



FINAL
Examination Paper

(COVER PAGE)

Session : April 2019

Programme : Foundation in Science (CFSI)

Course : CHM1203 : CHEMISTRY 1

Date of Examination : 29 July 2019 (Monday)

Time : 11:00AM – 1:00PM Reading Time : Nil

Duration : 2 hours

Special Instructions :

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Periodic Table

Examiner(s) : Ms. Gurdeep Kaur A/P Baksis Singh

Moderator : Dr. Lim Gin Keat

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

INTI INTERNATIONAL COLLEGE PENANG
FOUNDATION IN SCIENCE (CSFI)
CHM 1203 : CHEMISTRY 1
FINAL EXAM : APRIL 2019 SESSION

Instructions : This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. 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) Carbon monoxide is a poisonous gas (1 mark)
 - (ii) Water boils at 100°C at sea level (1 mark)
 - (iii) Burning of gasoline (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) A homogenous liquid that when boiled away leaves a residual solid.
 - (ii) A cloudy liquid that after a certain time seems more cloudy towards the bottom.
 - (iii) A uniform red 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 reacts with hot copper (4 marks)
- (d) Gold has a density of 19.3gcm^{-3} . A young woman was interested in purchasing a sample of pure gold having a mass of 8.99g. With a quick test using a measuring cylinder, she found that the sample was a volume of 0.796cm^3 . Was the substance gold? Show your working. (2 marks)
- (e) Bromine is composed of 50.5% ^{79}Br and 49.5% ^{81}Br . The atomic mass of ^{79}Br is 78.92 amu and that of ^{81}Br , 80.92 amu. What is the atomic mass of bromine? (2 marks)
- (f) How many protons, neutrons and electrons are there in the three isotopes of oxygen, ^{16}O , ^{17}O and ^{18}O ? (3 marks)

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

- (i) [Kr] 5s²
 - (ii) [Kr] 5s²4d¹⁰5p²
 - (iii) [Ar] 4s²3d²
 - (iv) [Ne] 3s²3p²
- (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) 1s²2s²2p⁶3s²3p⁴ and 1s²2s²2p⁶3s²3p⁶4s²3d¹⁰4p⁴ (2 marks)
- (ii) 1s²2s¹ and 1s²2s²2p⁶3s²3p⁶4s¹ (2 marks)

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

- (a) Mg (b) Ga (c) Br (d) S (e) P (5 marks)

(TOTAL : 25 MARKS)

Question 2

- (a) Write the formula of compounds formed between Calcium 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) O^- (ii) Ba^+ (iii) I^- (3 marks)
- (c) What is the formula of the ionic compound formed between
 (i) Aluminium and fluorine (ii) barium and sulfur (2 marks)
- (d) Determine the charge on the following polyatomic anions from the charge on the cation :
 (i) $NaClO_2$
 (ii) $SrSeO_3$
 (iii) $Ca_3(PO_4)_2$
 (iv) K_2SO_4 (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) I – F
 (ii) C–H
 (iii) N–Br (3 marks)
- (g) From the geometry of the following determine which of these molecules is polar or non-polar
 (i) CS_2 : linear
 (ii) CO_2 : linear
 (iii) SF_2 : bent
 (iv) CCl_4 : tetrahedral (4 marks)

(TOTAL : 25 MARKS)

Question 3

- (a) (i) What are the 2 factors that determine the polarity of a covalent molecule? (2 marks)
- (ii) Compare the expected molecular polarities of CH_4 and CH_2F_2 (2 marks)
- (b) How many moles of each element are present in 0.345 mol of $\text{Al}_2(\text{CO}_3)_3$? (3 marks)
- What is the total number of mols of atoms present? (1 mark)
- (c) Find the percent composition of elements in CaCO_3 . (3 marks)
- (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) $\text{Si}_2\text{H}_6 + \text{H}_2\text{O} \rightarrow \text{Si}(\text{OH})_4 + \text{H}_2$
- (ii) $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (2 marks)
- (f) A 125g sample of impure calcium carbonate is heated to drive off all of the CO_2 according to the equation
- $$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$$
- 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 methane behaves as an ideal gas. The gas laws can be summarized in the ideal gas equation below
- $$pV = nRT$$
- The volume of a sample is measured at a temperature of 60°C and a pressure of 1atm. The volume measured is 53.7 L
- What is the mass of the sample of methane, given to 2 significant figures? (where $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$). (3 marks)
- (h) State Charles' Law. (1 marks)
- A certain quantity of gas in a balloon has a volume of 185mL at a temperature of 52°C . What is the volume of the balloon if the temperature is lowered to -17°C ? Assume that the pressure remains constant. (1 mark)

(TOTAL : 25 MARKS)

Question 4

- (a) (i) 2.00 mol of carbon dioxide gas is mixed with 3.00 mol of hydrogen gas at the same temperature. If the pressure of the mixture is 1.00×10^5 Pa, calculate the partial pressure of carbon dioxide and hydrogen. (2 marks)
- (ii) The total pressure in a gaseous mixture of 1 mol of ethanol and 2 mols of methanol is 135KPa. Using Dalton's law of partial pressures, determine the partial pressure of each gas. (2 marks)
- (b) Calculate the concentration, in mol dm^{-3} of each of the following solutions formed.
- (i) 0.3mol 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 $0.125 \text{ mol dm}^{-3}$ 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 2mol dm^{-3} is produced. Calculate the molarity of concentrated sulfuric acid. (2 marks)
- (e) Calculate the volume of 2mol dm^{-3} sodium carbonate needed to prepare 50cm^3 of 0.1mol dm^{-3} sodium carbonate solution. (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) Name an insoluble salt containing Pb^{2+} ions? (1 mark)
- (ii) A student dilutes 15cm^3 of 0.2mol dm^{-3} sodium hydroxide solution in a conical flask with 10cm^3 of distilled water. The sodium hydroxide is then titrated with $Q\text{cm}^3$ of 0.1mol dm^{-3} hydrochloric acid. Calculate the value of Q. (4 marks)

(TOTAL : 25 MARKS)

Question 5

- (a) Determine which is the acid, base, conjugate acid, conjugate base in the following ionic equations according to the Bronstead-Lowry theory:
- (i) $\text{H}_3\text{PO}_4 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{PO}_4^- + \text{H}_3\text{O}^+$
 - (ii) $\text{CO}_3^{2-} + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{OH}^-$
 - (iii) $\text{HCN} + \text{H}_2\text{O} \rightarrow \text{CN}^- + \text{H}_3\text{O}^+$
 - (iv) $\text{CN}^- + \text{H}_2\text{O} \rightarrow \text{HCN} + \text{OH}^-$
- (8 marks)
- (b) State 2 differences between a strong acid and a weak acid. (2 marks)
- (c) Using a balanced equation explain self-ionisation of water. State the *Ion Product Constant* of water. (3 marks)
- (d) 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
 - (ii) Curium is produced according to this equation
- $${}^{239}_{94}\text{Pu} + \text{X} \rightarrow {}^{242}_{96}\text{Cm} + {}^1_0\text{n}$$
- (2 marks)
- (e) The radioisotope ${}^{242}_{94}\text{Pu}$ 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 (2 marks)
- (f) Describe one use of radioactive isotopes in :
- (i) Medicine (2 marks)
 - (ii) Industry (2 marks)
- (g) High concentrations of caesium-137 were found over much of Europe after the Chernobyl nuclear power plant explosion. Write a balance equation for the decay of caesium-137 by beta emission (2 marks)

(TOTAL : 25 MARKS)