UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: FSC 1074
COURSE	: CHEMISTRY 1
SEMESTER/SESSION	: 2 - 2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1 **25 MARKS**

a) Bromine, Br is a halogen gas. The bromine atom has 35 protons and 45 neutrons. Write the symbol for the bromine atom. (2 Marks)

b) Calculate the mass of sodium hydroxide, NaOH in a sample containing 2.0×10^{24} molecules of NaOH (4 Marks)

c) Construct a balance equation for the following chemical reaction. (4 Marks)

i) $Al + Fe_2O_3 \rightarrow Al_2O_3 + Fe$

ii) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

d) Determine the empirical and molecular formula for chrysotile asbestos. Chrysotile has the following percent composition: 28.03% Mg, 21.60% Si, 1.16% H and 49.21% O. the molar mass for chrysotile is 520.8g/mol. (8 Marks)

e) Ethyl bromide, C_2H_5Br is prepared by the reaction of ethene gas, C2H4 with hydrogen bromide, HBr. In the experiment, 11.2g of ethene is used to react with 45.4g of hydrogen bromide. (7 Marks)

i) Write a chemical equation for the reaction.

ii) Identify the limiting reactant.

iii) Calculate the mass of ethyl bromide produced.

QUESTION 2 **25 MARKS**

a) Discuss the electronic configuration, in *spdf* notation, and orbital diagram of

(i) Potassium, K^+ ion (proton number of K atom is 19) (5 marks)

(ii) Krypton, Kr (proton number of Kr atom is 36) (5 marks

b) Electronic configuration for element Y is shown below. (4 Marks)

Y $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

Predict the position of Y in the periodic table.

c) From each of the following groups, choose the largest atom.

(i) Na, K, Rb (2 marks)

(ii) C, N, O (2 marks)

d) Element X has 15 number of proton

(i) Write the electronic configuration of element X in *spdf notation* (4 Marks)

(ii) Identify the group and period of element X in periodic table (3 Marks)

QUESTION 3 **25 MARKS**

a) A beaker was filled with 200 mL of H_2SO_4 solution. The solution mass is 65.3g. Find:

(i) Density (3 marks)

(ii) Number of moles (3 marks)

(iii) Molarity (3 marks)

b) In an experiment, the student needs to prepare 2.78 mol $CaSO_4$. Calculate

(i) The mass in grams (3 marks)

(ii) The molarity when all $CaSO_4$ dissolve in 2500 mL of water. (3 marks)

c) Find the mass of acetic acid, CH_3COOH required to make 250 mL of a solution that has a concentration of 0.105 M. (4 marks)

d) The solubility of baking soda, $NaHCO_3$, is 9.6 g in 150 g of H_2O. Determine

(i) The mole fraction of $NaHCO_3$ in a saturated solution. (3 marks)

(ii) The molality of the solution (3 marks)

QUESTION 4 **25 MARKS**

a) State the meaning of colloid, suspension, and true solution (6 Marks)

b) A 2.25 g sample of glucose, $C_6H_{12}O_6$ is dissolved in 500 g of water. The vapor pressure of water at 60°C is 149.4 mmHg. Find

(i) Mole fraction of water (3 marks)

(ii) Vapor pressure of the water-glucose solution at 60°C. (2 marks)

(iii) ΔP that was obtained after dissolving the solute (2 marks)

c)

Solvent	Boiling point (°C)	K_b (°C/m)	Freezing point (°C)	K_f (°C/m)
Water	100.0	0.51	0.0	1.86
Benzene	80.1	2.53	5.5	5.12

Table 2: Boiling point elevation and freezing point depression constants

(i) Find the boiling point for 0.200 mol of solute dissolves in 125 g of benzene C_6H_6. The boiling point of a solution is 84.15°C. (4 marks)

(ii) An aqueous solution contains 0.180 g of unknown solute in 50.0 g of water. The solution freezes at -0.040°C. Determine the mass of the solute. (4 marks)

(iii) Compute the boiling point of a solution composed of 15.0 g of $CHCl_3$ in 0.6 kg of water? (4 marks)

End of question

APPENDIX I

$$Molarity = \frac{mol\ solute}{L\ solution}$$

$$Molality = \frac{mol\ solute}{kg\ solvent}$$

$$mol\ fraction\ (X_A) = \frac{mol\ of\ A}{total\ mol}$$

$$mass\ \%\ (solute\ or\ solvent) = \left(\frac{mass\ of\ solute\ or\ solvent}{mass\ of\ solution}\right) \times 100$$

FORMULA:
m = mass (g)
n = number of moles (mol)
M = Molar Mass (g/mol)

$$n = \frac{m}{M}$$

m ⟷ n ⟷ N ⟷ atoms

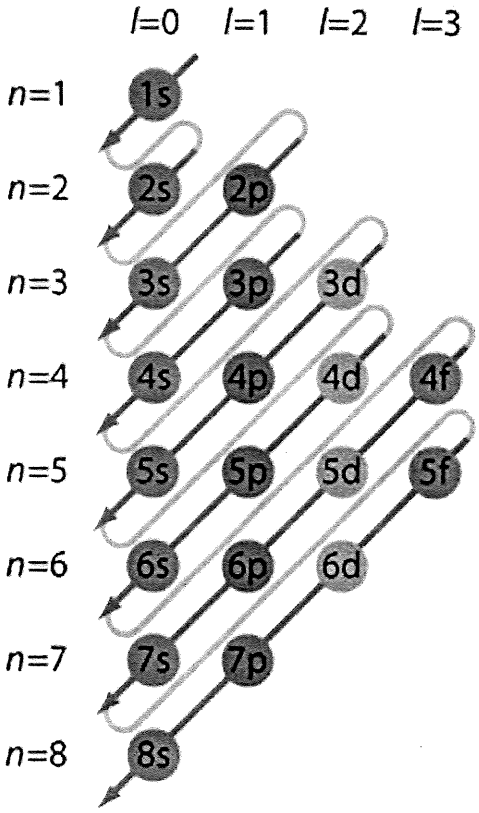
Avogadro's Constant
6.022×10^{23} molecules = 1 mol

Raoult'law (Partial@vapour pressure)
$P_{solution} = X_{solvent}\ P°_{solvent}$

Raoult's law lowering of the vapor pressure, ΔP_{solv}
$\Delta P_{solution} = P_{solution} - P°_{solvent}$

Freezing Point Depression & Boiling Point Elevation
$\Delta T_b = K_b\ m$
$\Delta T_f = K_f\ m$
K_b = molal boiling pooint elevation constant
K_f = molal freezing point depression constant

Energy Level



APPENDIX II

THE PERIODIC TABLE

1 IA													13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
H 1 1.008 Hydrogen	2 IIA																	**He** 2 4.00 Helium
Li 3 6.94 Lithium	**Be** 4 9.01 Beryllium												**B** 5 10.81 Boron	**C** 6 12.01 Carbon	**N** 7 14.01 Nitrogen	**O** 8 16.00 Oxygen	**F** 9 19.00 Fluorine	**Ne** 10 20.18 Neon
Na 11 22.99 Sodium	**Mg** 12 24.31 Magnesium	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB		**Al** 13 26.98 Aluminum	**Si** 14 28.09 Silicon	**P** 15 30.97 Phosphorus	**S** 16 32.07 Sulfur	**Cl** 17 35.45 Chlorine	**Ar** 18 39.95 Argon
K 19 39.10 Potassium	**Ca** 20 40.08 Calcium	**Sc** 21 44.96 Scandium	**Ti** 22 47.88 Titanium	**V** 23 50.94 Vanadium	**Cr** 24 52.00 Chromium	**Mn** 25 54.94 Manganese	**Fe** 26 55.85 Iron	**Co** 27 58.93 Cobalt	**Ni** 28 58.69 Nickel	**Cu** 29 63.55 Copper	**Zn** 30 65.39 Zinc	**Ga** 31 69.72 Gallium	**Ge** 32 72.61 Germanium	**As** 33 74.92 Arsenic	**Se** 34 78.96 Selenium	**Br** 35 79.90 Bromine	**Kr** 36 83.80 Krypton
Rb 37 85.47 Rubidium	**Sr** 38 87.62 Strontium	**Y** 39 88.91 Yttrium	**Zr** 40 91.22 Zirconium	**Nb** 41 92.91 Niobium	**Mo** 42 95.94 Molybdenum	**Tc** 43 (97.9) Technetium	**Ru** 44 101.07 Ruthenium	**Rh** 45 102.91 Rhodium	**Pd** 46 106.42 Palladium	**Ag** 47 107.87 Silver	**Cd** 48 112.41 Cadmium	**In** 49 114.82 Indium	**Sn** 50 118.71 Tin	**Sb** 51 121.76 Antimony	**Te** 52 127.60 Tellurium	**I** 53 126.90 Iodine	**Xe** 54 131.29 Xenon
Cs 55 132.91 Cesium	**Ba** 56 137.33 Barium	**La** 57 138.91 Lanthanum	**Hf** 72 178.49 Hafnium	**Ta** 73 180.95 Tantalum	**W** 74 183.85 Tungsten	**Re** 75 186.21 Rhenium	**Os** 76 190.2 Osmium	**Ir** 77 192.22 Iridium	**Pt** 78 195.08 Platinum	**Au** 79 196.97 Gold	**Hg** 80 200.59 Mercury	**Tl** 81 204.38 Thallium	**Pb** 82 207.2 Lead	**Bi** 83 208.98 Bismuth	**Po** 84 (209) Polonium	**At** 85 (210) Astatine	**Rn** 86 (222) Radon
Fr 87 223.02 Francium	**Ra** 88 226.03 Radium	**Ac** 89 227.03 Actinium	**Rf** 104 (261) Rutherfordium	**Db** 105 (262) Dubnium	**Sg** 106 (263) Seaborgium	**Bh** 107 (262) Bohrium	**Hs** 108 (265) Hassium	**Mt** 109 (266) Meitnerium	Unnamed Discovery 110 Nov. 1994	Unnamed Discovery 111 Nov. 1994	Unnamed Discovery 112 1996		Unnamed Discovery 114 1999		Unnamed Discovery 116 1999		Unnamed Discovery 118 1999

ALKALI METALS — ALKALI EARTH METALS — HALOGENS — NOBLE GASES

SYMBOL
ATOMIC NUMBER
ATOMIC WEIGHT
NAME

( ) = ESTIMATES

LANTHANIDES														
Ce 58 140.12 Cerium	**Pr** 59 140.91 Praseodymium	**Nd** 60 144.24 Neodymium	**Pm** 61 (145) Promethium	**Sm** 62 150.36 Samarium	**Eu** 63 152.97 Europium	**Gd** 64 157.25 Gadolinium	**Tb** 65 158.93 Terbium	**Dy** 66 162.50 Dysprosium	**Ho** 67 164.93 Holmium	**Er** 68 167.26 Erbium	**Tm** 69 168.93 Thulium	**Yb** 70 173.04 Ytterbium	**Lu** 71 174.97 Lutetium
ACTINIDES														
Th 90 232.04 Thorium	**Pa** 91 231.04 Protactinium	**U** 92 238.03 Uranium	**Np** 93 237.05 Neptunium	**Pu** 94 (240) Plutonium	**Am** 95 243.06 Americium	**Cm** 96 (247) Curium	**Bk** 97 (248) Berkelium	**Cf** 98 (251) Californium	**Es** 99 252.08 Einsteinium	**Fm** 100 257.10 Fermium	**Md** 101 (257) Mendelevium	**No** 102 259.10 Nobelium	**Lr** 103 262.11 Lawrencium

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