Name: Key
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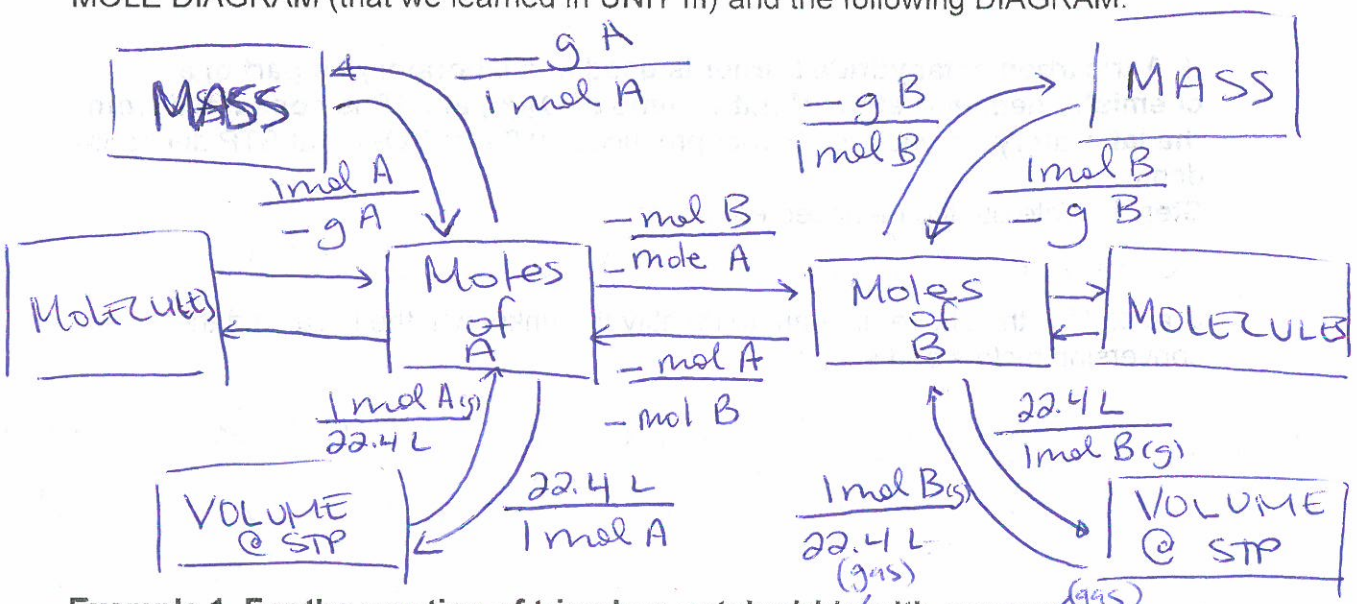
**Chemistry 11**
**STOICHIOMETRY Calculations Involving MOLES, MASS, GAS VOLUME AND MOLECULES**

The balanced equation gives rise to CONVERSION FACTORS that are sometimes referred to as the MOLE BRIDGE.

The mole bridge is the ratio which allows us to make connections between the MOLE DIAGRAM (that we learned in UNIT III) and the following DIAGRAM:




**Example 1. For the reaction of tricarbon octahydride with oxygen:**
**a. What mass of $CO_2$ is produced by reacting 2.00 mol of $O_2$ (g)?**
**Step 1**. Write out the balanced equation:

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(\ell)$$

**Step 2**. Use the above diagram to identify the unknown, the initial and the conversion factors and solve:

1 C = 12.0
2 O = 32.0
44.0 g

$$2.00 \text{ mol } O_2 \times \frac{3 \text{ mol } CO_2}{5 \text{ mol } O_2} \times \frac{44.0 \text{ g } CO_2}{1 \text{ mol } CO_2} = \boxed{52.8 \text{ g } CO_2}$$

**b. What mass of $C_3H_8$ is required to produce 100.0 grams of $H_2O$?**
**Step 1**. Write out the balanced equation:

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(\ell)$$

**Step 2**. Use the above diagram to identify the unknown, the initial and the conversion factors and solve:

2 H = 2.0
1 O = 16.0
18.0

$$100.0 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.0 \text{ g } H_2O} \times \frac{1 \text{ mol } C_3H_8}{4 \text{ mol } H_2O} \times \frac{44.0 \text{ g } C_3H_8}{1 \text{ mol } C_3H_8} = \boxed{61.1 \text{ g } C_3H_8}$$

**c. If a sample of tricarbon octahydride is burned, what mass of $H_2O$ (l) is produced if the reaction also produces 50.0 L of $CO_2$ at STP?**

**Step 1**. Write out the balanced equation:

$C_3H_{8(g)} + \underline{5}\, O_{2(g)} \longrightarrow \underline{3}\, CO_{2(g)} + \underline{4}\, H_2O_{(\ell)}$

**Step 2**. Use the above diagram to identify the unknown, the initial and the conversion factors and solve:

$$50.0\,L\,CO_{2(g)} \times \frac{1\,mol\,CO_2}{22.4\,L} \times \frac{4\,mol\,H_2O}{3\,mol\,CO_2} \times \frac{18.0\,g\,H_2O}{1\,mol\,H_2O} = 53.6\,g\,H_2O$$

**d. A tricarbon octahydride burner is used in a laboratory as part of a chemistry demonstration. What volume of $O_2$ (g) at STP is consumed from the laboratory** air when the burner produces 10.0 L of $CO_2$ (g) at STP during the demo?

**Step 1**. Write out the balanced equation:

$C_3H_{8(g)} + 5\,O_{2(g)} \longrightarrow 3\,CO_{2(g)} + \underline{4}\, H_2O_{(\ell)}$

**Step 2**. Use the above diagram to identify the unknown, the initial and the conversion factors and solve:

$$10.0\,L\,CO_2 \times \frac{1\,mol\,CO_2}{22.4\,L\,CO_2} \times \frac{5\,mol\,O_2}{3\,mol\,CO_2} \times \frac{22.4\,L\,O_2}{1\,mol\,O_2} = 16.7\,L\,O_{2(g)}$$

**e. A sample of porous, gas-bearing rock is crushed and $1.35 \times 10^{-6}$ grams of $CH_4$ (g) is extracted from the powdered rock. How many molecules of $CO_2$ (g) are produced if the gas sample is burned in the presence of $O_2$ (g)?**

**Step 1**. Write out the balanced equation:

$1C = 12.0$
$4H = 4.0$
$16.0$

$\underline{1}\, CH_{4(g)} + \underline{2}\, O_{2(g)} \longrightarrow \underline{1}\, CO_{2(g)} + \underline{2}\, H_2O_{(\ell)}$

**Step 2**. Use the above diagram to identify the unknown, the initial and the conversion factors and solve:

$$1.35 \times 10^{-6}\,g\,CH_4 \times \frac{1\,mol\,CH_4}{16.0\,g\,CH_4} \times \frac{1\,molecule\,CO_2}{1\,mol\,CH_4} \times \frac{6.02 \times 10^{23}\,m.c\,CO_2}{1\,mol\,CO_2} =$$

$5.08 \times 10^{16}$ m.c of $CO_2$