Core Worksheet 1 – Chapter 1

1 Determine the number of moles present in each of the following: [9]

a 2.3 g of sodium

b 0.32 g of O_2

c 1.0 g of CH_4

d 0.10 g of SO_2

e 4.0 g of N_2

f 2.5 g of Na_2CO_3

g 15.6 g of $Cu(NO_3)_2$

h 2.7 g Fe_2O_3

i 3.0 g $(NH_4)_2SO_4$

2 Work out the mass of each of the following: [9]

a 3.0 mol NaOH

b 0.10 mol C_3H_8

c 0.400 mol $CuSO_4$

d 100.0 mol SO_3

e 0.27 mol HNO_3

f 0.85 mol $Al_2(SO_4)_3$

g 0.600 mol $CaCl_2$

h 2.40 mol NH_4NO_3

i 2.0 mol $CaCO_3$

3 Calculate the mass of one atom of each of the following: [3]

a He **b** O **c** Mg

4 Calculate the mass of one molecule of each of the following: [2]

a H_2O_2 **b** C_2H_5OH

5 Calculate the number of molecules present in 10.0 g of each of the following: [3]

a H_2O **b** N_2H_4 **c** C_3H_8

6 Calculate the number of hydrogen atoms in each of the following: [3]

a 0.10 g H_2

b 2.0 g C_3H_8

c 100 g $C_{10}H_{21}OH$

7 Work out the relative molecular mass given the mass of a molecule: [3]

a **X**: 9.30×10^{-23} g

b **Q**: 1.79×10^{-22} g

c **Z**: 4.22×10^{-22} g

8 Calculate the percentage by mass of carbon in each of the following: [4]

a CO_2

b C_2H_6

c $C_6H_5NO_2$

d $C_6H_5COCH_3$

9 Work out the empirical formulas of each of the following: [3]

a Compound **A**, which contains 12.5% hydrogen and 87.5% nitrogen.

b Compound **B**, which has the following percentage composition: C 26.7%, O 71.1% and H 2.2%.

c Compound **C**, which contains 48.6% C, 10.8% H, 21.6% O and 18.9% N.

10 Work out the molecular formula of each of the following given the empirical formula and the relative molecular mass: [3]

a CH_2, $M_r = 70$

b OH, $M_r = 34$

c C_2H_5O, $M_r = 90$

11 For each of the following calculate the empirical formula: [9]

a When 2.20 g of a hydrocarbon, **D**, is burnt in excess oxygen, 6.90 g of CO_2 and 2.83 g of water are produced.

b When 1.52 g of compound **E**, which contains carbon, hydrogen and oxygen only, is burnt in excess oxygen, 3.04 g CO_2 and 1.24 g H_2O are produced.

12 Balance the following equations: [5]

a $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

b $Sb_2S_3 + HCl \rightarrow SbCl_3 + H_2S$

c $PbCl_4 + H_2O \rightarrow PbO_2 + HCl$

d $Ag + HNO_3 \rightarrow AgNO_3 + H_2O + NO$

e $Fe_2O_3 + CO \rightarrow Fe + CO_2$

13 Calculate the number of moles in each of the following: [4]

a How many moles of H_2 gas are produced when 0.1 mol of Mg reacts with excess HCl according to the following equation:

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

b How many moles of NaCl are produced when 0.5 moles of Na_2CO_3 react with excess hydrochloric acid?

$$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$

c How many moles of hydrogen gas are produced when 0.4 moles of sodium react with excess water?

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

d How many moles of oxygen are formed when 6 moles of $KClO_3$ react?

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

14 Calculate the numbers of moles present in each of the following at STP: [4]

a 2.0 dm^3 of $O_2(g)$

b 200 cm^3 of $NH_3(g)$

c 1.2 dm^3 of $N_2(g)$

d 750 cm^3 of $CO_2(g)$

15 Calculate the volume of gas produced in each of the following (assume STP): [2]

a The volume of ammonia produced when 20.0 g of hydrogen reacts with excess nitrogen according to the equation:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

b The volume of CO_2 produced when 1.00 g of methane is burnt in excess oxygen.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

16 Calculate the number of moles present in each of the following ideal gases: [4]

a Gas **X** occupies a volume of 150 cm^3 at 300 K and 2.00×10^5 Pa.

b Gas **Y** occupies a volume of 200 cm^3 at 25 °C and 1.10×10^5 Pa.

17 In each of the following, select the reactant in excess: [2]

a 0.1 mol Mg reacts with 0.1 mol HCl according to the equation:

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

b 0.01 mol C_3H_8 reacts with 0.04 mol O_2:

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

18 Identify the limiting reactant in each of the following: [2]

a 0.1 mol HCl reacts with 0.2 mol $CaCO_3$:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

b 0.9 mol carbon monoxide reacts with 0.6 mol iron oxide

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

19 Work out the number of moles in each of the following solutions: [2]

a 100 cm^3 of 0.100 mol dm^{-3} NaOH

b 25.0 cm^3 of 0.200 mol dm^{-3} H_2SO_4

20 Work out the volume (in cm^3) of 0.100 mol dm^{-3} NaOH needed to neutralise each of the following solutions: [9]

a 20.0 cm^3 of 0.200 mol dm^{-3} HCl(aq)

b 25.0 cm^3 of 0.125 mol dm^{-3} nitric acid

c 30.0 cm^3 of 0.100 mol dm^{-3} sulfuric acid