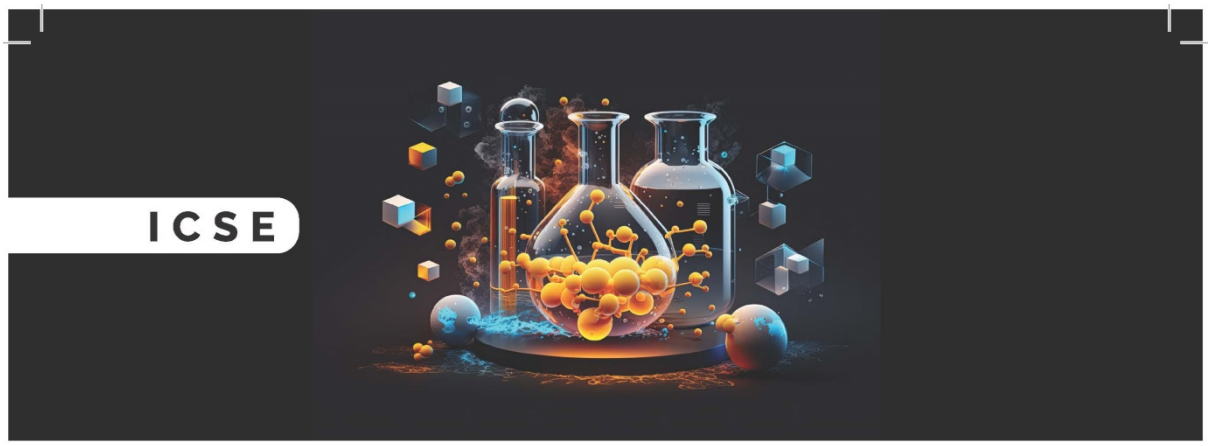

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- Multi-Disciplinary Based Questions
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- Stem Projects

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6

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ANSWER KEY

ICSE Chemistry-6

Chapter-1

Introduction To Chemistry

Intext Questions (Page No. 12)

1. 0.15% Carbon, 0.25%, Phosphorous, 0.005% Sulphur

0.05% Silicon, 0.02%, nitrogen, 0.05% Manganese

0.03% copper, 0.05%, nickel and the balance iron

2.

1. **Food Science**: Chemistry is crucial in understanding food composition, flavour development, preservation techniques, and food safety measures.
2. **Materials Science**: Chemistry is integral to developing new materials with desired properties for various applications, such as electronics, construction, and transportation.

3. AZT stands for Azidothymidine. It is also known as Zidovudine and is a medication used to treat HIV/AIDS.

Exercise Corner

A. MCQs

1. (a) Insecticide
2. (d) Metalachlor
3. (d) Fertiliser
4. (a) BHC
5. (c) Benzene hexa chloride

B. Fill in the Blanks

1. L.P.G is used for **cooking, heating, and as a fuel**.
2. John Dalton was born in **1766**.
3. The full form of TNT is **Trinitrotoluene**.
4. Radioactivity was discovered by **Henri Becquerel**.

C. State True Or False

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

D. Match the Following

1. CNG - (d) fuel
2. Explosive - (a) TNT
3. John Dalton - (b) Atomic theory
4. Oxygen - (e) Carl Wilhelm
5. Fertiliser - (c) Urea

E. Very short answer type questions

1. Science is the systematic study of the structure and behaviour of the physical and natural world through observation and experimentation.

2. Chemistry is the branch of science that deals with the composition, structure, properties, and reactions of matter.

3. Alchemy was an ancient philosophical and proto-scientific tradition that aimed to transform base metals into noble metals like gold, and to discover a universal elixir of immortality.

4. One example of a fertilizer is ammonium nitrate.

5. An insecticide is a substance used for killing insects.

F. Short answer type questions

1. The chemicals found in chillies and lemons include **capsaicin** in chillies and **citric acid** in lemons.

2. In ancient India, chemistry played a significant role in various domains such as metallurgy, medicine, and alchemy. Indian metallurgists produced high-quality steel known as Wootz steel through advanced smelting techniques. In medicine,

Ayurveda, the ancient Indian system of medicine, utilized various herbs and minerals, demonstrating an understanding of chemical properties. Alchemy, although more mystical, laid the groundwork for experimental chemistry.

3. (a) TNT: Trinitrotoluene (b) LPG: Liquefied Petroleum Gas

4. (a) Fungicide example: Chlorothalonil (b) Weedicide example: Glyphosate

5. Chemistry is crucial in industry for various reasons. It's used in manufacturing processes to synthesize and refine raw materials into finished products. Chemical reactions and processes are employed in industries such as pharmaceuticals, petrochemicals, textiles, and food processing. Quality control and analysis rely on chemical principles to ensure products meet safety and regulatory standards. Additionally, chemistry contributes to innovation in materials science, developing new materials with desirable properties for diverse applications.

G. Long answer type questions

1.

1. (a) Eric Fawcett and Reginald Gibson in the 1933.
2. (b) Hydrogen: Hydrogen was discovered by the British scientist Henry Cavendish in 1766.
3. (c) Aspirin: Aspirin, also known as acetylsalicylic acid, was synthesized by the German chemist Felix Hoffmann in 1897.

2. (a) **Talcum Powder:** Talcum powder is primarily composed of the mineral talc, which is a hydrated magnesium silicate. It also may contain additional ingredients such as fragrances, anti-caking agents (like magnesium carbonate or zinc oxide), and moisturizers (such as cornstarch or oat flour). Talcum powder is known for its softness and ability to absorb moisture, making it a common ingredient in cosmetics and personal care products.

(b) **Cement:** Cement is a mixture primarily composed of calcium silicates, typically calcium silicate ($CaSiO_3$) and dicalcium silicate (Ca_2SiO_4). These silicates are produced by heating a mixture of limestone (calcium carbonate) and clay or shale to high temperatures in a kiln, a process known as calcination. Other components of cement may include gypsum (calcium sulfate) to regulate setting time, as well as small amounts of other materials such as iron ore and alumina. When mixed with water, cement undergoes hydration reactions to form a hardened mass, binding together aggregates such as sand and gravel in concrete.

(c) **Toothpaste:** Water, Aluminium hydroxide, calcium hydrogen sulphate, calcium carbonate, silica and hydroxyapatite. In some toothpaste brand sodium fluoride also found.

3. While chemistry brings numerous benefits to society, it also has several disadvantages and challenges. Here are three significant disadvantages of chemistry:

1. Environmental Pollution: One of the most significant disadvantages of chemistry is its role in environmental pollution. Chemical industries, agricultural practices, and everyday activities release pollutants into the air, water, and soil, leading to environmental degradation and adverse effects on ecosystems and human health. For example, industrial emissions of greenhouse gases contribute to climate change, while the discharge of toxic chemicals into water bodies can contaminate drinking water sources and harm aquatic life. Pesticides and fertilizers used in agriculture can also pollute soil and water, leading to ecosystem imbalances and biodiversity loss.
2. Health Risks: Another disadvantage of chemistry is the potential health risks associated with exposure to hazardous chemicals. Many industrial chemicals, pesticides, and consumer products contain toxic substances that can cause acute or chronic health problems if not handled properly. For instance, exposure to carcinogenic compounds like benzene or asbestos can increase the risk of cancer, while inhalation of air pollutants like nitrogen oxides or particulate matter can exacerbate respiratory conditions such as asthma. Moreover, chemical accidents, spills, or leaks in industrial facilities can result in immediate health hazards for nearby communities and workers.
3. Chemical Dependency and Addiction: Chemistry has led to the development of various substances with psychoactive effects, including drugs, alcohol, and synthetic compounds. While some of these substances have legitimate medical uses, others are abused for their euphoric or mind-altering effects, leading to addiction, dependency, and social problems. For example, opioid painkillers, stimulants like cocaine or amphetamines, and illicit drugs such as heroin and methamphetamine can cause addiction and have devastating effects on individuals, families, and communities. Additionally, the production and trafficking of illegal drugs contribute to organized crime, violence, and social instability in many regions.

4. (a) Iron Pillar of Delhi: The Iron Pillar of Delhi is a remarkable ancient artifact located in the Qutb complex in Delhi, India. Dating back to the 4th century AD, this iron pillar stands approximately 7.2 meters tall and weighs over 6 tons. What makes the Iron Pillar particularly fascinating is its exceptional resistance to corrosion despite being exposed to the elements for over a millennium. The pillar's composition primarily consists of wrought iron, with trace

amounts of other elements such as phosphorus, sulfur, and carbon. The presence of phosphorus in particular is believed to contribute to its rust-resistant properties.

The Iron Pillar of Delhi is a testament to the advanced metallurgical skills of ancient Indian craftsmen. The precise method by which the pillar was constructed remains a subject of debate among historians and scientists. Various theories suggest that the iron was smelted using a specific technique or that it was forged with a combination of additives to enhance its corrosion resistance.

(b) RDX: RDX, or Research Department Explosive, is a powerful and highly explosive compound. RDX is widely used as a military explosive due to its high detonation velocity, stability, and insensitivity to shock and friction.

RDX was first synthesized in the late 19th century and gained prominence during World War.

(c) Dmitri Mendeleev: Dmitri Mendeleev was a Russian chemist who is best known for his development of the periodic table of elements. Born in 1834 in Siberia, Mendeleev made significant contributions to the field of chemistry during the 19th century. In 1869, he published his ground breaking work, "Principles of Chemistry," in which he introduced the periodic law and organized the known elements into a systematic table based on their atomic weights and chemical properties.

Mendeleev's periodic table arranged the elements in rows and columns according to their atomic masses, grouping together elements with similar chemical properties. He left gaps in his table for elements that were yet to be discovered, accurately predicting the properties of these missing elements based on their positions in the table. Mendeleev's periodic table provided a framework for understanding the relationships between different elements and laid the foundation for modern chemistry.

5. Chemistry plays a crucial role in various fields, including clothing, cosmetics, medicines, food preservation, and comforts/pleasure:

(a) Clothing: Chemistry contributes to the clothing industry in several ways. Synthetic fibers such as polyester, nylon, and acrylic are produced through chemical processes, providing durable and versatile materials for clothing. Chemical treatments like dyeing, bleaching, and finishing enhance the aesthetic appeal and functionality of fabrics. Additionally, chemical coatings and treatments can impart properties such as water repellency, flame resistance, and wrinkle resistance to textiles, improving their performance and durability.

(b) Cosmetics: Chemistry is fundamental to the formulation and production of cosmetics. Chemical compounds serve as the basis for ingredients such as surfactants, emulsifiers, preservatives, and pigments used in skincare, makeup, haircare, and personal hygiene products. Through chemical synthesis and

modification, cosmetic chemists develop formulations that enhance the appearance, texture, and longevity of cosmetics while ensuring safety and stability.

(c) Medicines: Chemistry plays a central role in the discovery, development, and production of medicines. Pharmaceutical chemistry involves the design, synthesis, and analysis of chemical compounds with therapeutic properties. Medicinal chemists study the structure-activity relationships of drugs to optimize their efficacy, minimize side effects, and improve pharmacokinetic properties. Analytical chemistry techniques are used to characterize drug substances and ensure their purity and quality. Chemistry also contributes to drug delivery systems, enabling targeted and controlled release of active ingredients for optimal therapeutic outcomes.

(d) Food Preservation: Chemistry is essential for preserving the freshness, safety, and nutritional quality of food products. Chemical preservatives such as antioxidants, antimicrobials, and chelating agents inhibit microbial growth, prevent oxidation, and extend the shelf life of foods. Chemical processes such as pasteurization, canning, and dehydration are used to reduce microbial contamination and enzymatic activity, preserving the quality and safety of perishable foods. Packaging materials with barrier properties and controlled atmosphere storage systems rely on chemical principles to maintain food freshness and prevent spoilage.

(e) Comforts and Pleasure: Chemistry contributes to various comforts and pleasures in everyday life. Fragrances and flavours are created using chemical compounds that evoke specific sensory experiences. Synthetic materials developed through chemistry, such as soft furnishings, mattresses, and insulation materials, enhance comfort and improve living environments. Chemical innovations also play a role in recreational activities, entertainment, and leisure pursuits, ranging from synthetic pigments in artwork to chemical processes in photography and film production. Additionally, chemistry enables the synthesis of recreational drugs, perfumes, and other products that enhance pleasure and relaxation, although their use should be approached with caution due to potential risks.

H. Application based questions

1. Students do it yourself

2. Students do it yourself

Multi-disciplinary question

1. Chemistry has made significant contributions to the development of nations in various ways:

1. **Industrial Growth**: Chemistry has been instrumental in driving industrial growth by providing the foundation for numerous industries such as pharmaceuticals, petrochemicals, textiles, agriculture, and manufacturing. Chemical processes and innovations have led to the production of essential materials, fuels, and products that support economic development and infrastructure growth.
2. **Technological Advancements**: Chemistry has fueled technological advancements across multiple sectors. It has enabled the development of new materials with specific properties, such as polymers, ceramics, and composites, which have applications in construction, transportation, electronics, and healthcare. Chemistry also underpins advancements in areas like nanotechnology, renewable energy, information technology, and biotechnology, driving innovation and competitiveness in the global market.
3. **Healthcare and Medicine**: Chemistry plays a vital role in healthcare and medicine, contributing to the development of pharmaceuticals, diagnostic tools, and medical devices. Chemists design and synthesize new drugs to treat diseases, alleviate symptoms, and improve patient outcomes. Chemistry also enables the production of vaccines, antibiotics, imaging agents, and medical implants, enhancing healthcare delivery and public health outcomes.
4. **Agricultural Productivity**: Chemistry has revolutionized agriculture through the development of fertilizers, pesticides, and herbicides that improve crop yields and protect plants from pests and diseases. Chemical innovations in plant breeding, soil science, and crop protection have contributed to increased agricultural productivity, food security, and rural livelihoods, supporting economic growth and poverty reduction efforts.
5. **Environmental Protection**: Chemistry plays a critical role in addressing environmental challenges such as pollution, resource depletion, and climate change. It enables the development of clean technologies, renewable energy sources, and sustainable materials that reduce environmental impact and promote conservation. Chemistry also contributes to waste management, water treatment, and air pollution control, safeguarding ecosystems and public health.
6. **Education and Research**: Chemistry education and research institutions provide the knowledge and skills necessary to train scientists, engineers, and professionals who drive innovation and development. Research in chemistry leads to discoveries and breakthroughs that advance scientific knowledge, technology, and societal progress.

Play and Learn

Students do it yourself

Stem Project

Students do it yourself

Image based questions

Students do it yourself

Value and Life skills

(a) As a student of chemistry, I would suggest Sarthak's father to buy the battery with cadmium plate for several reasons:

1. **Higher Energy Density**: Cadmium batteries typically have a higher energy density compared to lead-acid batteries. This means they can store more energy per unit volume or weight, resulting in longer-lasting power and better performance.
2. **Longer Lifespan**: Cadmium batteries tend to have a longer lifespan and a higher number of charge-discharge cycles compared to lead-acid batteries. This can result in cost savings in the long run as the battery may need to be replaced less frequently.
3. **Faster Charging**: Cadmium batteries often have faster charging times compared to lead-acid batteries, allowing for quicker recharging and greater convenience.
4. **Environmental Impact**: While cadmium batteries do pose environmental concerns due to the toxicity of cadmium, modern cadmium batteries are designed with improved recycling processes and environmental safeguards. Lead-acid batteries, on the other hand, contain lead, which is also toxic and poses environmental risks, especially if not properly disposed of or recycled.
5. **Application Specificity**: Depending on the intended application, cadmium batteries may be better suited for certain uses such as in portable electronics, power tools, or emergency backup systems where high performance and reliability are crucial.

(b) The values associated with the above discussion include:

1. Quality over Price
2. Environmental Awareness
3. Long-Term Planning
4. Safety and Efficiency

ICSE Chemistry-6

Chapter-2

Common Laboratory Apparatus and Equipment

Intext Questions (Page No. 26)

1. A Bunsen burner is a laboratory device used for heating, sterilizing, and combustion purposes. It produces a single open gas flame, which can be adjusted in size and intensity.

2. Safety is paramount in a chemistry laboratory to prevent accidents and ensure the well-being of everyone present. Here are some essential safety rules that should be followed:

1. **Wear appropriate attire:** Always wear proper laboratory attire, including a lab coat, safety goggles, closed-toe shoes, and gloves when handling chemicals or performing experiments.
2. **Know emergency procedures:** Familiarize yourself with the location of safety equipment such as fire extinguishers, eye wash stations, safety showers, and first aid kits. Know the emergency evacuation routes and procedures in case of fire, chemical spills, or other emergencies.
3. **Handle chemicals safely:** Read and understand the labels and Safety Data Sheets (SDS) for all chemicals before use. Use appropriate handling techniques, such as wearing gloves and using a fume hood when working with volatile or toxic substances.
4. **Use equipment properly:** Follow proper procedures for using laboratory equipment such as glassware, balances, Bunsen burners, and hot plates. Ensure that equipment is set up and operated according to instructions and guidelines.
5. **Avoid contamination:** Keep work areas clean and organized to prevent contamination of samples and chemicals. Use separate equipment and glassware for different experiments, and never eat, drink, or apply cosmetics in the laboratory.
6. **Dispose of waste properly:** Dispose of chemical waste according to laboratory guidelines and local regulations. Use designated waste containers for different types of waste, and never pour chemicals down the sink unless instructed to do so.
7. **Handle glassware with care:** Handle glassware carefully to avoid breakage and injury. Inspect glassware for chips or cracks before use, and use appropriate techniques for heating, cooling, and transferring liquids.

8. **Work in a well-ventilated area:** Use fume hoods or work in a well-ventilated area when working with volatile or hazardous chemicals to minimize exposure to fumes and vapours.
9. **Report accidents and incidents:** Report any accidents, spills, or injuries to laboratory personnel or instructors immediately, no matter how minor they may seem. Follow proper procedures for reporting and documenting incidents.
10. **Follow instructions:** Always follow instructions from laboratory personnel, instructors, or supervisors. If you are unsure about something or need clarification, ask for assistance before proceeding.

3. (i) **Beaker**:

- Mixing and stirring liquids
- Heating liquids over a Bunsen burner or hot plate
- Holding and measuring approximate volumes of liquids
- Reacting chemicals in larger quantities
- Serving as a container for various laboratory operations

(ii) **Flask**:

- Holding, mixing, and heating liquids
- Storing solutions and cultures
- Conducting chemical reactions on a small scale
- Providing a vessel for titrations and other analytical procedures
- Allowing for the collection of gases during reactions

(iii) **Test-tube**:

- Holding small amounts of liquid or solid samples
- Heating small quantities of substances over a Bunsen burner
- Observing chemical reactions on a small scale
- Performing qualitative tests such as colour changes, precipitation, or gas evolution
- Conducting simple experiments and analyses

(iv) **Spatula**:

- Transferring small amounts of solid chemicals
- Mixing and stirring powders or granules
- Scooping out precise amounts of reagents or samples
- Manipulating and handling solid substances without direct contact

- Dispensing dry chemicals into containers or reaction vessels

These apparatus are fundamental tools in a chemistry laboratory and are used for a wide range of experimental procedures, from basic mixing and heating to more complex chemical reactions and analyses.

Exercise Corner

A. MCQs

1. (a) measure volume of liquid
2. (b) iron
3. (d) round-bottom flask
4. (d) green zone
5. (c) flammable

B. Fill in the Blanks

1. Chemistry is a branch of science which is mostly based on **chemical reactions**.
2. The desiccator is used to remove **moisture** from a substance.
3. The Bunsen burner has different parts like base, hole, collar, and **air vents**.
4. **The Bunsen burner** or Bunsen burner is a source of heat in chemistry.

C. State True Or False

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

D. Match the Following

1. Iron stand - (d) Supports apparatus
2. Measuring cylinder - (b) Measures volume
3. Burette - (e) Used in titration
4. Porcelain - (c) China dish
5. Bent tube - (a) Used for pass gas

E. Very short answer type questions

1. Two laboratory rules are: "Wear appropriate safety gear" and "Handle chemicals with care".

2. Students are not allowed to mix up any chemicals without approval from the subject teacher to prevent accidents or dangerous reactions.

3. Five glass apparatus used in a chemistry laboratory are: beaker, flask, test tube, burette, and pipette.

4. The apparatus used for collecting gas is called a gas collection tube or gas syringe.

F. Short answer type questions

1.

(a) Test tube: Used for holding small amounts of liquid or conducting simple **experiments**.
(b) Conical flask: Used for mixing, heating, and storing liquids, especially those that require swirling or mixing without significant loss of contents.

2. The apparatus used to measure an accurate volume of liquid is a volumetric flask.

3. The role of an air adjuster in a Bunsen burner is to control the air supply to the burner, which affects the flame's characteristics, such as color and temperature. By adjusting the air intake, the burner's flame can be made more or less oxygen-rich, influencing the combustion process and the type of flame produced.

4. Four items of daily use made using the knowledge of chemistry are:

- Soap and detergents
- Plastic bottles and containers
- Medicines and pharmaceuticals
- Cosmetics and personal care products

G. Long answer type questions

1. Students do it yourself

2. Procedure of measuring the volume of water:

- Take a clean and dry volumetric flask of appropriate size.
- Use a funnel to carefully pour the water into the flask until it reaches slightly above the calibration mark.
- Use a dropper or pipette to add water drop by drop until the bottom of the meniscus aligns exactly with the calibration mark.
- Avoid any air bubbles trapped in the flask.
- Once the correct volume is reached, stop adding water.
- Remove the funnel and any excess water from the neck of the flask using a clean tissue.
- Cap the flask and mix the contents gently to ensure homogeneity if necessary.

3. Laboratory safety rules are crucial to ensure the well-being of everyone present and prevent accidents. Some key safety rules include:

- Always wear appropriate personal protective equipment (PPE) such as lab coats, safety goggles, gloves, and closed-toe shoes.
- Follow proper handling and storage procedures for chemicals, including reading and understanding Safety Data Sheets (SDS).
- Use equipment and glassware properly and with caution, ensuring they are clean and free from damage.
- Be aware of emergency procedures, including the location of safety equipment like fire extinguishers, eyewash stations, and emergency showers.
- Never eat, drink, or apply cosmetics in the laboratory, and wash hands thoroughly after handling chemicals.
- Report any accidents, spills, or injuries immediately to laboratory personnel or instructors.

4. Students Do it yourself

H. Application based question

1. (i) **Desiccator**: Used for drying moisture-sensitive substances or storing hygroscopic chemicals in a dry environment.

(ii) **Measuring cylinder**: Used for measuring the volume of liquids with relatively high accuracy.

(iii) **Beaker**: Used for holding, mixing, and heating liquids in laboratory experiments.

(iv) **Funnel**: Used for transferring liquids or fine-grained substances into containers with small openings without spillage.

Multi-disciplinary questions

1. five precautions to be taken care of while performing an experiment in a chemistry laboratory:

1. **Wear appropriate personal protective equipment (PPE)**: Always wear safety goggles, lab coats, gloves, and closed-toe shoes to protect yourself from chemical splashes, spills, and other hazards.
2. **Read and understand the experimental procedure**: Before starting the experiment, carefully read and understand the experimental procedure, including any potential hazards, safety precautions, and emergency procedures.
3. **Handle chemicals with care**: Use caution when handling chemicals, including wearing gloves and using appropriate techniques for measuring, mixing, and transferring substances. Always use the smallest amount of chemicals necessary for the experiment and avoid unnecessary exposure.
4. **Work in a well-ventilated area**: Perform experiments in a fume hood or a well-ventilated area to minimize exposure to fumes, vapors, and gases released during the experiment. If working with volatile or toxic substances, take extra precautions to ensure proper ventilation.
5. **Clean up properly**: After completing the experiment, clean up the work area, glassware, and equipment thoroughly to prevent contamination and ensure safety for the next user. Dispose of chemical waste according to laboratory guidelines and local regulations.

2. Chemistry is known as an experimental science because it relies heavily on experimentation to investigate and understand the behaviour of matter, the composition of substances, and the interactions between different elements and compounds. Here are a few reasons why chemistry is considered an experimental science:

1. **Observation and experimentation**: Chemistry involves making observations and conducting experiments to study chemical reactions, physical properties, and other phenomena. Through experimentation, chemists can gather data, analyze results, and draw conclusions about the behaviour of substances.
2. **Verification of theories and hypotheses**: Experimental studies in chemistry help to verify or refute theories and hypotheses proposed by scientists. By

testing ideas through controlled experiments, chemists can validate scientific principles and contribute to the advancement of knowledge in the field.

3. **Development of new materials and technologies**: Experimental research in chemistry often leads to the discovery and development of new materials, compounds, and technologies with practical applications. From pharmaceuticals and polymers to renewable energy sources and nanotechnology, chemistry plays a vital role in innovation and technological advancement.
4. **Quantitative analysis and measurement**: Chemistry relies on precise measurement techniques and quantitative analysis to characterize the properties of substances, determine their composition, and quantify chemical reactions. Experimental methods such as titration, spectroscopy, and chromatography allow chemists to make accurate measurements and obtain reliable data.
5. **Reproducibility and validation**: Experimental results in chemistry should be reproducible, meaning that other researchers should be able to replicate the experiments and obtain similar results. Reproducibility helps to validate scientific findings and ensure the reliability of experimental data.

Play and Learn

1. Students do it yourself

2. Students do it yourself

Stem Project

This experiment involves several common household items and can produce an interesting chemical reaction. Here's what you can expect to observe:

1. **Water with food coloring**: The water will take on the color of the food coloring you added, creating a colored solution.
2. **Baking soda**: When you add the baking soda to the colored water and stir, you may observe some fizzing or bubbling. This reaction occurs because baking soda (sodium bicarbonate) reacts with the vinegar (acetic acid) to produce carbon dioxide gas, water, and sodium acetate according to the following reaction:

   $NaHCO_3 + CH_3COOH \rightarrow CO_2 + H_2O + CH_3COONa$

   The carbon dioxide gas produced during this reaction is responsible for the bubbling or fizzing.
3. **Uncooked rice**: The uncooked rice will sink to the bottom of the jar and may absorb some of the coloured water.

4. **White vinegar**: When you add the white vinegar to the mixture, you may observe additional bubbling or fizzing. This reaction occurs because the vinegar (acetic acid) reacts with the baking soda (sodium bicarbonate) to produce carbon dioxide gas, water, and sodium acetate, similar to the reaction described above.

Image based questions

Students Do it Yourself

Value And Life Skills

(a) General precautions in a laboratory include:

1. Always wear appropriate personal protective equipment (PPE) such as safety goggles, lab coats, and gloves.
2. Follow all instructions carefully and never deviate from the experimental procedure without permission.
3. Handle chemicals with care, and never taste or smell them directly.
4. Keep the work area clean and organized to prevent accidents and contamination.
5. Use equipment properly and with caution, ensuring it is clean and in good condition.
6. Be aware of emergency procedures and the location of safety equipment such as fire extinguishers and eyewash stations.
7. Never eat, drink, or apply cosmetics in the laboratory.
8. Report any accidents, spills, or injuries immediately to the teacher or supervisor.

(b) Values shown by Ravi:

1. Responsibility
2. Concern for safety
3. Respect for rules and authority

Chapter-3

Elements and Compounds

Intext Questions (Page No. 34)

1. Matter is anything that has mass and occupies space. It encompasses all substances and materials that we encounter in the physical world, including solids, liquids, gases, and plasma. Matter is composed of atoms and molecules, which are the building blocks of all substances.

2. The physical classification of matter categorizes substances based on their physical properties, such as state of matter (solid, liquid, gas), appearance, texture, and conductivity. This classification does not involve changes in chemical composition. Matter can be classified into three main states: solid, liquid, and gas. Additionally, substances can exhibit properties such as solubility, density, melting point, boiling point, and electrical conductivity, which further classify them within each state.

3. An orbit is the path followed by an object as it revolves around another object in space due to gravitational attraction. In the context of atomic structure, an orbit refers to the path followed by electrons as they move around the nucleus of an atom. Orbits are characterized by their shape, size, and energy level, and they play a crucial role in understanding the behavior of atoms and molecules.

4. Two examples of non-metalloids, also known as metals, are:

- Iron (Fe)
- Aluminum (Al)

5. Mercury (Hg) is the metal found in a liquid state at room temperature. Mercury is the only metal that is liquid at room temperature and standard atmospheric pressure.

Intext Questions (Page No. 40)

1. Students do it Yourself

2. (a) Cl - Chlorine (b) Ca - Calcium (c) Co – Cobalt

3. A compound is a substance composed of two or more different elements chemically bonded together in fixed proportions. Compounds can be formed through chemical reactions, where atoms of different elements combine to form new chemical bonds. Compounds have distinct chemical properties that are different from the elements they are composed of.

4. Two differences between elements and compounds:

- **Composition**: Elements are substances composed of only one type of atom, whereas compounds are substances composed of two or more different types of atoms chemically bonded together.
- **Properties**: Elements have characteristic physical and chemical properties based on their atomic structure, whereas compounds have properties distinct from their component elements due to the chemical bonds that hold their atoms together.

Intext Questions (Page No. 45)

1. An atom is the smallest unit of an element that retains the chemical properties of that element. Atoms are composed of a nucleus containing protons and neutrons, surrounded by a cloud of electrons. The number of protons in the nucleus determines the atomic number and defines the identity of the element.

2. Two examples of diatomic molecules are:

- Oxygen (O_2)
- Hydrogen (H_2)

3. A chemical formula is a symbolic representation that expresses the composition of a chemical compound. It consists of symbols of the elements present in the compound, along with subscripts indicating the ratio of each element's atoms in the compound. For example, the chemical formula for water is H_2O, indicating that each molecule of water contains two hydrogen atoms and one oxygen atom.

4. An ion is an atom or molecule that has gained or lost one or more electrons, resulting in a positive or negative electrical charge. Ions are formed through the process of ionization, which occurs when atoms undergo chemical reactions or interact with electromagnetic fields. Positively charged ions are called cations, while negatively charged ions are called anions.

5. Uses of aluminium include:

- Manufacturing of lightweight and durable alloys for aerospace, automotive, and construction industries.
- Production of packaging materials such as cans and foils due to its corrosion resistance and malleability.
- Construction of electrical wiring and transmission lines due to its excellent conductivity.
- Manufacturing of household items like cookware, utensils, and window frames.

6. Baking soda, also known as sodium bicarbonate, has the chemical formula $NaHCO_3$. Its constituents are:

- Sodium (Na)
- Hydrogen (H)
- Carbon (C)
- Oxygen (O)

Exercise Corner

A. MCQs

1. (b) compound
2. (d) all of them
3. (a) Sugar
4. (a) Copper
5. (d) both a and b

B. Fill in the Blanks

1. Solid has definite **shape** and definite mass.
2. Pure substances have **fixed** composition.
3. Proton is a **positively** charged particle.
4. Ca is the symbol of **calcium**.
5. The symbol of gold is **Au**.

C. State True Or False

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

D. Match the Following

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

E. Very short answer type questions

1. Definite shape and volume.

2.

- **Elements**: Substances composed of only one type of atom, which cannot be broken down further by chemical means.
- **Compounds**: Substances composed of two or more different types of atoms chemically bonded together in fixed proportions.

3. A metal is a type of element characterized by its luster, malleability, ductility, and conductivity of heat and electricity. Three examples are iron, copper, and aluminum.

4. A symbol is a shorthand representation of an element, typically one or two letters derived from its name in English or another language.

5. A molecule is the smallest particle of a substance that retains all the chemical properties of that substance. It consists of two or more atoms chemically bonded together.

F. Short answer type questions

1. Two examples of a non-metal are sulphur and oxygen.

2. Characteristics of non-metals:

- Poor conductors of heat and electricity
- Generally brittle in solid form
- Low melting and boiling points
- Tend to gain electrons in chemical reactions

3. Elements generally found in living beings include carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur (CHONPS).

4. Latin names:

- (a) Potassium: Kalium
- (b) Sodium: Natrium
- (c) Zinc: Zincum

5. Symbols of the following elements:

- (a) Boron: B
- (b) Silicon: Si
- (c) Neon: Ne

G. Long answer type questions

1. Students Do it yourself

2. Characteristics of compounds:

- Composed of two or more different elements chemically bonded together.
- Have a fixed chemical composition.
- Can have properties different from those of their constituent elements.
- Can be decomposed into simpler substances by chemical means.

3. Elements found in the following compounds:

- (a) Sugar: Carbon, hydrogen, oxygen
- (b) Silica: Silicon, oxygen
- (c) Copper chloride: Copper, chlorine

4. Formulas of compounds:

- (a) Ammonia: NH_3
- (b) Glucose: $C_6H_{12}O_6$
- (c) Methane: CH_4

H. Application based questions

1. (i) Sodium chloride: Sodium, chlorine (ii) Water: Hydrogen, oxygen (iii) Sugar: Carbon, hydrogen, oxygen

2. Students do it Yourself

Experiential learning questions

1. Properties of compounds:

- Have a fixed chemical composition: Compounds are composed of two or more different elements chemically bonded together in fixed proportions.
- Can have properties different from those of their constituent elements: Compounds often exhibit properties distinct from the elements they are composed of, due to the chemical bonds holding their atoms together.

2. Uses of elements and compounds available at home:

- **Elements**:
  - Iron (Fe): Used in cooking utensils, tools, and construction materials.
  - Copper (Cu): Used in electrical wiring, plumbing pipes, and decorative items.
- **Compounds**:
  - Sodium chloride (NaCl): Commonly known as table salt, used as a seasoning in cooking and food preservation.
  - Baking soda (sodium bicarbonate, $NaHCO_3$): Used as a leavening agent in baking, as a household cleaner, and for personal care purposes such as toothpaste and deodorant.

Multi- disciplinary questions

1. (c) 94

2. All living beings inhale it during breathing. Oxygen

Play and Learn

Students Do it yourself

Stem Project

Students do it yourself

Image based questions

Students do it yourself

Values and Life skills

(a) Symbols help to identify elements by providing a concise and standardized representation of the name of an element. Each element is assigned a unique symbol, typically consisting of one or two letters derived from its name. These symbols are widely used in chemical equations, formulas, and other scientific contexts to represent elements and their properties. By using symbols, scientists and students can easily identify and refer to specific elements without having to write out their full names.

(b) Values attached for using symbols:

1. Efficiency
2. Standardization
3. Convenience
4. Accuracy

Chapter-4

Air and Atmosphere

Intext Questions (Page No. 51)

1. The gas in the atmosphere essential for respiration is oxygen (O_2). It is required by living organisms for the process of cellular respiration, where oxygen is used to break down organic molecules to release energy.

2. The atmosphere is divided into different layers based on temperature variations and other characteristics. These layers, from closest to farthest from the Earth's surface, are:

- Troposphere: The lowest layer where weather occurs, and temperature decreases with altitude.
- Stratosphere: Contains the ozone layer, where temperature increases with altitude due to absorption of ultraviolet radiation.
- Mesosphere: The middle layer where temperature decreases with altitude, and meteoroids burn up upon entering.
- Thermosphere: Contains the ionosphere, where temperature increases dramatically with altitude due to absorption of solar radiation.
- Exosphere: The outermost layer where atoms and molecules escape into space.

3. To prove that air is a mixture of several gases and not a compound, one can perform experiments such as:

- Demonstrate that the composition of air varies at different altitudes.
- Show that the properties of air, such as boiling point and density, are consistent with those of a mixture rather than a compound.
- Conduct experiments to separate the components of air, such as distillation or fractional distillation, which would be possible if air were a mixture but not if it were a compound.

4. Substances present in traces in the air include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Ozone (O_3)
- Water vapor (H_2O)
- Particulate matter (such as dust and pollen)

- Trace gases (such as helium, neon, argon, krypton, and xenon)

Intext Questions (Page No. 58)

1. Two uses of nitrogen:

- Nitrogen is used in the production of ammonia (NH_3), which is a key component of fertilizers for agriculture.
- Liquid nitrogen (N_2) is used in cryogenic applications, such as preserving biological samples, freezing food products, and cooling machinery and equipment.

2. A fuel is a substance that undergoes combustion to release energy. It is typically used to produce heat or power through various processes such as burning, oxidation, or reaction with other substances. Common fuels include gasoline, diesel, natural gas, coal, and biomass.

3. Properties of air:

- Air is a mixture of gases, primarily nitrogen (78%) and oxygen (21%), with trace amounts of other gases.
- It is colourless, odourless, and tasteless.
- Air is compressible and expands to fill the space available to it.
- It exerts pressure, known as atmospheric pressure, due to the weight of the air above.
- Air has variable humidity levels, depending on factors such as temperature and location.

4. Oxygen becomes available to animals in water and soil through processes such as diffusion and photosynthesis. In water, oxygen dissolves from the atmosphere and is also produced by aquatic plants through photosynthesis. In soil, oxygen is present in air spaces between soil particles and is utilized by plant roots and soil-dwelling organisms.

5. Rusting is a chemical process in which iron and steel react with oxygen and water to form iron oxide (rust). Rusting occurs when iron or steel is exposed to moisture and oxygen over time, leading to the formation of reddish-brown flakes on the surface of the metal.

6. Prevention methods for rusting include:

- Applying protective coatings, such as paint or varnish, to metal surfaces to create a barrier against moisture and oxygen.

- Galvanizing or electroplating metal surfaces with a layer of zinc to provide sacrificial protection.
- Using corrosion-resistant alloys, such as stainless steel, in place of pure iron or steel.
- Implementing proper maintenance practices, such as keeping metal surfaces dry and clean, to minimize exposure to moisture and oxygen.

7. Full forms of CNG and LPG:

- CNG: Compressed Natural Gas
- LPG: Liquefied Petroleum Gas

Intext Questions (Page No. 60)

1. Air pollution refers to the presence of harmful or excessive quantities of substances in the air, which can have adverse effects on human health, the environment, and the climate. These substances, known as air pollutants, can be emitted from various sources such as industrial activities, transportation, agriculture, and natural processes.

2. Carbon dioxide (CO_2) is known as a greenhouse gas because it absorbs and emits infrared radiation within the thermal infrared range, leading to the greenhouse effect. This effect causes heat to be trapped in the Earth's atmosphere, leading to an increase in global temperatures and climate change.

3. Three greenhouse gases are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)

4. Two air pollutants that affect our health are:

- Particulate matter (PM): Tiny particles suspended in the air, which can penetrate deep into the lungs and bloodstream, causing respiratory and cardiovascular problems.
- Nitrogen dioxide (NO_2): A gas produced by combustion processes, primarily from vehicles and industrial activities, which can irritate the airways and exacerbate respiratory conditions such as asthma.

5. Global warming refers to the long-term increase in Earth's average surface temperature, primarily due to human activities that increase the concentration of greenhouse gases in the atmosphere. This increase in temperature leads to changes in climate patterns, including rising sea levels, melting glaciers, shifts in weather patterns, and more frequent extreme weather events.

Exercise Corner

A. MCQs

1. (a) nitrogen
2. (b) Oxygen
3. (c) Oxygen
4. (c) air in motion
5. (d) everywhere

B. Fill in the Blanks

1. When air is in **motion**, it is called wind.
2. The component of air that supports burning is called **oxygen**.
3. Our earth is surrounded by the **atmosphere**.
4. The aquatic animals use dissolved oxygen in water for respiration. This is possible because oxygen is **soluble** in water.
5. Nitrogen in the air is used on a large scale to manufacture **fertilizers**.

C. State True Or False

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

D. Match the Following

1. Damage ozone layer - (a) Chlorofluorocarbons
2. Acid rain - (c) Sulphur dioxide
3. Global warming - (d) Carbon dioxide
4. Inert gas - (b) Argon
5. Humidity - (e) Water vapour in the air

E. Very short answer type questions

1. The composition of air is primarily nitrogen (about 78%), oxygen (about 21%), and trace amounts of other gases such as argon, carbon dioxide, and water vapor.

2. The atmosphere is the envelope of gases surrounding the Earth. It consists of different layers of gases held in place by gravity, providing the air we breathe and influencing weather patterns and climate.

3. Two uses of oxygen are:

- Essential for respiration: Oxygen is required by living organisms for the process of cellular respiration, where it is used to break down organic molecules to release energy.
- Combustion: Oxygen supports combustion and is used in various industrial processes such as oxy-fuel welding and cutting, metallurgy, and chemical production.

F. Short answer type Questions

1. Gases present in the air include nitrogen, oxygen, argon, carbon dioxide, and trace amounts of other gases. Nitrogen is the most abundant gas in the air, constituting approximately 78% of the atmosphere.

2. Air dissolves in water when the gases present in the air, such as oxygen and nitrogen, mix with water molecules to form a solution. This can be observed when bubbles of air rise to the surface of water or when the dissolved gases affect the properties of the water, such as its taste or ability to support aquatic life.

3. Two processes supported by oxygen present in the air are:

- Combustion: Oxygen supports the process of combustion by combining with other substances, releasing energy in the form of heat and light.
- Respiration: Oxygen is essential for aerobic respiration in living organisms, where it is used to break down organic molecules to release energy for cellular processes.

4. Characteristics of ideal fuels include:

- High energy content: Ideal fuels have a high energy density, meaning they can produce a large amount of energy per unit mass or volume.

- Clean combustion: Ideal fuels produce minimal pollutants or harmful emissions when burned, contributing to environmental sustainability.
- Availability and affordability: Ideal fuels are readily available and economically viable for widespread use.
- Easy storage and transportation: Ideal fuels can be stored and transported safely and efficiently, without the need for complex infrastructure.

5. If the amount of oxygen is increased in the air, it can lead to enhanced combustion processes and increased availability of oxygen for respiration in living organisms. However, excessively high levels of oxygen can also pose a fire hazard, as it increases the risk of spontaneous combustion and intensifies fires. Additionally, high levels of oxygen can lead to oxygen toxicity in humans and other organisms, causing respiratory and central nervous system problems.

G. Long answer type questions

1. Prove that oxygen has 1/5th part in the air: To prove that oxygen constitutes approximately 1/5th part of the air, we can perform the following experiment:

- Take a sample of air and separate its components using a method such as fractional distillation or gas chromatography.
- Measure the volume of oxygen present in the sample.
- Compare the volume of oxygen with the total volume of air to determine the percentage of oxygen.
- The result will show that oxygen makes up roughly 21% of the air, which is equivalent to 1/5th of the total volume.

2. Breathing: Air provides oxygen necessary for respiration in humans and other organisms.

- Combustion: Air supports combustion processes by providing oxygen necessary for burning fuels.
- Weather phenomena: Air plays a crucial role in various weather phenomena such as wind, clouds, precipitation, and atmospheric pressure.
- Flight: Air enables the flight of birds, insects, and aircraft by providing lift and propulsion.
- Sound transmission: Air is essential for the transmission of sound waves, allowing communication and auditory perception.

3. Mountaineers carry oxygen cylinders while climbing high mountains because:

- At high altitudes, the air pressure decreases, leading to lower oxygen concentrations in the air.

- The reduced oxygen levels can cause altitude sickness, hypoxia, and difficulty in breathing.
- Supplemental oxygen from cylinders helps mountaineers to overcome these challenges and maintain sufficient oxygen levels for respiration, preventing altitude-related health problems and ensuring their safety during the ascent and descent.

4. Students do it yourself

5. Air pollution: It is contamination of the air due to the presence of various pollutants in it.

Measure to control Air pollution:

- **Proper treatment of industrial gaseous waste:** The gaseous wastes should be treated in a cyclone collector or electrostatic precipitator prior to disposal.
- **Segregated localization of industrial plants:** Industrial plants should be located in areas far from human settlements and be surrounded by sufficient greenery to compensate for the pollution caused by them.
- **Usage of green:** Green fuel refers to biodegradable fuel derived from natural gas that can be used to replace petroleum and diesel.
- **Installation of scrubbers:** Installing scrubbers in the engines of cars will sequester the oxides of sulfur and nitrogen. Thus, they will not be released into the environment.
- **Reducing the burning of coal:** This will lower the concentration of unburnt hydrocarbons released in the air.

H. Application based questions

1. We do not see it, yet we know air is all around us. Justify the statement with examples:

- Example 1: Wind: We cannot see air, but we can feel its presence when wind blows. Wind is the movement of air molecules and is often felt as a breeze or a strong gust. For example, we can see the effects of wind when it moves leaves on trees, causes ripples on water surfaces, or blows dust and debris.
- Example 2: Breathing: We do not see air, but we know it is essential for breathing. Humans and other animals require oxygen from the air for respiration. Although we cannot see oxygen molecules, we can observe the effects of breathing, such as the rise and fall of the chest and the exchange of gases in the lungs.

- Example 3: Sound transmission: Air is necessary for the transmission of sound waves. We may not see the air molecules vibrating, but we hear the sound produced by objects vibrating in the air. For example, we can hear voices, music, or the sound of objects moving through the air.

2. Significance of ozone layer for us:

- Protection from ultraviolet (UV) radiation: The ozone layer in the Earth's stratosphere absorbs the majority of the Sun's harmful ultraviolet (UV) radiation. This protects living organisms on Earth's surface, including humans, animals, and plants, from the harmful effects of UV radiation such as skin cancer, cataracts, and damage to marine ecosystems.
- Preservation of climate and ecosystems: The ozone layer plays a crucial role in regulating Earth's climate by preventing excessive heating of the atmosphere. It also supports the growth of phytoplankton in oceans, which are essential for marine food chains and the absorption of carbon dioxide from the atmosphere.
- Environmental sustainability: The ozone layer is a vital component of Earth's environment, and its protection is essential for maintaining ecological balance and ensuring the well-being of present and future generations. Efforts to preserve and restore the ozone layer contribute to global efforts for environmental sustainability and climate change mitigation.

Multi disciplinary questions

1. Utilization of nitrogen by plants for their growth:

- Plants utilize nitrogen primarily in the form of nitrate ions (NO_3-) and ammonium ions (NH_4+), which they absorb from the soil through their root systems.
- Nitrogen is a crucial component of amino acids, proteins, chlorophyll, and nucleic acids, which are essential for plant growth and development.
- Nitrogen is a major nutrient required for various physiological processes in plants, including photosynthesis, respiration, and the synthesis of enzymes and hormones.
- Nitrogen-fixing bacteria in the soil play a vital role in converting atmospheric nitrogen (N_2) into a form that plants can absorb and utilize. Some plants, such as legumes, form symbiotic relationships with these bacteria to acquire nitrogen.

Reason why nitrogen is used in finishing food packages:

- Nitrogen gas (N_2) is commonly used in finishing food packages to displace oxygen (O_2) from the packaging environment.
- By replacing oxygen with nitrogen, the food packaging creates a modified atmosphere with reduced oxygen levels, which helps to slow down the oxidative degradation of food products and inhibit the growth of aerobic spoilage microorganisms.
- Nitrogen flushing or purging is a common method used in the food packaging industry to extend the shelf life of perishable food items, such as snacks, grains, and bakery products, by reducing the rate of oxidation and spoilage.

2. Dependence of all living beings on the atmosphere for their survival:

- Oxygen for respiration: All living beings, including humans, animals, and microorganisms, depend on the atmosphere for the supply of oxygen (O_2) required for respiration. Oxygen is necessary for the aerobic cellular respiration process, where it is used to break down organic molecules to release energy for cellular activities.
- Carbon dioxide for photosynthesis: Plants and photosynthetic organisms depend on the atmosphere for the supply of carbon dioxide (CO_2) required for photosynthesis. During photosynthesis, plants utilize carbon dioxide from the atmosphere, along with water and sunlight, to produce glucose and oxygen.
- Protection from harmful radiation: The atmosphere, particularly the ozone layer, protects living beings from harmful ultraviolet (UV) radiation from the Sun. UV radiation can cause DNA damage, skin cancer, and other health problems in humans and animals. The ozone layer absorbs the majority of UV radiation, preventing it from reaching the Earth's surface and harming living organisms.
- Regulation of climate and temperature: The atmosphere plays a crucial role in regulating Earth's climate and temperature by trapping heat through the greenhouse effect. This helps to maintain moderate temperatures suitable for life on Earth and prevents extreme fluctuations in temperature.

Play and Learn

Students Do It yourself

Stem Project

Students Do It yourself

Image based questions

Students Do It yourself

Value and Life Skills

1. The gas that supports burning is oxygen (O_2). Oxygen is necessary for combustion to occur, as it reacts with the fuel to produce heat and light.
2. Reena displayed the values of quick thinking, courage, and presence of mind in the face of an emergency. Instead of panicking, she acted swiftly to assess the situation and provide immediate assistance to her mother. Her quick action of bringing a blanket and covering her mother helped to extinguish the fire and prevent her mother from sustaining severe burns. Reena's actions demonstrate her concern for her mother's safety and her ability to respond effectively in a crisis.

Chapter-5
Water

Intext Questions (Page No. 69)

1. The chemistry of water revolves around its molecular structure and properties. Water (H_2O) consists of two hydrogen atoms covalently bonded to one oxygen atom. Due to its bent shape and polar nature, water exhibits several unique properties such as high surface tension, cohesion, adhesion, and excellent solvent capabilities. These properties make water essential for life and various chemical processes.

2. Major impurities present in river water include organic matter (such as decaying plant and animal debris), suspended solids (like silt, clay, and sand), dissolved minerals (such as calcium, magnesium, sodium, and potassium), nutrients (like nitrogen and phosphorus from fertilizers), bacteria, viruses, and industrial pollutants (including heavy metals, pesticides, and chemicals).

3. The water cycle, also known as the hydrological cycle, is crucial for maintaining life on Earth. It describes the continuous movement of water on, above, and below the surface of the Earth. The cycle involves processes such as evaporation, condensation, precipitation, runoff, infiltration, and transpiration. The importance of the water cycle lies in regulating the distribution of freshwater across the planet, replenishing groundwater reserves, sustaining ecosystems, driving weather patterns, and supporting human activities like agriculture, industry, and drinking water supply.

4. Fog forms when air near the Earth's surface cools to the point where it can no longer hold its moisture in vapor form, causing condensation. This typically occurs when warm, moist air comes into contact with a cooler surface or encounters cooler air masses. As the air cools, water vapor condenses around tiny particles like dust, smoke, or salt, forming small water droplets or ice crystals suspended in the air. These tiny droplets or crystals reduce visibility, creating the characteristic haze known as fog.

5. Dew is formed when moisture in the air condenses onto surfaces such as grass, leaves, or cars during the night when the temperature drops. It occurs when the temperature of these surfaces falls below the dew point temperature, causing water vapor in the air to undergo condensation and form water droplets. Dew is more likely to form on clear, calm nights with high humidity levels. Dew plays a crucial role in providing moisture to plants and aiding in the growth of vegetation, especially in arid regions.

Intext Questions (Page No. 77)

1. Water is often referred to as a universal solvent because it has the ability to dissolve a wide range of substances. This is due to its unique molecular structure, with polar covalent bonds between oxygen and hydrogen atoms. The polarity of water molecules allows them to attract and surround ions and polar molecules, breaking them apart and dissolving them in the water. This property enables water to dissolve various solutes, making it essential for many biological, chemical, and industrial processes.

2. Water conservation can be achieved through various measures:

- Fixing leaks in plumbing and irrigation systems to reduce wastage.
- Using water-saving appliances and fixtures like low-flow toilets and showerheads.
- Practicing responsible water use in daily activities such as washing dishes, laundry, and bathing.
- Employing efficient irrigation methods in agriculture, such as drip irrigation.
- Capturing rainwater for reuse in gardening, landscaping, or non-potable household uses.
- Implementing water reuse and recycling technologies in industries.

3. Causes of water pollution include:

- Industrial discharge of pollutants such as heavy metals, chemicals, and toxins.
- Agricultural runoff containing pesticides, fertilizers, and animal waste.

- Municipal wastewater containing sewage, organic matter, and pathogens.
- Improper disposal of household chemicals, pharmaceuticals, and hazardous waste.
- Oil spills and other forms of marine pollution.
- Sedimentation from erosion and construction activities.

4. Steps to prevent water pollution include:

- Implementing strict regulations and enforcement to control industrial discharges and waste management.
- Promoting sustainable agricultural practices to minimize runoff and soil erosion.
- Upgrading sewage treatment plants and implementing advanced wastewater treatment technologies.
- Educating the public about proper waste disposal and recycling practices.
- Monitoring water quality regularly and taking corrective actions when necessary.
- Investing in pollution prevention technologies and research.

5. Heavy rainfall can lead to various consequences, including:

- Flooding of low-lying areas, rivers, and urban drainage systems.
- Soil erosion and landslides in hilly or deforested regions.
- Contamination of water bodies due to runoff carrying pollutants from urban and agricultural areas.
- Disruption of transportation and infrastructure.
- Increased risk of flash floods and damage to property and crops.

6. Characteristics of potable water include:

- Clarity: Potable water should be clear and free from suspended particles, sediment, and turbidity.
- Odour: It should be odourless or have a mild, pleasant odour.
- Taste: Potable water should have a clean, refreshing taste without any unpleasant or unusual flavours.
- Colour: Water should be colourless or have a slight tint, indicating the absence of dissolved substances.
- pH: The pH of potable water should be within a neutral range (around 6.5 to 8.5).
- Absence of contaminants: Potable water should be free from harmful microorganisms, chemicals, heavy metals, and other pollutants that pose health risks to humans.

Exercise Corner

A. MCQs

1. (c) Rainwater
2. (a) Water cycle
3. (a) 88%
4. (d) Sea water
5. (a) 100°C

B. Fill in the Blanks

1. Large part of the Earth's surface is covered with **water**.
2. The water in the ocean is very **salty** in taste.
3. The process of conversion of vapor into liquid is known as **condensation**.
4. Falling of **rain** is called precipitation.
5. Most of the water that human beings use comes from **freshwater sources**.

C. State True Or False

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

D. Match the Following

1. Purest form of water – (b) Rainwater
2. Change of water to water vapour – (c) Evaporation
3. Solution – (d) Homogeneous mixture of solute and solvent
4. Potable water – (a) Water used for drinking purpose
5. Purification of water – (e) Water treatment plant

E. Very short answer type questions

1. The states of water are solid, liquid, and gas. At low temperatures, water exists as ice (solid), at moderate temperatures as liquid water, and at high temperatures as water vapor (gas).

2. Rainwater harvesting involves collecting and storing rainwater for future use. This can be done through various methods such as rooftop harvesting, surface

runoff harvesting, and groundwater recharge. Rainwater harvesting helps in conserving water resources, reducing dependency on municipal water supply, and mitigating flooding and soil erosion.

3. Water pollution refers to the contamination of water bodies (such as rivers, lakes, oceans, and groundwater) by harmful substances, making it unsuitable for human use and damaging aquatic ecosystems. Sources of water pollution include industrial discharge, agricultural runoff, sewage discharge, oil spills, and improper waste disposal.

4. Floods can be caused by heavy rainfall, melting snow, storm surges, or the sudden release of water from reservoirs. Droughts occur due to prolonged periods of low precipitation, resulting in water scarcity, crop failure, and ecosystem stress. Both flood and drought can also be exacerbated by factors like deforestation, urbanization, and climate change.

5. Four waterborne diseases and their symptoms are:

- Cholera: Symptoms include severe Diarrhoea, vomiting, and dehydration.
- Typhoid fever: Symptoms include high fever, weakness, stomach pain, and headache.
- Dysentery: Symptoms include bloody Diarrhoea, abdominal cramps, and fever.
- Giardiasis: Symptoms include Diarrhoea, abdominal cramps, bloating, and fatigue.

F. Short answer type questions

1. In human blood, water makes up about 90% of its volume, while in fish, water content varies widely depending on the species, but it can range from 40% to 80%.

2. Two major sources of natural water are rainfall and groundwater recharge. For surface water, the two major sources are rivers and lakes. For underground water, the two major sources are aquifers and springs.

3. (a) The source of water containing the highest concentration of salt is the ocean.

(b) Spring water is often pure enough for drinking because it comes from underground sources and is naturally filtered through layers of soil and

rock. However, it may contain dissolved minerals that could interfere with laboratory experiments or analyses.

4. Floods can benefit farmers by replenishing soil moisture, recharging groundwater reserves, and depositing nutrient-rich sediment onto farmland. Floodwaters can also remove salts from soil and control pests and weeds.

5.Four benefits of water include:

- Supporting life: Water is essential for the survival of all living organisms.
- Agriculture: Water is crucial for irrigating crops and sustaining agricultural productivity.
- Hygiene and sanitation: Water is vital for personal hygiene, sanitation, and preventing the spread of diseases.
- Industrial and economic activities: Water is used in various industrial processes, energy production, transportation, and recreation, contributing to economic development and human well-being.

G. Long answer type questions

1. Groundwater refers to the water found beneath the Earth's surface in saturated zones of soil and rock formations called aquifers. It originates from precipitation that infiltrates the ground and percolates downward until it reaches the water table, where the soil and rock are saturated with water. Groundwater plays a crucial role in supplying water for drinking, irrigation, and industrial purposes and sustains streams, wetlands, and ecosystems through baseflow discharge.

2. The water table is the upper boundary of the zone of saturation in an aquifer, where the soil or rock is completely filled with water. It represents the level below which all available spaces in the soil or rock are filled with water. The depth of the water table fluctuates seasonally and in response to changes in precipitation, evaporation, and groundwater withdrawal.

3. The water cycle, also known as the hydrological cycle, describes the continuous movement and exchange of water between the Earth's surface, atmosphere, and subsurface. It involves processes such as evaporation from oceans, lakes, and rivers; condensation to form clouds; precipitation in the form of rain, snow, sleet, or hail; runoff into streams and rivers; infiltration into the ground; groundwater flow; and transpiration from plants. The water cycle is driven by solar energy and plays a crucial role in regulating Earth's climate, weather patterns, and distribution of freshwater resources.

4. **(a)** **Solute**: A solute is a substance that is dissolved in a solvent to form a solution. It is typically present in smaller quantities than the solvent and can be a solid, liquid, or gas.

   (b) **Solvent**: A solvent is a substance capable of dissolving other substances (solute) to form a homogeneous mixture (solution). Water is a common solvent in many natural and industrial processes.

   (c) **Solution**: A solution is a homogeneous mixture composed of a solvent and one or more solutes, where the solutes are uniformly dispersed at the molecular level throughout the solvent.

   (d) **Saturated solution**: A saturated solution is a solution in which the solvent has dissolved the maximum amount of solute possible at a given temperature and pressure, resulting in equilibrium between dissolved and undissolved solute.

   (e) **Aqueous solution:** An aqueous solution is a solution in which water is the solvent, meaning that water molecules surround and solvate the dissolved solutes.

5. **(a)** **Sterilization**: Sterilization is the process of eliminating or killing all forms of microbial life, including bacteria, viruses, fungi, and spores, from a surface, medium, or object to render it free from viable microorganisms**.**

   (b) **Sedimentation**: Sedimentation is the process by which solid particles settle out of a liquid suspension due to gravity, forming a sediment layer at the bottom of a container or body of water.

   (c) **Loading**: Loading refers to the accumulation or introduction of substances (such as pollutants, nutrients, or sediments) into a body of water, soil, or ecosystem, often leading to environmental degradation or ecological imbalance.

   (d) **Aeration**: Aeration is the process of introducing air or oxygen into water, soil, or another medium to improve oxygen levels, promote biological activity, and remove dissolved gases such as carbon dioxide or hydrogen sulfide.

Application based questions

1. Aquatic plants and animals have adapted to survive in colder regions by various means, such as developing antifreeze compounds or adjusting their

metabolism to cope with low temperatures. Some aquatic organisms may also hibernate or migrate to warmer areas during extreme cold periods.

2. Ice floats on water because it is less dense than liquid water. When water freezes, its molecules form a crystal lattice structure with open spaces, causing ice to be less dense than liquid water. As a result, ice floats on the surface of water bodies, such as lakes, rivers, and oceans. This property of ice is crucial for the survival of aquatic life during winter months, as it insulates the water below, preventing it from freezing solid and allowing organisms to survive in the liquid water beneath the ice.

Multi disciplinary questions

1. The statement is true. Water availability per person in India is indeed declining due to various factors such as population growth, urbanization, industrialization, and inefficient water management practices. These factors lead to increased water demand and stress on water resources, resulting in declining per capita water availability.

2. Human interference and changes in climate can disrupt and destabilize ecosystems rather than maintaining them. While some human interventions may aim to conserve or restore ecosystems, such as habitat restoration projects or conservation efforts, many human activities, such as deforestation, pollution, habitat destruction, and climate change, have negative impacts on ecosystems. These disturbances can lead to loss of biodiversity, ecosystem degradation, and disruption of ecological balance, making it difficult for ecosystems to thrive or maintain themselves without further intervention.

Play and Learn

Students do it yourself

Stem Project

Students do it yourself

Image based questions

Students do it yourself

Values and life skills

1. Pinky insisted on passing the sewage water through an electrode-filled tunnel because this method utilizes electrocoagulation, a process in which electric current is used to remove contaminants from water. The high potential difference maintained by the metallic electrodes causes ions and particles in the sewage water to coagulate and settle out, leading to the purification of the water. Additionally, the process can generate hydrogen gas, which can be used for various purposes, and the sludge produced can be used as manure for agricultural fields. Therefore, Pinky's idea not only addresses the sewage disposal problem but also provides a solution for water purification and resource recycling.

2. The attitude of Pinky and her friends reflects several values:

- Environmental consciousness
- Problem-solving skills
- Resourcefulness
- Community engagement

Chapter-6

Matter

Intext Questions (Page No. 87)

1. Examples:

(a) Living matter: 1. Plants (e.g., trees, flowers) 2. Animals (e.g., mammals, birds)

(b) Non-living matter: 1. Rocks (e.g., granite, limestone) 2. Metals (e.g., iron, copper)

2. Natural and man-made matter:

- Natural matter: Coal, wood, silk, cotton
- Man-made matter: Nylon, cellulose, medicines, plastic

3. Properties of solids:

- Definite shape: Solids have a fixed shape and volume.
- High density: Solids are generally denser than liquids and gases.
- Incompressibility: Solids are difficult to compress due to the close arrangement of particles.
- Rigidity: Solids are rigid and maintain their shape unless subjected to external forces.

4. Properties of liquids:

- Indefinite shape: Liquids have a fixed volume but take the shape of their container.
- Moderate density: Liquids are denser than gases but less dense than solids.
- Incompressibility: Liquids are relatively incompressible, similar to solids.
- Flow: Liquids flow and can be poured, allowing them to take the shape of their container.

5. Cohesive force is the attractive force between molecules of the same substance. It is responsible for the tendency of molecules within a substance to stick together and form drops or beads. Cohesive forces are particularly strong in liquids such as water, where water molecules are attracted to each other due to hydrogen bonding. This cohesion gives water its surface tension and allows it to form droplets.

Exercise Corner

A. MCQs

1. (d) Juice
2. (c) Solid
3. (a) Increase in temperature of water
4. (b) Gas
5. (a) evaporation

B. Fill in the Blanks

1. Everything, living or non-living, is part of the **universe**.
2. **Inanimate** organism do not exhibit any form of life.
3. Cement is a **non-living** matter.
4. Solid is very difficult to **compress**.
5. **Gases** have no definite shape.

C. State True Or False

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

D. Very short answer type questions

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

2. Density is a measure of how much mass is contained in a given volume of a substance. It is typically expressed as mass per unit volume.

3. You smell a flower from a distance because aromatic molecules released by the flower travel through the air and reach your nose, where they are detected by olfactory receptors, allowing you to perceive the scent.

4. The three states of matter (solid, liquid, gas) all consist of particles (atoms, molecules, or ions) that are in constant motion.

5. Latent heat of vaporization is the amount of heat energy required to change a unit mass of a substance from liquid to vapor phase at constant temperature and pressure, without a change in temperature.

E. Short answer type questions

1. Characteristics of matter include:

- Occupies space: Matter has volume and takes up space.
- Has mass: Matter has mass, which is a measure of the amount of substance present.
- Exhibits inertia: Matter resists changes in motion and tends to maintain its state of rest or uniform motion in a straight line.
- Can exist in different states: Matter can exist as solid, liquid, or gas, depending on the arrangement and motion of its particles.
- Consists of particles: Matter is composed of tiny particles such as atoms, molecules, or ions.

2. Difference between gas and vapor:

- Gas: A gas is a state of matter that has no definite shape or volume and fills the entire space available to it. It exists above its critical temperature.
- Vapor: Vapor refers to the gaseous state of a substance that is normally in the liquid or solid state at room temperature and pressure. It is formed by evaporation or sublimation.

3. Differences between boiling and evaporation:

- Boiling occurs throughout the bulk of the liquid and at a specific temperature called the boiling point, while evaporation occurs only at the surface of the liquid and can occur at any temperature.
- Boiling is a rapid process and produces bubbles of vapor within the liquid, while evaporation is a slower process and involves the gradual escape of molecules from the liquid surface.

4. A gas exerts pressure on the walls of the container due to the constant and random motion of its particles. When gas particles collide with the walls of the container, they exert a force on the walls, resulting in pressure. The pressure exerted by a gas is due to the momentum transfer from the gas particles to the walls of the container during collisions.

5. No, the evaporation of a liquid does not occur only at a fixed temperature. Evaporation can occur at any temperature below the boiling point of the liquid. However, the rate of evaporation increases with an increase in temperature because higher temperatures provide more energy for the liquid molecules to overcome the attractive forces holding them in the liquid phase and escape into the vapor phase.

F. Long answer type questions

1. Properties of gas:

- No definite shape or volume: Gases expand to fill the entire space available to them and take the shape of their container.
- Compressibility: Gases can be compressed or squeezed into a smaller volume under pressure.
- Low density: Gases have low density compared to solids and liquids because their particles are spaced far apart.
- High mobility: Gas particles move rapidly and randomly in all directions, resulting in high mobility and diffusion.

2. Differences between solid, liquid, and gas:

- Solid: Solids have a definite shape and volume, with particles tightly packed together in a regular arrangement. They have strong intermolecular forces and low mobility of particles.
- Liquid: Liquids have a definite volume but take the shape of their container. They have moderate intermolecular forces, allowing particles to move past each other but still remain close together.
- Gas: Gases have neither a definite shape nor volume and fill the entire space available to them. They have weak intermolecular forces and high mobility of particles.

3. **(a)** **Naphthalene balls disappear with time without leaving any solid:** This phenomenon is due to sublimation, where the naphthalene balls transition directly from the solid phase to the vapor phase without passing through the liquid phase. Sublimation occurs because the vapor pressure of naphthalene is high enough at room temperature to allow particles from the solid phase to escape into the vapor phase.

(b) **We can get the smell of perfume sitting several meters away:** The smell of perfume reaches our nose from a distance due to diffusion. Perfume molecules are volatile and diffuse in the air, spreading outwards from the source of the perfume. Over time, the perfume molecules spread and mix with the surrounding air, reaching our nose even at a considerable distance.

4. **(a)** **Sublimation:** Sublimation is the process in which a substance transitions directly from the solid phase to the vapor phase without passing through the liquid phase. It occurs when the vapor pressure of the substance exceeds atmospheric pressure at a given temperature.

(b) **Boiling point:** The boiling point of a substance is the temperature at which its vapor pressure equals the atmospheric pressure, causing bubbles of vapor to form throughout the liquid and allowing it to change into the gaseous phase.

(c) **Condensation point:** The condensation point is the temperature at which a substance transitions from the gaseous phase to the liquid phase through condensation, where vapor molecules lose energy and come together to form a liquid.

(d) **Vapour:** Vapour refers to the gaseous phase of a substance that is normally in the liquid or solid phase at room temperature and pressure. It can be formed by evaporation, sublimation, or boiling.

G. Application based questions

1. The water droplets collected on the outer surface of a glass container containing ice are the result of condensation. When warm, humid air comes into contact with the cold surface of the glass containing ice, it cools down. As the air temperature decreases, its ability to hold moisture decreases, leading to condensation. The water vapor present in the air condenses into liquid water droplets on the cold surface of the glass, forming the water droplets you observe. This phenomenon occurs because the surface of the glass is colder than the dew point temperature of the surrounding air, causing the water vapor to change from the gaseous phase to the liquid phase.

2. Pressure and temperature are two critical factors that determine the state (solid, liquid, gas) of a substance. The relationship between pressure and temperature can be explained using the phase diagram of a substance.

- Phase diagram: A phase diagram is a graphical representation that shows the phases (solid, liquid, gas) of a substance under different combinations of pressure and temperature. It typically consists of regions representing different phases separated by lines indicating phase boundaries.
- Triple point: The triple point on a phase diagram represents the unique combination of pressure and temperature at which all three phases of a substance (solid, liquid, gas) coexist in equilibrium.

- Phase boundaries: Phase boundaries on a phase diagram separate regions representing different phases of a substance. For example, the boundary between the solid and liquid phases is called the melting curve, while the boundary between the liquid and gas phases is called the vaporization curve.
- Effect of pressure: Increasing pressure tends to favour the denser phase of a substance. For example, increasing pressure can cause a substance to change from the gas phase to the liquid phase (condensation) or from the liquid phase to the solid phase (freezing). Decreasing pressure can have the opposite effect, causing a substance to change from the solid phase to the liquid phase (melting) or from the liquid phase to the gas phase (vaporization).
- Effect of temperature: Increasing temperature tends to favour the less dense phase of a substance. For example, increasing temperature can cause a substance to change from the solid phase to the liquid phase (melting) or from the liquid phase to the gas phase (vaporization). Decreasing temperature can have the opposite effect, causing a substance to change from the gas phase to the liquid phase (condensation) or from the liquid phase to the solid phase (freezing).

Experiential Learning questions

1. Liquid and gas behave like fluids because they both flow and take the shape of their containers. This behaviour is due to the relatively weak intermolecular forces present in both liquids and gases, which allow their particles to move past each other with relative ease.

In liquids, the intermolecular forces are strong enough to keep the particles close together but not rigidly fixed in place. As a result, the particles can slide past each other, allowing liquids to flow and take the shape of their containers. This behaviour is exemplified by substances like water or oil.

In gases, the intermolecular forces are even weaker, and the particles are much more spread out compared to liquids. Gas particles move freely and rapidly in all directions, colliding with each other and the walls of their container. This constant motion and collision of gas particles allow gases to fill the entire volume of their container and exert pressure on its walls.

Therefore, both liquids and gases exhibit fluid behaviour because their particles can move and flow in response to external forces, allowing them to take the shape of their containers and flow from one place to another.

Multi- disciplinary questions

1. When a drop of Dettol is added to water, the process that occurs is called diffusion. Diffusion is the movement of molecules from an area of higher concentration to an area of lower concentration, resulting in the mixing or spreading out of substances. In this case, the molecules of Dettol in the drop spread out in the water until they are evenly distributed, leading to the characteristic smell and disinfecting properties of Dettol throughout the water.

2. Substance 'A' is likely to be a gas. Gases have high compressibility and can be easily liquefied under the right conditions of temperature and pressure. They also take the shape of any container they are placed in, as they have neither a definite shape nor volume.

Two properties of gases:

- High compressibility: Gases can be compressed or squeezed into a smaller volume under pressure due to the large spaces between their particles.
- Conform to the shape of their container: Gases fill the entire volume of their container and take its shape, as their particles are free to move and spread out.

Play and Learn

Students do it yourself

Stem Projects

Students do it yourself

Image based questions

Do it yourself

Value and Life Skills

1. The pungent smell filling the laboratory was due to the release of ammonia gas from the spilled bottle. Ammonia (NH_3) is a highly soluble and volatile compound with a strong, unpleasant odour. When the bottle spilled, the ammonia gas began to diffuse and spread throughout the laboratory, filling the air with its odour.

Opening the windows and doors and switching on the exhaust fans were essential actions taken by the students to address the situation. By doing so, they increased ventilation and airflow within the laboratory, allowing the ammonia gas to dissipate more quickly. Ventilation helps to dilute the concentration of ammonia in the air by replacing the contaminated air with fresh air from outside. The exhaust fans also aid in removing the contaminated air from the laboratory, helping to reduce the concentration of ammonia indoors.

Over time, with increased ventilation and airflow, the concentration of ammonia in the laboratory decreases, and the pungent smell dissipates. This process provides relief to the students and restores a safe and comfortable environment in the laboratory.

2. The actions taken by the students demonstrate their commitment to safety and their ability to respond effectively to an emergency situation. By promptly opening the windows and doors and activating the exhaust fans, the students prioritized the well-being of themselves and their peers by minimizing exposure to harmful fumes. This action reflects the value of responsibility, as the students took proactive measures to mitigate the potential risks associated with the ammonia spill and ensure the safety of everyone in the laboratory.

Chapter-7

Pure Substances and Separation of Mixture

Intext questions (Page No. 98)

1. A pure substance is a substance that consists of only one type of particle and has consistent chemical composition throughout. It cannot be separated into simpler substances by physical means and retains its characteristic properties.

2. Segregation of substances:

- Pure substances: (a) Distilled water (f) Diamond
- Mixtures: (b) Curd (c) Ice cream (d) Cooking oil (e) Solder wire

3. Classification of substances:

- Homogeneous mixtures: (a) Soda water (d) Air
- Heterogeneous mixtures: (b) Wood (c) Soil

4. Differences between mixture and compound:

- Composition:
  - Mixture: A mixture is composed of two or more substances that are physically combined and can be separated by physical means.
  - Compound: A compound is composed of two or more elements chemically combined in fixed proportions and cannot be separated by physical means.
- Properties:
  - Mixture: The properties of a mixture are the sum of the properties of its individual components, and the components retain their original properties.
  - Compound: Compounds have properties that are different from those of their constituent elements.
- Separation:
  - Mixture: Mixtures can be separated into their individual components by physical methods such as filtration, distillation, or chromatography.

- Compound: Compounds cannot be separated into their constituent elements by physical means but require chemical methods such as chemical reactions.

- Examples:
  - Mixture: Examples of mixtures include air, seawater, and sand.
  - Compound: Examples of compounds include water (H2O), carbon dioxide (CO2), and sodium chloride (NaCl).

Intext Questions (Page No. 103)

1. To separate husk or dirt particles from a given sample of pulses before cooking, you can use the method of winnowing. In winnowing, the mixture of pulses and husk/dirt particles is poured from a height in front of a gentle breeze or fan. The lighter husk or dirt particles are carried away by the wind, leaving behind the heavier pulses, which can then be collected.

2. Sugar can be separated from wheat flour by the method of sieving. Sieving involves passing the mixture of sugar and wheat flour through a sieve or mesh with fine holes. The smaller particles of sugar pass through the sieve and are collected, while the larger particles of wheat flour remain on top of the sieve.

3. Cashew nut factories typically use mechanical methods such as sorting and grading to separate cashew nuts from their shells. Machines are employed to crack open the shells and separate the kernels from the shells based on size, shape, and quality. This process involves a combination of sieving, air blowing, and gravity separation techniques.

4. Alum is used in loading to cause coagulation of suspended impurities in water, making them settle down rapidly. In the context of water treatment, loading refers to the addition of a small amount of alum (aluminium sulfate) to water to clarify it by removing suspended particles, turbidity, and colloidal matter. The alum forms a gel-like precipitate with the impurities, which settles at the bottom of the container, allowing clear water to be decanted or filtered off.

5. Decantation is the process of separating a liquid mixture from solid particles or another liquid by carefully pouring off the liquid phase while leaving the solid or less dense liquid behind. Decantation is commonly used to separate a clear liquid from a precipitate or sediment that has settled at the bottom of a container. It is a simple and effective method for separating insoluble solids from liquids or immiscible liquids from each other.

Exercise Corner

A. MCQs

1. (d) all of these
2. (c) both (a) and (b)
3. (c) sieving
4. (b) evaporation
5. (c) filtration

B. Fill in the Blanks

1. Components retain their properties in a **mixture**.
2. Compounds have **fixed** melting points.
3. Sugarcane juice is a mixture of **sucrose**, water and many other substances.
4. Separation of components is done to obtain a **pure** substance.
5. Boiling point of pure water is **higher** than that of impure water.

C. State True Or False

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

D. Match the Following

(a) Hand picking → (iii) Separating larger-size impurities (b) Winnowing → (v) Separation by wind or by blowing air (c) Sieving → (ii) Separating bran from flour (d) Evaporation → (iv) Conversion of water into its vapour (e) Condensation → (i) Conversion of water vapour into liquids

E. Very short answer type questions

1. A mixture is a combination of two or more substances that are not chemically bonded and can be separated by physical means.
2. The method used to separate husk from wheat is winnowing.
3. The drawback of evaporation is that it is a slow process, especially for separating components from large volumes of solutions, and it requires a significant amount of time.

4. Homogeneous mixtures, such as solutions, can be separated by evaporation.

5. To obtain pure salt from rock salt, you can dissolve the rock salt in water to form a saturated solution. Then, carefully heat the solution to evaporate the water, leaving behind the pure salt crystals. These salt crystals can be collected and dried to obtain pure salt.

F. Short answer questions

1. Examples of mixtures: (a) Solid – Solid: Alloy (e.g., brass, bronze) (b) Solid – Liquid: Saltwater, sugar dissolved in water (c) Liquid – Gas: Air (oxygen and nitrogen in gas phase), carbonated beverages (carbon dioxide gas dissolved in liquid)

2. Composition and use: (a) Brass: Composition - Copper and zinc; Use - Brass is used in various applications such as making musical instruments, decorative items, and plumbing fittings. (b) Bronze: Composition - Copper and tin; Use - Bronze is used in making statues, sculptures, bells, and bearings due to its strength, durability, and resistance to corrosion. (c) Solder: Composition - Typically a mixture of lead and tin; Use - Solder is used for joining metals together, particularly in electronics, plumbing, and metalwork.

3. Characteristics of mixture:

- Mixtures consist of two or more substances physically combined together.
- The components of a mixture can be separated by physical means such as filtration, distillation, or chromatography.
- Mixtures do not have a fixed composition and can vary in proportions.
- The properties of a mixture are the sum of the properties of its individual components.

4. The opposite process of condensation is evaporation. Evaporation is the process by which a liquid changes into its gaseous state at temperatures below its boiling point, while condensation is the process by which a gas changes into its liquid state.

5. Pure water can be separated from a solution by the process of distillation. In distillation, the solution is heated to its boiling point, and the vapor is then cooled and condensed back into a liquid form. The condensed liquid is collected separately from the remaining solution, resulting in the separation of pure water from the other components of the solution.

G. Long answer type questions

1. (a) Sodium: Element

- Sodium (Na) is a pure substance consisting of only one type of atom, making it an element.

(b) Soil: Mixture

- Soil is a heterogeneous mixture composed of various substances such as minerals, organic matter, water, air, and living organisms. It does not have a fixed composition and can vary widely in its constituents.

(c) Sugar solution: Homogeneous mixture

- A sugar solution is a homogeneous mixture composed of sugar (sucrose) dissolved in water. It has a uniform composition and properties throughout, making it a homogeneous mixture. However, if the sugar is completely chemically dissolved in water, it forms a compound (sucrose) dissolved in a solvent (water).

(d) Silver: Element

- Silver (Ag) is a pure substance consisting of only one type of atom, making it an element.

(e) Calcium carbonate: Compound

- Calcium carbonate ($CaCO_3$) is a compound composed of calcium, carbon, and oxygen atoms chemically bonded in fixed proportions. It is a pure substance with a specific chemical formula, making it a compound.

2.
Differences between mixture and compound:

1. Composition:
    - Mixture: A mixture is composed of two or more substances physically combined together, with variable composition. The components of a mixture retain their individual properties and can be present in any proportion.
    - Compound: A compound is composed of two or more elements chemically bonded together in fixed proportions. The components of a compound are chemically combined, forming new substances with unique properties. Compounds have a specific chemical formula indicating the ratio of atoms of each element present.
2. Separation:

- Mixture: Components of a mixture can be separated by physical methods such as filtration, distillation, chromatography, or evaporation. These methods exploit differences in physical properties such as solubility, boiling point, or particle size to separate the components.
- Compound: Components of a compound cannot be separated by physical methods. Compounds can only be broken down into their constituent elements by chemical means, such as through chemical reactions.

3. Properties:
    - Mixture: Properties of a mixture are the sum of the properties of its individual components. Mixtures do not have unique properties but rather exhibit a range of properties depending on the composition and proportion of their components.
    - Compound: Compounds have unique properties distinct from their constituent elements. The properties of a compound are different from those of the elements that make it up. For example, water (H2O) has different properties from hydrogen (H_2) and oxygen (O_2), its constituent elements.
4. Formation:
    - Mixture: Mixtures are formed by the physical mixing of substances without any chemical reaction occurring. The components of a mixture can be separated back into their original substances without undergoing any chemical change.
    - Compound: Compounds are formed by chemical reactions between elements. Chemical reactions involve the rearrangement of atoms to form new chemical bonds, resulting in the formation of entirely new substances with different properties from the original elements. Once formed, compounds cannot be easily broken down into their constituent elements without chemical reactions.

3. (a) Alloy: An alloy is a homogeneous mixture of two or more metals, or a metal and a non-metal. Alloys are typically formed to enhance the properties of the individual metals, such as strength, hardness, corrosion resistance, or appearance. Common examples of alloys include brass (copper and zinc), bronze (copper and tin), and steel (iron and carbon).

(b) Homogeneous mixture: A homogeneous mixture, also known as a solution, is a mixture with uniform composition and properties throughout. In a homogeneous mixture, the components are evenly distributed at a molecular level, resulting in a single phase. This means that the mixture appears uniform and cannot be visibly distinguished into its individual components. Examples of homogeneous mixtures include salt dissolved in water, sugar dissolved in tea, and air.

(c) Impure substance: An impure substance is a substance that contains other substances mixed in with it. It may consist of a pure substance mixed with other materials or contain multiple substances. Impurities can alter the properties of the substance and may affect its intended use or application. Impure substances are commonly encountered in everyday life and may require purification or separation to obtain the desired pure substance. Examples of impure substances include impure metals, contaminated water, and mixed chemicals.

(d) Solution: A solution is a homogeneous mixture composed of two or more substances, where one substance (the solute) is dissolved in another substance (the solvent). The solute particles are uniformly dispersed and cannot be easily separated by filtration. Solutions can be in any state of matter, such as solid solutions (e.g., alloys), liquid solutions (e.g., saltwater), or gaseous solutions (e.g., air). Solutions play a crucial role in various processes and applications, including chemistry, biology, industry, and everyday life.

(e) Solute: A solute is a substance that is dissolved in a solvent to form a solution. The solute is present in lesser quantity compared to the solvent. Solute particles are typically of molecular or ionic nature and are dispersed uniformly throughout the solvent. The solute may be a solid, liquid, or gas, depending on the state of the resulting solution. Examples of solutes include salt in saltwater, sugar in tea, and carbon dioxide in soda.

(f) Solvent: A solvent is a substance that dissolves a solute to form a solution. The solvent is present in greater quantity compared to the solute. Solvents are usually liquids, but they can also be gases or solids under certain conditions. Solvents have the ability to dissolve a wide range of solutes due to their polarity or non-polarity, making them essential in various processes such as cleaning, extraction, and chemical reactions. Examples of solvents include water, alcohol, acetone, and hexane.

4. The properties of the components used for separating each of the following mixtures are as follows:

(a) Salt and Camphor:

- Property used: Solubility in a solvent
- Method: Dissolution and filtration
- Explanation: Salt is soluble in water, while camphor is insoluble. By adding water to the mixture, salt will dissolve, but camphor will remain as solid particles. Filtration is then used to separate the insoluble camphor from the soluble salt solution.

(b) Wheat and husk:

- Property used: Difference in density or particle size
- Method: Winnowing
- Explanation: Husk is lighter and less dense than wheat grains. When the mixture of wheat and husk is agitated or tossed in the air, the lighter husk particles are blown away by the wind or air currents, while the heavier wheat grains fall back down, allowing for the separation of husk from wheat.

(c) Iron fillings and sulphur:

- Property used: Difference in magnetic properties
- Method: Magnetic separation
- Explanation: Iron fillings are attracted to magnets and can be easily separated using a magnet. When a magnet is brought close to the mixture of iron fillings and sulphur, the iron fillings are attracted to the magnet and cling to it, allowing for their separation from the non-magnetic sulphur particles.

5.

We need to separate different components of a mixture for several reasons, primarily to obtain pure substances for specific applications and to remove impurities or unwanted substances. Here are two examples illustrating the importance of separating components of mixtures:

1. Obtaining Pure Substances: One of the primary reasons for separating components of a mixture is to obtain pure substances for various applications. Pure substances have uniform composition and properties, making them suitable for specific uses in industry, research, and everyday life. Some examples include:
    - Distillation of alcoholic beverages: Distillation is used to separate the components of alcoholic beverages such as wine, beer, and spirits to obtain pure ethanol (alcohol). During distillation, the mixture is heated, and the vapor is condensed back into liquid form, resulting in the separation of ethanol from water and other impurities.
    - Purification of salt from seawater: Seawater contains various dissolved salts and impurities. Evaporation is used to separate water from salt in seawater, leaving behind pure salt crystals. The purified salt can then be used for various purposes, including cooking, food preservation, and industrial applications.
2. Removal of Impurities: Another important reason for separating components of a mixture is to remove impurities or unwanted substances that may affect the properties or quality of the mixture. Removing impurities improves the purity and usability of the mixture for its intended purpose. Some examples include:

- Filtration of drinking water: Filtration is used to remove suspended particles, sediment, and microorganisms from drinking water to make it safe for consumption. Water treatment plants use various filtration techniques such as sand filtration, activated carbon filtration, and membrane filtration to remove impurities and provide clean, potable water to communities.
- Extraction of metals from ores: Ores extracted from the earth often contain metals along with impurities such as rock, soil, and other minerals. Metallurgical processes such as crushing, grinding, and flotation are used to separate the metal-bearing minerals from the gangue (unwanted materials). Further refining processes such as smelting and electrolysis are then employed to extract pure metals from the ore concentrates.

H. Application based questions

1. Your mother can remove pieces of wheat grains from a large quantity of flour quickly by using a simple method known as sieving. Sieving involves passing the flour through a sieve or mesh with small holes that allow fine particles of flour to pass through while retaining larger pieces of wheat grains. Here's how she can do it:

- Take a large quantity of flour in a bowl or container.
- Place a sieve or mesh over another container or a clean surface.
- Pour the flour onto the sieve in small batches.
- Gently shake or tap the sieve to allow the fine flour particles to pass through the mesh, while the larger pieces of wheat grains remain on top of the sieve.
- Collect the separated wheat grains from the sieve and repeat the process until all the flour has been sieved.
- Dispose of the separated wheat grains or use them for other purposes.

2. Alloys are used in various everyday applications due to their unique properties and advantages over pure metals. Some common uses of alloys include:

- Stainless steel: Stainless steel is an alloy of iron, chromium, nickel, and other elements. It is widely used in kitchen appliances, cookware, utensils, and cutlery due to its corrosion resistance, durability, and aesthetic appeal.
- Brass: Brass is an alloy of copper and zinc. It is used in plumbing fixtures, electrical components, decorative items, musical instruments (e.g., brass instruments), and hardware due to its malleability, acoustic properties, and attractive appearance.

- Bronze: Bronze is an alloy of copper and tin, with additional elements such as aluminium, silicon, or manganese. It is used in statues, sculptures, bells, bearings, and decorative items due to its strength, durability, and resistance to corrosion.
- Solder: Solder is an alloy of lead and tin, sometimes with other metals such as silver or copper. It is used in electronics, plumbing, metalwork, and jewellery making for joining or bonding metal components together due to its low melting point, good electrical conductivity, and mechanical properties.
- Aluminium alloys: Aluminium alloys are used in automotive parts, aircraft components, construction materials, and consumer products due to their lightweight, strength, and corrosion resistance. Examples include aluminium -silicon alloys, aluminium -magnesium alloys, and aluminium -lithium alloys.

Multi-disciplinary question

To separate acetone from the saltwater solution, a technique called distillation can be employed. Distillation is a method used to separate components of a mixture based on differences in their boiling points. Here's how the distillation process can be used to recover acetone from the saltwater solution:

1. Set up a distillation apparatus: The distillation apparatus typically consists of a round-bottom flask containing the saltwater solution, a distillation flask or receiver to collect the distillate, a condenser to cool and condense the vapors, and a heat source such as a Bunsen burner or hot plate.
2. Heat the mixture: Apply heat to the round-bottom flask containing the saltwater solution. As the solution heats up, acetone, being volatile with a lower boiling point than water (56°C compared to 100°C for water), will vaporize first.
3. Collect the distillate: The acetone vapor rises through the distillation apparatus and enters the condenser, where it is cooled and condenses back into a liquid. The condensed acetone, now in liquid form, is collected in the distillation flask or receiver.
4. Leave behind the residue: Since salt does not vaporize under normal distillation conditions, it remains behind in the round-bottom flask as the acetone is distilled off. The saltwater solution becomes more concentrated with salt as distillation progresses.
5. Monitor the temperature: During distillation, it's important to monitor the temperature carefully. Acetone boils at 56°C, so the temperature should not exceed this value to prevent boiling off water. Once most of the acetone has been distilled off, the temperature will start to rise, indicating that primarily water is left in the flask.

6. Repeat if necessary: Depending on the initial concentration of acetone in the solution, it may be necessary to repeat the distillation process multiple times to recover as much acetone as possible.

By employing distillation, the acetone can be separated from the saltwater solution, allowing for its recovery and reuse. The choice of distillation is justified because acetone has a significantly lower boiling point than water, making it possible to vaporize and collect it separately from the saltwater solution.

Play and Learn
Students do it yourself

Stem Project
Students do it yourself

Image based questions
Students do it yourself

Value and Life Skills

1. The sublimation process didn't succeed in separating sulphur completely from sand because sublimation is a process where a substance transitions directly from a solid to a gas phase without passing through the liquid phase. Sulphur undergoes sublimation at a relatively low temperature, allowing it to sublime while leaving behind non-sublimable impurities like sand. However, if the impure sample contains a significant amount of sand mixed with sulphur, it can hinder the sublimation process by physically blocking the sublimation of sulphur particles. This prevents the complete separation of sulphur from sand.

2. The value-based information associated with this situation revolves around the importance of perseverance, experimentation, and problem-solving skills. Despite facing initial failure in achieving the desired purification using sublimation, the student's attempt reflects a proactive attitude towards problem-solving. It encourages the student to analyze the situation, learn from the unsuccessful attempt, and explore alternative methods or adjustments to achieve the desired outcome. This experience fosters resilience, adaptability, and a growth mindset, which are valuable qualities in both academic and real-life scenarios.