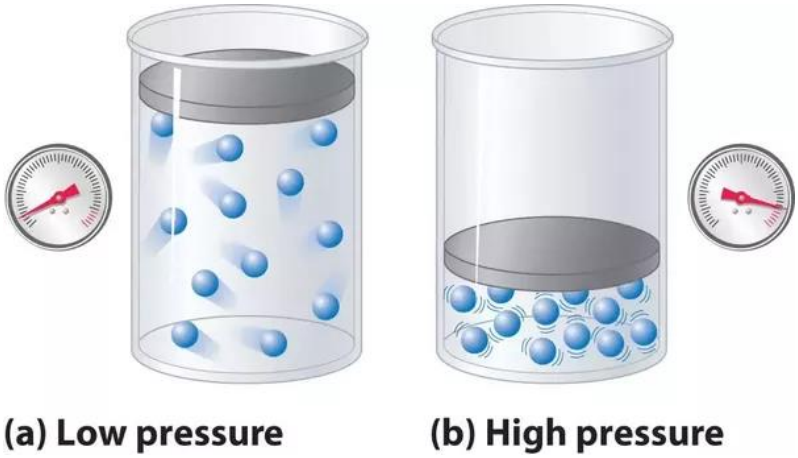
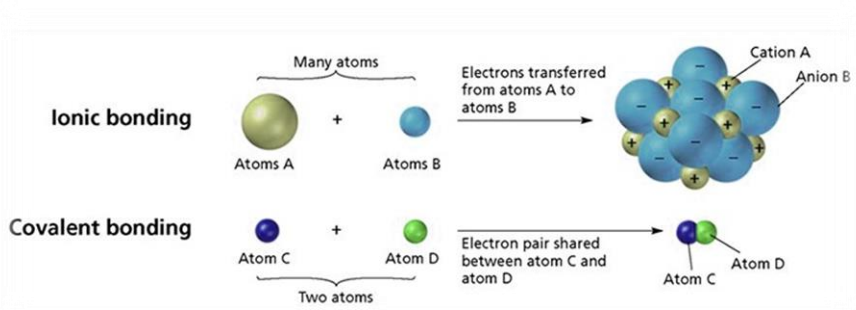
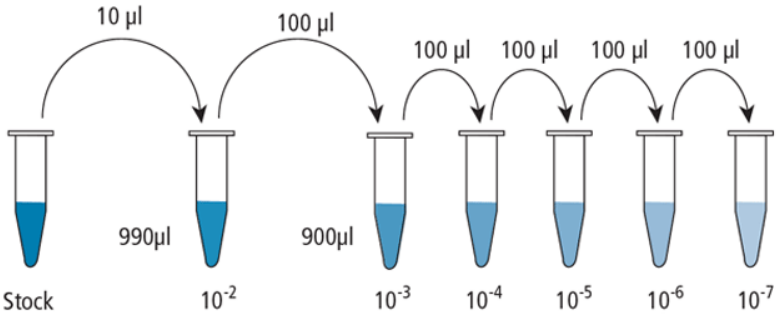






TOPIC NOTES FOR CHEM1201: GENERAL CHEMISTRY

Completed in 2016 with High Distinction

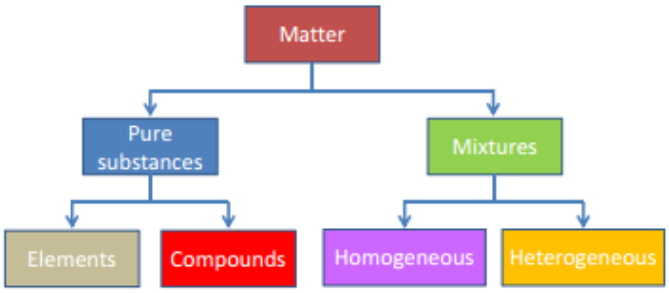
Contents

WK1: Introduction to Chemistry – (Dr. Susan Pyke)

Chemistry: the science that studies matter and its changes.

Matter: anything that with mass that occupies space, therefore everything comprised of chemicals.

In chemical reactions there are changes taking place, observable changes are macroscopic and occur to the properties of the chemical such as a change in its physical state, mass or colour. Changes to the bonding cannot be seen with the naked eye and therefore are microscopic.



WK1: Introduction to Matter - (Dr. Susan Pyke)

Pure substances: Consist of only one type of atom or molecule e.g. pure nitrogen gas or water

Elements: matter that is comprised of only one kind of atom.

Compounds: are comprised of atoms of more than one type which are present in fixed proportions e.g. CO_2 & H_2O

Mixtures: contain more than one compound or element and its components can be separated through physical means (e.g. distillation for two liquids or filtration for a liquid and a solid)

- Homogenous mixtures: have an even distribution of its components throughout the mixture e.g. milk
- Heterogeneous mixtures: an uneven distribution of its components e.g. oil & water

Physical Changes: a change to the physical state that does not alter the chemical composition e.g. freezing liquid water

Chemical changes: changes that occur on the atomic level whereby the chemical bonds are altered e.g. iron rusting

$$Density = \frac{mass}{volume} = \frac{gram}{cm^3} = \frac{gram}{ml} \qquad 1cm^3 = 1ml$$

e.g., 5grams of mercury fills a 4cm^3 vial ∴ density = $\frac{5}{4} = 1.25\ g/cm^3$

WK1: Atoms- (Dr. Susan Pyke)

Atoms include a central nucleus comprised of protons (positive) and neutrons (neutral) and orbiting electrons (negative).

Different types of elements are identified by their number of protons, called the atomic number (Z). The average mass of an atom is called its atomic mass.

Ions are atoms that lack a neutral charge as the number of protons ≠ number of electrons causing there to be either a positive (cation) or negative (anion) charge.

When writing chemical formulas generally the atoms with positive charges go first, followed by the negative valence atoms. E.g. H_2O ($H_2^{+2}O^{-2}$)

Groups go down, periods across

WK2: Moles - (Dr. Susan Pyke)

Transition metals are able to exhibit more than one valency for instance Fe^{2+} and Fe^{3+}.

The number of atoms can be measured in moles with each mole= 6.022×10^{23} (of whatever is being measured). This number is called Avogadro's number (N_A): the value is equal to the number of atoms in 12 grams of carbon-12.

Atomic mass: the average number of one mole of atoms in a given element.

Molar mass: the combined molar mass of all constitutes

Number of moles (n) = $\frac{mass\ (g)}{atomic\ mass\ (\frac{g}{mol})}$

Valencies or "charge on the most stable ion"

+1	+2	+3		-2	-1
Na^+	Mg^{2+}	Al^{3+}		O^{2-} (oxide)	Cl^- (chloride)
K^+	Ca^{2+}	Fe^{3+} (ferric)		S^{2-} (sulfide)	Br^- (bromide)
NH_4^+ (ammonium)	Zn^{2+}			CO_3^{2-} (carbonate)	I^- (iodide)
Ag^+	Cu^{2+}			SO_4^{2-} (sulfate)	OH^- (hydroxide)
H^+	Pb^{2+}				NO_3^- (nitrate)
	Fe^{2+} (ferrous)				HCO_3^- (bicarbonate)
					HSO_4^- (bisulfate)

Wk2: Molar Mass and Chemical Reactions– (Dr. Susan Pyke)

Molar mass can be calculated by identifying the atomic mass of each of the elements present in the chemical. The atomic mass of each element can then be multiplied by the number of appearance of the respective element. The resulting values can be added together which results in the total molar mass of the chemical.

E.g. the molar mass of $C_6H_{12}0_6$ atomic masses: C = 12.01 g/mol, H = 1.01 g/mol, & O = 16.00 g/mol

∴ Molar mass = (12.01 x6) + (1.01 x 12) + (16.00 x 6) = 180.18 g/mol

Elemental formulae

- Most elements are composed of single atoms (monoatomic), e.g. sodium is a highly reactive solid metal
- Some elements also exist as diatomic molecules e.g. chlorine (Cl_2) a coloured gas
- Two other elements that are not monoatomic (or diatomic) include sulfur (S_8) arranged in a ring, and phosphorus (P_4) arranged in a tetrahedral arrangement.

Elements that occur as diatomic molecules	
Hydrogen	H_2
Nitrogen	N_2
Oxygen	O_2
Fluorine	F_2
Chlorine	Cl_2
Bromine	Br_2
Iodine	I_2

In chemical equations, the chemicals are often divided into either reactants or products. Reactants refer to the species that react together (on the left) whereas products refer to the species that are formed from the reaction (on the right).

Chemical reactions do not create or destroy atoms they, merely involve the rearrangement of atoms, some bonds are broken, and new ones are formed. This also indicates that the mass of the reactants is equal to that of the products.

Symptoms of a chemical reaction occurring include:

- Solid formation
- Colour change
- Gas formation
- heat being produced or absorbed
- light being produced or absorbed
- sound being produced