7.1 MOLE RATIOS IN CHEMICAL EQUATIONS

WHAT IS A MOLE RATIO?

It is the ratio amounts of the entities in a chemical reaction.

ex. $H_{2(g)} + O_{2(g)} \rightarrow H_2O_{(g)}$

$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

2 : 1 : 2

The RATIO of the amount (in moles) of one chemical to another in a chemical equation

A Ratio Analogy

2 s'more Recipe Serves: _____

4 Graham cracker, Gc

8 Chocolate chip, Cc

2 Marshmallow, Mm

2 s'mores

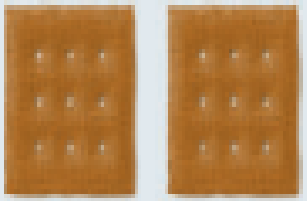
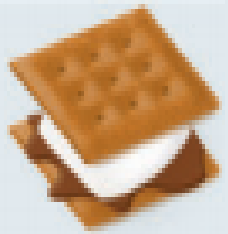
4 Gc + 8 Cc + 2 Mm → 2 Sm

A Ratio Analogy

4 Gc + 8 Cc + 2 Mm → 2 Sm

1. If you want to make 1 s'mores, how many cracker, chocolate chip and marshmallow do you need?

2. If you have 50 crackers, how many chocolate chip do you need?

2 Gc	+	4 Cc	+	Mm	→	Sm
Number of Gc entities 		Number of Cc entities 		Number of Mm entities		Number of Sm entities 
2		4		1		1
4		8		2		2
50		100		25		25
2000		4000		1000		1000
$2 \times 6.02 \times 10^{23} = 2$ mol		$4 \times 6.02 \times 10^{23} = 4$ mol		$1 \times 6.02 \times 10^{23} = 1$ mol		$1 \times 6.02 \times 10^{23} = 1$ mol

WHAT IS A MOLE RATIO?

ex. $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

2 moles : 1 moles : 2 moles

? : ? : 6 moles (3x)

6 moles : 3 moles

SCALE UP OR SCALE DOWN

Changing Moles

moles A to moles B

The Mole ratios are used as a conversion factor to change between substances

Stoichiometry: Moles to Moles

Template Problem:

If # mol of A reacts completely, how many moles of C is produced?

EXAMPLE 1: How many moles of hydrogen gas is produced when 5.2 mol of ammonia decomposes?

Step 1: Write a balanced chemical equation.

$$2\,NH_3(g) \rightarrow N_2(g) + 3\,H_2(g)$$

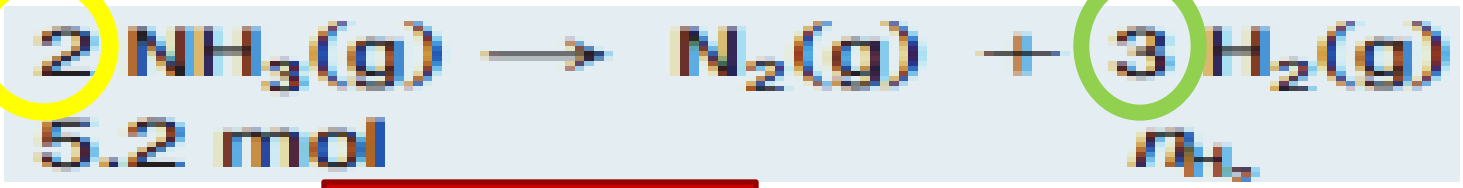
5.2 mol $\qquad$ n_{H_2}

Given: amount of ammonia, $n_{NH_3} = 5.2$ mol

Required amount of hydrogen, n_{H_2}

EXAMPLE 1: What amount of hydrogen is produced when 5.2 mol of ammonia decomposes?

Step 2: Convert amount of the given substance to amount of the required substance.



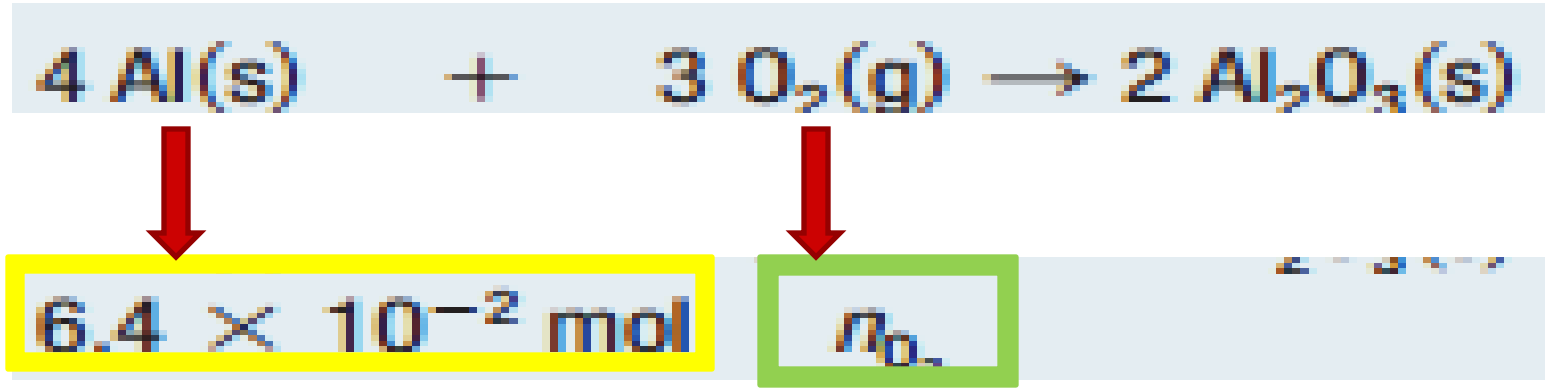
factor $\frac{3\ \text{mol}_{H_2}}{2\ \text{mol}_{NH_3}}$ as follows:

3 mol...

A mole ratio between X:Y tells you the relative amount of X and Y in a reaction. The coefficients (such as 3X and 4Y) come from the balanced chemical equation.

EXAMPLE 2: What amount of oxygen is required to react completely with 6.4×10^{-2} mol of aluminum to produce aluminum oxide?

Step 1: Write a balanced chemical equation.



Given: $n_{Al} = 6.4 \times 10^{-2}$ mol

Required amount of oxygen, n_{O_2}

EXAMPLE 2: What amount of oxygen is required to react completely with 6.4×10^{-2} mol of aluminum to produce aluminum oxide?

Step 2: Find the appropriate mole ratio and set up an equation. Then solve for x.

$$4\,Al(s) + 3\,O_2(g) \rightarrow 2\,Al_2O_3(s)$$
$$6.4 \times 10^{-2}\ mol \quad n_{O_2}$$

$$n_{O_2} = 6.4 \times 10^{-2}\ \text{mol}_{Al} \times \frac{3\ \text{mol}_{O_2}}{4\ \text{mol}_{Al}}$$

$$n_{O_2} = 4.8 \times 10^{-2}\ \text{mol}$$

Statement: 4.8×10^{-2} mol of oxygen is required to react completely with 6.4×10^{-2} mol of aluminum.

HOMEWORK:

Mole :mole ratio worksheet

Page 298 # 1-10

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