CHEMISTRY CALCULATIONS WS 4
Moles & Volume

1 Consider the following reaction for the synthesis of methanol:

$$CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$$
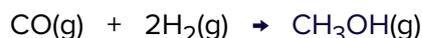
a. What volume of H_2 reacts exactly with 2.50 dm^3 of CO?

b. What volume of CH_3OH is produced?

2 a. Calculate the number of moles in 250 cm^3 of O_2 @ *r.t.p.*

b. Calculate the volume of 0.135 mol of CO_2 @ *r.t.p.*

3 Calculate the volume of carbon dioxide (@ *r.t.p.*) produced when 10.01 g of calcium carbonate decomposes according to the equation:

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

4 Potassium chlorate(V) decomposes when heated:

$$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$$

What mass of potassium chlorate(V) decomposes to produce 100.0 cm^3 of oxygen gas measured @ *r.t.p*?

5 What volume of SO_2 is obtained (measured @ *r.t.p*) when 1.000 kg of As_2S_3 is heated in oxygen?

$$2As_2S_3 + 9O_2 \rightarrow 2As_2O_3 + 6SO_2$$

6 a. Calculate the volume of CO_2 produced when 100cm^3 of ethene burns in excess oxygen according to the equation:

$$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$$

b. Calculate the volume of NO produced when 2.0 dm^3 of oxygen is reacted with excess ammonia according to the equation:

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$$

7 Determine the number of moles present in each of the following at standard temperature and pressure:

a. 0.240dm^3 of O_2

d. 400.0 cm^3 of N_2

b. 2.00dm^3 of CH_4

e. 250.0cm^3 of CO_2

c. 0.100dm^3 of SO_2

8 Work out the volume of each of the following at standard temperature and pressure:

  a. 0.100 mol C_3H_8 **d.**   0.8500 mol NH_3
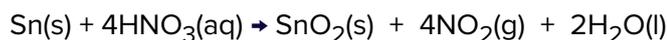
  b. 100.0 mol SO_3 **e.**   0.600 mol O_2

  c. 0.270mol N_2

9 Sodium nitrate(V) decomposes according to the equation:

$$2NaNO_3(s) \rightarrow 2NaNO_2(s) + O_2(g)$$
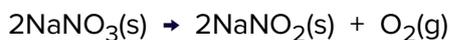
Calculate the volume (in cm^3) of oxygen produced (measured @ *r.t.p*) when 0.820 g of sodium nitrate(V) decomposes.

10 Tin reacts with nitric acid according to the equation:

$$Sn(s) + 4HNO_3(aq) \rightarrow SnO_2(s) + 4NO_2(g) + 2H_2O(l)$$

If 2.50g of tin are reacted with excess nitric acid what volume of NO_2 (in cm^3) is produced @ *r.t.p?*

11 Calculate the mass of sodium carbonate that must be reacted with excess hydrochloric acid to produce 100.0 cm^3 of CO_2 @ *r.t.p.*
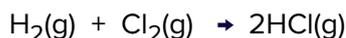
$$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

12 a. Oxygen (O_2) can be converted to ozone (O_3) by passing it through a silent electric discharge.

$$3O_2(g) \rightarrow 2O_3(g)$$

If 300 cm^3 of oxygen is used and 10% of the oxygen is converted to ozone, calculate the total volume of gas present at the end of the experiment.

b. Hydrogen reacts with chlorine according to the equation:

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

What is the total volume of gas present in the container at the end of the experiment if 100cm^3 of hydrogen is reacted with 200cm^3 of chlorine?

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