

## SCH 4U UNIT 1 - REVIEW

### Atomic Structure, Bonding, Moles and Stoichiometry

Students will be able to:

#### **Atomic Structure**

##### Objective 1

- define or identify what each of the following terms mean: observation, interpretation, scientific law, hypothesis, theory, model, empirical knowledge, negative results, scientific literature, intuition
- recognize some of the methods of the scientific approach to problem solving

##### Objective 2

- briefly explain how the atomic model developed/changed from Aristotle to the Quantum Mechanical view

##### Objective 3

- what is the difference between the Bohr-Rutherford model of the atom and the Quantum Mechanical model of the atom

##### Objective 4

- write out the electron configurations (eg  $1s^2 2s^2 2p^1$ ) for the first twenty elements and to be able to draw the 3-dimensional diagram for each of these elements

##### Objective 5

- list some properties (physical and chemical) of representative elements of various groups in the periodic table (vertical columns)

#### **Bonding**

##### Objective 6

- define ionic bond and explain the properties of substances that are held together by ionic bonds

##### Objective 7

- define covalent bond and explain the properties of molecular substances that are held together by covalent bonds

#### Objective 8

- identify the criteria that make a bond predominantly covalent or ionic

#### Objective 9

- define and explain the meaning of polar and non-polar covalent bonds and develop skill in using electronegativities to identify the type of covalent bond

#### Objective 10

- understand the meaning of the following: bonding capacity (valence), hybridization, hybrid orbital, polar molecules, non-polar molecules

#### Objective 11

- identify the bonding orbitals ( $sp$ ,  $sp_2$ ,  $sp_3$ , ...) and molecular shape (linear, planar triangular, tetrahedral, ...) for  $LiF$ ,  $BeF_2$ ,  $BF_3$ ,  $CF_4$ ,  $NF_3$ ,  $OF_2$  and  $F_2$ .

#### Objective 12

- identify the bonding orbitals ( $sp_3d$ ,  $sp_3d_2$ ) and molecular shape (trigonal pyramidal, octahedral, ...) for phosphorus (V) chloride and sulfur (VI) fluoride

#### Objective 13

- figure out the structural shape of simple molecules by means of the bonding theory learned in grade 11 chemistry, VSEPR (valence shell electron pair repulsion) and orbital hybridization theory

#### Objective 14

- use electronegativities along with the molecular shape to identify polar molecules

#### Objective 15

- draw Lewis dot diagrams including slightly positive and negative signs and using VSEPR theory, sketch the resulting ball and stick diagram of the molecule and state whether it is a polar or non-polar molecule

### **Moles and Solutions**

#### Objective 17

- understand the terms: solvent, solute, solution, solubility and concentration

#### Objective 18

- understand the terms: colligative property and vapour pressure and identify colligative properties of solutions

#### Objective 19

- solve problems involving mass, moles, molar masses and solution concentration

#### Objective 20

- calculate the amount of solid solute needed to prepare given volumes of solutions of desired concentrations (and vice versa for volume or concentration)

#### Objective 21

- calculate the amount of concentrated solution needed to prepare given volumes of more dilute solutions of desired concentrations and vice versa ( $C_cV_c = C_dV_d$ )

### **Gas Laws**

#### Objective 22

- use Boyle's and Charles' (and their combination) gas laws qualitatively and quantitatively

#### Objective 23

- use Dalton's gas laws qualitatively and quantitatively

#### Objective 24

- use the ideal gas law ( $PV = nRT$ ) quantitatively

### **Stoichiometry**

#### Objective 28

- understand how to determine mole ratios from a balanced chemical equation and calculate mole-mole stoichiometry relationships from these chemical equations

#### Objective 29

- calculate mole-mass stoichiometry relationships from balanced chemical equations

#### Objective 30

- calculate mass-mass stoichiometry relationships from balanced chemical equations

#### Objective 31

- calculate gas volume-volume stoichiometry ( $PV = nRT$ ) relationships from chemical equations

Objective 32

- calculate mass-gas volume stoichiometry relationships from chemical equations

Objective 33

- calculate solution stoichiometry ( mass-concentration, volume-concentration) relationships from chemical equations

Objective 34

- calculate stoichiometry relationships of all types in limiting reactant problems