FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**CHM1203: Chemistry 1**
Date of Examination	:	8 December 2021 (Wednesday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.
All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**Ms. Gurdeep Kaur Baksis Singh**
Chief Moderator	:	Ms. Mazlita Yahya

*This paper consists of **7** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
CHM1203: CHEMISTRY 1
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

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Time : 2hrs

Question 1

(a) Tick the appropriate box for each type of classification of matter. Each sample may have more than one tick

Sample	Element	Compound	Homogeneous mixture	Heterogeneous mixture
Snowflake				
Concrete				
Brass alloy				
Rusty nail				
Fruit cake				

(5 marks)

(b) Carry out the following operations. Express the answer in scientific notation and proper significant figures :

(i) 43.6 x 365.22
(ii) 365 x 2.20
(ii) 0.0091 + 5.451

(3 marks)

(c) State the period and group for each of the following :

(i) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$
(ii) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^5$
(iii) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2$
(iv) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^3\,4s^2$

(4 marks)

(d) Some trends can be discovered from the Periodic Table. Explain the following trends :

(i) The electronegativity going down a group (4 marks)

(ii) Atomic radii going across a period (4 marks)

(e) Using Lewis structures, show how ionic compounds are formed between the following elements ;

(i) Mg and O (2 marks)

(ii) Ca and F (2 marks)

(f) Name one physical property of ionic compounds (1 mark)

[TOTAL : 25 MARKS]

Question 2

(a) Write the formulas of the following binary ionic compounds :

(i) Copper (I) chloride (1 mark)

(ii) Ammonium nitrate (1 mark)

(iii) Lithium acetate (1 mark)

(iv) Magnesium nitrate (1 mark)

(b) With the aid of a diagram choose a covalent compound that has dative bonds and show clearly how the dative bonds differs from a normal covalent bond. Name the compound (3 marks)

(c) Draw the Lewis structure for the following covalent molecules :

(i) C_2H_4 (1 mark)

(ii) CO_2 (1 mark)

(iii) NH_3 (1 mark)

(d) State what is meant by the term electronegativity and hence explain the polarity in the bonds of a molecule of ClF_3 (3 marks)

(e) Using the VSEPR Theory, draw the geometry of the following molecules and hence indicate the major type of intermolecular forces (dipole-dipole, Van der Waals, hydrogen bonding) that exists between the particles

(i) $CHCl_3$ (2 marks)

(ii) H_2O (2 marks)

(f) Predict which compound in each of the following pairs has higher melting point and boiling point :

(i) CO and CH_4 (1 mark)

(ii) NH_3 and N_2 (1 mark)

(g) The diagram shows bond angles in ammonia and water

Explain why the bond angle in water is less than the bond angle in ammonia

(2 marks)

(h) Write a balanced ionic equation for the redox reaction below :

$Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) \rightarrow Fe^{3+}(aq) + Cr^{3+}(aq)$ (4 marks)

[TOTAL : 25 marks]

Question 3

(a) Answer the following questions :

(i) The food we eat is degraded, or broken down, in our bodies to provide energy for growth and function. A general overall equation for this very complex process represents the degradation of glucose ($C_6H_{12}O_6$) to carbon dioxide and water :

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

If 856g of $C_6H_{12}O_6$ is consumed by a person over a certain period of time, what is the mass of CO_2 produced ?

(3 marks)

(ii) Methanol (CH_3OH) burns in air according to the equation :

$$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$$

If 209g of methanol are used up in a combustion process, what is the mass of H_2O produced ?

(3 marks)

(iii) Nitric oxide (NO) reacts with oxygen gas to form nitrogen dioxide (NO_2), a dark brown gas :

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

In one experiment 0.886 mole of NO is mixed with 0.503 moles of O_2 Which of the two reactants is the limiting reactant. Show your calculation.

(3 marks)

(b) When aluminium is added to an aqueous solution of copper(II) chloride, $CuCl_2$, copper metal and aluminium chloride, $AlCl_3$, are formed. Write an equation to represent this reaction. (1mark)

(c) Lead(II) nitrate may be produced by the reaction between nitric acid and lead(II) oxide as shown by the equation below

$$PbO + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O$$

An excess of lead(II) oxide was allowed to react with 175 cm^3 of 1.50 mol dm^{-3} nitric acid.
Calculate the maximum mass of lead(II) nitrate which could be obtained from this reaction.

(4 marks)

(d) Compound A is an oxide of sulphur. At 415 K, a gaseous sample of A, of mass 0.304 g, occupied a volume of 127 cm^3 at a pressure of 103 kPa.

Use the Ideal Gas equation to calculate the number of moles of A in the sample, and hence calculate the relative molecular mass of A.

(4 marks)

(e) Based on the Kinetic Molecular Theory (KMT), explain the process evaporation and freezing. (4 marks)

(f) Fritz Haber, a German chemist, first manufactured ammonia in 1909.
Ammonia is very soluble in water.

(i) State the strongest type of intermolecular force between one molecule of ammonia and one water (1 mark)

(ii) Draw a diagram to show how one molecule of ammonia is attracted to one molecule of water (2 mark)

[TOTAL : 25 marks]

Question 4

(a) The exothermic reaction between carbon monoxide and hydrogen can be used industrially to make methanol. The process is carried out at 250 °C and between 50 and 100 atm

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

(i) Explain why increasing the pressure increases the yield of methanol. Give one **disadvantage** of increasing the pressure.

(2 marks)

(ii) The reaction gives a greater equilibrium yield at 100 °C than at 250 °C. Using Le Chatelier's Principle explain why this is so.

(2 marks)

(iii) Explain why the reaction is, nevertheless, carried out at 250 °C.

(1 mark)

(iv) Suggest two ways in which the yield of methanol, CH_3OH, can be increased without changing the temperature or pressure.

(2 marks)

(v) Write the K_{eq} expression for this reaction. (1 mark)

(b) A buffer solution is formed from disodium hydrogenphosphate, containing HPO_4^{2-} ions, and sodium dihydrogenphosphate, containing $H_2PO_4^-$ ions.

(i) Write an equation to show how this solution acts as a buffer when a small amount of acid, H^+ ions is added (1 mark)

(ii) Write an equation to show how this solution acts as a buffer when a small amount of base, OH^- ions is added (1 mark)

(c) A 20 cm^3 solution containing 1.75×10^{-3} of CH_3COOH is added to a 25 cm^3 solution containing 2×10^{-3} mols of CH_3COONa to form a buffer solution.
[K_a of $CH_3COOH = 1.74 \times 10^{-5}$]

Answer the following questions :

(i) Calculate the concentration of CH_3COOH in the buffer solution

(1 mark)

(ii) Calculate the concentration of CH_3COONa in the buffer solution

(1 mark)

(iii) Calculate the pH of this buffer solution (4 marks)

(d) Complete the table below to indicate the name and the type of salt formed (acidic salt or basic salt or neutral salt) when the following acid and base is added together to form a neutral solution

Acid	Base	Name of salt	Type of salt
HCl	NH_4OH		
HNO_3	$Mg(OH)_2$		
CH_3COOH	NaOH		

(6 marks)

(e) Complete the following nuclear equations to indicate the particle emitted during radioactive decay :

(i) $^{209}_{83}Bi \rightarrow {}^{205}_{81}Tl + \_\_\_\_\_$ (1 mark)

(ii) $^{232}_{90}Th \rightarrow \_\_\_\_\_ + {}^{232}_{91}Pa$ (1 mark)

(iii) $^{245}_{96}Cm \rightarrow \_\_\_\_\_ + {}^{241}_{94}Pu$ (1 mark)

[TOTAL : 25 marks]

--THE END--