STOICHIOMETRIC PROBLEMS

SHEET #5

1. Coal from a certain mine contains 2.8 % S. When the coal is burned at a power generating station, the sulphur is converted to $SO_2(g)$. The $SO_2(g)$ is then reacted at the plant with $CaO(s)$ to form $CaSO_3(s)$. If 1200 tonne of coal is burned at the power plant each day, what is the daily output of $CaSO_3(s)$?

2. Copper metal reacts with silver nitrate solution to form silver and copper (ii) nitrate. Calculate the mass of silver formed when 158 g of copper reacts.

3. A 12.0 g sample of ammonium nitrate is exploded. What is the total volume of gas produced at 745 torr and 527 °C? The reaction is:

$$2NH_4NO_3(s) \Longrightarrow 4H_2O(g) + 2N_2(g) + O_2(g)$$

4. Calcium carbonate under goes thermal decomposition according to the equation:

$$CaCO_3(s) \Longrightarrow CaO(s) + CO_2(g)$$

When an impure sample of $CaCO_3(s)$, with a mass of 500 g, was completely decomposed, the residue had a mass of 300 g. What was the percentage of $CaCO_3(s)$ in the original sample? Hint: use the mass of $CO_2(g)$ to figure out the mass of $CaCO_3(s)$ in the original sample.

5. What mass of $CO_2(g)$ is released when a 50.0 g sample of $Na_2CO_3(s)$ with a 60.0 % purity react completely with HCl according to the following equation.

$$Na_2CO_3(s) + HCl(aq) \Longrightarrow CO_2(g) + H_2O(l) + NaCl(aq)$$

6. Iron (III) oxide reacts with carbon monoxide to produce iron and carbon dioxide. How many kilograms of iron can be produced by 1.00 t of iron (III) oxide)?

7. The most common ore of arsenic (mispickel) can be heated to produce arsenic:

$$FeSAs(s) \Longrightarrow FeS(s) + As(s)$$

How many kilograms of mispickel are required to produce one kilogram of arsenic?

8. The following reaction between nitrogen tetroxide and hydrazine is used in rocket engines:

$$N_2O_4(l) + 2N_2H_4(l) \Longrightarrow 3N_2(g) + 4H_2O(g)$$

If 25.0 t of nitrogen tetroxide is carried in one tank, what mass of hydrazine should be carried in the other tank?

Answers:

1. 126 t $CaCO_3(s)$
2. 537 g Ag(s)
3. 35.1 L gas
4. 91.0 %
5. 12.5 g $CO_2(g)$
6. 698 kg Fe(s)
7. 2.17 kg FeSAs(s)
8. 17.39 t $N_2H_4(l)$