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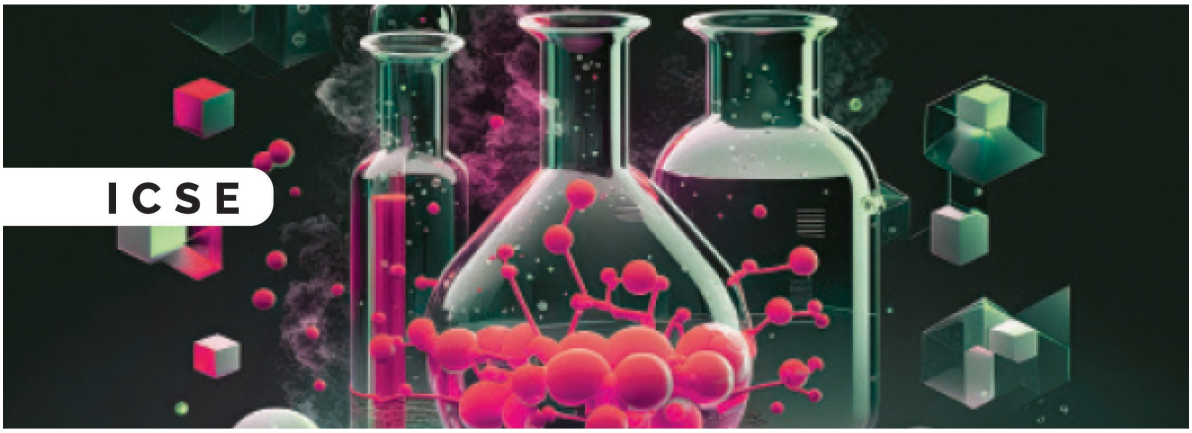

Prodigy

CHEMISTRY

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DR. N.K. SHARMA
Ph.D

R.V. SINGH
M.Sc, B.Ed

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PRODIGY
CHEMISTRY -7

ANSWER KEY

ICSE Chemistry-7

Chapter-1

Matter And Its Composition

Exercise Corner

A. MCQs

1. (d) Matter
2. (b) The particles move faster
3. (a) melting
4. (b) Convection
5. (a) boiling point

B. Fill in the Blanks

(a) Homogenous mixture (b) Atoms or molecules (c) Solid (d) compress (e) Gases (f) Rapidly (g) 100°C

C. True Or False

(a) True
(b) False (Liquid changing to gas is called vaporization)
(c) True
(d) True
(e) True

D. Match the Following

1. Plastic - (e) Man-made matter
2. Generally possess high densities - (a) Solid
3. Gas - (b) No definite shape, takes the shape and volume of the container
4. The force of attraction between - (c) Cohesive force
5. Boiling - (d) In the change of state of a liquid, the particles change into vapour state.

Very Short Type answer questions

1. Mass is the amount of matter in an object.

2. Volume is the amount of space occupied by an object or substance.

3. Matter is anything that has mass and occupies space.

4. Condensation is the process by which a substance changes from its gaseous state to its liquid state, usually due to cooling.

5. Gases exert pressure because their molecules are in constant motion and collide with the walls of their container, creating force per unit area.

Short answer type questions

1. Natural matter: coal, wood, silk, cotton, water, cellulose
Man-made matter: soap, nylon, plastic, medicine

2. Characteristics of matter:

1. Mass: Matter has mass, which is a measure of the amount of material present in an object.
2. Volume: Matter occupies space and has volume, which is the amount of space it occupies.
3. Density: Matter has density, which is the mass per unit volume of a substance.
4. State: Matter exists in different states: solid, liquid, and gas, depending on the arrangement and motion of its particles.
5. Particle arrangement: Matter consists of tiny particles (atoms, molecules, or ions) that are arranged in a specific pattern or structure.

3. Differences between boiling and evaporation:

1. Temperature Requirement:
    - Boiling occurs at the boiling point of a substance, which is a specific temperature at which the vapor pressure of the liquid equals the atmospheric pressure.
    - Evaporation can occur at any temperature below the boiling point of a substance, as long as sufficient energy is supplied to overcome the intermolecular forces holding the liquid together.
2. Speed of Process:
    - Boiling is a rapid process that occurs throughout the liquid volume when it reaches its boiling point.

- Evaporation is a slower process that occurs only at the surface of the liquid, where molecules with sufficient kinetic energy escape into the gas phase.

4. The particles of a gas have the maximum movement. Due to this gas exerts pressure on the walls of the container because its molecules are in constant motion and collide with the container walls, creating force per unit area.

5. (i) Naphthalene balls disappear with time without leaving any solid because they undergo sublimation, which is a process where a solid directly converts into vapor without passing through the liquid phase. Therefore, the naphthalene balls gradually sublimate into vapor, leaving no solid residue behind.

(ii) We can get the smell of perfume sitting several meters away because perfume molecules diffuse through the air. Diffusion is the process by which molecules move from an area of higher concentration to an area of lower concentration until equilibrium is reached. Since perfume molecules are volatile, they evaporate easily and spread out in the air, allowing us to detect their scent even at a distance.

Long answer type questions

1. Properties of solids:

1. Definite Shape: Solids have a definite shape, meaning they maintain a fixed and rigid structure. The arrangement of particles in solids is such that they maintain their shape even when subjected to external forces. This property is due to the strong intermolecular forces and close packing of particles in solids.
2. Definite Volume: Solids also have a definite volume, meaning they occupy a specific amount of space and maintain this volume regardless of external conditions. The particles in solids are closely packed and do not have the freedom to move around, leading to a fixed volume.
3. High Density: Solids generally possess high density compared to liquids and gases. This is because the particles in solids are tightly packed, resulting in a high mass per unit volume. The high density of solids contributes to their stability and resistance to compression.
4. Incompressibility: Solids are largely incompressible, meaning they cannot be easily squeezed into a smaller volume. When external pressure is applied to a solid, the particles are forced closer together, but they resist further compression due to the strong intermolecular forces between them.

2. Properties of liquids:

1. Fluidity: Liquids have the ability to flow and take the shape of their container. Unlike solids, where particles are tightly packed and maintain a fixed shape, the particles in liquids are more loosely arranged and can move past each other. This allows liquids to flow and adapt to the shape of the container they are placed in, making them suitable for applications such as transportation, hydraulic systems, and various industrial processes.
2. Definite Volume: Like solids, liquids also have a definite volume, meaning they occupy a specific amount of space. The volume of a liquid remains constant regardless of the shape of the container it is placed in. This property is due to the cohesive forces between liquid particles, which keep them close together and prevent them from expanding or contracting to fill the entire container.
3. Indefinite Shape: Unlike solids, which have a definite shape, liquids do not have a fixed shape of their own. Instead, they take the shape of the container they are poured into. This property is a result of the weak intermolecular forces between liquid particles, which allow them to move past each other and flow freely. The ability of liquids to conform to the shape of their container makes them useful in applications such as storage, transportation, and processing of fluids.
4. Surface Tension: Liquids exhibit surface tension, which is the tendency of the surface of a liquid to minimize its surface area and form a thin, elastic-like film. Surface tension is caused by the cohesive forces between liquid molecules at the surface, which pull the molecules inward and create a "skin" or surface film. This property allows insects, such as water striders, to walk on the surface of water without sinking and enables certain liquids to form droplets or maintain a curved meniscus in narrow containers. Surface tension also plays a crucial role in capillary action, where liquids are drawn upward in narrow tubes due to adhesive and cohesive forces between the liquid and the tube material.

3. Properties of gases:

1. Expansion: Gases have the ability to expand and fill the entire volume of their container. Unlike solids and liquids, which have definite shapes and volumes, gases have neither a fixed shape nor a fixed volume. Instead, they uniformly spread out to occupy the entire available space within their container. This property is a result of the high kinetic energy of gas particles, which enables them to move freely and rapidly in all directions.
2. Compressibility: Gases are highly compressible, meaning they can be easily squeezed into a smaller volume under pressure. When external pressure is applied to a gas, the gas particles are forced closer together, reducing the volume they occupy. This property is due to the large spaces between gas

particles and the weak intermolecular forces between them. Compressibility is a crucial property of gases and is exploited in various industrial processes, such as the compression of air in pneumatic systems and the liquefaction of gases for storage and transportation.

3. Low Density: Gases generally have low densities compared to solids and liquids. This is because the particles in gases are widely spaced apart, resulting in a low mass per unit volume. The low density of gases allows them to rise in air and disperse quickly, making them suitable for applications such as atmospheric studies, weather forecasting, and propulsion systems.

4. Diffusibility and Effusion: Gases exhibit high diffusibility, meaning they mix readily with other gases and spread out uniformly when placed in contact with each other. This property is a result of the rapid and random motion of gas particles, which enables them to intermingle and disperse throughout a given space. Gases also undergo effusion, which is the process by which gas molecules escape through a tiny opening into a vacuum or another region of lower pressure.

4. (i) Sublimation: Sublimation is a phase transition process in which a substance transitions directly from the solid phase to the gas phase without passing through the intermediate liquid phase. During sublimation, the solid substance absorbs heat energy from its surroundings, causing its particles to gain enough energy to break free from their fixed positions and enter the gas phase. Sublimation occurs when the vapor pressure of the solid exceeds the atmospheric pressure at a given temperature. Common examples of substances that undergo sublimation include dry ice (solid carbon dioxide), mothballs (naphthalene), and camphor. Sublimation is utilized in various applications, such as freeze drying, purification of substances, and deposition of thin films in manufacturing processes.

(ii) Boiling Point: The boiling point of a substance is the temperature at which the vapor pressure of the liquid equals the atmospheric pressure, resulting in the formation of bubbles throughout the liquid volume. At the boiling point, the vapor pressure of the liquid phase matches the pressure exerted by the surrounding atmosphere, allowing the liquid to undergo a phase transition from the liquid phase to the gas phase. The boiling point is a characteristic property of a substance and depends on factors such as atmospheric pressure and the strength of intermolecular forces within the liquid. Boiling points are commonly used to identify and classify substances, and they have significant implications in various fields, including chemistry, thermodynamics, and food processing.

(iii) Condensation Point: The condensation point, also known as the dew point, is the temperature at which a substance transitions from the gaseous phase to the liquid phase through condensation. Condensation occurs when the vapor pressure of the gas equals the saturation vapor pressure at a given temperature, causing the gas molecules to lose energy and form a liquid. The condensation point is essentially the reverse process of boiling, where a gas condenses into a liquid instead of a liquid boiling into a gas. The condensation point is influenced by factors such as temperature, pressure, and the presence of condensation nuclei. Condensation plays a critical role in various natural phenomena, including cloud formation, precipitation, and the water cycle, as well as in technological applications such as refrigeration and distillation.

Application Based Questions

(i) If a bottle of perfume on opening evolves an odor that can be sensed over a long distance, you would observe the process of diffusion. Diffusion is the movement of particles from an area of high concentration to an area of low concentration. In this case, the perfume molecules, which are volatile and easily evaporate, spread out through the air and diffuse over a wide area, allowing the scent to be detected even at a considerable distance from the source.

(ii) When a solid expands on heating, you would observe an increase in its dimensions or volume. This expansion occurs because heating provides additional energy to the particles within the solid, causing them to vibrate more vigorously and occupy a larger space. As a result, the solid material expands, and this expansion can be observed as an increase in length, width, or volume, depending on the nature of the solid and its thermal expansion properties.

(iii) The conversion of liquid to solid on cooling is called freezing. On freezing the kinetic energy of water particles decreases and the interparticles attraction between water particles increases. As a result water gets converted into ice.

Multi-disciplinary questions

1. If a crystal of iodine is placed in a closed flat flask and heated, the observation can help conclude that interparticle space is minimum in solids and maximum in gases by observing the behavior of iodine during the heating process:

1. Initial Observation: Initially, the crystal of iodine is solid and occupies a relatively small volume within the flask. This indicates that the particles of iodine are closely packed together, suggesting minimal interparticle space characteristic of solids.
2. Heating Process: As the flask is heated, the crystal of iodine undergoes sublimation, transitioning directly from the solid phase to the gaseous phase without passing through the liquid phase. This indicates that the particles of iodine gain sufficient energy to overcome the intermolecular forces holding

them in the solid lattice and enter a state of increased motion and interparticle distance, characteristic of gases.

3. Observation of Gas: The iodine gas fills the entire volume of the flask, expanding to occupy the available space. This observation suggests that the particles of iodine in the gaseous state have maximum interparticle space, allowing them to move freely and occupy the entire volume of the container.

By observing the transition of iodine from a solid to a gas upon heating, we can infer that solids have minimal interparticle space, as their particles are tightly packed, while gases have maximum interparticle space, as their particles are widely spaced apart and can move freely. This demonstrates the fundamental difference in the arrangement and spacing of particles between solids and gases, supporting the conclusion that interparticle space is minimum in solids and maximum in gases.

2. In solids, particles possess kinetic energy due to their vibrational motion within fixed positions in the solid lattice. The particles in a solid have the least amount of kinetic energy among the three states of matter because their motion is limited to vibrations around their equilibrium positions. The kinetic energy of solid particles is primarily determined by factors such as temperature and the strength of intermolecular forces.

In liquids, particles possess more kinetic energy compared to solids because they are not confined to fixed positions and can move past each other. The particles in a liquid exhibit translational, rotational, and vibrational motion, allowing them to flow and take the shape of their container. While the particles in a liquid have greater kinetic energy than those in a solid, their motion is still somewhat restricted by cohesive forces between neighboring particles.

In gases, particles possess the highest amount of kinetic energy among the three states of matter because they are not bound by intermolecular forces and are free to move independently. Gas particles move randomly and rapidly in all directions, colliding with each other and the walls of their container. The kinetic energy of gas particles is primarily determined by factors such as temperature and pressure, with higher temperatures leading to increased kinetic energy and faster particle motion.

In summary, the particles in a gas possess the highest amount of kinetic energy due to their rapid and unrestricted motion. Liquid particles possess intermediate kinetic energy, while solid particles possess the least amount of kinetic energy due to their restricted vibrational motion within fixed positions.

Play and Learn

1. Students do your self
2. Student do your self

Stem Project

Factors affecting evaporation

1. Surface Area: Greater the surface area, higher will be the rate of evaporation.
2. Temperature: Higher the temperature, higher will be the rate evaporation.
3. Humidity: Higher the humidity in atmosphere, lesser will be the rate of evaporation.
4. Wind speed: Higher the wind speed, higher will be the rate of evaporation.

Value and Like Skills

(a) Air is compressible as it has large intermolecular space.
(b) Rohit showed the value of intelligency, awareness and self responsibility.

ICSE Chemistry-7

Chapter-2

Metals and Non- Metals

Exercise Corner

A. MCQs

1. (a) Malleability
2. (c) Na (Sodium)
3. (a) Helium
4. (a) Iron
5. (c) Zinc

B. Fill in the Blanks

(a) Phosphorus is a very **reactive** non-metal. (b) The most ductile metal is **gold**. (c) A metal which is stored in kerosene oil is **sodium**. (d) Iron is **more** reactive than copper. (e) A non-metal which is used to purify water is **chlorine**. (f) Metals react with acid to produce **hydrogen** gas. (g) Chemical formula of rusting of iron is $\mathbf{Fe_2O_3.}x\ \mathbf{H_2O}$.

C. True Or False

(a) False
(b) False
(c) False
(d) True
(e) True

D. Match the Following

1. Argon - (e) Noble gas
2. Germanium - (a) Metalloids
3. Mercury - (d) Liquid metal
4. Neon - (e) Advertising sign board
5. Chlorine - (b) Non-metal
6. Gold - (c) Noble metal

E. Very Short answer type questions

1. Metalloids are elements that have properties intermediate between those of metals and non-metals. They exhibit characteristics of both metals and non-metals, such as conductivity that varies with conditions and semiconducting properties.

2. Two conditions for corrosion are:

1. Presence of oxygen (in the air or dissolved in water)
2. Presence of moisture (water or humidity)

3. An element consists of only one type of particles. These particles may be atoms or molecules An element is a substance composed of atoms that have the same number of protons in their atomic nuclei, characterized by its unique atomic number.

4.

A compound is a substance composed of two or more different elements chemically bonded together in fixed proportions. They are always homogeneous in nature.

5. Mercury.

F. Short Answer type Questions

1. Noble gases are a group of elements located in group 18 of the periodic table. They are characterized by their filled outer electron shells, making them very stable and unreactive under normal conditions. For examples.

1. Helium (He)
2. Neon (Ne)
3. Argon (Ar)
4. Krypton (Kr)
5. Xenon (Xe)
6. Radon (Rn)

2. Helium gas is used for various purposes due to its unique properties. Some common uses of helium gas include:

1. **Balloons:** Helium is commonly used to fill balloons for celebrations and events due to its low density, which makes balloons float in the air.

2. **Airships and Blimps:** Helium is used as a lifting gas in airships and blimps due to its low density and non-flammability, providing buoyancy without the risk of combustion.
3. **Cooling:** Helium is used as a coolant in applications where low temperatures are required, such as cryogenic research, superconductivity, and cooling nuclear reactors.
4. **Welding:** Helium is used as a shielding gas in welding processes, particularly for high-energy applications like laser welding and plasma arc welding, where it provides inert protection to the weld area.
5. **Medical Imaging:** Helium is used in magnetic resonance imaging (MRI) machines to cool the superconducting magnets, enabling the machine to operate at extremely low temperatures and produce high-quality images.
6. **Leak Detection:** Helium is used as a tracer gas for leak detection in various industries, such as HVAC systems, refrigeration, and pipeline systems, due to its low reactivity and ability to penetrate small leaks.
7. **Research:** Helium is used in scientific research and experiments, including particle accelerators, spectroscopy, and gas chromatography, due to its inert nature and unique physical properties.

3. Corrosion is a natural process that occurs when metals react with substances in their environment, such as oxygen and water, leading to the deterioration of the metal surface. This reaction results in the formation of corrosion products, which can weaken the metal structure and compromise its integrity over time. Corrosion is often characterized by the formation of rust (iron oxide) on iron and steel surfaces, but it can occur in various forms depending on the metal involved and the specific environmental conditions. Factors such as moisture, temperature, pH, and the presence of impurities can influence the rate and extent of corrosion. Corrosion can have significant economic and safety implications, affecting industries such as transportation, infrastructure, and manufacturing, and efforts are made to prevent or mitigate its effects through various protective coatings, alloys, and corrosion-resistant materials.

4.

A metal is a type of chemical element characterized by its luster, malleability, ductility, and ability to conduct electricity and heat. Metals typically have a crystalline structure. Some examples of metals are

1. Iron (Fe)
2. Copper (Cu)
3. Aluminum (Al)
4. Gold (Au)
5. Silver (Ag)
6. Zinc (Zn)
7. Titanium (Ti)

8. Nickel (Ni)
9. Lead (Pb)
10. Tin (Sn)

These are just a few examples of the numerous metals found in nature and utilized in various industries and applications.

5. Non-metals occur abundantly in nature and are found in various forms, including solids, liquids, and gases. They are typically located on the right side of the periodic table and lack many of the characteristic properties of metals. Non-metals can be found in both pure form and in compounds with other elements. Some common occurrences of non-metals include:

1. **Atmosphere:** Several non-metals, such as nitrogen (N_2), oxygen (O_2), and carbon dioxide (CO_2), are present in the Earth's atmosphere in the form of gases. These gases play essential roles in supporting life and regulating climate.
2. **Minerals:** Non-metals are found in various minerals and ores. For example, sulfur (S) occurs naturally in minerals such as pyrite and gypsum, while carbon (C) is found in graphite and diamond.
3. **Organic Matter:** Non-metals are essential components of organic matter, including living organisms and organic compounds. Carbon is a fundamental element in all living organisms and is found in proteins, carbohydrates, fats, and nucleic acids.
4. **Water Bodies:** Non-metals such as hydrogen (H) and oxygen (O) are present in water (H_2O) and are crucial for supporting life and sustaining ecosystems.
5. **Rocks and Soils:** Non-metals can also be found in rocks and soils. For example, silicon (Si) is a common non-metallic element found in rocks such as quartz and sandstone.

G. Long answer type questions

1.
(i) Silicon:

1. Semiconductor Industry: Silicon is widely used in the semiconductor industry to manufacture electronic devices such as transistors, diodes, and integrated circuits. Its semiconductor properties, combined with its abundance and relative purity, make it an essential material for the production of computer chips, solar cells, and other electronic components.
2. Glass and Ceramics: Silicon compounds such as silicon dioxide (silica) are key components in the production of glass and ceramics. Silicon dioxide is a major ingredient in glassmaking, providing strength and durability to glass products.

Additionally, silicon carbide is used as an abrasive material in grinding wheels and cutting tools due to its hardness and thermal conductivity.

(ii) Germanium:

1. Semiconductor Devices: Germanium is used as a semiconductor material in various electronic devices, particularly in the early days of semiconductor technology. Although silicon has largely replaced germanium in many applications, germanium is still used in infrared detectors, diodes, and transistors, especially in niche applications where its unique properties are advantageous.
2. Fiber Optics: Germanium is used as a dopant in the production of optical fibers for telecommunications and data transmission. Doped germanium fibers can improve the efficiency and performance of optical communication systems by enhancing signal transmission and reducing losses.

(iii) Antimony:

1. Flame Retardants: Antimony compounds, such as antimony trioxide, are widely used as flame retardants in plastics, textiles, and building materials. These compounds help to inhibit or suppress the combustion process, thereby reducing the spread of fires and improving fire safety in various applications.
2. Alloys: Antimony is commonly used as an alloying element in metal alloys, particularly in combination with lead, tin, and copper. Antimony alloys, such as lead-antimony alloys, are used in batteries, ammunition, and soldering materials due to their hardness, low melting point, and resistance to corrosion. Additionally, antimony-tin alloys are used in the production of pewter and other casting alloys.

2. Electroplating is a process in which a thin layer of metal is deposited onto the surface of a conductive object using an electrochemical reaction. This process involves passing an electric current through a solution containing dissolved metal ions (the electrolyte) and immersing both the object to be plated (the substrate) and a metal electrode (the anode) into the electrolyte solution. The metal ions in the electrolyte solution are attracted to the substrate surface by the electric current and are reduced to form a thin, adherent layer of metal coating on the substrate surface.

Applications of electroplating:

1. Decorative Finishes: Electroplating is commonly used to apply decorative metal finishes to objects such as jewelry, watches, silverware, and automobile trim. Metals such as gold, silver, nickel, and chromium are often electroplated onto the surfaces of these objects to enhance their appearance, provide corrosion resistance, and improve durability.
2. Corrosion Protection: Electroplating can be used to apply protective metal coatings to substrates to enhance their resistance to corrosion, wear, and abrasion. Metals such as zinc (as zinc plating or galvanizing) and chromium

are frequently used for corrosion protection in applications such as automotive parts, fasteners, and industrial equipment.

3. Electrical Conductivity: Electroplating is used to deposit thin metal layers onto electronic components and connectors to improve electrical conductivity, solderability, and contact resistance. Metals such as gold and tin are commonly electroplated onto circuit boards, connectors, and semiconductor devices in the electronics industry.
4. Engineering Applications: Electroplating is utilized in various engineering applications to provide surface coatings with specific properties such as hardness, lubricity, and chemical resistance. For example, metals such as copper, nickel, and chromium are electroplated onto components in the aerospace, automotive, and machinery industries to improve performance and longevity.

3. Gold, silver, and platinum are considered noble metals due to their unique chemical properties and resistance to corrosion and oxidation in various environmental conditions. Several factors contribute to their classification as noble metals:

1. **Chemical Inertness:** Noble metals have a high resistance to chemical reactions and corrosion, particularly in aqueous environments. This inertness is attributed to the stability of their electron configurations and the strong metallic bonding present in their crystal structures. As a result, noble metals are less prone to tarnishing, rusting, or reacting with acids and other substances compared to other metals.
2. **Low Reactivity:** Noble metals exhibit low reactivity with other elements, including oxygen, water, and acids. This low reactivity is due to their filled outer electron shells, which make them less likely to gain or lose electrons and form chemical bonds with other elements. Consequently, noble metals tend to remain in their metallic form and maintain their luster and properties over time.
3. **Resistance to Corrosion:** Noble metals are highly resistant to corrosion and oxidation, even in harsh or corrosive environments. This resistance is essential for their use in applications where durability, longevity, and aesthetic appeal are paramount. For example, gold, silver, and platinum are widely used in jewelry, dental alloys, and electronic components due to their resistance to tarnishing and degradation.
4. **Biocompatibility:** Noble metals exhibit biocompatibility and are non-toxic to living organisms. This property makes them suitable for use in medical implants, prosthetics, and surgical instruments, where biocompatibility and resistance to corrosion are critical considerations.

5. **High Value and Rarity:** Gold, silver, and platinum are highly valued and prized for their rarity, beauty, and intrinsic properties. Their scarcity and desirability have contributed to their historical and cultural significance as symbols of wealth, prestige, and luxury.

Application based questions

1. Copper is commonly used in coins for several reasons:

1. **Durability:** Copper is a durable metal that resists wear and corrosion over time. This durability ensures that copper coins maintain their appearance and value even with frequent handling and circulation.
2. **Malleability:** Copper is highly malleable, meaning it can be easily shaped and stamped into coins of various sizes and designs. Its malleability allows for the production of intricate coin designs and details.
3. **Conductivity:** Copper is an excellent conductor of electricity and heat. While this property is not directly related to the function of coins, it can be advantageous in coin production processes, such as minting and electroplating.
4. **Cost-Effectiveness:** Copper is relatively abundant and cost-effective compared to precious metals like gold and silver. Using copper in coins helps to keep production costs low while still providing a valuable and durable currency.
5. **Tradition:** Copper has a long history of use in coinage, dating back thousands of years. Its familiarity and widespread acceptance as a coinage metal contribute to its continued use in modern coin production.

2. (i) Iron:

1. Construction: Iron is widely used in construction for structural components such as beams, columns, and reinforcement bars (rebar) due to its strength and durability.
2. Transportation: Iron and iron alloys (e.g., steel) are used in the manufacturing of vehicles, including cars, trucks, trains, and ships, as well as in infrastructure such as bridges and railway tracks.
3. Household Appliances: Iron is used in the production of household appliances such as refrigerators, washing machines, ovens, and stoves due to its strength and heat resistance.
4. Tools and Machinery: Iron is used to manufacture a wide range of tools and machinery, including hand tools, power tools, engines, and heavy equipment, due to its hardness and machinability.

(ii) Zinc:

1. Galvanization: Zinc is commonly used to coat iron and steel surfaces through a process called galvanization to protect them from corrosion. Galvanized steel

is used in construction, automotive manufacturing, and various other applications.
2. Batteries: Zinc is used in the production of batteries, particularly in alkaline batteries and zinc-carbon batteries, where it serves as the anode material.
3. Dietary Supplements: Zinc is an essential nutrient for human health and is used in dietary supplements to support immune function, wound healing, and overall health.
4. Alloys: Zinc is used as an alloying element in various metals and alloys, including brass (copper-zinc alloy), bronze (copper-tin-zinc alloy), and nickel silver (copper-nickel-zinc alloy).

(iii) Lead:

1. Batteries: Lead-acid batteries are widely used in vehicles, uninterruptible power supplies (UPS), and backup power systems due to their reliability and low cost.
2. Roofing and Flashings: Lead is used in roofing materials and flashings to provide waterproofing and weatherproofing in construction applications.
3. Radiation Shielding: Lead is used as a radiation shielding material in healthcare facilities, nuclear power plants, and other industries to protect workers and the environment from ionizing radiation.
4. Ammunition and Firearms: Lead is used in the production of ammunition and bullets due to its density, malleability, and ability to fragment upon impact. However, there is increasing concern about the environmental and health impacts of lead exposure from ammunition.

Multi-Disciplinary and Experiential Learning Based Question

1. Iodine (I)
2. Gold jewellery are polished in a solution, mixture of nitric acid and hydrochloric acid (1: 3 ratio) aqua regia.

The outer layer of the gold jewellery dissolve in the acidic solution and the inner shiny layer will be visible. Due to this loss of the upper layer of jewellery, the weight of jewellery will get reduced.

Play and Learn

1. Students do your self
2. Student do your self

Stem Projects

Student do yourself

Image Based Question

Students Observe Yourself

Value and Life Skills

1. 24K (Karat) Gold signifies 99.9 percent purity and also called pure gold and as if does not contain traces of any other metals. In 22k gold gold contains 91.67 purity and rest of part as other metals.
2. Freshly trained goldsmith realised his mistake and could complete his task otherwise we might have been in problem.
3. The trained goldsmith has a big heart and he was very sincere in his approach and helded to freshly trained goldsmith.

ICSE Chemistry-7

Chapter-3

Physical and Chemical Changes

Exercise Corner

A. MCQs

1. (b) Wet clothes to dry clothes
2. (a) milk to paneer
3. (c) sodium chloride
4. (c) Wax vapour burns into flame
5. (c) Natural process

B. Fill in the Blanks

(a) Changes that bring formation of new substances are called **chemical changes**. (b) Burning of wood is a **chemical change**. (c) Revolution of the Earth around the Sun is a **periodic change**. (d) As small plant converting into a tree is a natural change. (e) Melting of candle wax is a **physical change**. (f) Conversion of liquid to vapor by heating is called **boiling**. (g) The changes which are controlled by man are called man made changes.

C. True Or False

(a) False
(b) False
(c) True
(d) False
(e) True

D. Match the Following

1. Irreversible change - (b) No new substance is formed
2. Reversible change - (e) Physical change
3. Germination of a seed - (a) Natural change
4. Formation of sugar - (c) Chemical change
5. Change of season - (f) Periodic change
6. Evaporation of water - (d) Natural change
7. Earthquake - (g) Non-periodic

E. Very Short answer type questions

1. Physical changes are changes in which the substance undergoes a change in its physical state or appearance without forming new substances. These changes are typically reversible and do not alter the chemical composition of the material. Examples include changes in state (e.g., melting, freezing, evaporation), changes in shape or size (e.g., cutting, crushing), and changes in appearance (e.g., dissolving, phase transitions).

2.
Chemical changes are changes in which one or more substances are transformed into new substances with different chemical compositions.

3.
Slow changes refer to changes that occur gradually over an extended period of time. These changes may not be immediately noticeable and can occur over hours, days, months, or even years. Examples of slow changes include erosion of rocks, growth of plants, aging of living organisms, and geological processes such as weathering and sedimentation.

4. (i) A chemical change that takes place in the presence of **heat** is combustion, such as the burning of wood, the combustion of gasoline in an engine, cooking food.

(ii) A chemical change that takes place in the presence of **light** is photosynthesis, where plants convert carbon dioxide and water into glucose and oxygen using light energy.

5. Freezing point is the temperature at which a substance changes from its liquid state to its solid state at atmospheric pressure.

F. Short Answer type questions

1. (i) **A periodic change**: The change of seasons is an example of a periodic change. It occurs in a regular pattern, transitioning from spring to summer, summer to fall, fall to winter, and then back to spring in a repeating cycle.

(ii) **An undesirable change:** Rusting of iron is an example of an undesirable change. It leads to the corrosion and degradation of iron objects, reducing their strength and aesthetic appeal.

2. Three examples of physical changes:

1. **Melting of ice:** Ice (solid water) melts into liquid water when heated, but no new substances are formed. The change in state is reversible.
2. **Tearing a piece of paper:** When a piece of paper is torn into smaller pieces, its physical appearance changes, but its chemical composition remains the same.
3. **Dissolving sugar in water:** When sugar is added to water, it dissolves to form a sugar solution. Despite the change in state, no new substances are formed, and the sugar can be recovered by evaporating the water.

Three examples of chemical changes:

1. **Combustion of methane:** When methane gas (CH_4) is burned in the presence of oxygen, it reacts to form carbon dioxide (CO_2) and water (H_2O), releasing heat and light.
2. **Rusting of iron:** Iron metal reacts with oxygen and water in the air to form iron oxide (rust), which is a new substance with different properties than iron.
3. **Fermentation of grapes:** Grapes undergo fermentation by yeast in the absence of oxygen to produce ethanol (alcohol) and carbon dioxide, resulting in the production of wine.

3.

1. Physical Change:
   - LPG changes its state from a liquid to a gas when it is burned. This change in state is a physical change because no new substances are formed, and the chemical composition of LPG remains the same.
   - The physical change involves the evaporation of the liquid LPG into gaseous form due to the heat from the flame.
2. Chemical Change:
   - When LPG burns, it undergoes combustion, which is a chemical change. The LPG molecules (typically propane or butane) react with oxygen in the air to produce carbon dioxide (CO_2) and water (H_2O), along with releasing heat and light.
   - The chemical change involves the breaking of chemical bonds in the LPG molecules and the formation of new chemical bonds in the combustion products.

4. (i) **Evaporation:** Evaporation is the process by which a liquid changes into vapor or gas state at temperatures below its boiling point. During evaporation, molecules of the liquid gain enough kinetic energy to overcome the attractive forces holding them together and escape into the surrounding space as vapor. Evaporation occurs at the surface of the liquid and is influenced by factors such as temperature, surface area, humidity, and air movement. Examples of evaporation include drying of wet clothes, formation of clouds from water bodies, and cooling effect of sweating.

(ii) **Boiling:** Boiling is the rapid vaporization of a liquid when it is heated to its boiling point. At the boiling point, the vapor pressure of the liquid equals the atmospheric pressure, causing bubbles of vapor to form throughout the liquid. Boiling is a bulk phenomenon, occurring throughout the volume of the liquid, unlike evaporation which occurs only at the surface. The boiling point of a substance depends on factors such as atmospheric pressure and the nature of the liquid. Boiling is an essential process in cooking, sterilization, and various industrial applications such as power generation in steam turbines.

5. Setting of curd is considered a chemical change because it involves the action of bacteria (Lactobacillus species) on milk, leading to the fermentation of lactose (milk sugar) into lactic acid. This fermentation process alters the chemical composition of the milk, resulting in the formation of curd, which is a new substance with different properties than milk. The curd formation is irreversible, and the change is accompanied by the production of carbon dioxide gas and changes in texture and taste. Therefore, setting of curd involves both physical and chemical changes, with the chemical change being the conversion of lactose into lactic acid by bacterial action.

G. Long answer type questions

1.

1. **Dissolving Salt in Water:** When salt (sodium chloride) is added to water, it dissolves to form a salt solution. This is a physical change as no new substances are formed, and it is reversible by evaporation.
2. **Cooking an Egg:** When an egg is cooked, its protein structure undergoes denaturation and coagulation due to heat. This is a chemical change as new substances with altered properties are formed.
3. **Rusting of Iron:** When iron is exposed to oxygen and moisture in the air, it undergoes oxidation to form iron oxide (rust). This is a chemical change, irreversible and leads to the degradation of iron objects.
4. **Burning of Wood:** When wood is burned, it undergoes combustion in the presence of oxygen to produce carbon dioxide, water vapor, heat, and light. This is a chemical change as new substances are formed.
5. **Photosynthesis in Plants:** During photosynthesis, plants use sunlight, carbon dioxide, and water to produce glucose and oxygen. This is a complex chemical change involving multiple reactions, enabling plants to produce food and release oxygen.

2. (i) Photosynthesis:

- Photosynthesis involves a complex series of chemical reactions in plants.
- It is a: Chemical change.

(ii) Dissolving sugar in water:

- Dissolving sugar in water is a physical process where sugar molecules disperse throughout the water.
- It is a: Physical change.

(iii) Burning of coal:

- Burning of coal involves combustion, where coal reacts with oxygen to produce carbon dioxide, water vapor, and heat.
- It is a: Chemical change.

(iv) Melting wax:

- Melting wax involves a phase transition from solid to liquid state due to the application of heat.
- It is a: Physical change.

(v) Beating aluminum to make aluminum foil:

- Beating aluminum involves shaping the metal without altering its chemical composition.
- It is a: Physical change.

(vi) Digestion of food:

- Digestion of food involves the breakdown of complex organic molecules into simpler forms by enzymes in the digestive system.
- It is a: Chemical change.

3. Chemical changes play several important roles in our daily lives and in various industries. Here are four key importance of chemical changes:

1. **Food Digestion:** Chemical changes occur during the digestion process, where complex molecules such as proteins, carbohydrates, and fats are broken down into simpler forms that can be absorbed by the body. Enzymes in the digestive system catalyze these reactions, enabling the release of energy and nutrients essential for cellular functions and growth.
2. **Energy Production:** Chemical changes are fundamental to energy production in various forms. Combustion reactions, such as burning fossil fuels or wood, release heat energy used for heating, cooking, and generating electricity.

Chemical reactions in batteries and fuel cells convert chemical energy into electrical energy, powering electronic devices, vehicles, and industrial processes.

3. **Manufacturing and Industry:** Chemical changes are central to manufacturing processes in industries such as pharmaceuticals, textiles, plastics, and electronics. Synthesis reactions are used to produce a wide range of products, including drugs, polymers, dyes, and semiconductors. Chemical transformations enable the creation of new materials with desired properties and functionalities, driving innovation and economic growth.
4. **Environmental Protection:** Chemical changes play a crucial role in environmental protection and remediation. Processes such as bioremediation utilize microbial metabolism to degrade pollutants and contaminants in soil and water, facilitating their removal or detoxification. Chemical reactions are also employed in wastewater treatment, air pollution control, and soil remediation to minimize environmental impact and promote sustainability.

Application based question

1.

(i) Tarnishing of silver:

- Chemical Change: Tarnishing involves the reaction of silver with sulfur compounds or atmospheric gases to form silver sulfide (Ag2S) or other tarnish compounds.
- Reason: Silver undergoes a chemical reaction with sulfur or sulfur-containing compounds in the air or on surfaces, resulting in the formation of a new substance (tarnish) with different properties.

(ii) Ripening of fruits:

- Chemical Change: Ripening of fruits involves the breakdown of complex organic molecules such as starches and acids into simpler sugars and volatile compounds, mediated by enzymes such as ethylene.
- Reason: Enzymatic reactions catalyze the conversion of starches and acids into sugars and aroma compounds, leading to changes in texture, color, and flavor characteristic of ripened fruits.

(iii) Dissolution of sulfur in carbon dioxide:

- Physical Change: Dissolution of sulfur in carbon dioxide involves the dispersal of sulfur particles in the carbon dioxide solvent without any chemical reaction.
- Reason: Sulfur particles are dispersed in the carbon dioxide solvent, leading to a homogeneous mixture. No new substances are formed, and the chemical composition of sulfur and carbon dioxide remains unchanged.

(iv) Magnesium burns with air:

- Chemical Change: Magnesium reacts with oxygen in the air to form magnesium oxide (MgO) along with the release of heat and light.
- Reason: Magnesium undergoes a chemical reaction with oxygen, resulting in the formation of a new substance (magnesium oxide) with different properties. Heat and light are released as a result of the exothermic reaction.

(v) Making an omelette from an egg:

- Chemical Change: Making an omelette involves the denaturation and coagulation of proteins in the egg upon heating.
- Physical Change: The change in state of the egg from liquid to solid during cooking is a physical change.
- Reason: The denaturation of proteins in the egg involves the disruption of protein structures, leading to the formation of a new network with a solid texture characteristic of cooked eggs. The change in state from liquid to solid is a physical change, as no new substances are formed.

Multi-Disciplinary-Questions

1. The wex become molten and lose its original shape, therefore, it is a physical change. Another example in our surrounding is the melting of ice. It is also a physical change. Ice melt and change into water and on freezing water, change into ice, so it is a physical change.
2. A change in which one or more new substance are formed is known as chemical change. When iron is exposed to air and moisture than iron oxide, a new product is formed. The colour of the surface of the iron also change. Hence rustring of iron is a chemical change.

Play and Learn:

Student do yourself

Stem Project:

Students do your self

Value and Life Skills

1. Melting of wax is physical change. So he collect the wax in a diyas and formed a candle diyas.
2. Some Common physical changes

I. Melting of ice
II. Freezing of water
III. Digestion of food

ICSE Chemistry-7

Chapter-4

Elements, Compounds and Mixtures

Exercise Corner

A. MCQs

1. (b) mixture of a liquid and an insoluble substance.
2. (a) Stationary phase.
3. (c) Sieving.
4. (b) evaporation.
5. (c) filtration.

B. Fill in the Blanks

(a) Components retain their properties in at mixture. (b) Compounds have all **fixed** melting point (c) Sugarcane juice is a mixture of **sugar**, water, and many other substances.
(d) Separation of components is done to obtain a **pure** substance. (e) Boiling point of pure water is lower than that of impure water.

C. True Or False

(a) True (b) True (c) True (d) False (e) True

D. Match the Following

1. Handpicking - (c) Separating larger size impurities
2. Winnowing - (e) Separation by wind or by blowing air
3. Sieving - (b) Separating bran from flour
4. Evaporation - (d) Conversion of water into its vapors
5. Condensation - (a) Conversion of water vapor into liquids

E. Very Short answer type questions

1. A symbol is a graphical representation of an element or a concept, often used in chemistry to represent elements using letters or combinations of letters.

2. A compound is a substance composed of two or more different elements chemically bonded together in fixed proportions at by mass.

3. Centrifugation is a method used to separate particles from a suspension by spinning them at high speeds in a centrifuge.

4.

A mixture is a combination of two or more substances that are physically combined and can be separated by physical means.

5.

The method used to separate husk from wheat is called **winnowing**.

F. Short answer type questions

1.

1. Common names of the following compounds: (i) Calcium oxide: **Quicklime** (ii) Sodium carbonate: **Washing soda** (iii) Sodium bicarbonate: **Baking soda**

2. Symbols of the following elements: (i) Boron: **B** (ii) Silicon: **Si** (iii) Neon: **Ne**

3.

Chemical formulae of the following compounds: (i) Sodium hydrogen carbonate: $NaHCO_3$ (ii) Magnesium sulphate: $MgSO_4$

4. Differences between an element and a compound:

1. Composition:
   - An element consists of only one type of atom, while a compound consists of two or more different types of atoms chemically bonded together.
2. Properties:

- Elements have unique physical and chemical properties specific to their individual atoms, while compounds have properties distinct from their constituent elements due to the chemical bonds between them.

5. To obtain pure salt from rock salt, the following method can be used:

1. Crushing: The rock salt is first crushed into smaller pieces using a crusher or grinder to increase the surface area for further processing.
2. Dissolving: The crushed rock salt is then dissolved in water to form a salt solution. The insoluble impurities such as sand and mud settle down at the bottom.
3. Filtration: The salt solution is passed through a filter to separate the insoluble impurities from the salt solution. This process removes larger impurities from the solution.
4. Evaporation: The filtered salt solution is then heated gently to evaporate the water, leaving behind the salt crystals. As water evaporates, salt crystals start to form and eventually precipitate out of the solution.
5. Drying: The salt crystals obtained after evaporation are then dried to remove any remaining moisture. This can be done by spreading the salt crystals on trays and exposing them to air or by using a drying oven.
6. Collection: Once dried, the pure salt crystals are collected and packed into containers for storage or further processing.

G. Long answer type questions

1. Four characteristics of compounds are:

1. **Fixed Composition:** Compounds have a fixed chemical composition, meaning they are made up of specific elements in definite proportions. Each compound has a unique ratio of elements, which is constant regardless of its source or method of preparation.
2. **Chemical Bonding:** Compounds are held together by chemical bonds formed between atoms of different elements. These bonds can be covalent, where atoms share electrons, or ionic, where atoms transfer electrons to form ions. The type of bonding influences the physical and chemical properties of the compound.
3. **Distinct Properties:** Compounds exhibit properties that are distinct from those of their constituent elements. For example, sodium chloride (table salt) is composed of the highly reactive metal sodium and the poisonous gas chlorine, yet it is a stable compound commonly used as a seasoning.
4. **Energy Changes:** The formation and breaking of chemical bonds in compounds involve energy changes. During chemical reactions, energy is

either absorbed or released, resulting in changes in the overall energy of the system. These energy changes are crucial in determining the feasibility and rate of chemical reactions involving compounds.

2. The property of the component used for separating the following mixtures are:

(i) **Salt and camphor:**

- Property: Solubility in water
- Method: Dissolving the mixture in water and then filtering it. Salt dissolves in water, while camphor remains insoluble and can be separated by filtration.

(ii) **Wheat and husk:**

- Property: Difference in density
- Method: Winnowing. Husk, being lighter, is carried away by the wind or air blown over the mixture, while wheat grains, being denser, fall back down and can be collected separately.

(iii) **Iron filings and sulphur:**

- Property: Difference in magnetic properties
- Method: Magnetic separation. Iron filings are magnetic, so they can be separated from the mixture using a magnet. Sulphur, being non-magnetic, remains behind and can be collected separately.

3. Fractional distillation is a separation technique used to separate a mixture of liquids with different boiling points. It is based on the principle that each component of the mixture will vaporize at a temperature corresponding to its boiling point and can be condensed and collected separately.

Here's an explanation of fractional distillation with an example:

Example: Separation of crude oil into its components

Crude oil is a complex mixture of hydrocarbons of varying chain lengths. It contains different components such as gasoline, diesel, kerosene, and various other fractions, each with its own boiling point range.

Process:

1. Heating: The crude oil is first heated in a fractional distillation column. The column consists of several trays or plates, each at a different temperature. As the crude oil is heated, it vaporizes and rises up the column.

2. Fractional Distillation: As the vapors rise through the column, they cool and condense at different heights based on their boiling points. The vapors with lower boiling points condense at higher levels, while those with higher boiling points condense at lower levels.
3. Collection: The condensed fractions are collected at different levels of the column. At the top of the column, gases such as methane, ethane, propane, and butane are collected. As we move down the column, liquids with higher boiling points such as gasoline, kerosene, diesel, and lubricating oil are collected at different levels.
4. Separation: Each collected fraction undergoes further processing to remove impurities and achieve the desired purity. For example, gasoline may undergo processes such as catalytic cracking or reforming to improve its quality.
5. Utilization: The separated fractions obtained from fractional distillation have various industrial and commercial applications. For instance, gasoline is used as fuel for automobiles, kerosene for aviation fuel and heating, diesel for transportation and power generation, and lubricating oil for machinery.

Fractional distillation of crude oil is a critical process in the petroleum industry as it allows for the separation of crude oil into its various components, each of which has different economic value and utility.

4. Chromatography is a versatile separation technique used to separate and analyze the components of a mixture based on their differential partitioning between a mobile phase (fluid) and a stationary phase (solid or liquid). It is widely employed in various fields such as chemistry, biochemistry, pharmaceuticals, forensics, and environmental science for qualitative and quantitative analysis of complex mixtures.

Advantages of chromatography:

1. High Separation Efficiency: Chromatography offers high separation efficiency, allowing for the resolution of closely related compounds with similar chemical properties. This enables the identification and quantification of individual components in complex mixtures with high precision and accuracy.
2. Versatility and Selectivity: Chromatography methods can be tailored to meet specific separation requirements by selecting appropriate stationary and mobile phases. This versatility allows chromatography to separate a wide range of compounds, from small molecules to large biomolecules, including organic and inorganic compounds, amino acids, proteins, nucleic acids, and more. Additionally, different chromatographic techniques such as gas chromatography (GC), liquid chromatography (LC), and high-performance liquid chromatography (HPLC) offer different selectivity, sensitivity, and resolution, making chromatography suitable for diverse applications.

Applications based questions

1.
The principle involved in the separation of solid-solid mixtures by sieving and magnetic separation is based on the differences in the physical properties of the components.

(i) Sieving: Principle: Sieving is a method used to separate particles of different sizes in a mixture. It relies on the differences in the particle size of the components. The principle involved in sieving is that smaller particles pass through the pores or openings of the sieve, while larger particles are retained on the sieve.

Process:

1. Selection of Sieve: A sieve with appropriate mesh size is selected based on the size range of particles to be separated.
2. Sieving: The mixture is poured onto the sieve, and mechanical agitation or shaking is applied. As a result, particles smaller than the sieve openings pass through, while particles larger than the sieve openings are retained on the sieve.
3. Collection: The separated fractions are collected separately. The finer particles that pass through the sieve constitute the undersize fraction, while the coarser particles retained on the sieve constitute the oversize fraction.

Example: Separation of sand and gravel In this example, sand and gravel are mixed together, and sieving is used to separate them. The sand particles, being smaller in size, pass through the sieve, while the larger gravel particles are retained on the sieve.

(ii) Magnetic Separation: Principle: Magnetic separation is a method used to separate magnetic and non-magnetic components in a mixture. It relies on the differences in the magnetic properties of the components. The principle involved in magnetic separation is that magnetic materials are attracted to a magnet, while non-magnetic materials are not affected by the magnet.

Process:

1. Magnetization: The mixture is passed through a magnetic field. The magnetic component of the mixture is attracted to the magnet and adheres to it, while the non-magnetic component remains unaffected.
2. Separation: The magnet with the magnetic component attached to it is removed from the mixture, leaving behind the non-magnetic component.
3. Collection: The separated fractions are collected separately. The magnetic component adhering to the magnet constitutes the magnetic fraction, while the non-magnetic component constitutes the non-magnetic fraction.

Example: Separation of iron filings from sulfur powder In this example, iron filings and sulfur powder are mixed together, and magnetic separation is used to separate them. The iron filings, being magnetic, are attracted to the magnet and adhere to it, while the sulfur powder, being non-magnetic, remains unaffected and can be separated from the iron filings.

2. (i) **Separation of iron and chalk powder:** Technique: Magnetic separation Principle: Magnetic separation is based on the difference in magnetic properties between magnetic and non-magnetic materials. Iron is a magnetic material, while chalk powder is non-magnetic. When the mixture of iron and chalk powder is passed through a magnetic field, the iron particles get attracted to the magnet and are separated from the chalk powder, which remains unaffected by the magnet.

(ii) **Separation of potassium chloride from an aqueous solution of potassium chloride:** Technique: Evaporation Principle: Evaporation is a method used to separate a soluble solid from its solution. In this case, potassium chloride is dissolved in water to form an aqueous solution. By heating the solution, water evaporates, leaving behind solid potassium chloride. The process of evaporation separates the potassium chloride from the water, resulting in the recovery of solid potassium chloride.

(iii) **Separation of rice powder from soil particles:** Technique: Sieving Principle: Sieving is a method used to separate particles of different sizes in a mixture. Rice powder consists of fine particles, while soil particles are relatively larger. When the mixture of rice powder and soil particles is poured onto a sieve with appropriate mesh size and mechanically agitated or shaken, the rice powder particles, being smaller, pass through the sieve, while the larger soil particles are retained on the sieve. The process of sieving separates the rice powder from the soil particles.

Multi disciplinary & Experimental learning based questions

1. Alloys are classified as homogeneous mixtures.

Explanation:

1. Homogeneous Nature: Alloys are homogeneous mixtures because their components are uniformly distributed at a microscopic level. In an alloy, the atoms of different metals are interspersed and mixed together uniformly throughout the material. This uniform distribution results in a single phase with consistent properties throughout the alloy.
2. Single Phase: Unlike heterogeneous mixtures where the components remain distinct and can be visibly identified, alloys form a single phase where the components are indistinguishable even under a microscope. This uniformity in composition and properties is characteristic of homogeneous mixtures.
3. Solid State: Most alloys are solid solutions where the metals are mixed in the solid state. For example, brass (an alloy of copper and zinc) and steel (an alloy of iron and carbon) are solid solutions with homogeneous composition and properties.
4. Properties: Alloys exhibit properties distinct from those of their constituent metals due to the interaction between different atoms in the alloy. These properties, such as strength, hardness, corrosion resistance, and conductivity, are consistent throughout the material, further supporting their classification as homogeneous mixtures.

2. The statement "a solution is always a liquid" is not entirely accurate. A solution refers to a homogeneous mixture composed of two or more substances, where one substance (the solute) is dissolved in another substance (the solvent). While many solutions do indeed involve liquids as solvents, it's essential to note that solutions can also exist in other states of matter, including gases and solids.

Explanation:

1. Liquid Solutions: The most common type of solution involves a liquid solvent. For example, when sugar (solute) dissolves in water (solvent), it forms a liquid solution known as sugar water. Similarly, when salt (solute) dissolves in water, it forms a liquid solution called saltwater.
2. Gaseous Solutions: Solutions can also exist in the gaseous state. For instance, air is a solution of gases such as nitrogen, oxygen, carbon dioxide, and others in the gaseous state. The components of air are mixed uniformly throughout, forming a gaseous solution.
3. Solid Solutions: Solutions can also be formed in the solid state. These are known as solid solutions or alloys. For example, brass is a solid solution of copper and zinc, where the zinc atoms are uniformly distributed within the copper lattice. Similarly, steel is a solid solution of iron and carbon.
4. Importance of Solvents: While the solute can be a solid, liquid, or gas, the solvent is typically a liquid due to its ability to dissolve other substances effectively. Liquid solvents such as water, ethanol, and acetone are commonly used in chemical processes and everyday life because of their ability to dissolve a wide range of solutes.

Stem Project

Students do yourself

Value And Life Skills

1. Fractional column is quite effective in this case because it obstructs the distillation of ethyl alcohol which has higher boiling point (78 ºC) and at the same time actions has low boiling point (56 ºC)
2. Acetone was distilled first, since it has comparatively low boiling point.
3. Proper knowledge of simple distillation and frictional distillation for separation of two different miserable liquid.

ICSE Chemistry-7

Chapter-5

Atomic Structure

Exercise Corner

A. MCQs

1. (b) compound
2. (d) all of them
3. (a) sugar
4. (a) copper
5. (a) baking soda
6. (b) -1.602×10^{-19}C

B. Fill in the Blanks

(a) Liquid (b) Fixed (c) Positively (d) Calcium (e) Au

C. True Or False

(a) True (b) True (c) False (d) True (e) True

D. Match the Following

1. Magnesium oxide - (d) Metal oxide
2. Diatomic Element - (a) Oxygen gas
3. Noble gases - (e) Non-reactive
4. Ions - (b) Charged particle
5. Plutonium - (c) Pluto

E. Very Short answer type questions

1. An atom is the basic unit of a chemical element, consisting of a nucleus containing protons and neutrons, surrounded by electrons in orbitals.

2. A molecule is two or more atoms connected by chemical bond, which form the smallest unit of substance that retains the composition and properties of that substance.

3. A chemical formula is a symbolic representation of a chemical compound, showing the types and numbers of atoms present in a molecule using elemental symbols and numerical subscripts.

4. Valency refers to the combining capacity of an atom, representing the number of bonds an atom can form to achieve a stable electron configuration.

5. Atomicity refers to the number of atoms present in a molecule of a substance.

F. Short answer type questions

1. Two examples of diatomic molecules are:

1. Oxygen (O_2)
2. Hydrogen (H_2)

2.

1. **Composition:**
   - Elements consist of only one type of atom, whereas compounds consist of two or more different types of atoms chemically bonded together.
2. **Properties:**
   - Elements retain their characteristic properties regardless of the conditions, whereas compounds often exhibit properties distinct from their constituent elements due to the chemical bonds between them.

3.
Two examples of metallic oxides are:

1. Iron oxide (Fe_2O_3)
2. Copper oxide (CuO)

4. The postulates of Dalton's atomic theory are:

1. **Atoms as indivisible particles:** Atoms are the basic building blocks of matter and cannot be subdivided, created, or destroyed in chemical reactions.
2. **Atoms of the same element are identical:** Atoms of the same element are identical in mass and properties, while atoms of different elements have different masses and properties.
3. **Atoms combine to form compounds:** Chemical compounds are formed when atoms of different elements combine in simple, whole-number ratios to form compounds.
4. **Chemical reactions involve rearrangement of atoms:** In chemical reactions, atoms are rearranged to form new compounds, but the atoms themselves remain unchanged.

5.
Characteristics of a molecule:

1. **Composition:** A molecule is composed of two or more atoms chemically bonded together.
2. **Stability:** Molecules are stable structures due to the sharing or transfer of electrons between atoms to achieve a more stable electron configuration.
3. **Size:** Molecules can vary in size from small, consisting of just a few atoms, to large and complex structures like proteins or DNA.
4. **Shape:** Molecules have specific three-dimensional shapes determined by the arrangement of atoms and the nature of chemical bonds.
5. **Properties:** Molecules exhibit unique physical and chemical properties based on their composition and structure, which determine how they interact with other molecules.

G. Long answer type questions

1. Here are the formulas for the given substances:

(i) **Ammonia**: NH_3

(ii) **Glucose**: $C_6H_{12}O_6$

(iii) **Methane**: CH_4

2.
Here are the names of the given chemical formulas:

(i) NaOH: Sodium hydroxide (ii) NH_4OH: Ammonium hydroxide (iii) $LiCO_3$: Lithium carbonate

3. (i) **Electron**: An electron is a subatomic particle with a negative charge (-1) and a negligible mass relative to protons and neutrons. Electrons orbit the nucleus of an atom in specific energy levels or shells and are involved in chemical bonding.

(ii) **Proton**: A proton is a subatomic particle found in the nucleus of an atom. It carries a positive electrical charge equal in magnitude to that of an electron but opposite in sign (+1). Protons contribute to the mass of an atom and determine its atomic number, which in turn defines the element.

(iii) **Neutron**: A neutron is a subatomic particle found in the nucleus of an atom. Neutrons have no electrical charge, making them electrically neutral. They contribute to the mass of an atom but do not affect its atomic number. Neutrons help stabilize the nucleus of an atom through the strong nuclear force, which balances the repulsive forces between protons.

4. (i) **CH_3COONa**:

- Cation: Na^+ (Sodium ion)
- Anion: CH_3COO- (Acetate ion)

(ii) **NaCl**:

- Cation: Na+ (Sodium ion)
- Anion: Cl- (Chloride ion)

(iii) **K_2SO_4**:

- Cation: K^+ (Potassium ion)
- Anion: $SO4^{2-}$ (Sulfate ion)

Application based questions

1. If an atom of an element has 16 electrons, we can determine the number of valence electrons by considering its electron configuration. For elements up to atomic number 20, the number of valence electrons can be determined by looking at the group number in the periodic table.

Since the element has 16 electrons, it likely belongs to group 16 of the periodic table, also known as the oxygen group or chalcogens. Elements in group 16 typically have 6 valence electrons.

Therefore, the number of valence electrons in this element is 6.

Predicting whether the element is a metal or non-metal:

- Metals typically have fewer than 4 valence electrons (1 to 3).
- Non-metals typically have more than 4 valence electrons (5 to 7).

Since this element has 6 valence electrons, it falls within the range associated with non-metals. Therefore, it is likely a non-metal.

2. (a) Ammonium radical: The group of atoms present in the ammonium radical is NH4+. It consists of one nitrogen atom bonded to four hydrogen atoms through covalent bonds, resulting in a positively charged polyatomic ion.

(b) Bisulphate radical: The group of atoms present in the bisulfate radical is HSO4-. It consists of one hydrogen atom bonded to a sulfate group (SO4^2-) through a covalent bond, resulting in a negatively charged polyatomic ion.

(c) Carbonate radical: The group of atoms present in the carbonate radical is CO3^2-. It consists of one carbon atom bonded to three oxygen atoms through covalent bonds, resulting in a negatively charged polyatomic ion.

Multi-disciplinary and Experiential Learning Based Questions

1. Electron have the charge of 16 unit, so number of electrons = 16
   Name of the element is sulphure (s), symbol of sulphide ion (s^{2-}).
   Here, the ion contain –2 charge, so the ion contain two excess electrons as compared to the number of proton. Hence the total number of electrons in ion = 16 + 2

   = 18

2. There are four basic types of orbitals that is s,p,d, and f s= sharp, p = principle d= diffuse f = fundamental

Play and Learn

Student do yourself

Stem Projects

Student do yourself

Value and Life Skills

1. Plum pudding model
2. It successfully neutrality of an atom
3. The atomic structure refers to the structure of an atom comprising a nucleus and outer part of the nucleus. The first scientific theory of atomic structure was purposed for further knowledge.

ICSE Chemistry-7

Chapter-6

Language of Chemistry

Exercise Corner

A. MCQs

1. (a) MgO
2. (a) law of conservation of mass
3. (d) all of the above
4. (b) black
5. (c) Yellow ppt of lead iodide formed

B. Fill in the Blanks

(a) Magnesium oxide (b) Reactants (c) $NaNO_3$ (d) Potassium chloride (KCl) (e) Skeleton (f) Endothermic

C. True Or False

(a) True (b) True (c) True (d) True (e) True (f) True

D. Very short answer type questions

1. A chemical reaction is a process in which one or more substances (reactants) are converted into different substances (products) with different chemical properties.

2. A chemical equation is a symbolic representation of a chemical reaction, showing the reactants on the left side and the products on the right side, with arrows indicating the direction of the reaction.

3. Combustion of wood is an example of an exothermic reaction.

4. Rust is a reddish-brown substance formed on the surface of iron or steel when exposed to oxygen and moisture, primarily consisting of iron oxide compounds.

5. The Law of Conservation of Mass states that mass is neither created nor destroyed in a chemical reaction; it remains constant throughout the reaction.

E. Short answer type questions

1. Characteristics of a chemical equation:

1. **Reactants and Products:** A chemical equation must contain both reactants and products separated by an arrow to indicate the direction of the reaction.
2. **Chemical Formulas:** Chemical formulas of reactants and products are used to represent the substances involved in the reaction.
3. **Coefficients:** Coefficients are used to balance the equation, representing the relative amounts of each substance involved in the reaction.
4. **Conservation of Mass:** The Law of Conservation of Mass must be satisfied, meaning the total mass of reactants must be equal to the total mass of products.
5. **Physical States:** The physical states (solid, liquid, gas, aqueous) of reactants and products can be indicated using symbols (s, l, g, aq) placed after the chemical formula.
6. **Direction of Reaction:** The direction of the reaction is indicated by an arrow, typically pointing from reactants to products.

2. (i) $H_2 + N_2 \rightarrow 2\ NH_3$

(ii) $MnO_2 + 4\ HCl \rightarrow MnCl_2 + Cl_2 + 2\ H_2O$

3. Characteristics of chemical changes:

1. **Formation of new substances:** Chemical changes result in the formation of one or more new substances with different chemical properties compared to the reactants.
2. **Irreversibility:** Chemical changes are often irreversible, meaning it is difficult or impossible to reverse the reaction and recover the original reactants.
3. **Energy changes:** Chemical changes usually involve energy changes, either releasing (exothermic) or absorbing (endothermic) energy.
4. **Change in physical properties:** Chemical changes often lead to changes in physical properties such as color, odor, taste, or state of matter.
5. **Formation of precipitates or gases:** Chemical changes may result in the formation of precipitates (insoluble solids) or gases, which can be observed as bubbles or changes in solution clarity.
6. **Change in composition:** Chemical changes involve changes in the composition and arrangement of atoms within molecules, leading to the formation of different substances.

4. When an iron nail is dipped into a copper sulfate solution, the following reaction occurs:

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

In this reaction:

- Iron (Fe) from the nail displaces copper (Cu) from copper sulfate (CuSO4) solution.
- The iron nail loses electrons and is oxidized to form iron sulfate (FeSO4) solution.
- Copper ions in the solution gain electrons and are reduced, forming solid copper metal that deposits onto the surface of the iron nail.
- The color of the solution changes from blue (due to copper sulfate) to pale green or colorless (due to iron sulfate).

Overall, the iron nail appears to be coated with a layer of copper metal, while the copper sulfate solution becomes depleted of copper ions. This process is an example of a single displacement reaction or a displacement reaction.

F. Long answer type questions

1. (i) **Combination Reaction**:

- A combination reaction is a type of chemical reaction where two or more reactants combine to form a single product.
- Example:
    - Formation of water (H2O) by the combination of hydrogen gas (H2) and oxygen gas $2H_2(g)+O_2(g)\rightarrow 2H_2O(l)$
    - Formation of rust (iron oxide) by the combination of iron (Fe) with oxygen (O2) in the presence of moisture:

$$4Fe(s)+3O_2(g)+2H_2O(l)\rightarrow 2Fe_2O_3\cdot H_2O(s)$$

(ii) **Decomposition Reaction**:

- A decomposition reaction is a type of chemical reaction where a single compound breaks down into two or more simpler substances under suitable conditions such as heat, light, or electricity.
- Example:
    - Decomposition of hydrogen peroxide (H2O2) into water (H2O) and oxygen gas (O2): $2H_2O_2(aq)\rightarrow 2H_2O(l)+O_2(g)$
    - Decomposition of calcium carbonate ($CaCO_3$) into calcium oxide (CaO) and carbon dioxide gas (CO_2) upon heating:

$$CaCO_3(s)\rightarrow CaO(s)+CO_2(g)$$

(iii) **Simple Displacement Reaction**:

- A simple displacement reaction is a type of chemical reaction where a more reactive element displaces a less reactive element from its compound.
- Example:
  - Reaction of iron nail (Fe) with copper sulfate ($CuSO_4$) solution, where iron displaces copper from copper sulfate, forming iron sulfate ($FeSO_4$) and copper metal:

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

  - Reaction of zinc metal (Zn) with hydrochloric acid (HCl), where zinc displaces hydrogen from hydrochloric acid, forming zinc chloride (ZnCl2) and hydrogen gas (H_2):

$$Zn(s)+2HCl(aq)\rightarrow ZnCl_2(aq)+H_2(g)$$

2. Here are the word equations for the given skeletal equations:

(i) Zinc reacts with hydrochloric acid to form zinc chloride and hydrogen gas:
$$\text{Zinc}+\text{Hydrochloric acid}\rightarrow\text{Zinc chloride}+\text{Hydrogen gas}$$

(ii) Carbon monoxide reacts with oxygen to form carbon dioxide:
$$\text{Carbon monoxide}+\text{Oxygen}\rightarrow\text{Carbon dioxide}$$

(iii) Silver bromide decomposes into silver and bromine:
$$\text{Silver bromide}\rightarrow\text{Silver}+\text{Bromine}$$

3. Here are the observations and products obtained for the given chemical reactions:

(i) **Dilute acetic acid is poured on baking soda**:

- Observation: Effervescence (bubbling) and release of a gas.
- Products:
  - Sodium acetate ($CH3COONa$
  - Water (H_2O)
  - Carbon dioxide gas ($CO_2$$CO_2$)

(ii) **Sodium carbonate reacts with hydrochloric acid**:

- Observation: Effervescence (bubbling) and release of a gas.
- Products:
  - Sodium chloride ($NaCl$)
  - Water (H_2O)
  - Carbon dioxide gas (CO_2)

(iii) **Calcium carbonate is heated**:

- Observation: Evolution of a gas and formation of a white residue.
- Products:
    - Calcium oxide (CaO) - also known as quicklime.
    - Carbon dioxide gas (CO_2)

Application based questions

When 2 grams of silver chloride $AgCl$) is exposed to sunlight, it undergoes a photochemical reaction. Silver chloride decomposes into silver metal (Ag) and chlorine gas ($2Cl_2$).

The observation in this case would be a change in color. Silver chloride, which is initially white in color, will gradually turn gray or black due to the formation of silver metal. The release of chlorine gas may also be observed as a colorless gas evolving from the reaction mixture.

The chemical reaction involved is:

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

This reaction is a photochemical decomposition reaction, where light energy is absorbed by the silver chloride molecules, causing them to decompose into their constituent elements.

Multi-Disciplinary Questions

1 Marble is chemically calcium carbonate. When dilute HCI is added to calcium carbonate, it forms calcium chloride, water and carbon dioxide. The chemical equation for the reaction is as follows

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

Carbon dioxide gas turns lime water milky due to the formation of calcium carbonate. Following is the chemical equation showing the reaction between lime water and carbon dioxide.

$$Ca(OH)_2 + CO_2 \mid CaCO_3 + H_2O$$

on passing excess CO2, milkiness disappears because Ca(HCO3)2 is formed which is soluble in water $CaCO_3 + H_2O + CO_2\ Ca(HCO_3)_2$

Soluble in water

2. The name of the metal is copper (Cu) and the black coloured substance formed is copper oxide.

The balanced chemical reactions for both the reactions are as follow:

When powdered copper is heated strongly in presence of oxygen to form copper oxide

$$2cu(s)+O_{2(g)}\xrightarrow{Heat}2cuo(s)Copper\ oxide$$

When hydrogen gas is passed over copper oxide, it produces copper metal and water.

$$cu(s)+H_{2(g)}\longrightarrow cu(s)+\ \mathrm{H_2}O(l)$$

Play and Learn

1. Student do yourself
2. Student do yourself

Stem Project:

Student do yourself

Image Based Question:

1. When sodium chloride is added to the silver nitrate solution, a white curdy precipitate of silver chloride is formed
   $AgNo3(ag)+Nacl(ag)\longrightarrow Agcl(s)+NaNO_3(aq)$
2. Agcl and $NaNo_3$ are formed
3. No change in weight, This equation obeys the law of conservation of mass.

Value and Life Skills

1. Content of moisture in air is high is rainy season whereas air is almost dry in summer season. For rusting, the presence of both oxygen and water is essential. Rusting becomes faster, if the content of moisture in air is high. Hence, rusting of iron objects is faster in rainy season than in summer season.

2. The process of depositing a protective layer of zinc on steel or iron is called galvanization. It is a method used to prevent corrosion.

3. The knowledge of rusting to help the protection of iron articles.

ICSE Chemistry-7

Chapter-7

Air and Atmosphere

Exercise Corner

A. MCQs

1. (c) Nitrogen and oxygen
2. (d) Hydrosphere
3. (c) Sulphur dioxide
4. (a) Brick manufacturing
5. (c) 78%

B. Fill in the Blanks

1. Nitrogen gas is present in air for nearly **78%**.
2. **Argon** is the most abundant inert gas present in air.
3. Calcium cyanamide is used as **fertilizer**.
4. Oxide of sulphur and nitrogen are **air pollutants**.
5. The fixation of nitrogen by bacteria and algae is called **nitrogen fixation**.

C. True Or False

1. **True**.
2. **True**.
3. **False**.
4. **True**.
5. **True**.

D. Very short answer type questions

1. The percentage composition of air is approximately:

- Nitrogen: 78%
- Oxygen: 21%
- Argon: 0.93%
- Carbon dioxide: 0.04%
- Other gases: Trace amounts

2. Fuel is a substance that undergoes combustion to produce heat or energy.

3. Three greenhouse gases are:

1. Carbon dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous oxide (N_2O)

4. Two air pollutants that affect our health are:

1. Particulate matter (PM)
2. Ozone (O_3)

5. Acid rain is rain that has been made acidic by pollutants such as sulphur dioxide and nitrogen oxides, which are released into the atmosphere through human activities like burning fossil fuels.

E. Short answer type questions

1. Fertilizers are substances containing essential nutrients such as nitrogen, phosphorus, and potassium, which are applied to soil or plants to enhance their growth and productivity.

The applications of fertilizers include:

- Providing essential nutrients to plants that may be deficient in the soil.
- Promoting healthy plant growth and development.
- Increasing crop yield and quality.
- Correcting nutrient imbalances in the soil.
- Enhancing soil fertility and improving soil structure.
- Supporting the growth of lawns, gardens, and ornamental plants.

2.
(i) Nitrogen Cycle: The nitrogen cycle is a biogeochemical process that describes the movement of nitrogen through various reservoirs in the environment, including the atmosphere, soil, water bodies, and living organisms. It involves a series of processes such as nitrogen fixation, nitrification, assimilation, ammonification, and denitrification, through which nitrogen undergoes chemical and biological transformations, ultimately cycling between different forms and locations in the ecosystem.

(ii) Nitrogen Fixation: Nitrogen fixation is the biological or industrial process by which atmospheric nitrogen (N2) is converted into ammonia (NH_3) or other nitrogen compounds that can be used by plants and other organisms. This process is carried out by nitrogen-fixing bacteria, which possess the enzyme nitrogenase that enables them to convert inert atmospheric nitrogen into a form that is biologically available. Nitrogen fixation plays a crucial role in the nitrogen cycle, as it provides the essential nitrogen input necessary for the growth and productivity of living organisms.

3. When nitric acid reacts with calcium nitrate, it forms calcium nitrate again and nitric acid. This is because both nitric acid and calcium nitrate are strong electrolytes and dissociate completely in water into their respective ions. Therefore, the reaction is essentially a double displacement reaction where the ions switch partners but retain their original identities.

The chemical equation for this reaction is:

$$2\ HNO_3(aq) + Ca(NO_3)_2(aq) \rightarrow 2\ HCa(NO_3)_2(aq)$$

In this reaction, calcium nitrate remains unchanged, while nitric acid is regenerated.

4. Carbon dioxide is known as a greenhouse gas because it has the ability to trap heat in the Earth's atmosphere. When sunlight reaches the Earth's surface, some of the energy is absorbed and re-radiated as infrared radiation (heat). Greenhouse gases like carbon dioxide have the property of absorbing and trapping this infrared radiation, preventing it from escaping back into space. This trapped heat warms the Earth's surface and lower atmosphere, similar to how a greenhouse traps heat to keep plants warm. Thus, carbon dioxide and other greenhouse gases contribute to the greenhouse effect, which is essential for maintaining Earth's temperature within a habitable range. However, excessive emissions of carbon dioxide from human activities, such as burning fossil fuels, have led to an enhanced greenhouse effect, causing global warming and climate change.

5. Ozone depletion refers to the gradual thinning or reduction in the concentration of ozone (O_3) molecules in the Earth's stratosphere, particularly in the ozone layer. This depletion is primarily caused by human-made chemicals known as ozone-depleting substances (ODS), such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform.

When released into the atmosphere, these ODS rise to the stratosphere and undergo chemical reactions, releasing chlorine and bromine atoms. These chlorine and bromine atoms then catalytically destroy ozone molecules. One chlorine or bromine atom can destroy thousands of ozone molecules before being removed from the stratosphere.

The reduction in ozone concentration leads to the formation of the ozone hole, particularly over Antarctica, during the Southern Hemisphere spring. Ozone depletion allows more ultraviolet (UV) radiation from the sun to reach the Earth's surface, posing risks to human health, such as skin cancer, cataracts, and immune system suppression, as well as harmful effects on marine ecosystems and terrestrial plant life.

Efforts to address ozone depletion have been successful through international agreements such as the Montreal Protocol, which has phased out the production and use of most ozone-depleting substances. As a result, the ozone layer is gradually recovering, although complete recovery is expected to take several decades.

F. Long answer type questions

1. Controlling air pollution requires a multifaceted approach involving government regulations, technological advancements, public awareness, and individual actions. Here are several strategies that can help control air pollution:

1. **Regulations and Policies:**
    - Implementing strict emission standards for industries, vehicles, and power plants.
    - Enforcing regulations on the burning of fossil fuels and biomass.
    - Establishing zoning laws to prevent industrial activities near residential areas.
    - Encouraging the use of cleaner fuels and technologies through subsidies and incentives.
2. **Technological Solutions:**
    - Installing and upgrading pollution control equipment in industries, such as electrostatic precipitators, scrubbers, and catalytic converters.
    - Developing and promoting cleaner energy sources, such as renewable energy (solar, wind, hydroelectric) and nuclear power.
    - Advancing vehicle technologies, including electric and hybrid vehicles, fuel-efficient engines, and emission control systems.
    - Investing in research and development of innovative pollution mitigation technologies.
3. **Promoting Sustainable Practices:**
    - Encouraging public transportation, carpooling, biking, and walking to reduce vehicle emissions.
    - Implementing urban planning strategies to reduce traffic congestion and promote mixed land use.
    - Enhancing waste management practices, including recycling, composting, and proper disposal of hazardous materials.
    - Promoting energy efficiency in buildings, appliances, and industrial processes.
4. **Education and Awareness:**
    - Educating the public about the health impacts of air pollution and the importance of clean air.
    - Encouraging individuals to adopt eco-friendly behaviors, such as reducing energy consumption, conserving water, and minimizing waste generation.
    - Conducting public campaigns to raise awareness about air pollution sources, effects, and solutions.
5. **International Cooperation:**
    - Collaborating with other countries to address transboundary air pollution issues.
    - Participating in international agreements and protocols, such as the Paris Agreement and the Montreal Protocol, to reduce greenhouse gas emissions and ozone-depleting substances.

6. **Monitoring and Research:**
    - Establishing air quality monitoring networks to track pollution levels and identify hotspots.
    - Conducting scientific research to better understand the sources, transport, and impacts of air pollutants.
    - Using data-driven approaches to develop targeted interventions and assess the effectiveness of pollution control measures.

Overall, controlling air pollution requires a coordinated effort from governments, industries, communities, and individuals to mitigate emissions, adopt cleaner technologies, and promote sustainable practices for a cleaner and healthier environment.

2. Oxygen gas (O_2) exhibits several physical properties that make it essential for various industrial, medical, and environmental applications. Here are four key physical properties of oxygen gas:

1. **Colorless and Odorless:**
    - Oxygen gas is colorless, meaning it has no distinct color that can be observed visually.
    - It is also odorless, lacking any discernible smell.
    - This property makes it difficult to detect oxygen gas solely by sight or smell, necessitating the use of specialized equipment for measurement and detection.
2. **Highly Reactive:**
    - Oxygen gas is highly reactive, readily combining with many other elements and compounds under appropriate conditions.
    - This reactivity is essential for supporting combustion and various oxidation reactions, making oxygen a crucial component in processes such as respiration, combustion engines, and industrial chemical synthesis.
3. **Poor Solubility in Water:**
    - Oxygen gas has low solubility in water, meaning it does not readily dissolve in aqueous solutions.
    - While some oxygen can dissolve in water, especially at lower temperatures and higher pressures, its solubility is relatively low compared to other gases like carbon dioxide.
    - The poor solubility of oxygen in water is a limiting factor for aquatic organisms that rely on dissolved oxygen for respiration, particularly in polluted or oxygen-depleted environments.
4. **Density and Compressibility:**
    - Oxygen gas has a density of approximately 1.43 kg/m^3 at standard conditions (0°C and 1 atm pressure).
    - Like other gases, oxygen is compressible, meaning its volume can be reduced significantly under increased pressure.
    - This property of compressibility is exploited in various applications, such as oxygen storage and transportation in compressed gas cylinders, where oxygen is compressed to high pressures for efficient storage and transport.

Understanding these physical properties of oxygen gas is crucial for its safe handling, storage, and utilization across diverse industrial, medical, and environmental contexts.

3. When oxygen reacts with each of the following substances, various chemical reactions occur, leading to the formation of different compounds. Here are the reactions for each case:

(i) **Magnesium (Mg):** $2\ Mg + O_2 \rightarrow 2\ MgO$

- Magnesium reacts with oxygen to form magnesium oxide (MgO), a white solid. This reaction is an example of a combustion reaction, as magnesium undergoes rapid oxidation in the presence of oxygen, producing heat and light.

(ii) **Calcium (Ca):** $2\ Ca + O_2 \rightarrow 2\ CaO$

- Calcium reacts with oxygen to form calcium oxide (CaO), also known as quicklime. Similar to magnesium, this reaction is a combustion reaction, where calcium undergoes oxidation to produce calcium oxide.

(iii) **Hydrogen (H2):** $2\ H_2 + O_2 \rightarrow 2\ H_2O$

- Hydrogen reacts with oxygen to form water (H2O). This reaction is a combustion reaction as well, where hydrogen undergoes oxidation to produce water vapor.

(iv) **Sulfur (S):** $2S + O_2 \rightarrow SO_2$

- Sulphur reacts with oxygen to form sulfur dioxide (SO_2), a pungent-smelling gas. This reaction is also an example of combustion, where sulfur undergoes oxidation to produce sulfur dioxide.

These reactions illustrate the chemical reactivity of oxygen and its ability to form compounds with various elements through processes such as combustion and oxidation.

4. Photosynthesis and respiration are two fundamental biological processes that occur in living organisms, particularly in plants, to obtain energy and maintain life. Here are the key differences between photosynthesis and respiration:

1. **Definition:**
    - Photosynthesis: Photosynthesis is the process by which green plants, algae, and some bacteria convert light energy, carbon dioxide, and water into glucose (a sugar) and oxygen. This process occurs in chloroplasts and is responsible for producing oxygen and storing energy in the form of glucose.
    - Respiration: Respiration is the biochemical process that releases energy by breaking down glucose and other organic molecules in the presence of oxygen. It occurs in the mitochondria of cells and is essential for providing energy (in the form of ATP) for cellular activities.
2. **Occurrence:**

- Photosynthesis: Photosynthesis occurs in autotrophic organisms, such as plants, algae, and cyanobacteria, which are capable of producing their own food using light energy.
- Respiration: Respiration occurs in all living organisms, including plants, animals, fungi, and bacteria. Both autotrophs and heterotrophs undergo respiration to obtain energy from organic compounds.

3. **Input and Output:**
   - Photosynthesis: The inputs for photosynthesis are carbon dioxide, water, and light energy. The outputs are glucose (a carbohydrate) and oxygen.
   - Respiration: The inputs for respiration are glucose and oxygen. The outputs are carbon dioxide, water, and energy (in the form of ATP).
4. **Energy Transformation:**
   - Photosynthesis: Photosynthesis is an endothermic process, meaning it requires energy input (in the form of light) to drive the conversion of carbon dioxide and water into glucose and oxygen.
   - Respiration: Respiration is an exothermic process, meaning it releases energy as glucose and oxygen are broken down to produce carbon dioxide, water, and ATP.
5. **Location:**
   - Photosynthesis: Photosynthesis primarily occurs in the chloroplasts of plant cells, particularly in the chlorophyll-containing thylakoid membranes.
   - Respiration: Respiration occurs in the mitochondria of eukaryotic cells, where enzymes catalyze the breakdown of glucose to release energy.
6. **Purpose:**
   - Photosynthesis: The primary purpose of photosynthesis is to produce food (glucose) and oxygen, which are essential for the growth and survival of plants and other autotrophic organisms.
   - Respiration: The primary purpose of respiration is to release energy stored in glucose and other organic molecules, which is used to fuel cellular processes and activities, such as growth, metabolism, and reproduction.

In summary, while both photosynthesis and respiration are essential for life, they are distinct processes with different inputs, outputs, locations, and purposes. Photosynthesis converts light energy into chemical energy, storing it in glucose molecules, while respiration releases stored energy by breaking down glucose molecules to produce ATP and metabolic byproducts.

5. The oxygen cycle is a biogeochemical cycle that describes the movement of oxygen (O2) through various reservoirs on Earth, including the atmosphere, biosphere, lithosphere, and hydrosphere. Oxygen is a crucial element for life, as it is involved in respiration, combustion, and the oxidation of organic matter. The oxygen cycle involves processes such as photosynthesis, respiration, combustion, and chemical reactions in the atmosphere and oceans. Here is an explanation of the oxygen cycle:

1. **Photosynthesis:**
   - Photosynthesis is the primary process by which oxygen is produced on Earth. In this process, green plants, algae, and cyanobacteria use sunlight, carbon

dioxide (CO_2), and water (H_2O) to produce glucose ($C_6H_{12}O_6$) and oxygen (O_2).

- During photosynthesis, chlorophyll-containing chloroplasts in plant cells capture sunlight energy and convert it into chemical energy, which is used to split water molecules (H2O) into oxygen (O2) and hydrogen ions (H+).
- The released oxygen is then released into the atmosphere as a byproduct of photosynthesis, contributing to the oxygen content of the atmosphere.

2. **Respiration:**
   - Respiration is the process by which living organisms, including plants, animals, fungi, and bacteria, use oxygen to break down glucose and other organic molecules to release energy (in the form of ATP) for cellular activities.
   - During respiration, oxygen is consumed as it reacts with organic molecules, such as glucose, to produce carbon dioxide (CO_2), water (H_2O), and ATP.
   - While respiration consumes oxygen, it also releases carbon dioxide back into the atmosphere, completing the carbon-oxygen cycle.
3. **Combustion:**
   - Combustion is the chemical reaction between a fuel (such as wood, fossil fuels, or biomass) and oxygen in the presence of heat, resulting in the release of energy, carbon dioxide (CO_2), water vapor (H_2O), and other combustion byproducts.
   - Combustion processes, such as burning wood for heating or burning fossil fuels for energy production, consume oxygen from the atmosphere and produce carbon dioxide as a byproduct.
   - The combustion of biomass and fossil fuels contributes to the carbon-oxygen cycle by releasing carbon dioxide into the atmosphere, which can be used by plants during photosynthesis.
4. **Chemical Reactions:**
   - Oxygen is also involved in various chemical reactions in the atmosphere and oceans, such as the oxidation of atmospheric pollutants, the formation of ozone (O_3) in the stratosphere, and the oxidation of minerals in the Earth's crust.
   - Atmospheric oxygen participates in reactions with pollutants, such as nitrogen oxides (NOx) and sulfur dioxide (SO_2), to form secondary pollutants, including nitrogen dioxide (NO_2) and sulfur trioxide (SO_3).
   - Oxygen dissolved in water plays a vital role in supporting aquatic life through the process of aquatic respiration, where oxygen is consumed by aquatic organisms and released into the water as a byproduct of photosynthesis by aquatic plants.

Overall, the oxygen cycle is essential for maintaining the balance of oxygen in the atmosphere, supporting life on Earth, and regulating various biogeochemical processes, such as photosynthesis, respiration, and combustion. By cycling between different forms and locations in the environment, oxygen sustains ecosystems, atmospheric composition, and the health of living organisms.

Application based questions

1.

The greenhouse effect plays a crucial role in maintaining Earth's temperature within a habitable range by trapping heat in the atmosphere. However, human activities have intensified the greenhouse effect, leading to various impacts on the environment and climate. Here are some key impacts of the greenhouse effect:

1. **Global Warming:** The enhanced greenhouse effect has contributed to global warming, resulting in an increase in Earth's average surface temperature. This warming trend has led to changes in weather patterns, more frequent and severe heatwaves, melting ice caps and glaciers, and rising sea levels.
2. **Climate Change:** Global warming caused by the greenhouse effect has altered climate patterns worldwide, leading to shifts in precipitation, temperature extremes, and the frequency of extreme weather events such as hurricanes, droughts, floods, and wildfires. These changes have significant impacts on ecosystems, agriculture, water resources, and human societies.
3. **Melting Ice Caps and Glaciers:** The increased temperature due to the greenhouse effect has accelerated the melting of polar ice caps, glaciers, and ice sheets. This has contributed to rising sea levels, threatening coastal communities, habitats, and infrastructure with flooding and erosion.
4. **Ocean Acidification:** Excess carbon dioxide (CO_2) absorbed by the oceans leads to ocean acidification, which has harmful effects on marine ecosystems, including coral reefs, shellfish, and plankton. Acidification can disrupt the growth and reproduction of marine organisms, alter ocean chemistry, and degrade coral reef ecosystems.
5. **Biodiversity Loss:** Climate change driven by the greenhouse effect poses a significant threat to biodiversity, as ecosystems struggle to adapt to rapid shifts in temperature, precipitation, and habitat conditions. Many species are facing habitat loss, range shifts, reduced food availability, and increased susceptibility to diseases and invasive species.
6. **Human Health Risks:** The greenhouse effect exacerbates air pollution, heat-related illnesses, and the spread of vector-borne diseases such as malaria and dengue fever. Heatwaves, worsened by global warming, can cause heat stress, dehydration, and respiratory problems, particularly in vulnerable populations.
7. **Economic Disruptions:** Climate change impacts resulting from the greenhouse effect can lead to economic disruptions, including damage to infrastructure, loss of agricultural productivity, increased healthcare costs, property damage from extreme weather events, and displacement of populations due to sea-level rise and environmental degradation.

Overall, the greenhouse effect, when intensified by human activities, has far-reaching consequences for the environment, ecosystems, economies, and human societies. Addressing the causes of the greenhouse effect and mitigating its impacts are crucial for sustainable development and the well-being of present and future generations.

2.

The ozone layer plays a critical role in protecting living beings, including humans, animals, and plants, from the harmful effects of ultraviolet (UV) radiation from the sun. Here are the key effects of the ozone layer on living beings:

1. **Protection from UV Radiation:** The ozone layer absorbs the majority of the Sun's harmful ultraviolet (UV) radiation, particularly UV-B and UV-C rays, preventing them from reaching the Earth's surface in high concentrations. UV radiation is known to cause various adverse health effects in humans and other organisms, including skin cancer, cataracts, sunburns, immune suppression, and DNA damage.
2. **Skin Cancer Prevention:** By filtering out UV-B radiation, the ozone layer helps reduce the incidence of skin cancer in humans. Prolonged exposure to UV-B rays can damage the DNA in skin cells, leading to mutations and the development of skin cancers such as melanoma, basal cell carcinoma, and squamous cell carcinoma.
3. **Eye Protection:** The ozone layer also shields the eyes from UV radiation, reducing the risk of cataracts and other eye disorders caused by prolonged exposure to UV rays. Cataracts, a leading cause of vision impairment and blindness worldwide, can be induced or aggravated by UV radiation exposure.
4. **Protection of Marine Life:** UV radiation can penetrate water and affect marine ecosystems, including coral reefs, phytoplankton, and aquatic organisms. The ozone layer helps protect marine life from harmful UV radiation, preserving the health and biodiversity of ocean ecosystems.
5. **Preservation of Terrestrial Ecosystems:** Ozone depletion can lead to increased UV radiation exposure on land, affecting terrestrial ecosystems, vegetation, and agricultural productivity. High levels of UV radiation can impair plant growth, reduce crop yields, and disrupt ecological processes, impacting food chains and ecosystem services.
6. **Prevention of DNA Damage:** UV radiation can cause direct damage to the DNA molecules in living cells, leading to mutations, genetic instability, and cell death. The ozone layer acts as a shield against UV-induced DNA damage, reducing the risk of genetic mutations and related health effects in living organisms.

Multi-Disciplinary Questions

1. • Navigation (map & compass)
   • Sun protection (sunglasses & sunscreen)
   • Insulation (extra clothing)
   • Illumination (headamp/flashlight)

• First-aid supplies
• Fire (waterproof matches/lighter/candle)
• Repair kit and tools
• Nutrition (extra food)
• Hydration (extra water)
• Emergency shelter (tent/plastic tube tent/garbage bag)

2. •Student do your self
3. Effects of Global Warming

(i) Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~ 1 degrees. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal

(ii) Global warming has affected the coral reefs that can lead to the loss of plant and animals lives. Increase in global temperature has made the fragility of coral reefs even worse.

(iii) Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

(iv) Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

(v) Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increase. Also, such events can bring about the spread of diseases that can hamper human life.

(vi) A global shift in the climate lead to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

Way to reduce global warming:

- Planting trees.
- Creating more sustainable means of transportation, driving a fuel-efficient vehicle.
- Judicious use of electricity, power your home with renewable energy.
- Divest from the use of coal.
- Advocate the importance of a healthy planet.
- Reduce water waste.
- Shrink your carbon profile.

Play and Learn

1. Students do yourself
2. Student do yourself

Stem Project

Students do yourself