect
(*c*) dispersion effect (*d*) none of these

(*ii*) The colour of scattering light depends upon

(*a*) volume of particles (*b*) nature of particles
(*c*) size of particles (*d*) none of these

(*iii*) The colour of scattered light depends upon

(*a*) frequency of the scattered particles
(*b*) wavelength of the scattered particles
(*c*) velocity of the scattered particles
(*d*) all of the above

(*iv*) If the size of the scattering particles is large enough then

(*a*) the scattered light may appear red
(*b*) the scattered light may appear white
(*c*) the scattered light may appear blue
(*d*) none of these

(*v*) The blue colour of the sky is because

(*a*) red light is absorbed
(*b*) blue light is preferentially scattered
(*c*) blue is the natural colour of sky
(*d*) red light is preferentially scattered

2. Read the following and answer any four questions from (*i*) to (*v*).

The hotter air is lighter (less dense) than the cooler air above it, and has a refractive index slightly less than that of the cooler air. Since the physical condition of the refracting medium (air) are not stationary, therefore, the light goes from rarer medium to denser medium in atmosphere. This phenomenon is called atmospheric refraction.

The twinkling of stars and advanced sunrise and delayed sunset are common examples of atmospheric refraction.

(*i*) Stars appear to twinkle because of

(*a*) movement of air (*b*) atmospheric refraction
(*c*) both (*a*) and (*b*) (*d*) none of these

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(*ii*) Which of the following is not caused because of atmospheric refraction?

(*a*) Apparent image of Sun is formed closer to the Earth.
(*b*) Dawn or dusk are formed.
(*c*) Sun can be seen 2 minutes before actual sunrise and 2 minutes after actual sunset.
(*d*) Clouds look white.

(*iii*) During sunset or sunrise the Sun appears reddish because

(*a*) due to longer passage in atmosphere, even red light in the sunlight scatters
(*b*) Sun produces red light at this time
(*c*) at this time Sun is not very hot
(*d*) none of these

(*iv*) When sunlight enters the atmosphere the colours which scatter first are

(*a*) only red
(*b*) red, orange and yellow
(*c*) blue and green
(*d*) violet, indigo and blue

(*v*) The order of wavelength of seven colours in atmosphere is

(*a*) V < I < B < G < Y < O < R
(*b*) V > I > B > G > Y > O > R
(*c*) V < B < I < G < Y < O < R
(*d*) V > I > B > G > O > R > Y

Answers

1. (*i*)—(*b*)

The scattering of light by colloidal particle is called Tyndall effect.

(*ii*)—(*c*)

Size of particle because less size means more scattering of light and more size means less scattering of light then scattering nature depends on wavelength of colour.

(*iii*)—(*b*)

Wavelength of the scatter particles because colour of light depends on wavelength of chromatic light.

(*iv*)—(*b*)

The scattered light may appear white as particle of larger size scatter light of longer wavelengths.

(*v*)—(*b*)

Because of dust and fine particles in the sky, blue colour is scattered more.

2. (*i*)—(*b*)

Due to atmospheric refraction and moving air, the refractive index of medium is not stationary. So, due to multiple refraction through atmospheric layers, stars appears to twinkle.

(*ii*)—(*d*)

Clouds look white because water droplets present in the atmosphere scatter all wavelengths due to their large size.

(*iii*)—(*a*)

During sunrise or sunset, the light has to travel longer distance and the longer wavelengths (red) are scattered during this time.

(*iv*)—(*d*)

Violet, indigo and blue due to their short wavelengths so it gets scattered more.

(*v*)—(*a*)

V < I < B < G < Y < O < R because red colour has less deviation angle and more wavelength than other colours. So, the wavelengths vary as above.

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ASSERTION-REASON QUESTIONS

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (*A*) : White light is dispersed into its seven-colour components by a prism.

Reason (*R*) : Different colours of light bend through different angles with respect to the incident ray as they pass through a prism.

2. Assertion (*A*) : The phenomenon of scattering of light by the colloidal particles gives rise to Tyndall effect.

Reason (*R*) : The colour of the scattered light depends on the size of the scattering particles.

3. Assertion (*A*) : The scattering of longer wavelengths of light increases as the size of the particles increases.

Reason (*R*) : Large particles scatter lights of all wavelengths equally well,

4. Assertion (*A*) : A rainbow is sometimes seen in the sky in rainy season only when observer's back is towards the Sun.

Reason (*R*) : Internal reflection in the water droplets cause dispersion and the final rays are in backward direction.

5. Assertion (*A*) : Danger signals are made of red colour.

Reason (*R*) : Velocity of red light in air is maximum, so signals are visible even in dark.

6. Assertion (*A*) : The sky looks dark and black instead of blue in outer space.

Reason (*R*) : No atmosphere containing air in the outer space to scatter sunlight.

Answers

1. (*a*) **2.** (*b*) **3.** (*b*) **4.** (*a*) **5.** (*c*) **6.** (*a*)

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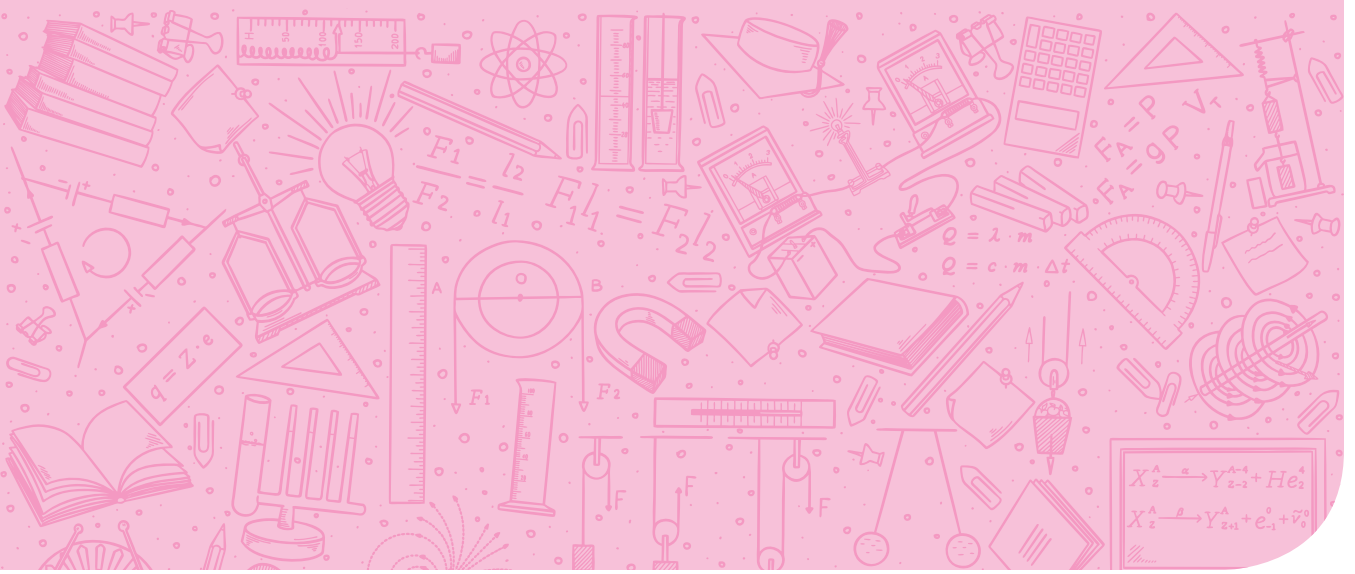
TERM–1

SCIENCE

BLUE PRINTS

PRACTICE PAPERS

OMR SHEETS



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BLUE PRINT–1

(FOR PRACTICE PAPER–01)

S. No.	Chapters	Multiple Choice Questions (1 Mark)	Case-based Questions (1 Mark)	Assertion-Reason Questions (1 Mark)	Total
1.	Chemical Reactions and Equations	—	4(4)	1(1)	16(16)
2.	Acids, Bases and Salts	5(5)	—	1(1)	
3.	Metals and Non-metals	4(4)	—	1(1)	
4.	Life Processes	5(5)	4(4)	1(1)	10(10)
5.	Light-Reflection and Refraction	4(4)	4(4)	1(1)	14(14)
6.	The Human Eye and The Colourful World	4(4)	—	1(1)	
	Total	**22(22)**	**12(12)**	**6(6)**	**40(40)**

BLUE PRINT–2

(FOR PRACTICE PAPER–02)

S. No.	Chapters	Multiple Choice Questions (1 Mark)	Case-based Questions (1 Mark)	Assertion-Reason Questions (1 Mark)	Total
1.	Chemical Reactions and Equations	4(4)	—	1(1)	16(16)
2.	Acids, Bases and Salts	1(1)	4(4)	1(1)	
3.	Metals and Non-metals	4(4)	—	1(1)	
4.	Life Processes	5(5)	4(4)	1(1)	10(10)
5.	Light-Reflection and Refraction	8(8)	—	1(1)	14(14)
6.	The Human Eye and The Colourful World	—	4(4)	1(1)	
	Total	**22(22)**	**12(12)**	**6(6)**	**40(40)**

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BLUE PRINT–3

(FOR PRACTICE PAPER–03)

S. No.	Chapters	Multiple Choice Questions (1 Mark)	Case-based Questions (1 Mark)	Assertion-Reason Questions (1 Mark)	Total
1.	Chemical Reactions and Equations	4(4)	—	1(1)	16(16)
2.	Acids, Bases and Salts	5(5)	—	1(1)	
3.	Metals and Non-metals	—	4(4)	1(1)	
4.	Life Processes	5(5)	4(4)	1(1)	10(10)
5.	Light-Reflection and Refraction	4(4)	4(4)	1(1)	14(14)
6.	The Human Eye and The Colourful World	4(4)	—	1(1)	
	Total	**22(22)**	**12(12)**	**6(6)**	**40(40)**

Note: 1. Number of question(s) is/are given in the brackets.
2. Case-based Questions contain Multiple Choice Questions (MCQs).
3. The above Blue Prints are only samples. Suitable internal variations may be made for generating similar Blue Prints keeping the overall weightage to different form of questions and typology of questions same.

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01 PRACTICE PAPER

Time: 90 minutes **Max. Marks: 40**

General Instructions:

(i) All questions are compulsory.

(ii) There are 40 questions in all.

(iii) This question paper contains Multiple Choice Questions (MCQs), Case-based MCQs and Assertion-Reason MCQs.

(iv) Only one of the options in every question is correct.

(v) An OMR sheet of every practice paper is given. The candidate has to give his/her answer of the question by darkening the circle against that question.

Question numbers 1 to 22 are multiple choice questions. Choose the correct option.

1. Which of the following acid is also known as vinegar?

(*a*) Dilute hydrochloric acid (*b*) Dilute sulphuric acid

(*c*) Dilute acetic acid (*d*) Dilute tartaric acid

2. What happens when metallic oxide reacts with an acid?

(*a*) Salt and water are formed

(*b*) Oxygen and water are formed

(*c*) Carbon dioxide gas and water are formed

(*d*) Hydrogen gas is formed along with water

3. A student learns that acid and base can conduct electricity because they have ions present in it. What are the ions present in acid and base?

(*a*) Acid: OH^-; base: H^+ (*b*) Acid: H^+; base: OH^-

(*c*) Acid: H^+; base: H^+ (*d*) Acid: OH^-; base: OH^-

4. Which option shows a balance equation of the formation of sodium hydroxide?

(*a*) $2NaCl + 2H_2O \rightarrow 2NaOH + 2HCl$

(*b*) $NaCl + 2H_2O \rightarrow NaOH + Cl_2 + H_2$

(*c*) $Na_2Cl + 2H_2O \rightarrow 2NaOH + 2HCl$

(*d*) $2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

5. A student has three sample of copper sulphate crystals in separate test tube X, Y and Z. The colour of copper sulphate in X is blue, in Y is white and in Z is blue. Which test tube require heating to remove water of crystallization?

(*a*) Only Y (*b*) Both Y and Z

(*c*) Both X and Z (*d*) Only Z

6. Sodium metal is dipped in which of the following substances for storage?

(*a*) Vaseline (*b*) Kerosene

(*c*) Hydrochloric acid (*d*) Sulphuric acid

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7. Which of the following order is correct for the reactivity of metals?

(*a*) Na > Au > Fe > Mg (*b*) Na > Mg > Fe > Au

(*c*) Mg > Fe > Na > Au (*d*) Mg > Na > Fe > Au

8. A student performs some activities on two substances and records the observations in a table as shown below:

Activity	Substance M	Substance N
cut with a knife	forms small pieces	forms small pieces
beaten with hammer	shape changes	changes into powder
stricken with a metal rod	makes a sound	changes into powder

Which option classifies the substances into metals and non-metals?

(*a*) Both the substances are non-metals.

(*b*) Both the substances are metals.

(*c*) Substance M is metal while substance N is non-metal.

(*d*) Substance M is non-metal while substance N is metal.

9. Which option classifies the substances based on their physical properties?

	Lustrous	Good Conductor of Electricity	Malleable	Bad Conductor of Electricity
(*a*)	Copper	Rubber	Iron	Graphite and silver
(*b*)	Graphite and Silver	Copper	Iron	Rubber
(*c*)	Copper	Graphite and silver	Iron	Rubber
(*d*)	Copper	Graphite and silver	Rubber	Iron

10. Which of the following statements about the autotrophs is incorrect?

(*a*) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll

(*b*) They store carbohydrates in the form of starch

(*c*) They convert carbon dioxide and water into carbohydrates in the absence of sunlight

(*d*) They constitute the first trophic level in food chains

11. In which of the following groups of organisms, food material is broken down outside the body and absorbed?

(*a*) Mushroom, green plants, *Amoeba*

(*b*) Yeast, mushroom, bread mould

(*c*) *Paramecium*, *Amoeba*, *Cuscuta*

(*d*) *Cuscuta*, lice, tapeworm

12. Select the correct statement.

(*a*) Heterotrophs do not synthesise their own food

(*b*) Heterotrophs utilise solar energy for photosynthesis

(*c*) Heterotrophs synthesise their own food

(*d*) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates

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13. Which part of alimentary canal receives bile from the liver?

(*a*) Stomach (*b*) Small intestine

(*c*) Large intestine (*d*) Oesophagus

14. Choose the function of the pancreatic juice from the following.

(*a*) trypsin digests proteins and lipase carbohydrates

(*b*) trypsin digests emulsified fats and lipase proteins

(*c*) trypsin and lipase digest fats

(*d*) trypsin digests proteins and lipase emulsified fats

15. Which of these mirrors will give the full image of a large object?

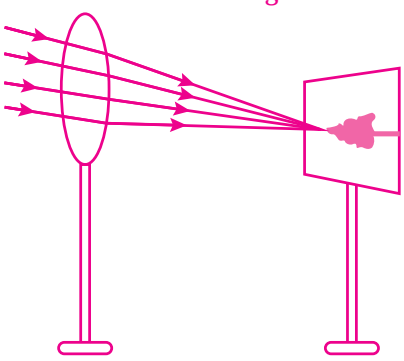
(*a*) Plane mirror (*b*) Concave mirror (*c*) Convex mirror (*d*) None of these

16. If the magnification of a lens has a negative value, the image is

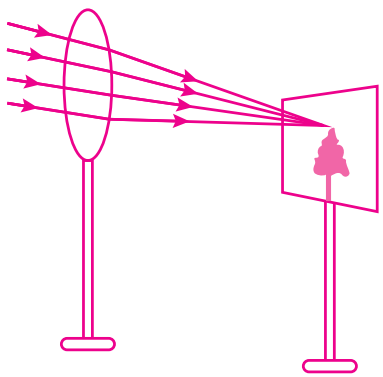
(*a*) real and inverted (*b*) virtual

(*c*) erect (*d*) none of these

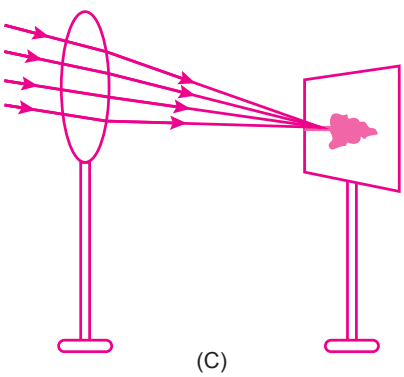
17. While performing an experiment on determination of focal length of a convex lens, four students obtained the image of the same distant tree on the screen as follows:



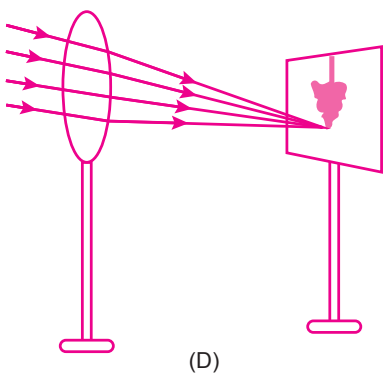
(A)



(B)



(C)



(D)

Which diagram shows the formation of image correctly?

(*a*) A (*b*) B

(*c*) C (*d*) D

18. If a man's face is 25 cm in front of concave shaving mirror producing erect image 1.5 times the size of face, focal length of the mirror would be

(*a*) 75 cm (*b*) 25 cm

(*c*) 15 cm (*d*) 60 cm

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19. When a beam of white light falls on a glass prism, the colour of light which will deviate least is:

(*a*) Violet (*b*) Red

(*c*) Green (*d*) Blue

20. Who discovered the experiments with glass prism that white light consists of seven colours?

(*a*) Newton (*b*) Faraday

(*c*) Maxwell (*d*) Young

21. Splitting of white light into seven colours on passing through the glass prism is called–

(*a*) Reflection (*b*) Refraction

(*c*) Scattering (*d*) Dispersion

22. Why stars appear to twinkle at night?

(*a*) Because the light of stars travels in different medium.

(*b*) Because the star changes its position relative to earth.

(*c*) Because the atmosphere reflects the light at different angles.

(*d*) Because the distance of star varies when earth rotates.

Case-based Question–I : Displacement and Double Displacement Reactions

A displacement reaction is one in which one element of a compound is replaced by another element. For example, when a strip of Zn is placed in aqueous $CuSO_4$ (blue), it does not take long for the displacement reaction to form metallic copper and colourless $ZnSO_4$ solution. In double displacement reactions, two reacting compounds exchange their corresponding ions and form two new compounds. For example, double displacement reaction takes place when aqueous solutions of barium chloride and sodium sulphate are mixed together; barium sulphate and sodium chloride are formed.

23. Displacement reaction is also known as

(*a*) precipitation reaction (*b*) substitution reaction

(*c*) combination reaction (*d*) none of the above

24. On keeping the iron nails dipped in copper sulphate solution for about 30 minutes, the changes you will observe is

(*a*) Iron nails become brownish in colour and the blue colour of copper sulphate solution fades.

(*b*) Iron nails become bluish in colour and the blue colour of copper sulphate fades.

(*c*) Iron nails become brownish in colour and the blue colour of copper sulphate solution changes to orange.

(*d*) No reaction takes place.

25. The colour of the precipitate obtained when aqueous silver nitrate and sodium chloride are mixed will be

(*a*) yellow (*b*) green

(*c*) white (*d*) orange

26. What happens when hydrogen sulphide gas is passed into an aqueous solution of copper sulphate?

(*a*) Yellow precipitate of copper oxide is obtained

(*b*) Black precipitate of copper sulphide is obtained

(*c*) Displacement reaction takes place

(*d*) Both (*b*) and (*c*)

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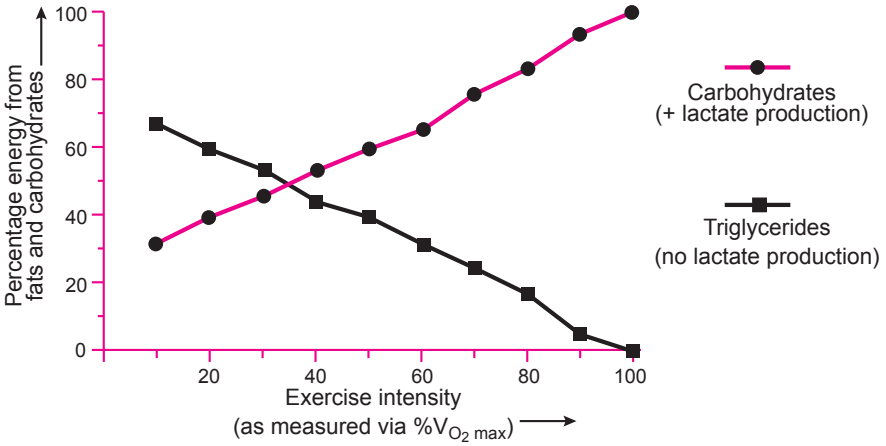
Case-based Question–II : Food Provides Energy

The food material taken in during the process of nutrition is used in cells to provide energy for various life processes. Diverse organisms do this in different ways – some use oxygen to break-down the food material completely, some use other pathways that do not involve oxygen. In all cases, the first step is the breakdown of food material and it takes place in the cytoplasm. Further, the products from breakdown of food may be converted into ethanol and carbon dioxide. Breakdown of food products using oxygen takes place in the mitochondria. Sometimes food products are converted into lactic acid which is also a three-carbon molecule.

27. Athletes suffers from muscle cramps due to

(*a*) conversion of pyruvate to ethanol
(*b*) conversion of pyruvate to glucose
(*c*) non-conversion of glucose to pyruvate
(*d*) conversion of pyruvate to lactic acid

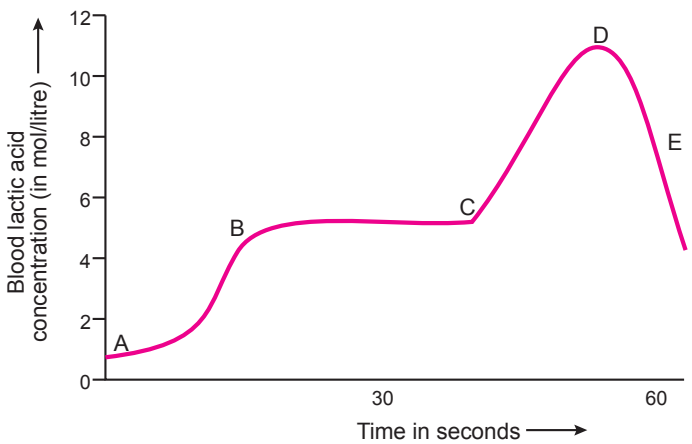
28. The given graph indicates the effect of exercise intensity on carbohydrate consumption.



At high intensity of exercise

(*a*) the anaerobic consumption of sugars increases
(*b*) the aerobic consumption of sugars increases
(*c*) the anaerobic consumption of sugars decreases
(*d*) no consumption of sugars takes place

29. Study the graph below that represents the blood test reports of an athlete just before and after a race.



Choose the correct combination of information provided in the following table.

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	Section of race	Concentration of lactic acid	Type of respiration
(*a*)	A-B (sprint start)	Changing from high to low	Changing from anaerobic to aerobic
(*b*)	B-C (maintaining speed)	Changing from high to low	Anaerobic
(*c*)	C-D (sprint finish)	High	Aerobic
(*d*)	D-E (just after sprint finishing)	Low	Aerobic

30. Which of the following statement(s) is (are) true about energy released during cellular respiration?

I. It is used immediately to synthesise ADP.

II. It is used to fuel all other activities in the cell.

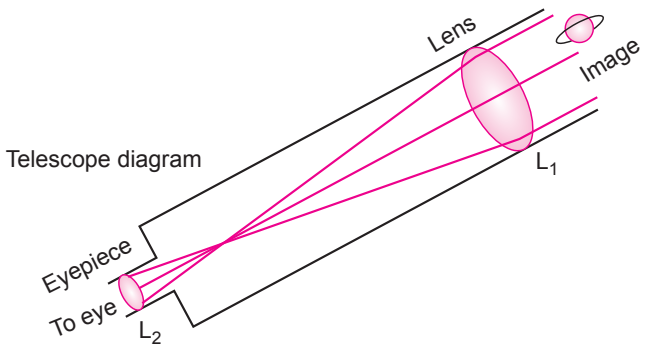
III. ADP is the energy currency for most cellular processes.

IV. An ADP molecule is formed from ATP and inorganic phosphate.

(*a*) I and II only
(*b*) II only
(*c*) I, II and III only
(*d*) I, III and IV only

Case-based Question–III : An Experiment with Convex Lens

Sumati wanted to see the stars of the night sky. She knows that she needs a telescope to see those distant stars. She finds out that the telescopes which are made of lenses are called refracting telescopes and the ones which are made of mirrors are called reflecting telescopes.



So, she decided to make a refracting telescope. She bought two lenses, L_1 and L_2 out of which L1 was bigger and L2 was smaller. The larger lens gathers and bends the light, while the smaller lens magnifies the image. Big, thick lenses are more powerful. So to see far away, she needed a big powerful lens. Unfortunately, she realized that a big lens is very heavy.

Heavy lenses are hard to make and difficult to hold in the right place. Also since the light is passing through the lens, the surface of the lens has to be extremely smooth. Any flaws in the lens will change the image. It would be like looking through a dirty window.

31. Based on the diagram shown, what kind of lenses would Sumati need to make the telescope?

(*a*) Concave lenses
(*b*) Convex lenses
(*c*) Bifocal lenses
(*d*) Flat lenses

32. If the powers of the lenses L_1 and L_2 are in the ratio of 4 : 1, what would be the ratio of the focal length of L_1 and L_2?

(*a*) 4 : 1
(*b*) 1 : 4
(*c*) 2 : 1
(*d*) 1 : 1

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33. What is the formula for magnification obtained with a lens?

(*a*) Ratio of height of image to height of object

(*b*) Double the focal length

(*c*) Inverse of the radius of curvature

(*d*) Inverse of the object distance

34. Sumati did some preliminary experiment with the lenses and found out that the magnification of the eyepiece (L_2) is 3. If in her experiment with L_2 she found an image at 24 cm from the lens, at what distance did she put the object?

(*a*) 72 cm (*b*) 12 cm

(*c*) 8 cm (*d*) 6 cm

For question numbers 35 to 40, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

35. Assertion (A) : Pungent smelling gas is produced when sulphur burns in air.
Reason (R) : Sulphur trioxide is formed on reaction of sulphur with oxygen.

36. Assertion (A) : Acids should be used carefully.
Reason (R) : All acids are corrosive.

37. Assertion (A) : Metals are sonorous.
Reason (R) : Metals are generally brittle in the solid state and they break into pieces when hammered.

38. Assertion (A) : Plants can survive without separate respiratory organs.
Reason (R) : Each plant part takes care of its own gas exchange needs.

39. Assertion (A) : Light does not travel in the same direction in all the media.
Reason (R) : The speed of light does not change as it enters from one transparent medium to another.

40. Assertion (A) : On a clear summer night twinkling of stars is observed.
Reason (R) : The twinkling of stars is caused by dispersion of star light by the atmosphere.

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PRACTICE PAPER 02

Time: 90 minutes **Max. Marks: 40**

General Instructions: *Same as Practice Paper–1.*

Question numbers 1 to 22 are multiple choice questions. Choose the correct option.

1. $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$

The above reaction is an example of:

(*a*) combination (*b*) double displacement

(*c*) decomposition (*d*) displacement

2. When green coloured ferrous sulphate crystals are heated, the colour of the crystal changes because

(*a*) it is decomposed to ferric oxide (*b*) it loses water of crystallisation

(*c*) it forms SO_2 (*d*) it forms SO_3

3. A student makes a list of some activities he observes one day.

1. Baking a cake in an oven
2. Cutting an apple pie into slices
3. Crushing the can after drinking a soda
4. Carving a wooden log to make a stand

Which activity can the student classify as a chemical change?

(*a*) Activity 1, as the properties of the substances in the mixture change.

(*b*) Activity 2, as the physical state of the apple pie changes when cut.

(*c*) Activity 3, as the shape of the can changes.

(*d*) Activity 4, as the shape and size of the wooden log changes.

4. Sodium and chlorine are reacted and as a result, sodium chloride is formed which is also called table salt. What option gives the reactants and products of the reaction?

(*a*) Reactants-table salt; products- sodium and chlorine

(*b*) Reactants-sodium and table salt; products- chlorine

(*c*) Reactants-sodium; products- chlorine

(*d*) Reactants-sodium and chlorine; products- sodium chloride

5. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

(*a*) absorb the evolved gas

(*b*) moisten the gas

(*c*) absorb moisture from the gas

(*d*) absorb Cl^- ions from the evolved gas

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6. A student writes the chemical equation of the reaction between lead and copper chloride.

$Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$

Which option explains the reason for the formation of lead chloride?

(*a*) Lead is less reactive than copper
(*b*) Lead and copper are equally reactive
(*c*) Copper is more reactive than lead
(*d*) Lead is more reactive than copper

7. A student adds an equal amount of copper sulphate solution in two beakers. He adds zinc in beaker P and silver in beaker Q. The student observes that the color of the solution in beaker P changes while no change is observed in beaker Q. Which option arranges the metals in increasing order of reactivity?

(*a*) Copper-silver-zinc
(*b*) Zinc-copper-silver
(*c*) Silver-copper-zinc
(*d*) Silver-zinc-copper

8. A student learns that sodium and magnesium react with chlorine to form sodium chloride and magnesium chloride, as shown below:

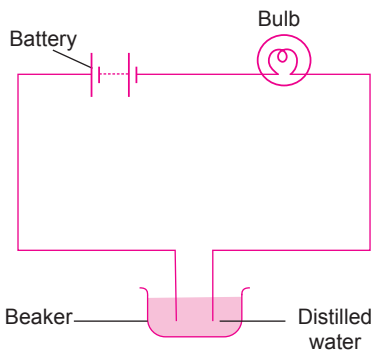
$2Na + Cl_2 \rightarrow 2NaCl$

$Mg + Cl_2 \rightarrow \rightarrow MgCl_2$

The melting point of sodium chloride is 1074 K while the melting point of magnesium chloride is 981 K. Why does sodium chloride and magnesium chlorine have a difference in melting point?

(*a*) Sodium chloride is formed by combining with one molecule of chlorine.
(*b*) Magnesium chloride is formed by combining only one molecule of magnesium.
(*c*) Sodium chloride has strong inter-ionic bonding than magnesium chloride.
(*d*) Magnesium chloride is soluble in kerosene and petrol.

9. A student makes an electric circuit using an LED, a battery and connecting wires as shown below:



The student notices that the LED does not glow. He replaces the distilled water with a salt solution and observes that the LED glows. How does the salt solution help the LED to glow?

(*a*) Salt solution is covalent in nature and conducts electricity.
(*b*) Salt solution has a high boiling point which allows the flow of current in the circuit without getting hot.
(*c*) Salt solution has a low melting point which allows the current to flow through it.
(*d*) Salt solution contain ions which makes it conductive and allows the electricity to flow through it.

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10. The kidneys in human beings are a part of the system for

(*a*) nutrition (*b*) respiration

(*c*) excretion (*d*) transportation

11. The xylem in plants are responsible for

(*a*) transport of water (*b*) transport of food

(*c*) transport of amino acids (*d*) transport of oxygen

12. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in

(*a*) cytoplasm (*b*) mitochondria

(*c*) chloroplast (*d*) nucleus

13. The main function of the ureters is to

(*a*) control the pressure of urine in urinary bladder.

(*b*) take urine from kidneys to urinary bladder.

(*c*) filter blood and remove it to urine.

(*d*) connect the parts of excretory system.

14. Alveoli are located at the end of

(*a*) bronchi (*b*) heart (*c*) lungs (*d*) bronchioles

15. If the magnification of a lens has a positive value, the image is

(*a*) real (*b*) virtual and erect

(*c*) inverted (*d*) none of these

16. An object is placed at 100 mm in front of a concave mirror which produces an upright image (erect image). The radius of curvature of the mirror is:

(*a*) Less than 100 mm (*b*) Between 100 mm and 200 mm

(*c*) Exactly 200 mm (*d*) More than 200 mm

17. An object at a distance of 30 cm from a concave mirror gets its image at the same point. The focal length of the mirror is

(*a*) – 30 cm (*b*) 30 cm (*c*) – 15 cm (*d*) +15 cm

18. The refractive index of water is 1.33. The speed of light in water will be

(*a*) 1.33×10^8 m/s (*b*) 3×10^8 m/s

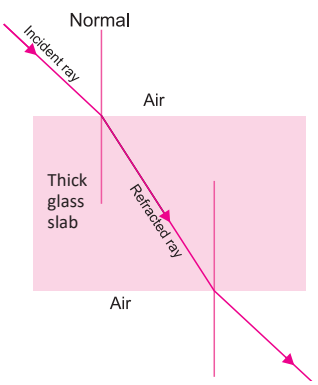
(*c*) 2.26×10^8 m/s (*d*) 2.66×10^8 m/s

19. A student conducts an activity using a flask of height 15 cm and a concave mirror. He finds that the image formed is 45 cm in height. What is the magnification of the image?

(*a*) – 3 times (*b*) 1/ 3 times

(*c*) – 1/ 3 times (*d*) 3 times

20. A student studies that when a ray of light travels from air into the glass slab, the ray of light bends towards the normal. But as refracted ray emerges out of the glass slab to the vacuum, it bends away from the normal, as shown.



Which option explains the law of refraction of light through the glass slab?

(*a*) Light always bends towards the normal in a glass slab.

(*b*) Ray of light travelling in the air is always considered as the incident ray, and the one in the glass is the refracted ray.

(*c*) The incident ray, the refracted ray, and the normal to the interface always lie on the same plane.

(*d*) Ray of light always travels in a straight path irrespective of change in medium.

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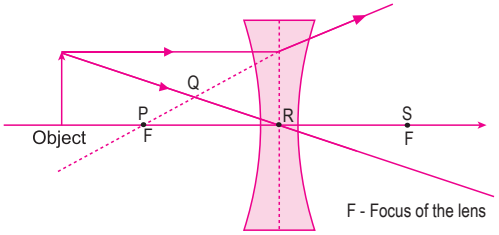
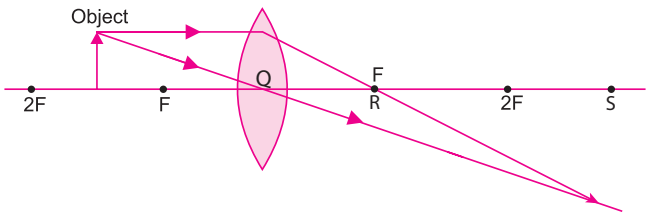
21. The image represents the rays of light travelling through a concave lens.



Where is the image most likely to form?

(*a*) R (*b*) Q (*c*) P (*d*) S

22. The image represents the rays of light travelling through a convex lens.



Where is the image most likely to form?

(*a*) Position Q (*b*) Position R

(*c*) Position P (*d*) Position S

Case-based Question–I : pH Scale

The pH of a solution is a measure of its hydrogen ion (H^+) concentration. It is measured generally using pH scale. The values on pH scale ranges from 0 to 14.

A pH of 1 is very acidic and corresponds to a high concentration of H^+ ions. A pH of 14 is very basic and corresponds to a low concentration of H^+ ions. The pH of a neutral solution is 7. The table given below shows the pH and H^+ ion concentration of some common aqueous solutions. The leftmost column shows the number of moles of H^+ ions in 1 mole of liquid.

The pH and Hydrogen ion (H^+) Concentration of Some Solutions

H^+ Concentration (mol/L)	pH	Solution
10^{-1}	1	
10^{-2}	2	Gastric (stomach) juice, cola, lemon juice
10^{-3}	3	Vinegar
10^{-4}	4	Tomato juice
10^{-5}	5	Black coffee, rain water
10^{-6}	6	Urine
10^{-7}	7	Pure water
10^{-8}	8	Sea water
10^{-9}	9	Baking soda
10^{-10}	10	
10^{-11}	11	Milk of magnesia
10^{-12}	12	Household bleach
10^{-13}	13	Oven cleaner
10^{-14}	14	

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23. How is the hydrogen ion concentration and pH related to each other?

(*a*) They are inversely proportional

(*b*) They are directly proportional

(*c*) They are equal

(*d*) They have no relation

24. Among the given solutions in the above table, the most basic in nature is

(*a*) pure water (*b*) oven cleaner

(*c*) household bleach (*d*) gastric juice

25. The acid having highest hydrogen ion concentration is one with

(*a*) pH =2.5 (*b*) pH=1.8

(*c*) pH=7 (*d*) pH=10

26. A basic solution could have a pH of

(*a*) 11 (*b*) 7

(*c*) 1 (*d*) 2

Case-based Question–II : Photosynthesis

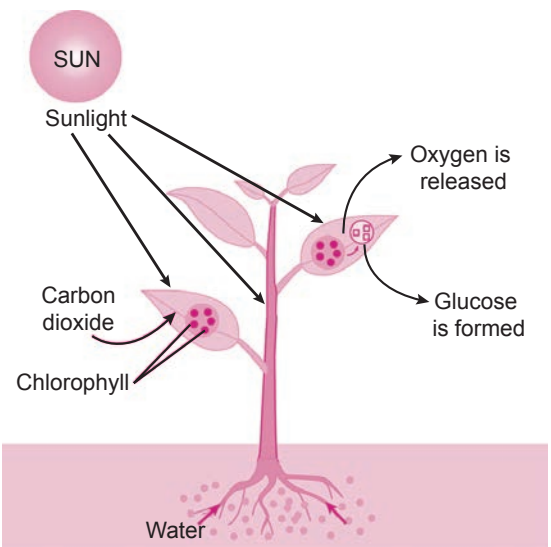
Carbon and energy requirements of the autotrophic organism are fulfilled by photosynthesis. It is the process by which autotrophs take in substances from the outside and convert them into stored forms of energy. This material is taken in the form of carbon dioxide and water which is converted into carbohydrates in the presence of sunlight and chlorophyll. Carbohydrates are utilised for providing energy to the plant. The carbohydrates which are not used immediately are stored in the form of starch, which serves as the internal energy reserve to be used as and when required by the plant. A somewhat similar situation is seen in humans where some of the energy derived from the food we eat is stored in our body in the form of glycogen. That means the complex substances have to be broken down into simpler ones before they can be used for the upkeep and growth of the body. To achieve this, organisms use biocatalysts.

27. Heterotrophs depend for energy on

(*a*) autotrophs (*b*) producers

(*c*) herbivores (*d*) both (*a*) and (*b*)

28. The picture given below represents how autotrophs take in substances from the outside and convert them into stored forms of energy.



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The correct equation for the given process is

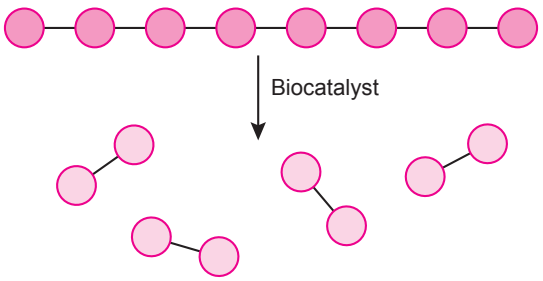
(*a*) $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

(*b*) $6O_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6CO_2$

(*c*) $C_6H_{12}O_6 + 6H_2O \longrightarrow 6CO_2 + 6O_2$

(*d*) $6CO_2 + 6O_2 \longrightarrow C_6H_{12}O_6 + 6H_2O$

29. Study the picture below that represents the mode of action of a biocatalyst.



Choose the correct combination of information provided in the following table.

	Biocatalyst also termed as	Biocatalyst found in human saliva	Biocatalyst produced in human stomach
(*a*)	Enzymes	Amylase	Pepsin
(*b*)	Hormones	Amylase	Trypsin
(*c*)	Enzymes	Trypsin	Pepsin
(*d*)	Energy	Pepsin	Amylase

30. Which of the following statement (s) is (are) true?

I. Carbon and energy requirements of the autotrophic organism are fulfilled by photosynthesis.

II. Carbohydrates are utilised for providing energy to the plant.

III. Chlorophyll is essential for photosynthesis.

IV. Survival of autotrophs depends directly or indirectly on heterotrophs.

(*a*) I and II only
(*b*) II and III only
(*c*) I, II and III only
(*d*) I, III and IV only

Case-based Question–III : Dispersion of Light by a Prism

Light spectrum is the many different wavelengths of energy produced by light source. Light is measured in nanometers (nm). Each nanometer represents a wavelength of light or band of light energy. Visible light is the part of spectrum from 380 nm to 780 nm.

Isaac Newton was the first to use a glass prism to obtain the spectrum of sunlight. He tried to split the colours of the spectrum of white light further by using another similar prism. He then placed a second identical prism in an inverted position with respect to the first prism. This allowed all the colours of the spectrum to pass through second prism.

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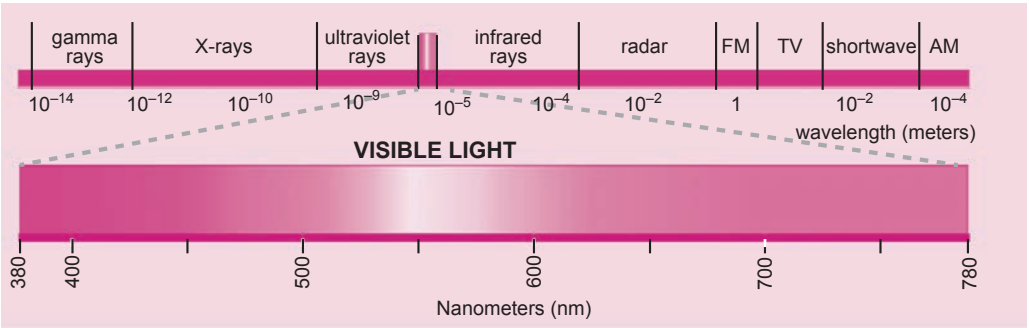
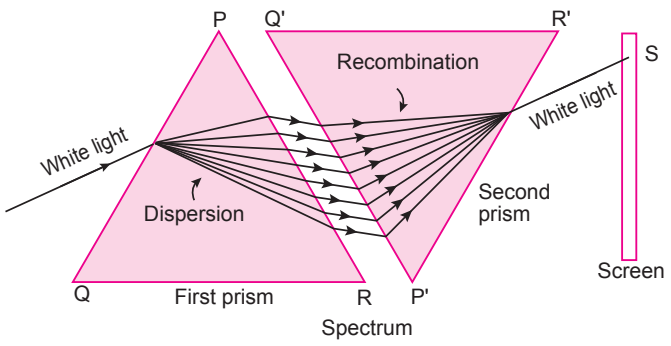
He found a beam of white light emerging from the other side of the second prism. This observation gave Newton the idea that the sunlight is made up of seven colours.

A rainbow is a natural spectrum appearing in the sky after rain.





31. The range of wavelength of visible light spectrum is

(*a*) 500 nm to 780 nm (*b*) 450 nm to 750 nm

(*c*) 380 nm to 780 nm (*d*) 300 nm to 700 nm

32. The many different wavelength of energy produced by light source through prism is called

(*a*) hydrogen spectrum

(*b*) light spectrum

(*c*) corona discharge

(*d*) frequency modulation

33. The critical angle between an equilateral prism and air is 45°, if the incident ray is perpendicular to the refracting surface, then

(*a*) it is reflected totally from the second surface and emerge perpendicular to the third surface

(*b*) it gets reflected from second surface and third surface and emerges from the third surface

(*c*) it keeps reflecting from all the three sides of the prism and never emerges out

(*d*) after deviation, it gets refracted from the second surface

34. The dispersive power of prism depends upon

(*a*) the shape of the prism

(*b*) the angle of the prism

(*c*) height of the prism

(*d*) the material of the prism

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For question numbers 35 to 40, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

35. **Assertion (A) :** Chemical reaction changes the physical and chemical state of a substance.

Reason (R) : When electric current is passed through water (liquid), it decomposes to produce hydrogen and oxygen gases.

36. **Assertion (A) :** Antacids are used to get rid of pain caused by indigestion.

Reason (R) : Antacids neutralise the excess acid produced in the stomach.

37. **Assertion (A) :** Metals have the quality of reflecting light from their surface and can be polished.

Reason (R) : Metals are malleable.

38. **Assertion (A) :** Human heart is four chambered.

Reason (R) : Vena cava is the only artery that supplies deoxygenated blood to the heart.

39. **Assertion (A) :** Keeping a point object fixed, if a plane is moved, the image will also move.

Reason (R) : In case of a plane mirror, distance of object and its image is equal from any point on the mirror.

40. **Assertion (A) :** On mid-day, the colour of the sunlight becomes white.

Reason (R) : No atmospheric refraction is caused due to overhead sun.

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PRACTICE PAPER 03

Time: 90 minutes **Max. Marks: 40**

General Instructions: *Same as Practice Paper–1.*

Question numbers 1 to 22 are multiple choice questions. Choose the correct option.

1. A balanced chemical equation of the reaction between sodium and chlorine to form sodium chloride is given below:

$2Na + Cl_2 \rightarrow 2NaCl$

Which option shows the number of atoms on both sides of the reaction?

	Element	Number of Atoms in Reactants (LHS)	Number of Atoms in Products (RHS)
(*a*)	Na	2	2
	Cl	1	1
(*b*)	Na	2	2
	Cl	2	2
(*c*)	Na	2	2
	Cl	1/2	1/2
(*d*)	Na	1	1
	Cl	2	2

2. A student writes a chemical equation of the reaction between carbon monoxide and hydrogen.

$CO + 2H_2 \rightarrow CH_3OH$

How can the reaction be classified?

(*a*) The reaction is an example of a decomposition reaction as two compounds react to form a single compound.

(*b*) The reaction is an example of a decomposition reaction as a compound dissociates into two compounds.

(*c*) The reaction is an example of a combination reaction as two compounds react to form a single compound.

(*d*) The reaction is an example of a combination reaction as a compound separates into two compounds.

3. A student notices that her silver jewellery turned dull and had a grey-black film over it after wearing for a few months. What results in the change in colour of the silver metal?

(*a*) The polish over the jewellery was removed after wearing for a few months.

(*b*) The jewellery comes in contact with air, moisture, and acids and corrodes.

(*c*) Dust deposits over the jewellery which changes its colour.

(*d*) Silver breaks due to wear and tear and in turn its colour changes due to rusting.

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4. A student learns that food companies fill bags of chips with nitrogen gas. What is the purpose of packing it with nitrogen?

(*a*) It prevents rancidity of chips.
(*b*) It keeps the chips dry if the pack falls in water.
(*c*) Prevents chips from spilling out when the pack is opened.
(*d*) It keeps the mosquitoes away from chips.

5. Which of the following is taken orally as medicine in the case of hyperacidity to get relief ?

(*a*) Sodium hydroxide (*b*) Calcium hydroxide
(*c*) Milk of sodium (*d*) Milk of magnesia

6. What happens when carbon dioxide gas reacts with water?

(*a*) Oxygen gas is formed (*b*) Carbon monoxide gas is formed
(*c*) Carbonic acid is formed (*d*) No reaction takes place

7. What is the nature of metal oxide?

(*a*) Basic (*b*) Acidic
(*c*) Neutral (*d*) None of the above

8. Which fruit is basic in nature?

(*a*) Strawberries (*b*) Oranges (*c*) Apples (*d*) Banana

9. A student listed some food items as shown.

(*i*) Lemon juice (*ii*) Baking Soda
(*iii*) Broccoli (*iv*) Curd

Which option classifies the food items on the basis of acidic and basic nature of food?

	Acid	Base
(*a*)	Broccoli	Curd
	Baking soda	Lemon juice
(*b*)	Lemon Juice	Baking soda
	Curd	Broccoli
(*c*)	Lemon Juice	Curd
	Baking soda	Broccoli
(*d*)	Lemon juice	Baking soda
	Broccoli	Curd

10. Products of anaerobic respiration in muscles are

(*a*) lactic acid and energy
(*b*) lactic acid, carbon dioxide and energy
(*c*) lactic acid, water, carbon dioxide and energy
(*d*) lactic acid, water, and energy

11. The blood cells responsible for clotting of blood are

(*a*) erythrocytes (*b*) blood platelets
(*c*) white blood corpuscles (*d*) red blood cells

12. Which of the following blood vessels have a thick muscular coat?

(*a*) Veins (*b*) Capillaries
(*c*) Arteries (*d*) All of these

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13. Reabsorption of glucose and other useful substances take place in

(*a*) ureters (*b*) glomerulus
(*c*) urinary bladder (*d*) coiled tubes of nephron

14. Excretion in man takes place through

(*a*) heart (*b*) nephridia
(*c*) contractile vacuole (*d*) none of these

15. Which mirror is to be used to obtain a parallel beam of light from a small lamp?

(*a*) plane mirror (*b*) convex mirror
(*c*) concave mirror (*d*) any one of the above

16. Why is refractive index in a transparent medium greater than one?

(*a*) because the speed of light in vacuum is always less than speed in a transparent medium
(*b*) because the speed of light in vacuum is always greater than the speed in a transparent medium
(*c*) frequency of wave changes when it crosses medium
(*d*) none of the above

17. When a ray of light enters a glass slab, then

(*a*) its frequency and velocity change (*b*) only frequency changes
(*c*) its frequency and wavelength change (*d*) its frequency does not change

18. In refraction, light waves are bent on passing from one medium to the second medium, because in the second medium

(*a*) the frequency is different (*b*) the coefficient of elasticity is different
(*c*) the speed is different (*d*) the amplitude is smaller

19. One cannot see through fog, because

(*a*) fog absorbs the light (*b*) light suffers total reflection at droplets
(*c*) refractive index of the fog is infinity (*d*) light is scattered by the droplets

20. A setting sun appears to be at an altitude higher than it really is. This is because of

(*a*) absorption of light (*b*) reflection of light
(*c*) refraction of light (*d*) dispersion of light

21. In the formation of a rainbow, the light from the sun on water droplets undergoes

(*a*) dispersion only (*b*) only total internal reflection
(*c*) dispersion and total internal reflection (*d*) none of the above

22. The light that refracts most while passing through a prism is

(*a*) Red (*b*) Violet
(*c*) Indigo (*d*) Yellow

Case-based Question–I : Reactivity of Metals with Oxygen

All metals do not react with oxygen with the same speed. Different metals show different reactivity towards oxygen. For example, potassium and sodium react so vigorously that they catch fire even if kept in the open air. They are, therefore, kept under kerosene or paraffin oil. Metal oxides are solids. They are basic in nature. Metal oxides being basic turn red litmus to blue. Some metal oxides such as aluminium oxide, zinc oxide, etc., show both acidic as well as basic behaviour.

23. Which of the following metals react violently with cold water?

(*a*) Potassium (*b*) Iron
(*c*) Aluminium (*d*) Zinc

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24. The metal which do not react with oxygen even at high temperature is

(*a*) copper (*b*) silver (*c*) zinc (*d*) magnesium

25. The solution of ash obtained after burning magnesium ribbon in air, will turn

(*a*) red litmus to blue because it is acidic in nature

(*b*) blue litmus to red because it is basic in nature

(*c*) blue litmus to red because it is acidic in nature

(*d*) red litmus to blue because it is basic in nature

26. An element X forms an oxide X_2O_3 which is basic in nature, the element X is

(*a*) non-metal (*b*) metal

(*c*) metalloid (*d*) both (*a*) and (*b*)

Case-based Question–II : Exchange of Gases

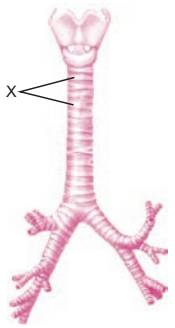
In human beings, air is taken into the body through the nostrils. From here, the air passes through the throat and into the lungs. Within the lungs, the passage divides into smaller and smaller tubes which finally terminate into balloon-like structures. The walls of these structures contain an extensive network of blood vessels. The blood brings carbon dioxide from the rest of the body for release into these and the oxygen from here is taken up by blood to be transported to all the cells in the body.

27. Gaseous exchange in humans takes place in

(*a*) alveoli (*b*) pharynx

(*c*) larynx (*d*) trachea

28. Consider the figure given below.



The given structure "X" is present in the throat to ensure that

(*a*) the airpassage must collapse (*b*) the airpassage does not collapse

(*c*) the airpassage does not expand (*d*) the foodpassage does not collapse

29. Study the flow chart given below that represents the transport of oxygen and carbon dioxide in human beings.

$$\text{Air} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Nostril} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{W} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Wind pipe} \rightleftharpoons \text{X}$$

$$\underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Lungs} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Y} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Blood} \underset{CO_2}{\overset{O_2}{\rightleftharpoons}} \text{Z}$$

Choose the correct combination of information provided in the following table.

	W	X	Y	Z
(*a*)	Pharynx	Bronchi	Alveoli	Tissue
(*b*)	Alveoli	Tissue	Bronchi	Pharynx
(*c*)	Tissue	Alveoli	Pharynx	Bronchi
(*d*)	Bronchi	Pharynx	Alveoli	Tissue

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30. Which of the following statement(s) is (are) true about human respiratory system?

I. When we breathe in, we lift our ribs and flatten our diaphragm.

II. Trachea is covered by epiglottis.

III. Lungs always contain a residual volume of air.

IV. The air passing through the nostrils is filtered by cilia.

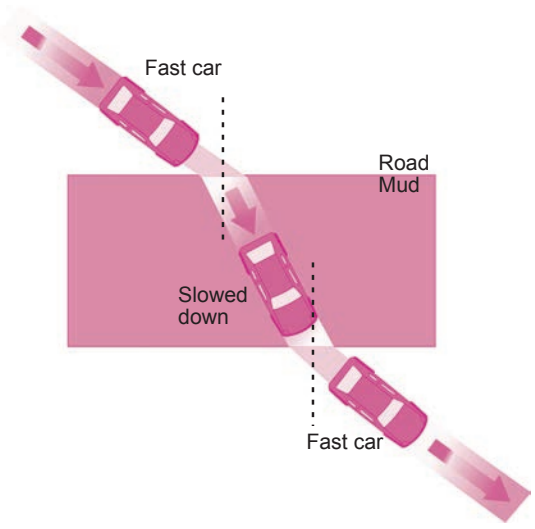
(*a*) I and II only (*b*) II and III only

(*c*) I, II and III only (*d*) I, III and IV only

Case-based Question–III : ***Refraction through a Rectangular Glass Slab***

A ray of light travelling from a rarer medium to a denser medium slows down and bends towards the normal. When it travels from denser medium to a rarer medium, it speeds up and bends away from the normal.

Consider an analogy to assist in our understanding of these two important principles. Suppose that a fast car is travelling across the road towards a thick mud at an angle, the mud slows down one side of the car, and the path of the car bends.



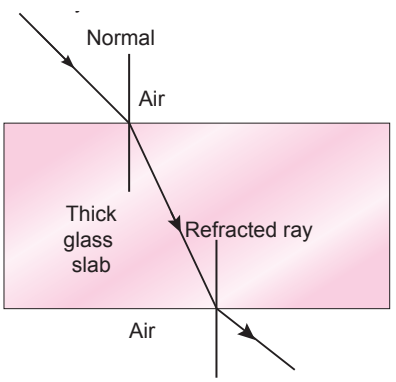
The more it is slowed, the more it bends.

Upon exiting the thick mud on the opposite side, the car speeds up and achieves its original speed. In effect, this analogy would be representative of light wave crossing two boundaries.

At the first boundary (the road to thick mud boundary), the light ray (or the car) would be slowing down; and at the second boundary (the mud to road boundary), the light ray (or the car) would be speeding up. We can apply our two important principles listed above and predict the direction of bending and the path of the car as it travels through the thick mud. As indicated in the diagram, upon entering the mud, the car slows down and the path of the car bends towards the normal (perpendicular line drawn to the surface). Upon exiting the mud, the car speeds up and the path of the car bends away from the normal. The path of the car is closer to the normal in the slower medium and farther from the normal in the faster medium.

This analogy can be extended to the path of a light ray as it passes from air into and out of a rectangular block of glass.

31. A student studies that when a ray of light travels from air into the glass slab, it bends towards the normal. But as refracted ray emerges out of the glass slab to the vacuum, it bends away from the normal, as shown.



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Which option explains the law of refraction of light through the glass slab?

(*a*) Light always bends towards the normal in a glass slab.

(*b*) Ray of light travelling in the air is always considered as the incident ray, and the one in the glass is the refracted ray.

(*c*) The incident ray, the refracted ray, and the normal to the interface always lie on the same plane.

(*d*) Ray of light always travels in a straight path irrespective of change in medium.

32. A student studies that speed of light in air is 300000 km/s whereas that of speed in a glass slab is about 197000 km/s. What causes the difference in speed of light in these two media?

(*a*) Difference in density

(*b*) Difference in amount of light

(*c*) Difference in direction of wind flow

(*d*) Difference in temperature

33. The speed of light in air is 3×10^8 ms^{-1}, whereas that of the speed of light in water is 2.26×10^8 ms^{-1}. What is the refractive index of water with respect to air?

(*a*) 2.64

(*b*) 1

(*c*) 1.32

(*d*) 0.75

34. Rahul conducts an experiment using an object of height 10 cm and a concave lens with focal length 20 cm. The object is placed at a distance of 25 cm from the lens. Can the image be formed on a screen?

(*a*) Yes, as the image formed will be real.

(*b*) No, as the image formed will be inverted.

(*c*) No, as the image formed will be virtual.

(*d*) Yes, as the image formed will be erect.

For question numbers 35 to 40, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

35. Assertion (A) : In a reaction of copper with oxygen, copper serves as a reducing agent.
Reason (R) : The substance which gains oxygen in a chemical reaction acts as a reducing agent.

36. Assertion (A) : Lime juice has a sour taste, while lime water is slightly bitter.
Reason (R) : The bitter taste of lime water is due to dilution.

37. Assertion (A) : $AlCl_3$ is an ionic compound.
Reason (R) : In this compound, chlorine donates its electrons to aluminium.

38. Assertion (A) : ATP acts as the energy currency of the cell.
Reason (R) : ATP can be broken down to release energy wherever and whenever energy needs to be utilised.

39. Assertion (A) : Large concave mirrors are used to concentrate sunlight to produce heat in solar cookers.
Reason (R) : Concave mirror converges the light rays falling on it to a point.

40. Assertion (A) : The stars twinkle, while the planets do not.
Reason (R) : The stars are much bigger in size than the planets.

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Answers of Practice Paper–01

1. (*c*)	**2.** (*a*)	**3.** (*b*)	**4.** (*d*)	**5.** (*c*)	**6** (*b*)	**7.** (*b*)	**8.** (*c*)
9. (*c*)	**10.** (*c*)	**11.** (*b*)	**12.** (*a*)	**13.** (*b*)	**14.** (*d*)	**15.** (*c*)	**16.** (*a*)
17. (*d*)	**18.** (*a*)	**19.** (*b*)	**20.** (*a*)	**21.** (*d*)	**22.** (*a*)	**23.** (*b*)	**24.** (*a*)
25. (*c*)	**26.** (*b*)	**27.** (*d*)	**28.** (*a*)	**29.** (*d*)	**30.** (*a*)	**31.** (*b*)	**32.** (*b*)
33. (*a*)	**34.** (*c*)	**35.** (*c*)	**36.** (*c*)	**37.** (*c*)	**38.** (*a*)	**39.** (*c*)	**40.** (*c*)

Answers of Practice Paper–02

1. (*d*)	**2.** (*b*)	**3.** (*a*)	**4.** (*d*)	**5.** (*c*)	**6.** (*d*)	**7.** (*c*)	**8.** (*c*)
9. (*d*)	**10.** (*c*)	**11.** (*a*)	**12.** (*b*)	**13.** (*b*)	**14.** (*d*)	**15.** (*b*)	**16.** (*d*)
17. (*c*)	**18.** (*c*)	**19.** (*d*)	**20.** (*c*)	**21.** (*b*)	**22.** (*d*)	**23.** (*a*)	**24.** (*b*)
25. (*b*)	**26.** (*a*)	**27.** (*d*)	**28.** (*a*)	**29.** (*a*)	**30.** (*c*)	**31.** (*c*)	**32.** (*b*)
33. (*a*)	**34.** (*d*)	**35.** (*b*)	**36.** (*a*)	**37.** (*b*)	**38.** (*c*)	**39.** (*d*)	**40.** (*c*)

Answers of Practice Paper–03

1. (*b*)	**2.** (*c*)	**3.** (*b*)	**4.** (*a*)	**5.** (*d*)	**6.** (*c*)	**7.** (*a*)	**8.** (*d*)
9. (*b*)	**10.** (*a*)	**11.** (*b*)	**12.** (*c*)	**13.** (*d*)	**14.** (*d*)	**15.** (*c*)	**16.** (*b*)
17. (*d*)	**18.** (*c*)	**19.** (*d*)	**20.** (*c*)	**21.** (*c*)	**22.** (*b*)	**23.** (*a*)	**24.** (*b*)
25. (*d*)	**26.** (*b*)	**27.** (*a*)	**28.** (*b*)	**29.** (*a*)	**30.** (*d*)	**31.** (*c*)	**32.** (*a*)
33. (*c*)	**34.** (*c*)	**35.** (*a*)	**36.** (*a*)	**37.** (*c*)	**38.** (*a*)	**39.** (*a*)	**40.** (*b*)

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PRACTICE PAPERS

1, 2 & 3

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R	A	J		K	U	M	A	R		S	H	A	R	M	A														

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	0	5	6	7	8	9

If your Roll Number is 6101234, write as

Roll Number in figures	6	1	0	1	2	3	4

Roll Number in words	SIXTY ONE LAKH ONE THOUSAND TWO HUNDRED THIRTY FOUR

CORRECT METHOD

Q. No.	*a*	*b*	*c*	*d*
03	●	(*b*)	(*c*)	(*d*)

WRONG METHOD

Q. No.	*a*	*b*	*c*	*d*
03	●	(*b*)	◒	(*d*)
03	✓ ●	●	(*c*)	(*d*)
03	~~(*a*)~~	(*b*)	●	(*d*)
03	●	~~(*b*)~~	(*c*)	(*d*)
03	(*a*)	(*b*)	◒	(*d*)

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Darken only one circle for each question.

Q. No.	Response			
	a	*b*	*c*	*d*
01	(a)	(b)	(c)	(d)
02	(a)	(b)	(c)	(d)
03	(a)	(b)	(c)	(d)
04	(a)	(b)	(c)	(d)
05	(a)	(b)	(c)	(d)
06	(a)	(b)	(c)	(d)
07	(a)	(b)	(c)	(d)
08	(a)	(b)	(c)	(d)
09	(a)	(b)	(c)	(d)
10	(a)	(b)	(c)	(d)
11	(a)	(b)	(c)	(d)
12	(a)	(b)	(c)	(d)
13	(a)	(b)	(c)	(d)
14	(a)	(b)	(c)	(d)

Q. No.	Response			
	a	*b*	*c*	*d*
15	(a)	(b)	(c)	(d)
16	(a)	(b)	(c)	(d)
17	(a)	(b)	(c)	(d)
18	(a)	(b)	(c)	(d)
19	(a)	(b)	(c)	(d)
20	(a)	(b)	(c)	(d)
21	(a)	(b)	(c)	(d)
22	(a)	(b)	(c)	(d)
23	(a)	(b)	(c)	(d)
24	(a)	(b)	(c)	(d)
25	(a)	(b)	(c)	(d)
26	(a)	(b)	(c)	(d)
27	(a)	(b)	(c)	(d)
28	(a)	(b)	(c)	(d)

Q. No.	Response			
	a	*b*	*c*	*d*
29	(a)	(b)	(c)	(d)
30	(a)	(b)	(c)	(d)
31	(a)	(b)	(c)	(d)
32	(a)	(b)	(c)	(d)
33	(a)	(b)	(c)	(d)
34	(a)	(b)	(c)	(d)
35	(a)	(b)	(c)	(d)
36	(a)	(b)	(c)	(d)
37	(a)	(b)	(c)	(d)
38	(a)	(b)	(c)	(d)
39	(a)	(b)	(c)	(d)
40	(a)	(b)	(c)	(d)

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   (v) Way of marking: If your response for question number 3 is a, darken as shown in correct method:

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Centre Number	2	0	0	9	

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Test Booklet Number						
	0	5	6	7	8	9

If your Roll Number is 6101234, write as

Roll Number in figures	6	1	0	1	2	3	4

Roll Number in words	SIXTY ONE LAKH ONE THOUSAND TWO HUNDRED THIRTY FOUR

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03	●	(*b*)	(*c*)	(*d*)

WRONG METHOD

Q. No.	*a*	*b*	*c*	*d*
03	●	(*b*)	◒	(*d*)
03	✓●	●	(*c*)	(*d*)
03	~~(*a*)~~	(*b*)	●	(*d*)
03	●	~~(*b*)~~	(*c*)	(*d*)
03	(*a*)	(*b*)	◒	(*d*)

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Use English Numbers/letters only. Use Blue/Black Ball Point Pen to write in box.

Test Booklet Code

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Roll Number in words

IMPORTANT

The Candidate should check that the Test Booklet Code printed on the Answer Sheet is the same as printed on the Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

Candidate's Name in CAPITAL letters as given in Admit Card

Darken only one circle for each question.

Q. No.	Response			
	a	*b*	*c*	*d*
01	(a)	(b)	(c)	(d)
02	(a)	(b)	(c)	(d)
03	(a)	(b)	(c)	(d)
04	(a)	(b)	(c)	(d)
05	(a)	(b)	(c)	(d)
06	(a)	(b)	(c)	(d)
07	(a)	(b)	(c)	(d)
08	(a)	(b)	(c)	(d)
09	(a)	(b)	(c)	(d)
10	(a)	(b)	(c)	(d)
11	(a)	(b)	(c)	(d)
12	(a)	(b)	(c)	(d)
13	(a)	(b)	(c)	(d)
14	(a)	(b)	(c)	(d)

Q. No.	Response			
	a	*b*	*c*	*d*
15	(a)	(b)	(c)	(d)
16	(a)	(b)	(c)	(d)
17	(a)	(b)	(c)	(d)
18	(a)	(b)	(c)	(d)
19	(a)	(b)	(c)	(d)
20	(a)	(b)	(c)	(d)
21	(a)	(b)	(c)	(d)
22	(a)	(b)	(c)	(d)
23	(a)	(b)	(c)	(d)
24	(a)	(b)	(c)	(d)
25	(a)	(b)	(c)	(d)
26	(a)	(b)	(c)	(d)
27	(a)	(b)	(c)	(d)
28	(a)	(b)	(c)	(d)

Q. No.	Response			
	a	*b*	*c*	*d*
29	(a)	(b)	(c)	(d)
30	(a)	(b)	(c)	(d)
31	(a)	(b)	(c)	(d)
32	(a)	(b)	(c)	(d)
33	(a)	(b)	(c)	(d)
34	(a)	(b)	(c)	(d)
35	(a)	(b)	(c)	(d)
36	(a)	(b)	(c)	(d)
37	(a)	(b)	(c)	(d)
38	(a)	(b)	(c)	(d)
39	(a)	(b)	(c)	(d)
40	(a)	(b)	(c)	(d)

Signature of Candidate (in running hand)

Signature of Invigilator

Before handing over the Answer Sheet to the invigilator, the candidate should check that Centre Number, Roll Number, Test Booklet Number and Candidate's Name have been filled in correctly.

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GENERAL INSTRUCTIONS FOR CANDIDATES

1. Use Blue/Black Ball Point only to write on this Answer Sheet. Use of Pencil is strictly prohibited.
2. The candidate should check carefully that the Test Booklet Code on SIDE-2 of the ANSWER SHEET is the same as printed on Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.
3. Do not use white/correction fluid on this Answer Sheet.
4. Overwriting, Cutting and Erasing on the Answer Sheet is not allowed. Do not make any stray mark on the Answer Sheet.
5. Rough work must not be done on this Answer Sheet. Use last page of the Test Booklet for rough work.
6. Use English Numbers/letters only to write on SIDE-2 of the Answer Sheet
7. Write Centre Number, Roll Number, Test Booklet Number (as given on top left hand side comer of the Test Booklet) on the Answer Sheet as shown in the example.
8. Candidates should write his/her name in CAPITAL LETTERS as given in Admit Card in the space earmarked for Candidate's Name. Each letter should be written in one box as shown below. One box should be left blank between each part of the name.

   Candidate's Name : RAJ KUMAR SHARMA

R	A	J		K	U	M	A	R		S	H	A	R	M	A														

9. (i) Darken the complete circle. A light or faintly darkened circle is liable to be rejected by the optical scanner.
   (ii) Darken only one circle for response against each question. The response once marked is not liable to be changed. More than one response indicated against a question will be deemed as incorrect response.
   (iii) If the candidate does not want to attempt any question, he/she should not darken the circle against that question.
   (iv) For the purpose of evaluation, the Test Booklet Code as printed in the Answer Sheet on SIDE-2 will be accepted as final.
   (v) Way of marking: If your response for question number 3 is a, darken as shown in correct method:

EXAMPLE-HOW TO FILL SIDE-2

If your Centre Number is 2009, write as

Centre Number	2	0	0	9	

If your Text Booklet Number is 056789 write as

Test Booklet Number						
	0	5	6	7	8	9

If your Roll Number is 6101234, write as

Roll Number in figures	6	1	0	1	2	3	4

Roll Number in words	SIXTY ONE LAKH ONE THOUSAND TWO HUNDRED THIRTY FOUR

CORRECT METHOD

Q. No.	*a*	*b*	*c*	*d*
03	●	(*b*)	(*c*)	(*d*)

WRONG METHOD

Q. No.	*a*	*b*	*c*	*d*
03	●	(*b*)	◒	(*d*)
03	✓●	●	(*c*)	(*d*)
03	~~(*a*)~~	(*b*)	●	(*d*)
03	●	~~(*b*)~~	(*c*)	(*d*)
03	(*a*)	(*b*)	◒	(*d*)

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ANSWER SHEET NUMBER

ANSWER SHEET

Use English Numbers/letters only. Use Blue/Black Ball Point Pen to write in box.

Test Booklet Code

A

Centre Number

Roll Number in figures

Test Booklet Number

Roll Number in words

IMPORTANT

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Candidate's Name in CAPITAL letters as given in Admit Card

Darken only one circle for each question.

Q. No.	Response			
	a	*b*	*c*	*d*
01	(a)	(b)	(c)	(d)
02	(a)	(b)	(c)	(d)
03	(a)	(b)	(c)	(d)
04	(a)	(b)	(c)	(d)
05	(a)	(b)	(c)	(d)
06	(a)	(b)	(c)	(d)
07	(a)	(b)	(c)	(d)
08	(a)	(b)	(c)	(d)
09	(a)	(b)	(c)	(d)
10	(a)	(b)	(c)	(d)
11	(a)	(b)	(c)	(d)
12	(a)	(b)	(c)	(d)
13	(a)	(b)	(c)	(d)
14	(a)	(b)	(c)	(d)

Q. No.	Response			
	a	*b*	*c*	*d*
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16	(a)	(b)	(c)	(d)
17	(a)	(b)	(c)	(d)
18	(a)	(b)	(c)	(d)
19	(a)	(b)	(c)	(d)
20	(a)	(b)	(c)	(d)
21	(a)	(b)	(c)	(d)
22	(a)	(b)	(c)	(d)
23	(a)	(b)	(c)	(d)
24	(a)	(b)	(c)	(d)
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Q. No.	Response			
	a	*b*	*c*	*d*
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31	(a)	(b)	(c)	(d)
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33	(a)	(b)	(c)	(d)
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35	(a)	(b)	(c)	(d)
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