Lesson 1.3 Pure Substance and Mixtures

Classification of Matter

- Matter may be **classified according to their state or phase.** - **three states of matter are solid, liquid, and gas.**
    - **Solid** - are rigid and have a definite shape
    - **Liquid** - have a definite volume but no definite shape
    - **Gases** - have no definite shape and volume
- Matter may be **classified according to their properties.** - are characteristics that a certain material possesses which makes it unique.
    - **Physical Properties** - characteristics that are observable even without changing the composition of matter
    - **Chemical Properties** - matter also possesses characteristics that can only be observed once a material undergoes a chemical reaction
- Matter may be **classified according to their composition.** - all matter is composed of tiny particles called atoms
    - **Substances** - have a fixed or definite composition
    - **Mixtures** - are combinations of two or more substances

Pure Substance

Pure Substance - is a kind of matter with a definite or fixed composition.

- are made up of atoms, they can be composed of a specific type of atom or combination of atoms
- also has definite physical and chemical properties such as appearance, melting point, and reactivity
- it will always have the same properties because it is made up of one type of particle
- are classified into elements and compounds
    - **Elements** - made up of one kind of atom, or two or more of the same kind of atoms that are chemically combined
    - **Compounds** - made up of different kinds of atoms that are combined through a chemical reaction

Elements

Elements - are the simplest substances because they are made up of only one kind of atom.

- cannot be decomposed into simpler substances by physical or chemical means but can be broken down into simpler forms **using extensive chemical or nuclear processes**
- Since elements are the simplest forms of substance, they are also considered as the building blocks of matter. This is because when elements react with one another, a new substance in the form of a compound is formed.

- **Periodic Table of Elements** - have 118 elements known to exist in which 94 of these occur naturally on Earth, while the remaining 24 are synthetic.
    - is a useful tool that can help in identifying elements that exhibit similar properties.
    - the table classifies the elements into three general categories: **metals, nonmetals, and metalloids.**

- the components of a heterogeneous mixture can be distinguished from each other.
- heterogeneous mixtures can be classified as **suspensions or colloids.**
  - ➢ **Colloids** - are heterogeneous mixtures with particles that are bigger than those of a solution but smaller than those of a suspension
    - their particles do not settle even after being left to stand for a long time. This is the reason why colloidal particles can exhibit **Tyndall effect,** a phenomenon wherein light is scattered.
  - ➢ **Suspensions** - are heterogeneous mixtures with suspended particles that are large enough to be seen by the naked eye.
    - due to the size of the particles of a suspension, they are greatly affected by gravity, causing them to settle at the bottom of the container.
    - for instance, a can of pineapple juice needs to be shaken well before drinking so that its pulp will mix well with the juice before drinking

📌 **Remember**
To easily distinguish the types of mixtures, always refer to the uniformity of its appearance. Homogeneous mixtures have a uniform appearance, while heterogeneous mixtures are not uniform in terms of its appearance.

Lesson 1.4 Elements and Compounds

Pure substances - are kinds of matter that have a definite or fixed composition. This means that it is either made up of only one kind of atom or group of atoms (or molecules) that are chemically combined.

- can be classified as elements or compounds

Element is the simplest form of pure substance since it is made up of only one kind of atom.

- any substance that cannot be decomposed into simpler substances by ordinary chemical processes
- Example: Copper, Iron, Nickel
- **ninety elements** are found in nature in significant amounts. They are found either chemically free, such as the oxygen gas in the atmosphere, or combined with other elements to form compounds. For example, hydrogen atoms and oxygen atoms form bonds to make up water.
- **eight elements** that exist in nature but only in trace amounts since they are radioactively unstable.
- there are **18 heavier elements** (also radioactively unstable) that were produced through nuclear physics experiments.

Compound is composed of two or more different kinds of atoms that are chemically bonded.

Mixtures - compounds that are physically combined produce another kind of matter

- Canola and olive oil both contain a high amount of **oleic acid** $(C_{18}H_{34}O_2)$

Cleaning Products

Cleaning products are chemical products that are used to remove dirt on hard surfaces.

It has a water-soluble compound that is made from **saponification** or a reaction between caustic soda **(sodium hydroxide, NaOH)** or caustic potash **(potassium hydroxide, KOH)** and animal or vegetable oils. Soap has surfactants that separate the oil from the skin and suspend the dirt in the water while rinsing off.

Detergents - are made from petroleum-based products and some heavy soaps that are made from **lead, zinc**, or other **heavy-metal compounds** that are mainly used in lubricating greases.

- Other common compounds that are used in detergents are **sodium carbonate** $(NaHCO_3)$, **sodium borate** $(Na[B_4O_5(OH)_4].\ 8H_2O)$, and **sodium triphosphate** $(Na_5P_3O_{10})$.

Dishwashing soaps contain sodium carbonate, which is effective in removing greases.

Bleach is a chemical product that is also used to remove stains in clothes.

- **Liquid bleach** is a diluted **sodium hypochlorite (NaClO) solution.**

Maintenance Products

Lubricants are **oils** that are used to reduce the friction on surfaces of objects that are in contact.

Paints are pigmented liquids that are used to color or protect the surface of an object.

- The main compounds that are present in most paints are **ethyl acetate** $(C_4H_8O_2)$, **toluene** (C_7H_8), **butyl acetate** $(CH_3COO(CH_2)_2CH_3)$, and **barium sulfate** $(BASO_4)$.

Unit 2: Separating Mixtures

Lesson 2.1 Homogeneous and Heterogeneous Mixtures

As you recall from the previous unit, there are two classifications for matter based on composition and properties—a **pure substance or a mixture.**

- **Pure substance** - cannot be further broken down or purified by physical means. Each substance has its own characteristic properties that are different from the set of properties of any other substance.
- **Mixtures** - are combinations of two or more pure substances in which each substance retains its own composition and properties.
  - can be classified based on the distribution of the components. It can be classified as a **homogeneous mixture or a heterogeneous mixture.**
    - ➢ **Homogeneous Mixture** - is a type of mixture that has uniform composition and properties.
      - their components are spread out evenly all throughout.
      - it has only one phase; thus, the components cannot be distinguished from each other.
      - are also called **solutions.**
      - Fruit juice, coins and soda are some examples
    - ➢ **Heterogeneous Mixture** - its components are distinguishable from one another, with each portion having recognizably different properties
      - Its not uniform throughout
      - Has varying composition and properties
      - It may have two or more phases, and the individual substance are visually distinct.
      - Candies, oil and water, soup are some examples