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

Additional Topic-Wise Short Questions & Answers

Topic 1.1: What is Chemistry?

1. Define chemistry.
   Answer: Chemistry is the branch of science that studies the composition, structure, properties, and interactions of matter.
2. Name three branches of chemistry.
   Answer: Organic Chemistry, Inorganic Chemistry, Biochemistry.
3. What is the role of analytical chemistry?
   Answer: It involves analyzing substances to determine their composition and concentration.
4. Which branch studies carbon-containing compounds?
   Answer: Organic Chemistry.
5. What does nuclear chemistry focus on?
   Answer: Reactions occurring in atomic nuclei, including radioactivity and nuclear energy.
6. How does environmental chemistry help society?
   Answer: By studying chemical pollutants and their effects on ecosystems.
7. What is medicinal chemistry?
   Answer: The design and synthesis of drugs for medical use.

Topic 1.2: States of Matter

1. List the four commonly observed states of matter.
   Answer: Solid, liquid, gas, plasma.
2. Why are solids rigid and incompressible?
   Answer: Due to tightly packed particles with strong intermolecular forces.
3. What is plasma? Give an example.
   Answer: A high-energy ionized gas; found in lightning and stars.
4. How do liquids differ from gases?
   Answer: Liquids have fixed volume but no fixed shape; gases have neither.
5. Define intermediate states of matter.
   Answer: States that exhibit properties of two phases (e.g., liquid crystals, supercritical fluids).
6. What are supercritical fluids?
   Answer: Substances at high pressure/temperature with properties of both liquids and gases.
7. Why is graphene considered a 2D material?
   Answer: It is a single layer of carbon atoms arranged in a hexagonal lattice.

Topic 1.3: Element, Compound and Mixture

1. Differentiate between elements and compounds.
   Answer: Elements contain one type of atom; compounds are chemically bonded elements in fixed ratios.
2. Why is air a mixture?
   Answer: It contains gases (O_2, N_2, CO_2) mixed physically in variable ratios.
3. Give an example of a homogeneous mixture.
   Answer: Saltwater.
4. How is a compound different from a mixture?
   Answer: Compounds are chemically bonded and pure; mixtures are physical combinations.
5. What is a heterogeneous mixture?
   Answer: A mixture with unevenly distributed components (e.g., concrete).
6. Name two gaseous elements.
   Answer: Oxygen (O_2), Nitrogen (N_2).
7. Why can't compounds be separated by physical methods?
   Answer: Their components are chemically bonded.

Topic 1.4: Allotropic Forms of Substances

1. Define allotropy.
   Answer: The existence of an element in multiple physical forms with different properties.

2. Name three allotropes of carbon.
Answer: Diamond, graphite, fullerenes.
3. Why is graphite a good conductor?
Answer: Its layered structure allows free electrons to move between layers.
4. What is the structure of C_{60} (Buckminsterfullerene)?
Answer: A spherical molecule with carbon atoms arranged in pentagons and hexagons.
5. How does rhombic sulfur differ from monoclinic sulfur?
Answer: Rhombic sulfur is stable at room temperature; monoclinic forms at higher temperatures.
6. Why is diamond hard?
Answer: Due to its rigid 3D network of covalent bonds.
7. What is graphene used for?
Answer: Electronics and lightweight materials due to its conductivity and strength.

Topic 1.6: Solution, Colloidal Solution and Suspension

1. What is a true solution?
Answer: A homogeneous mixture where solute particles dissolve completely (e.g., sugar water).
2. How does a colloid differ from a suspension?
Answer: Colloid particles are smaller and do not settle (e.g., milk); suspension particles settle (e.g., sand in water).
3. Give an example of a colloidal solution.
Answer: Starch solution.
4. Why can't suspension particles pass through filter paper?
Answer: Their large size blocks the pores.
5. What happens when a suspension is left undisturbed?
Answer: Particles settle at the bottom.
6. Name a natural colloid.
Answer: Egg white.
7. Why are colloidal solutions called "stable"?
Answer: Particles remain dispersed and do not settle.

Topic 1.7: Formation of Unsaturated and Saturated Solutions

1. Define unsaturated solution.
Answer: A solution where more solute can dissolve at a given temperature.
2. How is a saturated solution formed?
Answer: By dissolving the maximum amount of solute in a solvent at a specific temperature.
3. Why does sugar dissolve more in water than NaCl at 20°C?
Answer: Sugar molecules are larger and interact more with water molecules.
4. What happens if excess solute is added to a saturated solution?
Answer: The excess remains undissolved as residue.
5. How can you convert an unsaturated solution to a saturated one?
Answer: By adding more solute until no more dissolves.
6. What is solubility?
Answer: The maximum amount of solute that dissolves in 100g solvent at a specific temperature.
7. Why does heating increase solubility of most solids?
Answer: Higher temperature provides energy to break solute-solute bonds.

Topic 1.8: Effect of Temperature on the Solubility of Solutes

1. How does temperature affect gas solubility?
Answer: Solubility decreases as temperature increases.
2. Why is CO_2 more soluble in cold water?
Answer: Gases dissolve better at lower temperatures due to reduced kinetic energy.
3. What happens to KNO_3 solubility when temperature rises?
Answer: It increases significantly.

4. Why is NaCl's solubility less affected by temperature?

Answer: Its ionic structure requires minimal energy for dissolution.

5. Name a compound whose solubility decreases with temperature.

Answer: Lithium carbonate (Li_2CO_3).

6. How are solubility curves useful?

Answer: They show how solubility changes with temperature for different substances.

7. Why are soda bottles stored in refrigerators?

Answer: To retain dissolved CO_2 by keeping the temperature low.

Exercise

Q2. Answers to Short Questions: Page#15

i. Why is there a need to divide Chemistry into many branches? Give three reasons.

Ans: 1. Specialization: Allows scientists to focus on specific areas (e.g., biochemistry for biological processes, environmental chemistry for pollution).

2. Complexity Management: Simplifies study and research by breaking down the vast field into manageable parts.

3. Application-Specific Tools: Develops unique methodologies and techniques tailored to each branch (e.g., analytical chemistry for precise measurements).

ii. Which branches cover reactions due to electrons vs. nuclear reactions?

Ans: Electron-based reactions: Organic Chemistry (carbon compounds). Inorganic Chemistry (non-carbon compounds). Physical Chemistry (energy and dynamics of reactions). Nuclear reactions: Nuclear Chemistry (radioactivity, fission, fusion).

iii. Problems solved in analytical chemistry:

Ans: 1. identifying unknown substances (e.g., forensic analysis). 2. Measuring pollutant concentrations in air/water. 3. Quality control in pharmaceuticals and food industries.

iv. Difference between graphite and graphene:

Ans: Graphite: Multiple layers of carbon atoms in hexagonal sheets (weak interlayer bonds).

Graphene: A single layer of carbon atoms (stronger, thinner, and highly conductive).

v. Importance of supercritical fluids:

Ans: Act as solvents in industries (e.g., decaffeinating coffee using supercritical CO_2).

Enable efficient extraction and chemical synthesis due to hybrid liquid-gas properties.

vi. State of matter in the Sun:

Ans: Plasma (ionized gas with free electrons and ions).

vii. Importance of graphene:

Ans: Exceptional strength, flexibility, and conductivity.

Used in advanced electronics, energy storage, and composite materials.

viii. Dominant form of matter in "this world":

Ans: Solids, liquids, and gases (e.g., water, metals, air).

Note: Plasma dominates the universe but is rare on Earth.

Q3. Constructed Response Questions Page#15

i. How does a supercritical state look like?

Ans: A supercritical fluid appears as a hybrid phase with no distinct liquid-gas boundary. It exhibits properties of both: high density (like a liquid) and low viscosity (like a gas). For example, supercritical CO_2 is used in decaffeinating coffee.

ii. Plasma creation in a fluorescent tube:

Ans: Electric current passes through mercury vapor, ionizing the gas to form plasma. Excited mercury atoms emit UV light, which strikes the phosphor coating on the tube, producing visible light.

iii. Organic Chemistry vs. Biochemistry:

Ans: Organic Chemistry: Focuses on carbon compounds (e.g., hydrocarbons, polymers).

Biochemistry: Studies chemical processes in living organisms (e.g., enzyme reactions, DNA synthesis).

Difference: Biochemistry applies organic chemistry principles to biological systems.
iv. Diamond brilliance:
Ans: Brilliance arises from its high refractive index and precise crystal structure, which reflects and refracts light. It cannot be "improved" structurally, but expert cutting enhances its sparkle.
v. Dissolution of NaCl in water:
Ans: Water's polar molecules break NaCl's ionic bonds via ion-dipole interactions. Na^+ ions are surrounded by water's oxygen, and Cl^- ions by hydrogen, leading to hydration and dissolution.
vi. Variable solubility's:
Ans: Solubility depends on solute-solvent interactions (e.g., polarity). Ionic compounds (NaCl) dissolve in polar solvents; nonpolar substances (oil) do not. Molecular size and bond strength also matter.
vii. NaCl vs. KNO_3 crystallization:
Ans: KNO_3's solubility rises sharply with temperature, so cooling a hot solution crystallizes it. NaCl's solubility barely changes, requiring evaporation for crystallization.
viii. Graphite as a lubricant:
Ans: Graphite's layers slide easily due to weak van der Waals forces between hexagonal carbon layers. This property makes it slippery and ideal for lubricants.

Q4. Descriptive Questions Page#15

i. Branches of Chemistry:
(a) Physical Chemistry
(b) Biochemistry
(c) Nuclear Chemistry
(d) Environmental Chemistry
(e) Inorganic Chemistry
(f) Analytical Chemistry
ii. Allotropic forms:
Allotropy: Existence of an element in multiple structural forms.
Carbon:
Diamond: 3D covalent network (hard, non-conductive).
Graphite: Layered hexagonal sheets (conductive, slippery).
Fullerenes: Spherical (e.g., C_{60}).
Sulphur:
Rhombic (stable at room temp).
Monoclinic (stable above 95.6°C).
Coal vs. Diamond: Coal is amorphous carbon; diamond is crystalline.
iii. Supercritical fluids vs. ordinary liquids:
Supercritical fluids: No surface tension, diffuse like gases, dissolve materials like liquids.
Ordinary liquids: Fixed volume, surface tension, cannot effuse.
iv. Solubility and temperature:
Solubility: Maximum solute dissolving in 100g solvent at a specific temperature.
Effect:
Most solids: Solubility increases with temperature (e.g., KNO_3).
Gases: Solubility decreases (e.g., CO_2 in soda).
v. Molecular movements:
Gases: Random, high-speed, chaotic motion.
Liquids: Vibrational and rotational movement within confined spaces.
vi. Inorganic vs. Organic Chemistry: