

Unit 1: Matter & Qualitative Analysis

Text sections: 1.1 - 1.17
Pages 1 - 70

What Is Chemistry?

_____ is the study of the composition, structure, properties and transformations of matter.

_____ is defined as anything that has mass and takes up volume (space).

There are two types of chemistry:

Pure Chemistry	Applied Chemistry
- The _____ of principles of chemistry	- The _____ of chemistry for practical purposes (i.e. developing useful products)
- Involves the search for scientific knowledge	- Involves the use of scientific knowledge
- Involves the _____	- Involves the _____ method
<u>Areas of Study?</u> -Structure of Matter - Biochemistry of Blood -Types of Viruses	<u>Areas of Study?</u> -Atomic Energy - Medicines -Vaccines

Pure vs Applied Chemistry

Pure chemists study:

- Composition and structure of substances
- Properties of substances
- Conditions under which substances can be changed into new substances

Applied chemists use the knowledge gained by pure chemists to:

- Solve societal problems eg. diseases
- Improve standards of living eg. development of new materials: rubber, clothing, food

_____ refers to the use of basic scientific knowledge to develop useful products.

FIELDS OF	APPLIED CHEMISTRY
	- Study of soils, fertilizers, pesticides, herbicides
	- Effect of human activity on chemistry of air, land, water
	- Chemical composition of foods & food additives
	- Study of chemical compounds in marine life and sea water
	- Study of atomic nucleus
	- Study of processes and physical properties of living organisms

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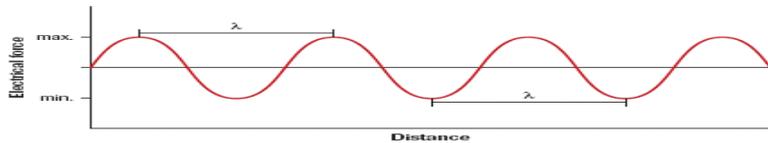
Observation, Inference & Empirical & Theoretical Knowledge

Term	Definition
	Determining the composition of a sample of matter from its physical and chemical properties Careers:
Observation	A statement based on your _____ senses (see, hear, touch, taste, and smell)
Inference	A _____ or _____ that is based on observations and/or conclusions from testing Example: "The ground is wet (Obs). It must have rained last night (I)"
Empirical Knowledge	Knowledge coming _____ from observations. Example: a thermometer placed in water that reads 100°C indicates water changing from liquid to gas
Theoretical Knowledge	Knowledge based on _____ that are created to explain observations. Example: Kinetic Molecular Theory is used to explain water changing from liquid to gas
Theory	An explanation of a _____ of observations
	A representation of a theoretical concept Example: A vibrating box that contains marble to demonstrate the kinetic molecular theory

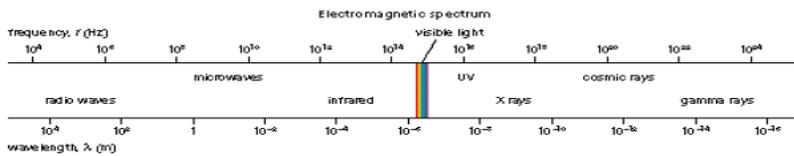
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The Electromagnetic Spectrum

A wave has maximum and minimum values called crests and troughs. The distance between 2 crests or 2 troughs is called the _____ (figure 1). Wavelength of visible light is usually measured in nanometers ($\text{nm} = 10^{-9}\text{m}$).



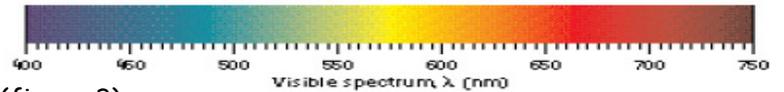
_____ : light energy that travels in the form of waves. The _____ of a light wave is the number of cycles that pass a point in one second. The electromagnetic spectrum consists of light waves of different frequencies and wavelengths (figure 2).



The electromagnetic spectrum encompasses an enormous range of wavelengths and energies. Waves in the X-ray range are 10^{11} times more energetic than waves in the radio range. The special band of light waves that the human eye can detect is called the _____ (400nm - 700nm).

The Electromagnetic Spectrum Cont'd

Term	Definition
	Uninterrupted pattern of colours that is observed when a narrow beam of white light passes through a prism Example: A rainbow
	Discontinuous spectrum that is produced when light emitted by an element is directed through a prism or a diffraction grating.



(figure 3)

Analyzing the spectrum of a sample is one way to distinguish between different types of matter.



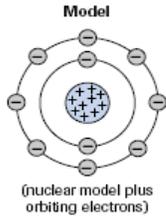
Figure 4
The line spectra produced by sodium (a) and helium (b)

(figure 4)

** An element's line spectrum is analogous to a human's fingerprint, therefore, using a spectroscope can identify the chemical composition of an unknown sample **

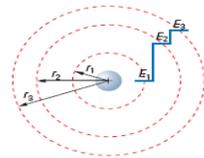
The Bohr Model of The Atom

In the Bohr model of the atom, electrons orbit the nucleus as the planets orbit the Sun. Only certain orbits are allowed, however, and an electron in each orbit has a specific energy.



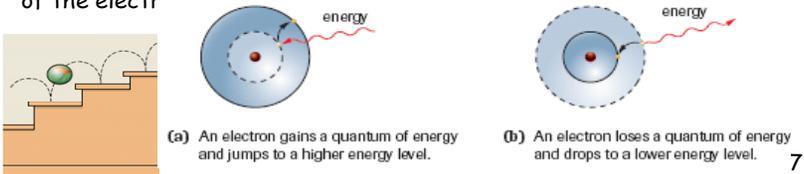
Bohr suggested that electrons revolve around the atom's nucleus in orbits of fixed energy. These orbits are similar to the fixed orbits of the planets as they revolve around the Sun.

The electrons are restricted to certain energy levels. Electrons must possess specific amounts "_____ " of energy at each energy level (figure 3)



When the hydrogen atom's electron falls back to its original position, it releases the same amount of energy it absorbed in order to reach the higher energy level. If the electron is found in the lowest possible energy level, it is said to be in its _____ (figures 4 and 5)

An electron dropping from a higher energy level to a lower energy level is like a ball bouncing down a staircase. The bottom stair = ground state of the electr



Conductivity & Ions

Term	Definition
	The ability of a substance to conduct electricity; a physical property

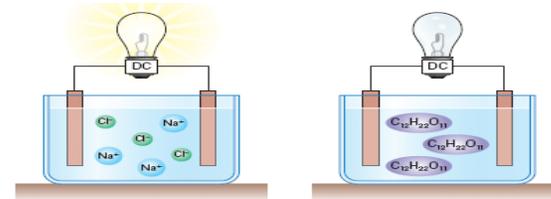
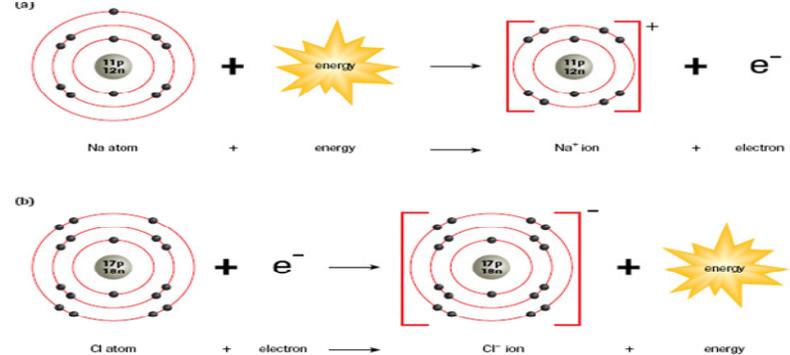


Figure 1: Electrolytes vs. non-electrolytes

The majority of elements on the face of the Earth exist as compounds. This is because elements desire to achieve a _____. In order to do this, elements gain and lose electrons to fill their _____ to 8.



Dot Diagrams & Ionic Compounds

Term	Definition
	A diagram showing both the chemical symbol and dots indicating the # of valence electrons

I							VIII
H·							He:
	II	III	IV	V	VI	VII	
Li·	Be·	B·	C·	N·	O·	F·	Ne:
Na·	Mg·	Al·	Si·	P·	S·	Cl·	Ar:
K·	Ca·						

** Review names of polyatomic ions p.33 Table 1**

Term	Definition
	Bonds that form between a metal and a non-metal due to an attraction between 2 oppositely charged ions
	A compound that consists of cations and anions held together by ionic bonds.
	The smallest amount of a substance having the composition given by its chemical formula
	Separate into positive and negative ions when placed in water

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Covalent Bonds

Term	Definition
Covalent Bond	Two non-metal atoms _____ one or more pairs of electrons between them. The shared electron pairs attracted to the nuclei of both atoms.
	Two or more atoms joined by covalent bonds
Lewis Structure	Representation of covalent bonding using Lewis diagrams with shared electron pairs shown as _____ and _____ shown as dots
	Pair of valence electrons that is not involved in bonding.

Read the SAMPLE PROBLEM p. 36 - 39 & Answer p. 39 # 1-4

Polarity & Bonding

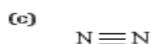
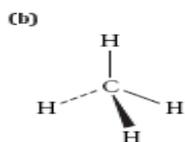
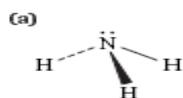
Term	Definition
	A measure of an atom's ability to attract a shared pair of electrons within a covalent bond.



Term	Definition
	Slightly positive end & slightly negative end
	No charged ends

Polarity of molecules depends on ____ characteristics:

1. The presence of polar covalent bonds
2. The three dimensional shape (geometry) of the molecule



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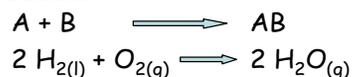
Intermolecular bonds

Type	Description	Example
(DDF)	Attraction that forms between the slightly positive end of one polar molecule and the slightly negative end of an adjacent polar molecule	
(LDF)	Attraction that forms between atoms of neighbouring molecules as a result of a temporary imbalance in the position of the atoms' electrons; can form between polar and non-polar molecules. BIG MOLECULES!	
(VWF)	Attraction between molecules: include DDF and LDF	

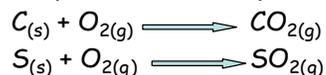
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Types of Reactions

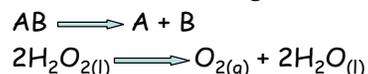
_____ = 2 or more little bits form a larger bit



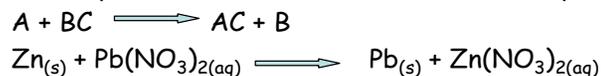
_____ = Elements combine rapidly with $\text{O}_2(\text{g})$ to form more complex molecules by burning



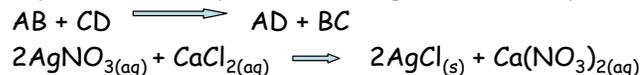
_____ = One big bit breaks into two or more bits



_____ = a reaction of an element with a compound to produce a new element and a new compound.



_____ = the anions and cations from the two compounds switch places, forming two new compounds.



Solubility Rules

- (a) Determine the products (if any) when a solution of sodium chloride is mixed with a solution of silver nitrate. If a reaction occurs, summarize the reaction as a balanced chemical equation.

Step 1: Identify Type of Reaction and Possible Products

Step 2: Look up Solubility of Both Products

Step 3: Indicates States of Reactants and Products

Step 4: Write Chemical Equation for Reaction

Step 5: Balance Equation

Total Ionic & Net Ionic Equations

Term	Definition
Net Ionic Equation	Equation that depicts _____ the ions that are involved in a chemical reaction
Total Ionic Equation	Equation that illustrates _____ soluble ionic compounds in their ionic form
Spectator Ion	An ion that is present during a chemical reaction but does _____ participate in the reaction.

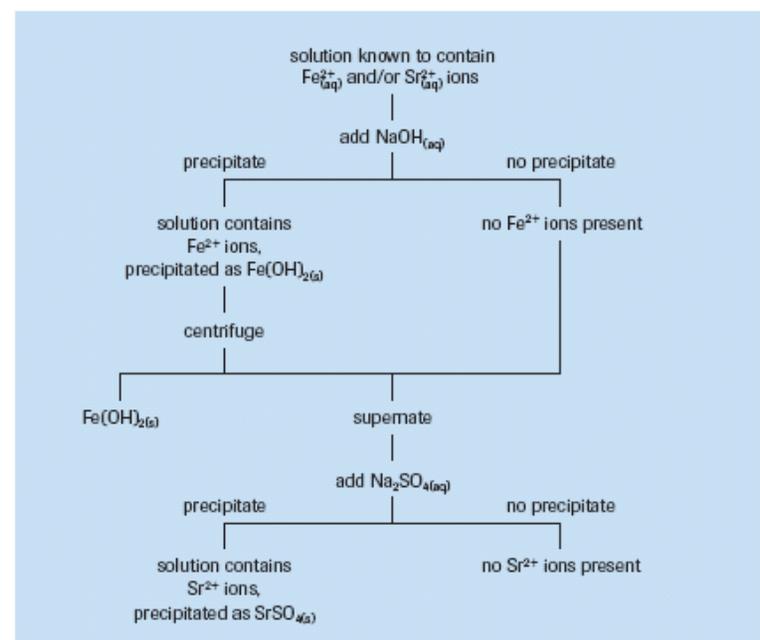
e.g. aqueous sodium chloride and aqueous lead (II) nitrate

- Write the double displacement reaction as a word equation
- Using the solubility rules, determine whether the products of the reaction have high or low solubility in water.
- Using this information, indicate the states of the reactants and products
- Write a chemical equation for the reaction.
- Balance the equation.
- Rewrite the equation, with all the ionic compounds that are soluble in water separated into their respective ions. Cancel identical amounts of identical ions that appear on both the reactant and product sides of the equation.
- Write the net ionic equation, reducing coefficients if necessary.

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Separating Ions

Term	Definition
	Lab equipment that spins solutions at very high speeds, to separate the different particles from each other based on their densities
	Part of a centrifuged solution that does not settle to the bottom of the centrifuge top



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