FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Foundation in Science (CFSI)
Course	:	**CHM1203: Chemistry 1**
Date of Examination	:	4 August 2020 (Tuesday)
Time	:	2:00pm – 4:30pm 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**
Chief Moderator	:	Ms. Lim Sze Theng

*This paper consists of **6** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
CHM 1203: CHEMISTRY 1
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

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

Question 1

(a) Identify the following as a physical change, physical property, a chemical change or a chemical property.

(i) Cyanide is a poisonous substance (1 mark)
(ii) Water freezes at 273K at sea level (1 mark)
(iii) Burning of methane gas (1 mark)

(b) Two centuries ago water was thought to be an element. Why do you think scientists decided that it is a compound? (1 mark)

(c) Indicate whether each of the following properties describes a heterogeneous mixture, a homogeneous mixture, a compound or an element.

(i) Sea water when boiled away leaves a residual solid.
(ii) Muddy water collected from a pond appears to become clear but more cloudy towards the bottom when left to settle
(iii) A metallic solid with a definite and sharp melting point that cannot be decomposed into simpler substances.
(iv) A sample of colourless gas, only part of which gets absorbed by concentrated NaOH solution

(4 marks)

(d) Bromine is extracted from the sea and is exported, by mass, as a 50% calcium bromide solution. What is the mass of bromine in a 120 000 kg solution?
(2 marks)

(e) Chlorine is composed of 74.9% ^{35}Cl and 25.1% ^{37}Cl. The atomic mass of ^{35}Cl is 34.92 amu and that of ^{79}Cl is 36.92 amu. What is the atomic mass of chlorine?
(2 marks)

(f) Using a balanced equation explain self-ionisation of water. State the *Ion Product Constan*t of water. (3 marks)

(g) Which two configurations belong to the same group in the periodic table?

(i) [Ar] $4s^2$

(ii) [Ne] $m3s^23p^2$

(iii) [Ar] $4s^23d^2$

(iv) [Ar] $4s^2\ 3d^{10}\ 4p^2$ (1 mark)

(h) Indicate whether the elements by the given pairs of electron configurations have similar chemical properties. State the reason for your answer.

(i) $1s^22s^22p^63s^23p^4$ and $1s^22s^22p^63s^23p^64s^23d^{10}4p^4$ (2 marks)

(ii) $1s^22s^1$ and $1s^22s^22p^63s^23p^64s^1$ (2 marks)

(I) Write the charge on the following atoms that would give the element a noble gas configuration :

(a) Ca (b) Al (c) Cl (d) Si (e) P (5 marks)

(**TOTAL : 25 MARKS)**

Question 2

(a) Write the formula of compounds formed between Aluminium metal and the following non-metals :

(i)Cl (ii) O (iii) I (3 marks)

(b) Write the Lewis dot symbols for the following ions :

(i) S^- (ii) Sr^+ (iii) I^- (3 marks)

(c) What is the formula of the ionic compound formed between

(i) Sodium and fluorine (ii) barium and oxygen (2 marks)

(d) Determine the charge on the following polyatomic anions from the charge on the cation :

(i) $KClO_2$

(ii) $CaSeO_3$

(iii) $Mg_3(PO_4)_2$

(iv) K_2CO_3 (4 marks)

(e) Write Lewis structures for the following compounds

(i) CO

(ii) KCN

(iii) SO_3 (6 marks)

(f) Indicate which of the following bonds is non-polar or polar?

(i) C –Cl

(ii) Br–Br

(iii) I –O (3 marks)

(g) Determine which is the acid, base, conjugate acid, conjugate base in the following ionic equations according to the Bronsted-Lowry theory:

(i) $H_3PO_4 + H_2O \rightarrow H_2PO_4^- + H_3O^+$
(ii) $CO_3^{2-} + H_2O \rightarrow HCO_3^- + OH^-$
(iii) $HCN + H_2O \rightarrow CN^- + H_3O^+$
(iv) $CN^- + H_2O \rightarrow HCN + OH^-$ (4 marks)

(**TOTAL : 25 MARKS)**

Question 3

(a) (i) What are the 2 factors that determine the polarity of a covalent bond? (2 marks)

(ii) Compare the expected molecular polarities of CCl_4 and CH_2F_2 (2 marks)

(b) Sulfur dioxide reacts with oxygen to make sulfur trioxide : $2SO_2 + O_2 \rightleftharpoons 2SO_3$

(i) Calculate the maximum theoretical mass of sulphur trioxide that can be made by reacting 96.0g of sulphur dioxide with excess oxygen (1 mark)
(ii) In the reaction, only 90.0g of sulphur trioxide was made. Calculate the theoretical yield. (1 mark)
(iii) Give 2 reasons why the amount of sulphur trioxide made was less than the maximum theoretical yield (2marks)

(c) How many carbon atoms are there in 72g of glucose, $C_6H_{12}O_6$? (1 mark)

(d) A new compound reported in 1970 has a composition of 34.9% K, 21.4% C, 12.5% N, 2.68% H and 28.6% O. It has a molar mass of about 224g/mol.
(i) Find the empirical formula of the compound (3 marks)
(ii) Determine its molecular formula (2 marks)

(e) Balance the following equations ;
(i) $Mg + HNO_3 \rightarrow Mg(NO_3)_2 + H_2$
(ii) $CuCl_2 + NaOH \rightarrow Cu(OH)_2 + NaCl$
(iii) $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$ (3 marks)

(f) A 125g sample of impure calcium carbonate is heated to drive off all of the CO_2 according to the equation

$$CaCO_3 \rightarrow CaO + CO_2$$

If 50.6g of carbon dioxide is collected, what is the purity of the original sample? (2 marks)

(g) In this question you should assume all the gases behave as ideal gases.
The gas laws can be summarized in the ideal gas equation below :

$$pV = nRT$$

(i) A certain mass of an ideal gas is sealed in a vessel of volume 3.25L. At a temperature of 25.0^{o}C it exerts a pressure of 2.18atm. What pressure will it exert at 100^{o}C ? (1 mark)

(ii) Calculate the relative molecular mass(Mr) of a gas which has a density of 2.615 gL^{-1} at 298K and 1atm. Give the answer in 2 significant figures.
(1 mark)

(iii) An ideal gas occupies a volume of 2.75L at 290K and 2atm. At what temperature will it occupy 3.95L at 3atm. (1 mark)

(where R = 0.0821 L.atm/mol.K).

(h) The radioisotope $^{242}{}_{94}Pu$ can be used as a nuclear fuel. What is meant by the terms :

(i) Isotope (1 mark)

(ii) Radioisotope (1 mark)

(iii) Write an equation for the alpha decay of Pu-242 1 mark)

(**TOTAL : 25 MARKS)**

Question 4

(a) (i) The total pressure produced by a mixture of gases which does not react is equal to the total pressure of the partial pressure produced by each gas in the mixture. Name this law. (1 mark)

(ii) What is meant by partial pressure of a gas? (1 marks)

(iii) 3L of carbon dioxide at 200kPa and 1L of nitrogen at 300kPa are placed in a 1.5L container. What is the total pressure of the container? (2 marks)

(b) Calculate the concentration, in $moldm^{-3}$ of each of the following solutions formed.

(i) 0.3 mol of sodium hydroxide is dissolved in distilled water to make up 250cm^3 of solution

(ii) 0.1 mol of calcium chloride is dissolved in 500cm^3 of water

(iii) 58.5g sodium chloride is dissolved in water to make up 50cm^3 solution
(3 marks)

(c) 45g of solid copper(II) nitrate is dissolved in water to make up 0.125 moldm^{-3} copper(II) nitrate solution. Calculate the volume of water in cm^3 (3 marks)

(d) When 200cm^3 of water is added to 40cm^3 of concentrated sulfuric acid, a solution with the concentration 2moldm^{-3} is produced. Calculate the molarity of concentrated sulfuric acid. (2 marks)

(e) State 2 differences between a strong acid and a weak acid. (2 marks)

(f) State 3 factors affecting the rate of a solution formed. Explain how each of the 3 factors can affect the rate.

(6 marks)

(g) (i) High concentrations of caesium-137 were found over much of Europe after the Chernobyl nuclear power plant explosion. Write a balanced equation for the decay of caesium-137 by beta emission (1 marks)

(ii) State two uses of radioisotopes in the medical field (2 marks)

(h) Identify particle X in the following radioactive decay of some isotopes.

(i) Carbon-14 undergoes radioactivity decay to produce nitrogen-14 and another particle, X (1 mark)

(ii) Curium is produced according to this equation

$^{239}_{94}Pu + X \rightarrow {}^{242}_{96}Cm + {}^{1}_{0}n$ (1 mark)

(**TOTAL : 25 MARKS)**

~ The End ~