## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 2: Analytical Chemistry**

**Chemists Calculating and Stoichiometry**

**Review Paper 1**

**DUE DATE:** Ref: ESSENTIALS pages 77 - 86

**Question 1**

i *Calculate the oxidation number* of the element in bold in each of the following:

a **Cu**2+ +2 b **N**2O4 +4 c **Cr**O42- +6

d **Pb 0** e **F**2 0 f H**P**O42- +5

ii Aluminium can be used in flash bulbs to produce an intense burst of light.

Aluminium is produced in the process. The equation for the reaction is:

4Al(s) + 3O2(g) 2Al2O3 (s)

State the *mole ratio* of oxygen to aluminium oxide in this reaction. 3:2

iii Palmitic acid is the main component of the oil found in palm trees. [*See diagram below*.]

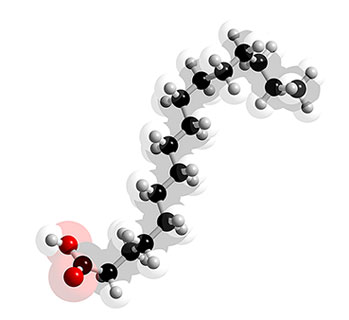
It has the molecular formula: CH3(CH2)14COOH.

Show by using the molar mass, that the percentage of carbon in palmitic acid is approximately 75%.

M(carbon) = 16 x 12.01 = 192.16

M(palm. a.) = 16 x 12.01 + 32 x 1.008 + 2 x 16 = 256.416

192.16/256.416 x 100 = 74.9% (5 marks)



**Question 2**

Calculate the mass (in grams), of 0.025 mol of

iron (II) chloride, FeCl3. (3 marks) (3 marks)

m = n M

m = 0.025 x (55.85 + 35.45 x 3)

m = 4.055 g

**Question 3**

1.48 g of potassium carbonate, K2CO3, is dissolved in distilled water to make a solution of volume 200.0 mL.

Calculate the concentration of this solution in **mol L-1**. (3 marks)

(3 marks)

n = m / M

n = 1.48 / (39.1 x 2 + 12.01 + 16 x 3)

n = 0.0107 mol

C = n / V

C = 0.0107 / 0.2000

C = 0.0535 mol L-1

**Question 4**

Calculate the mass of copper nitrate, Cu(NO3)2 needed to

prepare 250 mL of a 0.25 mol L-1 solution. (2 marks)

n = C V

n = 0.25 x 0.25

n = 0.0625 mol

m = n M

m = 0.0625 x (63.55 + 14.01 x 2 + 16 x 6)

m = 11.7 g

**Question 5**

Calculate the number of moles in 25 mL of 2.0 molL-1 potassium chloride solution. (2 marks)

n = C V

n = 2 x 0.025

n = 0.050 mol

**Question 6**

The combustion of octane in excess air can be represented by the equation:

2C8H18(g) + 25O2(g) 16CO2(g) + 18H2O(l)

i State the reacting mole ratio of octane, C8H18, to carbon dioxide.

2:16 or 1:8

ii Hence find the mass of octane, in grams, that would be needed to be burnt to produce 1000 g of CO2.

n = m /M

n = 1000 / (12.01 + 16 x 2)

n = 22.7 mol

n(octane) = n(CO2) / 8

n(octane) = 2.84 mol

m = n M

m = 2.84 x (12.01 x 8 + 1.008 x 18)

m = 324.4 g

(4 marks)

**Question 7**

*Credit will be given for the correct use of significant figures in answers to question 7.* (1 mark)

The process of respiration can be represented by the equation:

C6H12O6 (aq) + 6O2(g) 6CO2(g) + 6H2O(l)

i Calculate the mass of glucose, C6H12O6, required to prepare 200.0 mL of a solution with a

concentration of 0.200 mol L-1.

n = C V

n = 0.2 x 0.2

n = 0.04

m = n M

m = 0.04 x (12.01 x 6 + 1.008 x 12 + 6 x 16)

m = 7.24 g (3sf)

ii When a 10.0g glucose tablet completely reacts with oxygen according to the equation above,

calculate the mass of water produced.

n = m / M

n = 10 / (12.01 x 6 + 1.008 x 12 + 6 x 16)

n = 0.0555 mol

n (water) : n(glucose) = 6:1

n = 0.0555 x 6

n = 0.333 mol

m = n M

m = 0.333 x (1.008 x 2 + 16)

m = 6.00 g (3sf)

iii If the density of water is approximately 1.00 gmL-1,

convert the mass of water produced in part ii to a volume in mL. (6 marks)

6.00 g / 1.00 gmL-1 = 6.00 mL

**Question 8**

Consider the reaction represented by the *unbalanced* equation:

Ag(s) + 2HNO3(aq) AgNO3(aq) + NO2(g) + H2O(l)

i Balance the equation.

ii Name *one* of the reactants.

Silver *or* nitric acid

iii Calculate the mass of silver that would react with 50.0 mL of 2.50 M HNO3.

n = C V

n = 2.5 x 0.05

n = 0.125 mol

n(Ag) : n(HNO3) = 1:2

n = 0.125 / 2

n = 0.0625

m = n M

m = 0.0625 x (107.9)

m = 6.74g

iv Calculate the volume of 2.50 M HNO3 that would be needed to react with 100.0 g of silver.

n = m / M

n = 100 / 107.9

n = 0.927 mol

n(HNO3) : n(Ag) = 2:1

n = 0.927 x 2

n = 1.85 mol

V = n / C

V = 1.85 / 2.5

V = 0.741 L

(8 marks)

**TOTAL MARK = 34**