Quantities in Chemical Reactions:
Review

Date: _____

Balancing Equations

Basic concepts:

- Matter cannot be created nor destroyed (Law of Conservation of Matter)
- Balanced equations use COEFFICIENTS to show exactly how much reactant and product are involved in a reaction
- Never change SUBSCRIPTS of chemical formulas in order to balance an equation

Practice 1

a) ___ S_8 + ___ O_2 → ___ SO_3

b) ___ Al + ___ FeO → ___Al_2O_3 + ___ Fe

c) ___ $SiCl_4$ + ____ H_2O → ____H_4SiO_4 + ____HCl

d) ___ $Fe_2(SO_4)_3$ + ___ KOH → ____ K_2SO_4 + ____$Fe(OH)_3$

e) ___ Si_2H_3 + ___ O_2 → ____ SiO_2 + ____ H_2O_3

[ans: a) 1, 12, 8; b) 2, 3, 1, 3; c) 1, 4, 1, 4; d) 1, 6, 3, 2; e) 4, 17, 8, 6]

The Mole

Basic concepts:

- One mole is an amount equivalent to 6.02×10^{23} entities (atoms, molecules, or ANYTHING)
- The value 6.02×10^{23} is also known as Avogadro's number
- The mass of one mole of a substance is called its **MOLAR MASS**, and is expressed in grams/mole (g/mol). It is different for each element, and can be obtained from the atomic mass on the periodic table.
- Molar mass of a compound can be obtained by adding up the individual molar masses of its component atoms.

Practice 2

	Number of atoms	**Atomic mass** (with units)	**Molar mass** (with units)
a) H_2O	H=2 O=1	18.02 amu	18.02 g/mol
b) KNO_3			
c) C_3H_7OH			

Basic concepts:

- A molecule's molar mass can be used to convert between molar amounts and gram masses.

AMOUNT (moles) —*Conversion factor: Molar mass (g/mol)*→ MASS (grams)

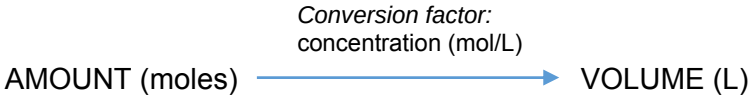
Practice 3

	Molar mass	**Mass**	**Amount**
a) PCl_5	208.24 g/mol		0.650 mol
b) $Al_2(SO_4)_3$	342.15 g/mol		1.007 mol
c) NaOH	40.00 g/mol	15.0 g	
d) Br_2	159.81 g/mol	2.20×10^2 g	
e) $MgCl_2$	95.21 g/mol	745 mg	

Molar Solutions

Basic concepts:

- Solute concentrations are usually expressed in moles of solute per litre of solution (mol/L = M)
- The molar concentration of a solution can be used to convert between molar amounts, and millilitre volumes.



Practice 4

	Concentration	Volume	Amount of solute	Mass of solute
a) $Mg(OH)_{2\,(aq)}$	1.58 mol/L	0.375 L		
b) $H_2CO_{3\,(aq)}$	2.00 mol/L		0.177 mol	
c) $NaF_{\,(aq)}$		220 mL		3.90 g
d) $H_2O_{2\,(aq)}$		375 mL	85 mmol	

Stoichiometry

Basic concepts:

- Coefficients in balanced equations reflect not only the molecular ratios between reactants and products, but also the **MOLAR RATIOS**.

Practice 5

a) $2\ Fe_2O_3 + 3C \rightarrow 4\ Fe + 3\ CO_2$

	Fe_2O_3	C	Fe	CO_2
Moles		12		
Mass				

b) $2\ Na_3PO_4 + 3\ MgCl_2 \rightarrow 6\ NaCl + Mg_3(PO_4)_2$

	Na_3PO_4	$MgCl_2$	NaCl	$Mg_3(PO_4)_2$
Moles			3	
Mass				

c) $N_2 + 3\ H_2 \rightarrow 2\ NH_3$

	N_2	H_2	NH_3
Moles		5.00	
Mass			

d) $2\ HNO_{3\,(aq)} + Ca(OH)_{2\,(aq)} \rightarrow Ca(NO_3)_{2\,(aq)} + 2\ H_2O_{\,(l)}$

	$HNO_{3\,(aq)}$	$Ca(OH)_{2\,(aq)}$	$Ca(NO_3)_{2\,(aq)}$	$H_2O_{\,(l)}$
Moles of solute				
Solution concentration	1.50 mol/L	1.25 mol/L	0.470 mol/L	N/A
Solution volume		0.250 L		N/A