CHEMISTRY 20 - UNIT 1

REVIEW FROM SCIENCE 10: (Chapter 1)

A. Definition of Chemistry:

-study of the composition of substances and the changes they undergo.

-Types: Organic, Inorganic, Analytical, Physical, Biochemistry

B. Six stages of the Scientific Process:

1. Defining the Problem
2. Proposing Ideas - Background info., Hypothesis, Prediction
3. Designing Experiments
4. Observing & Measuring
5. Processing the Evidence/Data - charts, tables, graphs
6. Interpretation of Evidence/Data - conclusions, error, further study

NOTE: Theories vs. Laws

A theory explains the results and a law describes the results

C. Properties of Matter

1. Matter:
   - anything that takes up space & has mass. Light & Heat are NOT examples of Matter.
2. Mass: the amount of matter
3. Substance: matter with a uniform & definite composition
   a. Elements
   b. Compounds
4. Physical properties: condition that can be observed or measured.
5. States of matter:
   - Solid: definite shape & volume
   - Liquid: flows & has a fixed volume-takes the container's shape. Aqueous solutions are liquids that contain water.
   - Gas: takes the shape & volume of the container, expands & compresses easily. Vapor is a gas that is a liquid or solid at room temperature.

6. Mixtures: blend of two or more substrates

a. heterogenous: not uniform (cement)

b. homogenous: uniform solutions (salt water)

D. Atomic Structure

1. Dalton's Atomic Theory

a. All elements are composed of atoms

b. atoms of the same element are identical; atoms of one element are different from atoms of another element.

c. atoms of different elements combine to form compound

d. atoms can be separate, joined or rearranged by chemical reactions.

2. Structure of Atoms. Atoms are made up of:

- Electrons: small negatively charged particles found around the nucleus of the atom in distinct energy levels.
- Protons: positively charged particles found in the nucleus. The # of protons in an atom remains constant.
- Neutrons: particles with no charge found in the nucleus. Protons & neutrons make up most of the mass of the atom.

3. Definitions (Look at the examples on the board)

- Isotopes: atoms that have the same # of protons & electrons but different # of neutrons
- Atomic number: Number of protons in the atom

If an atom is neutral than the proton # = electron #

- Atomic mass: the average mass of all the isotopes
- Mass number: Number of protons + neutrons

E. Periodic Table (Write down information on the table handout)

- Columns (from left to right) are called Groups/Family
- Elements are grouped according to similar properties
- Rows (up and down) are called Periods
- Elements are arranged horizontally by increasing atomic #

1. Metals

Location: left side of the stair case

State: solid at room temperature except mercury(l)

Properties: conducts electricity, ductile(flexible),

Malleable(hammered) & has luster

Group names:

- Alkali metals (Group 1A) - soft & react with H_2O
- Alkaline earth metals (Group 2A)-light & form oxides
- Transition metals (All the Group B's) Include the rare earths/lanthanide(58-71), actinide(90-103) & synthetics (93 and up)

2. Nonmetals

Location: right side of the stair case

State: gases, brittle solids, & liquids (Br) at room temp

Properties: poor electric conductors, non-lustrous

Group names:

- Halogen gases (Group 7A)-reactive
- Noble gases (Group 8A)-inert gases, little activity

3. Metalloids or Semimetals

Location: on the stair case (B,Si,As,Te,At,Ge,Sb,Po)

State: solid at room temperature

Properties: have properties of both metals & nonmetals

F. Ions: Elements on the Periodic table that lose or gain electrons

1. Cations: lose electrons and are positively charged (metals)
2. Anions:gain electrons and are negatively charged(non-metal
3. Valence electrons: outermost electrons that are lost or gain
4. Electron energy levels (Look at the diagrams on the board)

1^{st} level & Period 1 on the Periodic table have up to 2e-

2^{nd} level & Period 2 have up to 8e-

3^{rd} level & Period 3 have up to 8e-

4^{th} level & Period 4 have up to 18e-

5^{th} level & Period 5 have up to 18e- etc.

G. Nomenclature: naming compounds(Look at examples on board)

1. Ionic compounds

- made up of metals(positive) and non metals(negative)
- the ionic bond is due to attraction of opposite charges
- conduct electricity & transfer electrons
- solid at room temperature

a. Binary ionic compounds

- Formula-metal appears first & charges must be neutral
- ***Naming***:metal's name+ non metal's name less end+ ide
  e.g. Ca^{2+} & Cl^- = $CaCl_2$ called *calcium chloride*

b. Multiple charges - include a Roman Number to represent the charge. e.g. *copper(II) sulfate*

c. Polyatomic ions - complex ions on Periodic table are considered one ion. e.g. $Na(NO_3)_{(s)}$ called *sodium nitrate*

Prefixes

mono, di, tri, tetra
penta, hexa, hepta
octa, nona, deca

d. Hydrated compounds - decompose at low temperatures to produce water & ionic compounds.

Naming: Ionic name + prefix + hydrate

e.g. $CuSO_4.H_2O$ is called *copper(II) sulfate monohydrate*

2. Acids: Ionic compounds that produce hydrogen ions(H+, H_3O+) when dissolved in water (aq)

a. If the ion ends in "ide" ---- hydro(anion root)ic acid
  e.g. hydrogen sulfide = hydrosulfuric acid

b. If the ion ends in "ite" ---- (anion root)ous acid
  e.g. hydrogen sulfite = sulfurous acid

c. If the ion ends in "ate" ---- (anion root)ic acid
  e.g. hydrogen sulfate = sulfuric acid

3. Molecular compounds

- composed of two or more non-metals who share e-
- have low melting and boiling points & are (s), (l) or (g)
- DO NOT use ionic charges; DO NOT lose or gain e-
- ***Naming***:prefix+1st element + prefix+2nd element root+ide
  NOTE: Do not use ~~mono~~ for first name
  e.g. $CO_{(g)}$ is called ~~mono~~carbon monoxide $CO_{2(g)}$, $P_4O_{10(g)}$
- COMMON NAMES:

$H_2O_{(s)(l)(g)}$=water; $O_{3(g)}$=ozone; $CH_{4(g)}$=methane (natural gas) ; $CH_3OH_{(l)}$=methanol $C_6H_{12}O_{6(s)}$=glucose; $C_{12}H_{22}O_{11(s)}$=sucrose; $NH_{3(g)}$=ammonia, H_2O_2=hydrogen peroxide; $C_2H_{6(g)}$= ethane; $C_2H_5OH_{(l)}$=ethanol; $C_2H_{4(g)}$ = ethene or ethylene; $C_2H_{2(g)}$ ethyne or acetylene; C_3H_8(g) = propane; C_6H_6(g) = benzene; C_4H_{10}(g) = butane; C_8H_{18}(l) = octane

- Diatomic molecules: N_2, O_2 F_2, Cl_2, Br_2, I_2, At_2, H_2
  . e.g. O_2=oxygen gas
- Polyatomic molecules: molecular compounds with many of the same element. e.g. S_8(sulfur) & P_4(phosphorous)