

# 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)  $\_\_\_ \text{S}_8 + \_\_\_ \text{O}_2 \rightarrow \_\_\_ \text{SO}_3$
- b)  $\_\_\_ \text{Al} + \_\_\_ \text{FeO} \rightarrow \_\_\_ \text{Al}_2\text{O}_3 + \_\_\_ \text{Fe}$
- c)  $\_\_\_ \text{SiCl}_4 + \_\_\_ \text{H}_2\text{O} \rightarrow \_\_\_ \text{H}_4\text{SiO}_4 + \_\_\_ \text{HCl}$
- d)  $\_\_\_ \text{Fe}_2(\text{SO}_4)_3 + \_\_\_ \text{KOH} \rightarrow \_\_\_ \text{K}_2\text{SO}_4 + \_\_\_ \text{Fe}(\text{OH})_3$
- e)  $\_\_\_ \text{Si}_2\text{H}_3 + \_\_\_ \text{O}_2 \rightarrow \_\_\_ \text{SiO}_2 + \_\_\_ \text{H}_2\text{O}_3$

[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:

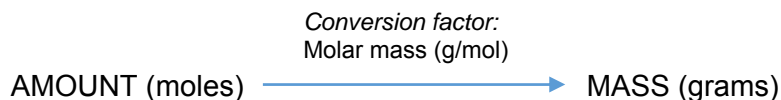
- One mole is an amount equivalent to  $6.02 \times 10^{23}$  entities (atoms, molecules, or ANYTHING)
- The value  $6.02 \times 10^{23}$  is also known as Avogadro's number
- The mass of one mole of a substance is called its **MOLAR MASS**, and is expressed in grams/mole (g/mol). It is different for 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 <sub>2</sub> O	H=2 O=1	18.02 amu	18.02 g/mol
b) KNO <sub>3</sub>	K=1 N=1 O=3	101.10 amu	101.10 g/mol
c) C <sub>3</sub> H <sub>7</sub> OH	C=3 H=8 O=1	60.09 amu	60.09 g/mol

### Basic concepts:

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



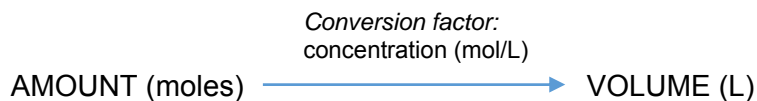
### Practice 3

	Molar mass	Mass	Amount
a) PCl <sub>5</sub>	208.24 g/mol	135 g	0.650 mol
b) Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	342.15 g/mol	344.5 g	1.007 mol
c) NaOH	40.00 g/mol	15.0 g	0.375 mol
d) Br <sub>2</sub>	159.81 g/mol	$2.20 \times 10^2$ g	1.38 mol
e) MgCl <sub>2</sub>	95.21 g/mol	745 mg	$7.82 \times 10^{-5}$ mol

## 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) <sub>2</sub> (aq)	1.58 mol/L	0.375 L	0.593 mol	34.6 g
b) H <sub>2</sub> CO <sub>3</sub> (aq)	2.00 mol/L	0.0885 L	0.177 mol	11.0 g
c) NaF (aq)	0.42 mol/L	220 mL	0.093 mol	3.90 g
d) H <sub>2</sub> O <sub>2</sub> (aq)	0.23 mol/L	375 mL	85 mmol	2.9 g

## Stoichiometry

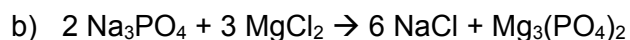
### Basic concepts:

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

### Practice 5



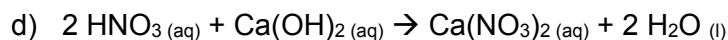
	Fe <sub>2</sub> O <sub>3</sub>	C	Fe	CO <sub>2</sub>
Moles	8	12	16	12
Mass	1277.52 g	144.00 g	893.44 g	528.12 g



	Na <sub>3</sub> PO <sub>4</sub>	MgCl <sub>2</sub>	NaCl	Mg <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
Moles	1	1.5	3	0.5
Mass	163.94 g	142.82 g	175.32 g	131.43 g



	N <sub>2</sub>	H <sub>2</sub>	NH <sub>3</sub>
Moles	1.67	5.00	3.33
Mass	46.8 g	10.1 g	56.7 g



	HNO <sub>3</sub> (aq)	Ca(OH) <sub>2</sub> (aq)	Ca(NO <sub>3</sub> ) <sub>2</sub> (aq)	H <sub>2</sub> O (l)
Moles of solute	0.626 mol	0.313 mol	0.313 mol	0.626 mol
Solution concentration	1.50 mol/L	1.25 mol/L	0.470 mol/L	N/A
Solution volume	0.417 L	0.250 L	0.667 L	N/A