**IDX G9 CHEMISTRY N STUDY GUIDE ISSUE 1**

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**Chapter 1: Introduction to Chemistry**

*(The term "chemistry" is derived from "alchemy”)*

Chemistry is defined as *the study of the composition of matter and the changes it undergoes.*

Matter: anything that has mass and occupies space.

Composition: the chemical identity of a substance.

Changes in matter: physical or chemical changes.

**Areas of Chemistry Study**

* **Organic Chemistry:** Study of chemicals containing carbon (e.g., pharmaceuticals, plastics).
* **Inorganic Chemistry:** Study of chemicals that generally do not contain carbon (e.g., minerals, metals). (Exception is CO2 and CO, also inorganic)
* **Biochemistry:** Study of processes in living organisms (e.g., metabolism, fermentation).
* **Analytical Chemistry:** Focus on the composition of matter (e.g., food nutrients, quality control).
* **Physical Chemistry:** Deals with mechanisms, rates, and energy transfer during changes in matter (e.g., reaction rates).

**The Scientific Method**

**Observation 🡪 Hypothesis 🡪 Experiment 🡪 Conclusion 🡪 Result**

* **Independent Variable:** The variable that is changed.
* **Dependent Variable:** The variable that is measured.
* **Controlled Variables:** Factors kept constant during the experiment.
* **Control Group:** A group that does not receive the experimental treatment.

**Theory vs. Scientific Laws**

Theories can predict outcomes and are open to revision, while scientific laws summarize observed phenomena.

In other words, theories explain why something happens, and scientific laws state that the thing happens. The latter is a fact, but theories can be changed or improved. For example:

Theory: Apple fall from the tree due to the gravitational pull exerted from Earth.

Scientific Law: When released from a height objects would fall to the ground.

Observation data an either be Qualitative or Quantitative.

Qualitative: A light grey, hard, shiny material.

Quantitative: A substance with an electronegativity of 2.5.

Tip: During lab, scale readings should be expressed in the form of ± (unit of the last significant figure/2).

e.g. A reading of 1.14cm should be expressed as (1.14 ± 0.005)cm, as 0.04 is the last significant figure, and its unit is in 0.01, therefore half of it should be 0.005.

Remember to put a bracket around the n±m format, like (n±m)unit instead of n±m unit!

Tip: During lab, always read from the the bottom of the Meniscus of a beaker or graduated cylinder.

**Chapter 2: Matter and Change**

**Properties of Matter**

Properties are characteristics that help identify types of matter.

Physical properties can be observed without changing the substance.

Chemical properties can only be observed during a chemical change.

**Physical and Chemical Changes**

A physical change may change state of matter, but not composition.

e.g. H20 (*l*) 🡪 H20 (*g*)

A chemical change changes the composition of matter.

e.g. NH4 (*aq*) + NO2 (*aq*) 🡪 N2(*g*) + 2 H2O(*l*)

**The Law of Conservation of Mass**

This law states that matter cannot be created or destroyed in a chemical reaction. (mreactant = mproduct)

**Mixtures**

A mixture is a physical blend of two or more components.

Mixtures can be homogeneous (uniform composition) or heterogeneous (non-uniform composition).

Separation techniques include filtration, distillation, and crystallization.

**Elements and Compounds**

Elements are pure substances made of one type of atom, while compounds consist of two or more elements chemically combined. Compounds can be broken down into simpler substances through chemical reactions.

Examples:

Mixture: Sand Water ( SiO2(*s*) + H2O(*l*) )

Element: Pure Oxygen Gas ( O2(*g*) )

Compound: Carbon Dioxide ( CO2(*g*) )

**Gas vs. Liquid vs. Solid**

Gas is shaped by its container and has no certain volume

Liquid is shaped by its container but has a certain volume

Solid has a certain shape and certain volume

**Filtration vs. Distillation vs. Crystallization**

Filtration: Utilizing particle mass difference to separate mixtures.

e.g. sand water 🡪 water(l) + sand(s)

Distillation: Using difference in boiling point to separate substances or mixtures.

e.g. alcoholic water 🡪 alcohol(g) + water (l)

Crystallization: Evaporating/Boiling a liquid to expose the solid solute.

e.g. salt water 🡪 water(g) + salt(s)

**The Magic Seven**

7 unique gas elements that exists naturally in diatomic pattern due to its tendency to form covalent bonds with the same element. (exist in forms of XX2)

H, N, O, F, Cl, Br, I

(easy way to remember: also forms a “7” shape on the periodic table, except for H)

**The Periodic Table**

The periodic table organizes elements by atomic number and groups them based on similar properties. Property of elements in one period change gradually and with pattern, while in same group elements have similar property.

Elements are classified as metals, nonmetals, or metalloids.

Metals are typically shiny and good conductors, and are typically solid in room temperature (except Hg-mercury)

Nonmetals are often dull and poor conductors, and are typically gas in room temperature (Br-bromine is liquid)

Metalloids have properties in between.