THE SMART STUDY NOTES
CLASS 9th New CHEMISTRY
Chapter 1: States of Matter and Phase Changes

Additional Multiple Choice Questions (MCQs)

1.1 What is Chemistry?

1. Which branch of chemistry deals with the study of carbon-containing compounds?
a) Inorganic Chemistry b) Physical Chemistry
c) Organic Chemistry d) Biochemistry
Ans. c) Organic Chemistry

2. Determination of the percentage of elements in a sample falls under:
a) Analytical Chemistry
b) Environmental Chemistry
c) Nuclear Chemistry d) Geochemistry
Ans. a) Analytical Chemistry

3. The study of chemical processes occurring in living organisms is the focus of:
a) Biochemistry b) Medicinal Chemistry
c) Polymer Chemistry d) Astrochemistry
Ans. a) Biochemistry

4. Which branch investigates the behavior of substances at atomic and molecular levels?
a) Physical Chemistry b) Inorganic Chemistry
c) Polymer Chemistry d) Environmental Chemistry
Ans. a) Physical Chemistry

5. Fertilizers and catalysts are primarily studied in:
a) Organic Chemistry b) Inorganic Chemistry
c) Nuclear Chemistry d) Geochemistry
Ans. b) Inorganic Chemistry

6. Geochemistry is concerned with:
a) Chemical composition of Earth and its minerals
b) Synthesis of polymers c) Radioactivity in nuclei
d) Drug metabolism in humans
Ans. a) Chemical composition of Earth and its minerals

7. Which branch helps in understanding pollution causes and solutions?
a) Environmental Chemistry
b) Analytical Chemistry
c) Medicinal Chemistry d) Astrochemistry
Ans. a) Environmental Chemistry

8. Nuclear chemistry primarily deals with:
a) Reactions in the nucleus of atoms
b) Carbon compounds
c) Separation of components in a mixture
d) Heat transfer in geothermal pumps
Ans. a) Reactions in the nucleus of atoms

9. Proteins and nucleic acids are examples of:
a) Inorganic compounds b) Polymers
c) Radioactive elements d) geochemical substances
Ans. b) Polymers

10. Designing and synthesizing medicines is the focus of:
a) Medicinal Chemistry b) Biochemistry
c) Astrochemistry d) Physical Chemistry
Ans. a) Medicinal Chemistry

11. Which branch studies molecules in interstellar space?
a) Astrochemistry b) Geochemistry
c) Polymer Chemistry d) Nuclear Chemistry
Ans. a) Astrochemistry

12. The study of physical properties of materials from the Moon would relate to:
a) Physical Chemistry b) Inorganic Chemistry
c) Analytical Chemistry d) Environmental Chemistry
Ans. a) Physical Chemistry

13. Carrying out reactions with inorganic reagents on lunar samples relates to:
a) Inorganic Chemistry b) Organic Chemistry
c) Biochemistry d) Medicinal Chemistry
Ans. a) Inorganic Chemistry

14. The geothermal heat pump application is linked to:
a) Geochemistry b) Environmental Chemistry
c) Nuclear Chemistry d) Analytical Chemistry
Ans. a) Geochemistry

15. Identifying the concentration of components in a material is part of:
a) Analytical Chemistry b) Biochemistry
c) Polymer Chemistry d) Medicinal Chemistry
Ans. a) Analytical Chemistry

1.2 States of Matter

16. Anything that occupies volume and has mass is called:
a) Energy b) Matter c) Plasma d) Force
Ans. b) Matter
17. The primary states of matter are:
a) Solid, Liquid, Gas b) Solid, Liquid, Plasma
c) Gas, Plasma, Bose-Einstein condensate
d) Liquid, Gas, Dark matter
Ans. a) Solid, Liquid, Gas
18. Which state of matter has weak intermolecular forces and low density?
a) Solid b) Liquid c) Gas d) Plasma
Ans. c) Gas
19. Solids are incompressible because:
a) Particles are widely spaced
b) Particles are closely packed with strong intermolecular forces
c) Particles have high kinetic energy
d) They exist in a partially ionized state
Ans. b) Particles are closely packed with strong intermolecular forces
20. Plasma is commonly found in:
a) Ice cubes b) Fluorescent tubes and lightning
c) Wooden blocks d) Water droplets
Ans. b) Fluorescent tubes and lightning
21. Supercritical fluids exhibit properties of:
a) Solids and liquids b) Gases and liquids
c) Plasmas and gases d) Liquids and plasmas
Ans. b) Gases and liquids
22. Liquid crystals are used in:
a) Cooking utensils b) Display devices (e.g., monitors, watches)
c) Nuclear reactors d) geothermal pumps
Ans. b) Display devices (e.g., monitors, watches)
23. Graphene is a:
a) Three-dimensional diamond structure
b) Single layer of carbon atoms arranged hexagonally
c) Type of plasma d) Supercritical fluid
Ans. b) Single layer of carbon atoms arranged hexagonally
24. Which state of matter does NOT require a container for storage?
a) Gas b) Liquid c) Solid d) Plasma
Ans. c) Solid
25. The state of matter with the highest density is:
a) Gas b) Liquid c) Solid d) Plasma
Ans. c) Solid
26. Bose-Einstein condensate is an example of:
a) Primary state of matter b) Intermediate state
c) Exotic state of matter d) Supercritical fluid
Ans. c) Exotic state of matter
27. Which intermediate state is used for chemical reactions in supercritical carbon dioxide?
a) Liquid crystals b) Graphene
c) Supercritical fluids d) Plasma
Ans. c) Supercritical fluids
28. Dark matter is classified under:
a) Primary states b) Exotic states
c) Intermediate states d) Conventional states
Ans. b) Exotic states
29. The random movement of closely attached molecules is a feature of:
a) Solids b) Liquids c) Gases d) Plasmas
Ans. b) Liquids
30. Which state of matter is partially ionized and contains electrons and ions?
a) Solid b) Liquid c) Gas d) Plasma
Ans. d) Plasma

1.3 Element, Compound and Mixture

31. Copper wire, commonly used in Lahore's electrical infrastructure, is an example of:
a) Compound b) Homogeneous mixture
c) Element d) Heterogeneous mixture
Answer: c) Element
32. Smog in Lahore is primarily a:

a) Compound of nitrogen and oxygen
b) Homogeneous mixture of pollutants
c) Heterogeneous mixture of dust and gases
d) Pure element like carbon
Answer: b) Homogeneous mixture of pollutants

33. Which compound is widely used as a fertilizer in Punjab's agricultural sector?
a) Sodium Carbonate b) Potassium Chloride
c) Urea (CH_4N_2O) d) Methane
Answer: c) Urea (CH_4N_2O)

34. Granite, found in northern regions of Pakistan, is classified as:
a) A compound b) A homogeneous mixture
c) A heterogeneous mixture d) An ionic solid
Answer: c) A heterogeneous mixture

35. Technetium, mentioned in the text, is significant because it is:
a) A naturally abundant noble gas
b) The first artificially created element
c) Used in Lahore's water purification
d) A component of table salt
Answer: b) The first artificially created element

36. Tap water in Lahore contains dissolved salts. This makes it a:
a) Compound b) Element
c) Homogeneous mixture d) Heterogeneous mixture Answer: c) Homogeneous mixture

37. Which element is essential for preventing rust in Lahore's metal structures?
a) Helium b) Zinc c) Bromine d) Silicon
Answer: b) Zinc

38. Iron sulfide (FeS) is formed by:
a) Mixing iron filings and sulfur powder
b) Chemically bonding iron and sulfur atoms
c) Dissolving iron in sulfuric acid
d) Heating sulfur alone
Answer: b) Chemically bonding iron and sulfur atoms

39. Limestone, used in Pakistan's construction industry, is primarily a:
a) Compound (calcium carbonate) b) Element
c) Homogeneous mixture d) Colloidal solution
Answer: a) Compound (calcium carbonate)

40. Milk sold in Lahore's markets is categorized as:
a) Pure compound b) Homogeneous mixture
c) Heterogeneous mixture d) Metallic alloy
Answer: c) Heterogeneous mixture

41. Which of the following is NOT an example of an element?
a) Copper wire (Fig 1.2) b) Zinc screws (Fig 1.2)
c) Iron sulphide (Fig 1.3) d) Helium gas
Answer: c) Iron sulphide (Fig 1.3)

42. Air in Lahore's atmosphere is a mixture because it:
a) Contains chemically bonded oxygen and nitrogen
b) Has a fixed ratio of gases
c) Combines gases without chemical bonding
d) Is a pure substance
Answer: c) Combines gases without chemical bonding

43. Which substance is critical for manufacturing soap in local industries?
a) Sodium Carbonate b) Carbon Dioxide
c) Ammonia d) Potassium Chloride
Answer: a) Sodium Carbonate

44. Chocolate (Fig 1.4) is a heterogeneous mixture due to its:
a) Uniform composition
b) Variable distribution of ingredients
c) Pure chemical structure
d) Single-phase appearance
Answer: b) Variable distribution of ingredients

45. A student observes a rock sample from Margalla Hills. It is a mixture because it contains:
a) One type of mineral
b) Chemically bonded elements
c) Multiple minerals like granite and mica
d) Only organic compounds
Answer: c) Multiple minerals like granite and mica

1.4 Allotropic Forms of Substances

46. The phenomenon where an element exists in different structural forms with varying properties is called:
a) Isotopy b) Allotropy
c) Polymerization d) Isomerism
Answer: b) Allotropy
47. Which element has O_2 and O_3 as its two common allotropes?
a) Carbon b) Sulfur
c) Oxygen d) Nitrogen
Answer: c) Oxygen
48. Which of the following is NOT an allotrope of carbon?
a) Diamond b) Graphite
c) Rhombic Sulfur d) Buckminsterfullerene
Answer: c) Rhombic Sulfur
49. Graphite conducts electricity due to its:
a) Giant covalent structure
b) Layered hexagonal rings with free electrons
c) Spherical cage-like structure
d) High melting point
Answer: b) Layered hexagonal rings with free electrons
50. Buckminsterfullerene (C_{60}) is unique because of its:
a) Use in jewelry b) Cage-like structure with pentagons and hexagons
c) High electrical conductivity
d) Giant macromolecular arrangement
Answer: b) Cage-like structure with pentagons and hexagons
51. Which sulfur allotrope is more stable at room temperature?
a) Monoclinic b) Rhombic
c) Amorphous d) Plastic
Answer: b) Rhombic
52. A key property of Buckminsterfullerene is that it is:
a) Soluble in organic solvents
b) A good conductor of heat
c) Extremely hard d) Used in lubricants
Answer: a) Soluble in organic solvents
53. Diamond is preferred in cutting tools because of its:
a) Layered structure
b) High electrical conductivity
c) Hardness due to giant covalent structure
d) Low melting point
Answer: c) Hardness due to giant covalent structure
54. Which allotrope of carbon is used in pencils and lubricants?
a) Diamond b) Graphite
c) Fullerene d) Coal
Answer: b) Graphite
55. Why can graphite layers slide over each other easily?
a) Presence of free ions b) Weak forces between layers
c) High density d) Metallic bonding
Answer: b) Weak forces between layers

1.5 Differences between Elements, Compounds and Mixtures

56. What is a key difference between a compound and a mixture?
a) Compounds are impure, while mixtures are pure.
b) Compounds have fixed ratios of elements, while mixtures do not.
c) Mixtures can be separated chemically, while compounds require physical methods.
d) Mixtures retain properties of individual components, while compounds do not.
Answer: b) Compounds have fixed ratios of elements, while mixtures do not.
57. Which statement is true about elements?
a) They can be broken down into simpler substances by physical methods.
b) They exist only as diatomic molecules.
c) Noble gases exist as mono-atomic molecules.
d) Their properties are a combination of their components.

Answer: c) Noble gases exist as mono-atomic molecules.

58. Water (H_2O) is a compound because:

a) It contains hydrogen and oxygen mixed in any ratio.

b) Its properties differ from hydrogen and oxygen.

c) It can be separated into its components by filtration.

d) It is a homogeneous mixture.

Answer: b) Its properties differ from hydrogen and oxygen.

59. Which method is used to separate components of a mixture?

a) Electrolysis b) Chemical reactions

c) Physical methods like distillation

d) Heating to break bonds

Answer: c) Physical methods like distillation

60. A sample of rock is a heterogeneous mixture because:

a) It has a uniform composition.

b) Its components are chemically bonded.

c) Its constituents are unevenly distributed.

d) It contains only one type of mineral.

Answer: c) Its constituents are unevenly distributed.

61. Which of the following is a compound?

a) Oxygen gas (O_2) b) Sodium chloride (NaCl)

c) Air d) Granite

Answer: b) Sodium chloride (NaCl)

62. Why can't an element be broken down by ordinary chemical reactions?

a) It is a mixture of different atoms.

b) It consists of only one type of atom.

c) It has a network structure.

d) It contains unpaired electrons.

Answer: b) It consists of only one type of atom.

63. Which property is common to both compounds and mixtures?

a) Fixed composition by weight

b) Components retain their identity

c) Formed by chemical bonding

d) Can exist as homogeneous substances

Answer: d) Can exist as homogeneous substances

64. Graphite and diamond are allotropes of carbon. What distinguishes them from compounds?

a) They are mixtures of different elements.

b) They contain chemically bonded atoms of different elements.

c) They are pure forms of the same element.

d) They can be separated by physical methods.

Answer: c) They are pure forms of the same element.

65. Which example represents a homogeneous mixture?

a) Rock b) Saltwater solution

c) Iron sulphide (FeS) d) Graphite

Answer: b) Saltwater solution

1.6 Solution, Colloidal Solution and Suspension /1.7 Formation of Unsaturated and Saturated Solutions

66. Which type of mixture allows solute particles to pass through filter paper without residue?

a) Suspension b) Colloidal solution

c) True solution d) Heterogeneous mixture

Answer: c) True solution

67. A chalk-water mixture is an example of:

a) Colloidal solution b) Saturated solution

c) Suspension d) unsaturated solution

Answer: c) Suspension

68. What distinguishes a colloidal solution from a true solution?

a) Particles settle over time

b) Particles are visible to the naked eye

c) Intermediate particle size between true solutions and suspensions

d) Components chemically bonded

Answer: c) Intermediate particle size between true solutions and suspensions

69. At 20°C, 203.9 g of sugar dissolves in 100 g of water. This describes a:

a) Colloidal solution b) Saturated solution

c) Suspension d) Unsaturated solution

Answer: b) Saturated solution

70. Which property is common to both colloidal solutions and true solutions?

a) Particles settle on standing

b) Particles pass through filter paper

c) Heterogeneous composition

d) Large visible solute particles

Answer: b) Particles pass through filter paper

71. Why can sugar dissolve in larger amounts than salt in water at 20°C?

a) Sugar has smaller molecules

b) Sugar molecules are surrounded by more water molecules

c) Salt forms covalent bonds

d) Sugar is ionic in nature

Answer: b) Sugar molecules are surrounded by more water molecules

72. A solution that can dissolve additional solute at a specific temperature is termed:

a) Saturated b) Colloidal

c) Unsaturated d) Suspension

Answer: c) Unsaturated

73. Which example is a colloidal solution commonly used in Pakistani households?

a) Saltwater b) Milk (starch-protein colloid)

c) Chalk-water mixture d) Sugar syrup

Answer: b) Milk (starch-protein colloid)

74. If undissolved sugar remains at the bottom of a beaker after stirring, the solution is:

a) Unsaturated b) Saturated

c) Colloidal d) Suspension

Answer: b) Saturated

75. Which factor directly affects the solubility of a solute in a solvent?

a) Color of the solute b) Temperature

c) Shape of the container d) Volume of air

Answer: b) Temperature

1.8 Effect of Temperature on the Solubility of Solutes

76. Solubility is defined as the amount of solute that can dissolve in:

a) 100g of solute at any temperature

b) 100g of solvent at a specific temperature

c) 1 liter of solvent under high pressure

d) Any quantity of solvent at room temperature

Answer: b) 100g of solvent at a specific temperature

77. Which compound's solubility decreases as temperature increases?

a) Potassium nitrate (KNO_3)

b) Calcium hydroxide ($Ca(OH)_2$)

c) Silver nitrate ($AgNO_3$)

d) Copper sulphate ($CuSO_4$)

Answer: b) Calcium hydroxide ($Ca(OH)_2$)

78. What happens to the solubility of gases in water when temperature rises?

a) Increases sharply b) Decreases

c) Remains constant

d) First increases, then decreases

Answer: b) Decreases

79. Heating a saturated sugar solution allows more sugar to dissolve because:

a) Sugar's solubility decreases with temperature

b) Sugar's solubility increases with temperature

c) Water evaporates, leaving space for more sugar

d) Sugar decomposes into smaller particles

Answer: b) Sugar's solubility increases with temperature

80. Which solute shows negligible increase in solubility with temperature?

a) Potassium chloride (KCl)

b) Sodium chloride (NaCl)

c) Lithium carbonate (Li_2CO_3)

d) Potassium nitrate (KNO_3)

Answer: b) Sodium chloride (NaCl)

81. A solubility curve primarily illustrates the relationship between:

a) Pressure and solubility

b) Temperature and solubility

c) Volume and concentration
d) pH and solubility
Answer: b) Temperature and solubility

82. In the activity described, dissolving more sugar in a heated solution demonstrates that solubility is:
a) Independent of temperature
b) Directly proportional to temperature
c) Inversely proportional to temperature
d) Unaffected by physical methods
Answer: b) Directly proportional to temperature

83. Which industrial process relies on solubility changes with temperature?
a) Filtration b) Crystallization
c) Distillation d) Sublimation
Answer: b) Crystallization

84. A steep upward slope in KNO_3's solubility curve indicates:
a) Solubility decreases sharply with temperature
b) Solubility increases sharply with temperature
c) No dependency on temperature
d) Irregular solubility behavior
Answer: b) Solubility increases sharply with temperature

85. Why is calcium hydroxide's decreasing solubility with temperature significant?
a) It enhances limewater's clarity
b) It explains precipitation in hot limewater
c) It increases gas absorption in water
d) It stabilizes antacid formulations
Answer: b) It explains precipitation in hot limewater

Exercise MCQs

(i) Matter is present in neon signs in the state of:
(a) Supercritical fluid (b) Plasma
(c) Gas (d) Liquid crystal
Answer: (b) Plasma

(ii) Hazardous effects of shopping bags are studied in:
(a) Geochemistry (b) Inorganic Chemistry
(c) Analytical Chemistry (d) Environmental Chemistry
Answer: (d) Environmental Chemistry

(iii) The man-made polymer is:
(a) Starch (b) Polystyrene (c) Protein (d) Cellulose
Answer: (b) Polystyrene

(iv) The crystals of which substance have rhombic shape?
(a) Brass (b) Sulphur (c) Graphite (d) Bronze
Answer: (b) Sulphur

(v) Which liquid among the following is a colloidal solution?
(a) Milk (b) Slaked lime used for white wash
(c) Vinegar solution (d) Mixture of AgCl in water
Answer: (a) Milk

(vi) Which of the following is a heterogeneous mixture?
(a) A solution of calcium hydroxide in water
(b) A solution of potassium nitrate in water
(c) Hot chocolate (d) Concrete mixture
Answer: (d) Concrete mixture

(vii) A state of matter whose properties are between those of liquids and crystalline solids:
(a) Liquid crystal (b) Supercritical fluid
(c) Plasma (d) Dark matter
Answer: (a) Liquid crystal

(viii) When the tiny visible particles of a substance are dispersed through a medium, the mixture is named as:
(a) True solution (b) Colloid
(c) Suspension (d) Saturated solution
Answer: (c) Suspension

(ix) A solution of $KClO_3$ has a solubility of about 13.2g per 100 cm^3 at 40°C. How its solubility will be affected, if you decrease the temperature?
(a) The solubility will increase
(b) The solubility will decrease
(c) The solubility will remain the same
(d) The solubility will first increase with temperature and then it will decrease
Answer: (b) The solubility will decrease

(x) You are studying the rate of hydrolysis of starch under different conditions of temperature. In which branch of chemistry does this topic fall?

(a) Organic Chemistry (b) Analytical Chemistry

(c) Biochemistry (d) Physical Chemistry

Answer: (c) Biochemistry