AP CHEMISTRY

TOPIC 2: STOICHIOMETRY, PART A

Day 13:

Stoichiometry (Basics)

Homework problems:

1) How many moles of oxygen are necessary to react completely with eight moles of propane (C_3H_8) to form carbon dioxide and water?

Answer:

$$\_\_\_\ C_3H_8 + \_5\_\ O_2 \rightarrow \_3\_\ CO_2 + \_4\_\ HOH$$

$$\frac{8\ mol\ C_3H_8}{} \times \frac{5\ mol\ O_2}{1\ mol\ C_3H_8} = 40\ mol\ O_2$$

2) ***Calculate the number of grams of potassium chloride that will be formed*** by the decomposition of 75 grams of potassium chlorate. Oxygen gas is also formed.

Answer:

$$\_2\_\ KClO_3 \rightarrow \_2\_\ KCl + \_3\_\ O_2$$

$$\frac{75g\ KClO_3}{} \times \frac{1\ mol\ KClO_3}{122.553\ g} \times \frac{2\ mol\ KCl}{2\ mol\ KClO_3} \times \frac{74.553\ g}{1\ mol\ KCl} = 46\ g\ KCl$$

3) How many moles of lead(II) nitrate will be needed to react with sodium chromate to produce 33.2 kg of lead(II)chromate? Sodium nitrate is also produced.

Answer:

$$\_\_\_\ Pb(NO_3)_2 + \_\_\_\ Na_2CrO_4 \rightarrow \_\_\_\ PbCrO_4 + \_2\_\ NaNO_3$$

$$\frac{33.2\ kg\ PbCrO_4}{} \times \frac{1000\ g}{1\ kg} \times \frac{1\ mol\ PbCrO_4}{323.2\ g} \times \frac{1\ mol\ Pb(NO_3)_2}{1\ mol\ PbCrO_4} = 103\ mol\ Pb(NO_3)_2$$

4) How many grams of hydrogen gas are produced when 45.0 g zinc metal completely replaces hydrogen in hydrochloric acid in a single replacement reaction? Zinc chloride is the other product.

Answer:

$$\_\_\_\ Zn + \_2\_\ HCl \rightarrow \_\_\_\ H_2 + \_\_\_\ ZnCl_2$$

$$\frac{45.0\ g\ Zn}{} \times \frac{1\ mol\ Zn}{65.39\ g} \times \frac{1\ mol\ H_2}{1\ mol\ Zn} \times \frac{2.0158\ g}{1\ mol\ H_2} = 1.39\ g\ H_2$$

5) Calculate the mass (in kilograms) of solid gold produced in the single replacement reaction when gold(III) nitrate reacts with 75.0 grams of solid copper to form copper(II) nitrate and solid gold.

Answer:

$$\_\_2\_\_\ Au\ (NO_3)_3 + \_3\_\ Cu \rightarrow \_\_2\_\_\ Au + \_\_3\_\_\ Cu\ (NO_3)_2$$

$$\frac{75.0\ g\ Cu}{} \times \frac{1\ mol\ Cu}{63.55\ g} \times \frac{2\ mol\ Au}{3\ mol\ Cu} \times \frac{196.97\ g}{1\ mol\ Au} \times \frac{1\ kg}{1000\ g} = 0.155\ kg\ Au$$

6) Calculate the mass (in milligrams) of decane gas, $C_{10}H_{22}$, when it reacts with 45.0 kilograms of oxygen gas in a combustion reaction.

Answer:

$$\_2\_\ C_{10}H_{22} + \_31\_\ O_2 \rightarrow \_20\_\ CO_2 + \_22\_\ H_2O$$

$$\frac{45.0\ kg\ O_2}{} \times \frac{1000\ g}{1\ kg} \times \frac{1\ mol\ O_2}{32.00\ g} \times \frac{2\ mol\ C_{10}H_{22}}{31\ mol\ O_2} \times \frac{142.2838\ g}{1\ mol\ C_{10}H_{22}} \times \frac{1000\ mg}{1\ g} = 1.29 \times 10^7\ mg\ C_{10}H_{22}$$