

Chapter 1 — States of Matter and Phase Changes**2. Questions for Short Answers****1. Why is there a need to divide Chemistry into many branches? Give three reasons.**

Ans: Chemistry is a very wide and complex subject, so it is divided into many branches. (1) Division allows scientists to concentrate on the specific aspects of the subject. (2) Each branch has its own distinct area of study, so scientists can specialise in it. (3) This specialisation makes breakthroughs and advancements possible in every field.

2. Reactions may take place due to electrons present outside the nucleus or they may take place inside the nucleus. Which branches of Chemistry cover these two types of reactions?

Ans: Reactions caused by the electrons present outside the nucleus are ordinary chemical reactions; they are studied in Physical Chemistry (and in the ordinary branches such as Inorganic and Organic Chemistry), because only the outermost electrons take part in them. Reactions taking place inside the nucleus are studied in Nuclear Chemistry, which deals with radioactivity, nuclear processes and the transformation of nuclei.

3. What types of problems are solved in analytical chemistry?

Ans: Analytical chemistry deals with the analysis of different substances. It solves problems of separation, identification and determination of the concentration of the components present in material things. Modern and sophisticated instruments are generally used for this analysis.

4. Both graphite and graphene have hexagonal layered structures. What is the difference?

Ans: Graphite is a bulk, three-dimensional form of carbon made of many layers of hexagonal rings of carbon stacked one above the other. Graphene is a two-dimensional crystal — a single layer of carbon atoms arranged in a hexagonal pattern. Graphene is tough, flexible and light and has a high resistance. So the difference is essentially many layers (graphite) against one single layer (graphene).

5. Why are supercritical fluids important?

Ans: Supercritical fluids are highly compressed states which show the properties of both gases and liquids. They are important because they act as solvents for chemical reactions which may not be carried out in conventional solvents — for example, such reactions may possibly be carried out in supercritical carbon dioxide.

6. In which state does matter exist in the Sun?

Ans: In the Sun matter exists in the plasma state. Plasma is composed of particles having very high kinetic energy; it is a partially ionized gas containing electrons, ions and photons. Most of the matter present in the rest of the universe also exists in this state.

7. What is the importance of graphene?

Ans: Graphene is an example of a two-dimensional crystal — a single layer of carbon atoms arranged in a hexagonal pattern. It is a tough, flexible and light material with a high resistance. These properties make it a very useful material.

8. Which form of matter do most of the material things in this world belong to?

Ans: Most of the material things in this world belong to the solid state, because most of the elements found in this world exist in solid form. Liquid and gaseous elements are very few in number as compared to solids.

3. Constructed Response Questions**1. How does a supercritical state look like?**

Ans: A supercritical state is an intermediate state lying at the borderline between a liquid and a gas. The substance is so highly compressed that it fills the whole container like a gas but its density is close to that of a liquid, and no separate liquid surface (meniscus) can be seen. It therefore looks like a single dense, hazy fluid rather than a liquid with a gas above it.

2. In what way is plasma created in a fluorescent tube?

Ans: A fluorescent tube contains a gas at a very low pressure. When a high voltage is applied across its electrodes, the gas particles gain very high kinetic energy and the gas becomes partially ionized, that is, electrons are knocked out of the atoms. The resulting partially ionized gas, containing electrons, positive ions and photons, is plasma, and it glows as it gives out light.

3. Most of the molecules we study in biochemistry are organic in nature. Where does the difference exist in organic and biochemistry branches of Chemistry?

Ans: Organic chemistry deals with all carbon compounds (hydrocarbons and their derivatives) — their structure, formation, properties, composition and reactions — whether or not they are connected with living things. Biochemistry deals only with those chemical substances and vital processes which occur inside living organisms, such as proteins, carbohydrates, lipids and nucleic acids. So the difference is not in the molecules themselves but in the context: organic chemistry studies carbon compounds in general, biochemistry studies the chemistry of life processes.

4. Give the reason of brilliance shown by diamond. Can you improve it?

Ans: In diamond each carbon atom is joined to four other carbon atoms by strong covalent bonds, giving a giant, rigid, closely packed macromolecular structure. Because of this rigid structure and its very high refractive index, light entering the diamond is reflected internally many times before it comes out, and this produces its brilliance. Yes, the brilliance can be improved by cutting and polishing the stone at proper angles (faceting), so that a still larger part of the light entering it is totally internally reflected back to the eye.

5. Explain the dissolution of sodium chloride in water.

Ans: Sodium chloride is an ionic compound made of Na^+ and Cl^- ions held in a crystal lattice by strong electrostatic forces. Water is a polar solvent. When sodium chloride is put in water, the polar water molecules surround the ions — the negative (oxygen) ends of the water molecules are attracted to the Na^+ ions and the positive (hydrogen) ends to the Cl^- ions. This hydration breaks the electrostatic force of attraction holding the lattice together, the ions become free and spread uniformly throughout the water, and a homogeneous (true) solution is obtained.

6. Why do different compounds have different solubilities in water at a particular temperature?

Ans: Different solutes have particles of different size and nature, so the number of water molecules that can surround one solute particle is different in each case. For example, sugar molecules are much larger than salt ions, so more water molecules can surround a single sugar molecule and it dissolves in a larger amount. At 20 °C, 203.9 g of table sugar dissolves in 100 g of water, while only 36 g of sodium chloride dissolves in the same amount of water.

7. Why can NaCl not be crystallized from water just like KNO_3 ?

Ans: Potassium nitrate can be crystallized from water because its solubility increases markedly with an increase in temperature: a hot saturated solution holds much more solute, and when it is cooled the extra solute separates out as crystals. The solubility of sodium chloride, however, does not increase appreciably with an increase in temperature, so a hot saturated solution of NaCl holds almost the same amount of salt as a cold one and gives practically no extra solid on cooling. It can therefore not be purified by crystallization from water in the same way.

8. Why is graphite slippery to touch? Which property of graphite enables it to be used as lubricant?

Ans: Graphite consists of a layered structure made of hexagonal rings of carbon. The layers are not bonded strongly to one another, so they can slip past each other easily; this is why graphite feels slippery to touch. It

is exactly this property — the ability of its layers to slide over one another — that enables graphite to be used as a lubricant in industry.

EXAMPAPERDESK.COM

EXAMPAPERDESK.COM