

Exercise

1. Tick (✓) the correct answer:

(i) Matter is present in neon signs in the state of:

- (a) Supercritical fluid
- **(b) Plasma ✓**
- (c) Gas
- (d) Liquid crystal

Explanation: In neon signs, electricity turns gas into plasma (a glowing state).

(ii) Hazardous effects of shopping bags are studied in:

- (a) Geochemistry
- (b) Inorganic Chemistry
- (c) Analytical Chemistry
- **(d) Environmental Chemistry ✓**

Explanation: Environmental Chemistry deals with pollution and harmful effects of chemicals.

(iii) The man-made polymer is:

- (a) Starch
- **(b) Polystyrene ✓**
- (c) Protein
- (d) Cellulose

Explanation: Polystyrene is a synthetic (man-made) plastic; the others are natural.

(iv) The crystals of which substance have rhombic shape?

- (a) Brass
- **(b) Sulphur ✓**
- (c) Graphite
- (d) Bronze

Explanation: Sulphur naturally forms rhombic-shaped crystals.

(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

Explanation: Milk is a colloid — it has tiny particles that don't settle or dissolve.

(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** ✓

Explanation: Concrete has different parts (cement, sand, stones) that are not evenly mixed.

2. Questions for Short Answers

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

Answer:

1. Chemistry has many topics, so dividing helps in better understanding.
 2. Each branch focuses on a special type of matter or reaction.
 3. It helps scientists solve real-life problems more easily, like pollution, medicines, or materials.
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ii. 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?

Answer:

- **Reactions outside the nucleus** are studied in **Physical Chemistry**.
 - **Reactions inside the nucleus** are studied in **Nuclear Chemistry**.
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iii. What types of problems are solved in analytical chemistry?

Answer:

Analytical Chemistry helps us:

- Find out **what substances** are in a sample.
 - Measure **how much** of a substance is present.
- Example: Testing water for pollution or food for sugar content.
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iv. Both graphite and graphene have hexagonal layered structures. What is the difference?

Answer:

- **Graphite** has **many layers** of carbon atoms.
 - **Graphene** has **only one layer** of carbon atoms.
- Graphene is thinner but stronger than graphite.
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v. Why are supercritical fluids important?

Answer:

Supercritical fluids are used in:

- **Removing caffeine** from coffee.
 - **Making medicines** and **cleaning** materials.
- They work better than liquids or gases in some cases.
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vi. In which state does matter exist in the Sun?

Answer:

Matter in the Sun exists in the **plasma state** (a very hot gas with charged particles).

vii. What is the importance of graphene?

Answer:

Graphene is:

- **Very strong** but **very light**.
 - **Good conductor** of heat and electricity.
- It is used in **electronics, batteries, and medicine**.
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viii. Which form of matter do most of the material things in this world belong to?

Answer:

Most things in our world are in the **solid state**.

3. Constructed response Questions:

i. How does a supercritical state look like?

A supercritical state is when a substance is both like a gas and a liquid at the same time. It does not have a clear surface like normal liquid. It spreads like a gas but dissolves things like a liquid. You cannot tell where the liquid ends and gas starts.

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

When electricity passes through a fluorescent tube, it gives energy to the gas inside. This energy removes electrons from the gas atoms. The gas becomes plasma – a mix of free electrons and ions that glows and gives light.

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

Organic chemistry studies all kinds of carbon compounds. Biochemistry focuses only on carbon compounds found in living things, like proteins, sugars, and fats. So, biochemistry is a part of organic chemistry but only for life-related compounds.

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

Diamond shines brightly because it bends (refracts) light a lot due to its strong and regular structure. This makes light bounce inside and sparkle. Yes, its shine can be improved by cutting it in a special way to reflect more light.

v. Explain the dissolution of sodium chloride in water.

When salt (NaCl) is put in water, water molecules pull apart the sodium (Na⁺) and chloride (Cl⁻) ions. These ions then spread out in the water. This is how salt dissolves in water.

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

Every compound has different forces between its particles. Water also has its own type of force. If a compound matches well with water's forces, it will dissolve easily. If not, it won't dissolve much. That's why solubility is different.

vii. Why NaCl can not be crystallized from water just like KNO₃?

NaCl does not dissolve much more in hot water than in cold water. But KNO₃ dissolves a lot more in hot water. So when hot KNO₃ solution cools, crystals form. This doesn't happen well with NaCl.

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

Graphite feels slippery because its layers can slide over each other easily. These layers are weakly held together. This sliding property makes graphite useful as a lubricant, like in machine parts or pencils.

4. Descriptive Questions:

i. Mention the name of the branch of Chemistry in which you will study each of the following topics:

(a) Rate of a reaction – Physical Chemistry

This branch studies how fast or slow a reaction happens.

(b) Digestion of food in human body – Biochemistry

Biochemistry explains how food breaks down inside our body using enzymes.

(c) Properties of plasma – Physical Chemistry

It studies the behavior of plasma (a state of matter) and how it acts like both gas and ionized particles.

(d) Ecosystem – Environmental Chemistry

This branch studies chemical changes in nature, including the environment, plants, and animals.

(e) Reactions taking place during fireworks – Inorganic Chemistry

Inorganic chemistry looks at metals and reactions (like burning of elements in fireworks).

(f) Measurement of the absorption of wavelength with the help of ultraviolet spectrometer – Analytical Chemistry

This branch helps measure how substances absorb light, helping in identifying them.

ii. What are allotropic forms? Explain the allotropic forms of carbon and sulphur. How does coal differ from diamond?

Allotropic forms are different physical forms of the same element. The atoms are the same but arranged in different ways.

Carbon's allotropes include:

- **Diamond** (hard, shiny, strong bonds)
- **Graphite** (soft, slippery, used in pencils)
- **Fullerenes** (ball-shaped molecules)

Sulphur's allotropes include:

- **Rhombic sulphur** (stable at room temperature)
- **Monoclinic sulphur** (stable at higher temperature)

Coal vs Diamond:

Coal is an impure form of carbon with no regular structure. It is black and soft.

Diamond is pure carbon with a crystal structure, making it hard and shiny.

iii. What are supercritical fluids? How are they different from ordinary liquids?

A **supercritical fluid** is a state where a substance behaves like both a gas and a liquid. This happens when it is heated and pressed beyond a certain point (critical temperature and pressure).

Difference from ordinary liquids:

- Supercritical fluids can spread like gases but dissolve things like liquids.
 - Ordinary liquids have a clear boundary with gases, but supercritical fluids don't.
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iv. Define solubility of a solute. How does the solubility of solutes change with the increase in temperature?

Solubility is the maximum amount of solute (like salt or sugar) that can dissolve in a certain amount of solvent (like water) at a given temperature.

Effect of temperature:

- For most solids, solubility **increases** with temperature.
 - For gases, solubility usually **decreases** when temperature goes up.
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v. What types of movements are present in gaseous and liquid molecules?

In gases: Molecules move **freely and fast** in all directions. They have high energy and are far apart.

In liquids: Molecules move **slower** than in gases. They slide past each other but stay close.

Both types of movement are called **random motion**.

vi. Differentiate between the areas which are studied under inorganic and organic chemistry.

Inorganic Chemistry studies:

- Elements and compounds that **do not have carbon-hydrogen bonds**.
- Examples: salts, metals, minerals, acids, bases.

Organic Chemistry studies:

- Compounds that **have carbon-hydrogen bonds**.
- Mostly found in living things.
- Examples: alcohols, fats, proteins, plastics.

Certainly! Here's a simple, clear, and concept-based explanation suitable for students whose first language is not English:

5. Investigative Questions

i. Preparation of solutions leads to an important process in chemistry which enables us to purify a compound through crystallization. Describe a process in which potassium nitrate is purified by crystallizing it in water.

Answer:

To purify potassium nitrate using crystallization, follow these steps:

1. **Dissolve:** Add impure potassium nitrate to hot water and stir. It dissolves, while some impurities may not.
2. **Filter:** Remove any undissolved impurities by filtering the hot solution.
3. **Cool:** Let the clear solution cool down slowly. Potassium nitrate crystals will start to form because it is less soluble in cold water.
4. **Collect Crystals:** Separate the crystals by filtering them out.
5. **Dry:** Let the crystals dry. These crystals are now more pure.

This method works because pure potassium nitrate comes out of the solution when it cools, leaving many impurities behind.

ii. Graphene is called a miracle material and it is the material of the future. Which of its many properties makes it very useful in electronics?

Answer:

Graphene is very useful in electronics because **it conducts electricity extremely well**. It allows electricity to pass through very fast and without much resistance. This means electronic devices made with graphene can be faster, smaller, and more efficient.