Sodium reacts with water to form sodium hydroxide and hydrogen gas according to the equation:

$$2 \text{ Na (s)} + 2 \text{ H}_2\text{O (l)} ---> 2 \text{ NaOH (aq)} + \text{H}_2 \text{ (g)}$$
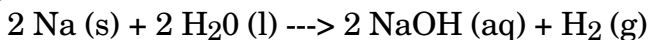
1. If 90.0 grams of sodium is dropped into 80.0 g of water, how many liters of hydrogen at STP would be produced?
2. Which reactant is in excess and how much of it is left over?

Phosphorus burns in oxygen gas to produce phosphorus (V) oxide (P_4O_{10}) according to the equation: $P_4 \text{ (s)} + 5O_2 \text{ (g)} ---> P_4O_{10} \text{ (g)}$
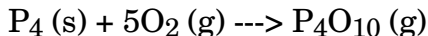
3. If 2.50 grams of phosphorus is ignited in a flask containing 750 mL of oxygen at STP, how many grams of P_4O_{10} are formed?
4. Which reactant is in excess and how much of it is left over?

Magnesium burns in oxygen to produce magnesium oxide.
5. If 1.00 of magnesium is ignited in a flask containing 0.500 liter of oxygen at STP, how many grams of magnesium oxide are produced?
6. What is the name and amount of the reactant in excess?

$$\text{MnO}_2 \text{ (s)} + 4 \text{ HCl (aq)} ---> \text{MnCl}_2 \text{ (aq)} + 2 \text{ H}_2\text{O (l)} + \text{Cl}_2 \text{ (g)}$$

1. How many grams of HCl are required to produce 224 liters of Cl_2 at 27.0 °C and 750 mm Hg?
2. How many liters of chlorine (Cl_2) at 20.0 °C and 765 mm Hg will be produced from 1.00 x 10^3 g of manganese dioxide (MnO_2)?

Turpentine ($C_{10}H_{16}$) burns in chlorine (Cl_2) to produce carbon (C) and hydrogen chloride (HCl) according to the equation:
$$C_{10}H_{16} \text{ (l)} + 8 \text{ Cl}_2 \text{ (g)} ---> 10 \text{ C (s)} + 16 \text{ HCl (g)}$$
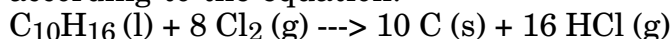
3. How many liters of HCl at 100.0 °C and 740 mm Hg are produced from 150.0 g of $C_{10}H_{16}$?
4. If 200.0 L of Cl_2 at 25.0 °C and 800.0 mm Hg reacts with sufficient $C_{10}H_{16}$, how many grams of C are produced?

$$12 \text{ CO}_2 \text{ (g)} + 11 \text{ H}_2\text{O (l)} ---> C_{12}H_{22}O_{11} \text{ (s)} + 12 \text{ O}_2 \text{ (g)}$$
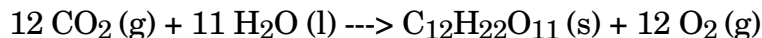
1. How many grams of sucrose ($C_{12}H_{22}O_{11}$) are produced from 224 liters of carbon dioxide (CO_2) at STP?
2. How many liters of carbon dioxide (CO_2) at STP are needed to produce 5.00 pounds of sugar? (1 kg = 2.20 lbs.)
3. What mass of water would be needed to combine with 100 liters of CO_2 at STP?

One of the steps in the production of iron utilizes the following chemical reaction:
$$3 \text{ CO (g)} + \text{Fe}_2\text{O}_3 \text{ (s)} ---> 2 \text{ Fe (s)} + 3 \text{ CO}_2 \text{ (g)}$$
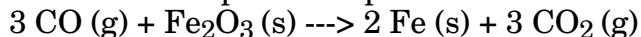
4. What mass of Fe_2O_3 would react with 500.0 liters of CO at STP?
5. What volume of carbon dioxide (CO_2) at STP is produced from 1000 grams of Fe_2O_3?
6. What mass of iron (Fe) is produced when 300 mL of CO_2 is produced at STP?
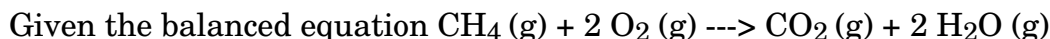
Given the balanced equation $CH_4 \text{ (g)} + 2 \text{ O}_2 \text{ (g)} ---> CO_2 \text{ (g)} + 2 \text{ H}_2\text{O (g)}$
1. How many moles of carbon dioxide (CO_2) are formed when 40 moles of oxygen (O_2) is consumed?
2. How many moles of methane (CH_4) are needed to form 200 moles of water?
3. How many moles of oxygen (O_2) combine with 0.05 mole of methane (CH_4)?

$2NO (g) + O_2 (g) ---> 2NO_2 (g)$,
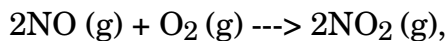
4. How many moles of O_2 combine with 500 moles of NO?

5. How many moles of NO_2 are formed from 0.25 mole of NO and sufficient O_2?

6. How many moles of O_2 are left over if 80 moles of NO is mixed with 200 moles of O_2 and the mixture reacts?

$Mg + 2 HCl ---> MgCl_2 + H_2$
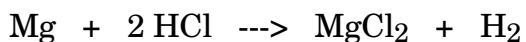
1. How many grams of magnesium (Mg) are needed to produce 100 grams of hydrogen (H_2)?

2. How many grams of hydrogen chloride (HCl) is needed to produce 200 g of hydrogen (H_2)?

3. If 500 g of magnesium chloride ($MgCl_2$) are produced in the above reaction, how many grams of hydrogen (H_2) would be produced?

$P_4 (s) + 5 O_2 (g) ---> P_4O_{10} (g)$
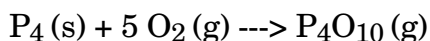
4. How many grams of phosphorus (V) oxide (P_4O_{10}) are produced if you burn 50.0 grams of phosphorus with sufficient oxygen (O_2)?

5. How many grams of oxygen would be needed in problem 4?

6. If 400 grams of phosphorus (V) oxide (P_4O_{10}) is needed for another experiment, how much phosphorus would have to be burned?

1. Consider the reaction: $4 Al + 3 O_2 ---> 2 Al_2O_3$
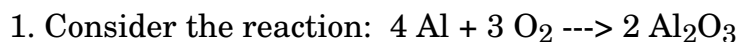
a. If 8.00 moles of aluminum react with an excess of oxygen, how many moles of aluminum oxide are produced?

b. The production of 0.438 moles of aluminum oxide requires the reaction of_____moles of aluminum and_____moles of oxygen?

c. When 1.830 moles of aluminum reacts, _____ moles of owxygen are consumed.

2. Butane burns according to the equation: $C_4H_{10} + 13/2 O_2 ---> 4 CO_2 + 5 H_2O$
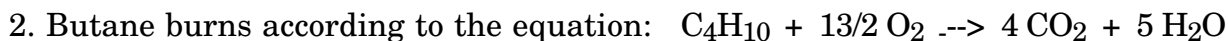
If you begin with 1.00 mole each of C_4H_{10} and O_2

  a. Which runs out first? What is in excess?

  b. How many moles of the excess material remain after reaction?

  c. How many moles of water are produced?

3. In the reaction $3 Ca^{+2} (aq) + 2 PO_4^{-3} (aq) ---> Ca_3(PO_4)_2$
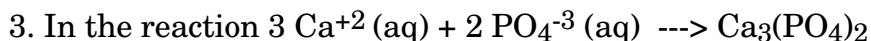
if 0.580 moles of Ca^{+2} and 0.475 moles of PO_4^{-3} are combined in 1.00 L of solution.

a. how many moles of $Ca_3(PO_4)_2$ would be form if all Ca^{+2} react? If all the PO_4^{-3} react?

b. How many moles of calcium phosphate are actually formed?

4. Consider this reaction: $Fe_3O_4 (s) + 4 Cl_2 (g) ---> 4 CO_2 (g) + 3 Fe (s)$. If you begin with 0.03820 moles of iron oxide and 0.120 moles of carbon monoxide.

  a. How many moles of iron are formed if all iron oxide is used? If all the carbon monoxide is used up?

  b. How many moles of iron are actually formed?

5. 0.142 moles of chromium and 0.180 moles of chlorine molecule react according to the equation: $2 Cr + 3 Cl_2 ---> 2 CrCl_3$
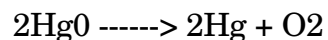
  a. How many moles of chromium (III) chloride wil form?

  b. How many (g) of chromium (III) chloride will form?

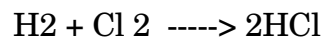1. How many liters of H2 gas at STP will be produced by 0.400 mole of Ca in the following

reaction?

       3Ca + 2H3PO 4 -----> Ca 3 (PO 4)2 + 3H2
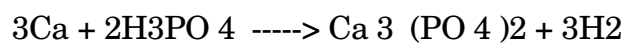
2. How many liters of 02 gas at STP will be produced by 54.0 g of HgO in the following reaction?

       2Hg0 ------> 2Hg + O2

3. What volume of HCl gas will be produced at 25.0 C and 2.75 atm from 5.0 g of H2 in the following reaction?

       H2 + Cl 2 -----> 2HCl

4. What volume of HCl gas can be produced from 8.5 liters of H2 in the following reaction?

       H2 + Cl 2 -----> 2HCl