



**ALL SAINTS'
COLLEGE**

Science Department

ANSWERS

Year 12 Chemistry
2017

Test 1: Chemical Fundamentals

Name: _____

Teacher: _____

Instructions to Students:

1. 50 minutes permitted
2. Attempt all questions
3. Write in the spaces provided
4. Show all working when required
5. All answers to be in blue or black pen, diagrams in pencil.

TOTAL
/45

Final Percentage

Calculations should be set out neatly with numerical answers given to the appropriate number of significant figures and units provided.

1. Solubility and Colours of substances (4 marks)

For each of the following equations, decide whether a precipitate is formed. Indicate this by writing the abbreviation 'ppt' behind the reaction arrow. What would be the colour of this precipitate?

	Precipitate formed Yes/No ?	Colour of precipitate
a) $\text{KOH}_{(\text{aq})} + \text{Fe}(\text{NO}_3)_{3(\text{aq})} \rightarrow$	Yes	pale brown
b) $\text{CH}_3\text{COONa}_{(\text{aq})} + \text{CaS}_{(\text{aq})} \rightarrow$	No	
c) $\text{K}_2\text{SO}_{4(\text{aq})} + \text{Pb}(\text{NO}_3)_{2(\text{aq})} \rightarrow$	Yes	white
d) $\text{KNO}_{3(\text{aq})} + \text{MgCl}_{2(\text{aq})} \rightarrow$	No	

2. Molar Mass Calculations (5 marks)

Determine the molar masses (M_r) for the following substances:

- a) $\text{Pb}(\text{OH})_2$
241.22 g.mol⁻¹
- b) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
342.296 g.mol⁻¹
- c) $\text{C}_2\text{H}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$
126.068 g.mol⁻¹
- d) $\text{Mg}(\text{NO}_3)_2$
148.33 g.mol⁻¹
- e) Carbonic acid
62.026 g.mol⁻¹

**Mole to Mass (Mass to mole) Calculations
marks)**

(6

a) Given the following, find the number of moles in:

i. 30 g of H_3PO_4

$$n = m/M \quad 30/97.994 = 0.3061 \text{ mol} = 0.3 \text{ mol}$$

ii. 25 g of HF

$$n = m/M \quad 25/20.008 = 1.250 \text{ mol} = 1.2 \text{ mol}$$

iii. 110 g of NaHCO_3

$$n = m/M \quad 110/71.998 = 1.309 \text{ mol} = 1.3 \text{ mol}$$

b) Given the following, find the mass of:

i. 4 moles of $\text{Cu}(\text{CN})_2$

$$m = n \times M \quad 4 \times 115.59 = 462.4 \text{ g} = 500 \text{ g}$$

ii. 1.26×10^{-4} mol of CH_3COOH

$$m = n \times M \quad 1.26 \times 10^{-4} \times 60.052 = 0.007567 \text{ g} = 7.57 \times 10^{-3} \text{ g}$$

iii. 1.2 moles of $(\text{NH}_4)_3\text{PO}_4$

$$m = n \times M \quad 1.2 \times 149.096 = 178.9 \text{ g} = 180 \text{ g}$$

3. Mole-Volume Conversions

(5 marks)

- a) Determine the volume, in litres, occupied by 0.030 moles of a gas at STP.

$$V = n \times 22.71 = 0.03 \times 22.71 = 0.68 \text{ L}$$

- b) How many moles of CO₂ are present in 11.2 L at STP?

$$n = V/22.71 = 11.2/22.71 = 0.493 \text{ mol}$$

- c) What is the volume of 0.05 mol of neon gas at STP?

$$V = n \times 22.71 = 0.05 \times 22.71 = 1 \text{ L}$$

- d) 100.0 g of an unknown gas took up a volume of 46.6 L at STP. Calculate the molar mass (M_r) of the gas.

$$n = V/22.71 = 46.6/22.71 = 2.052 \text{ mol}$$

$$M = m/n = 100/2.052 = 48.7 \text{ g/mol}$$

4. Solution concentration**(7 marks)**

a) What mass of $\text{KCl}_{(s)}$ is required to prepare 630.0 mL of 1.26 mol L^{-1} $\text{KCl}_{(aq)}$?

$$n = c \times V \quad n = 1.26 \times 0.630 = 0.7938 \text{ mol} \quad (1)$$

$$m = n \times M \quad m = 0.7938 \times 74.55 = 59.2 \text{ g} \quad (1)$$

b) What mass of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is required to prepare 250.0 mL $\text{Na}_2\text{CO}_3_{(aq)}$ with a concentration of 0.265 mol L^{-1} ?

$$n = c \times V \quad n = 0.25 \times 0.265 = 0.06625 \text{ mol} \quad (1)$$

$$m = n \times M \quad m = 0.06625 \times 286.15 = 19.0 \text{ g} \quad (1)$$

c) What is the concentration of a solution when 734 grams of lithium sulfate, Li_2SO_4 are dissolved to make 2500 mL of solution?

$$C = n/V = 734/2.5 = 294.6 \text{ g/L} \quad (1)$$

$$c = \text{g/L} \div M = 2.7 \text{ mol.L}^{-1}$$

d) Calculate the concentration in ppm of a solution that contains 0.0198 g of calcium carbonate, CaCO_3 in 2000g of solution.

$$\text{Conc (ppm)} = (\text{mass solute in g}/\text{mass everything in g}) \times 1,000,000$$
$$= (0.0198/2000) \times 10^6 \quad (1)$$

$$= 9.9 \text{ ppm}$$

$$= 10 \text{ ppm} \quad (1)$$

5. Ions in solution

(6 marks)

Calculate the number of moles of

- a) Nitrate ions in 2.20 L of $2.02 \times 10^{-3} \text{ mol L}^{-1}$ $\text{Pb}(\text{NO}_3)_2$

$$n(\text{Pb}(\text{NO}_3)_2) = c \times V = 2.20 \times 2.02 \times 10^{-3} = 0.004444 \text{ mol}$$

$$\begin{aligned} n(\text{NO}_3^{-1}) &= 2 \times n(\text{Pb}(\text{NO}_3)_2) \\ &= 2 \times 0.004444 \\ &= 8.9 \times 10^{-3} \text{ mol} \end{aligned}$$

- b) Chloride ions in 25.0 mL of 0.200 mol L^{-1} BaCl_2 solution

$$n(\text{BaCl}_2) = c \times V = 0.2 \times 0.025 = 0.005 \text{ mol}$$

$$n(\text{Cl}^-) = 2 \times n(\text{BaCl}_2) = 0.0100 \text{ mol}$$

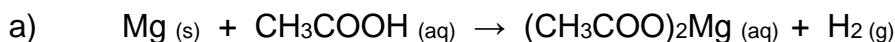
- c) Sulfate ions in 550.0 mL of 2.56 mol L^{-1} sodium sulfate solution

$$\begin{aligned} n(\text{Na}_2\text{SO}_4) &= c \times V = 2.56 \times 0.55 = 1.408 \text{ mol} \\ n(\text{SO}_4^{2-}) &= n(\text{Na}_2\text{SO}_4) \end{aligned}$$

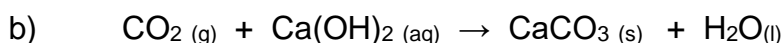
6. Ionic equations

(15 marks)

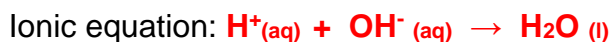
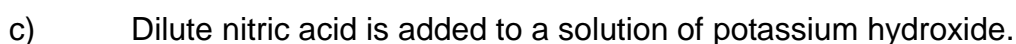
Write **balanced** ionic equations and observations for the following reactions. (**Include state symbols in the final ionic equation.**) For some of these reactions, you will have to predict the products formed.



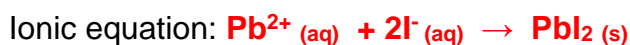
Observation: **silver solid dissolves in clear colourless solution;
colourless/odourless gas is evolved**



Observation: **colourless/odourless gas is bubbled through clear colourless solution;
Solution turns milky or white solid is produced**



Observation: **two clear colourless solutions are added to each other;
No visible change is observed**



Observation: **two clear colourless solutions are added to each other and a yellow precipitate is formed**

END OF TEST