Unit 3 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chemical Equations Date \_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_

& Stoichiometry

Unit 3A - Moles

### Knowledge/Understanding Goals:

* moles, molar mass

### Skills:

1. determine the molar mass of any compound

### Notes:

The Mole

mole (working definition): the number of grams of a substance that is equal to:

1. its atomic weight (for an element)
2. its molecular weight (for a molecular compound)
3. its formula weight (for an ionic compound)

Remember, the mole is just a conversion factor. You can have 1 mole of anything just like you can have a dozen of anything. It all depends on what you are trying to quantify…

1 mole = 6.02214179(30) × 1023 atoms, molecules, particles, formula units, *etc.*

Moles are useful because:

* An equal number of moles contain an equal number of molecules/atoms/formula units/ions.
  + Remember, reactions occur molecule to molecule, not gram to gram, so we need to know the number of particles involved in a reaction to make predictions
* Any proportion that exists for molecules/formula units/ions is the same for moles

Remember the trick for converting between molecules, moles, and grams?

Molar Mass

The molar mass of a compound is the mass of one mole of that compound.

* Molar mass is the sum of the molar masses of the atoms that make up the compound.

For example, the molar mass of ZnCl2 is the molar mass of:

* Zn (65.41 g)
* plus 2 times the molar mass of Cl (35.45 g × 2 = 70.90 g)
* which adds up to 136.31 g/mol.

\*\*\*Notice its good practice to carry over decimals for molar mass to the hundredths place\*\*\*

This molar mass value is in itself a ratio (g/mol) and therefore can be used as a conversion factor.

* 136.31 g ZnCl2 = 1 mol ZnCl2 or (136.31 g / 1 mol)

If you have a hydrate (a compound that attracts and absorbs water) the molar mass includes the water bound to the hydrate. For example, the molar mass of iron (III) chloride hexahydrate (FeCl3∙6 H2O) is the molar mass of:



Mole Calculations

Remember that you can calculate the number of moles in several different ways:

1. If you are working with a solid of known mass (g), use molar mass (g/mol) as a conversion factor:

Suppose you have 30.0 g of NaCl:



1. If the substance is a gas, use *PV*= *n*R*T*:

Suppose P = 1.10 atm, V = 25.0 L, and T = 298 K:



1. If you are working with a solution of known volume (L), use the concentration (mol/L) as a conversion factor:

Suppose you have 125 mL of a 2.25*M*  solution:



***\*\*\*Make sure your units match before trying to apply a conversion factor! Especially when dealing with a volume (mL vs L), pressure (atm vs bar), or temperature (⁰C vs K)\*\*\****