



UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: DTC 1033
COURSE	: GENERAL CHEMISTRY
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

- a) Bromine, Br is a halogen gas. The bromine atom has 35 protons and 45 neutrons. Write the symbol for the bromine atom. (4 marks)
- b) Find the number of atoms in 0.5 mole of ozone gas (O_3). (4 marks)
(Avogadro constant: 6.02×10^{23})
- c) Calculate the number of moles of sodium, Na in a sample containing 2.0×10^{24} atoms of Na. (Given Avogadro constant: 6.02×10^{23}) (5 marks)
(Relative atomic mass: Na=23)
- d) Write a balance equation for the following chemical reaction. (4 marks)
 $Al + Fe_2O_3 \longrightarrow Al_2O_3 + Fe$
- e) Find
- i) Molecular weight of sulfuric acid, (H_2SO_4). (4 marks)
(Relative atomic mass: H=2, S=32, O=16)
- ii) Molecular mass for magnesium oxide, (MgO). (4 marks)
(Relative atomic mass: Mg=24; O=16)

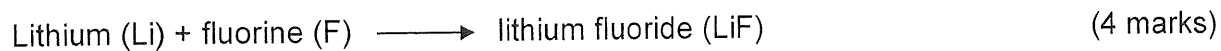
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QUESTION 2

- a) Discuss the electronic configuration, in *spdf* notation, and orbital diagram of
- i) Potassium, Mg (proton number of potassium atom is 12) (5 marks)
 - ii) Argon, Ar (proton number of krypton atom is 18) (5 marks)
- b) Element Y has 20 proton number. (4 marks)
Predict the position of Y in the periodic table by drawing the electron arrangement.
- c) From each of the following elements, 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

- a) Sketch the Lewis electron-dot diagram to show the formation of ionic compounds in the following reaction.



- b) Covalent bonds are formed when the atoms are sharing electron so that each atom achieves noble gas configuration. Draw the Lewis electron-dot diagram to show the formation of Br₂ molecules. (4 marks)

- c) Write the equilibrium constant expression K_c for each of the following reactions:



At equilibrium,

$$[HI] = 1.75 \text{ mol dm}^{-3}, [H_2] = 1.125 \text{ mol dm}^{-3}, [I_2] = 0.125 \text{ mol dm}^{-3}$$

Solve the value for K_c .

QUESTION 4

- a) The gases SO_2 , O_2 and SO_3 are allowed to reach equilibrium at a constant temperature. At equilibrium, the partial pressures of the gases are as follows.
Partial pressure of $\text{SO}_2 = 0.050 \text{ atm}$
Partial pressure of $\text{O}_2 = 0.025 \text{ atm}$
Partial pressure of $\text{SO}_3 = 1.00 \text{ atm}$
Calculate the value of K_p for the following reaction (5 marks)
- $$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$$
- b) Based on Brønsted-Lowry concept, give definition of acid and base. (4 marks)
- c) Label each species as an acid, base, conjugate acid and conjugate base based on Brønsted-Lowry concept in the following equations.
- i) $\text{HCl}(\text{aq}) + \text{NaOH}(\text{aq}) \rightleftharpoons \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ (4 marks)
- ii) $\text{HCl}(\text{aq}) + \text{NH}_3(\text{aq}) \rightleftharpoons \text{Cl}^- + \text{NH}_4^+(\text{aq})$ (4 marks)
- d) Find
- i) The pH of 0.02 mol dm^{-3} hydrochloric acid, HCl (4 marks)
- ii) The pH of 0.01 mol dm^{-3} sodium hydroxide, NaOH solution (4 marks)

-----End of question-----

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Appendix 1

$$\text{Avogadro constant} = 6.02 \times 10^{23}$$

$$\text{Number of moles} = \frac{\text{No of atoms or molecules}}{\text{Avogadro constant}}$$

$$\text{Number of atoms} = \text{no. of moles} \times \text{Avogadro constant}$$

$$\text{Number of moles} = \frac{\text{Mass (g)}}{\text{Molecular weight (MW)}}$$

$$\text{Mass} = \text{no. of moles} \times \text{Molecular weight}$$

$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pH} = 14 - \text{pOH}$$

APPENDIX 2

Periodic Table of the Elements

1 1A 11A Hydrogen 1.008	2 1A 2A Helium 4.002	3 1B 3A Lithium 6.941	4 1B 4A Beryllium 9.012	5 2B 5A Boron 10.81	6 2B 6A Carbon 12.011	7 2B 7A Nitrogen 14.007	8 2B 8A Oxygen 15.999	9 2B 9A Fluorine 18.998	10 2B 10A Neon 20.180	11 3B 11A Sodium 22.990	12 3B 12A Magnesium 24.305	13 3B 13A Aluminum 26.982	14 3B 14A Silicon 28.086	15 3B 15A Phosphorus 30.974	16 3B 16A Sulfur 32.065	17 3B 17A Chlorine 35.453	18 3B 18A Argon 39.948	19 4B 19A Potassium 39.098	20 4B 20A Calcium 40.078	21 4B 3B Scandium 44.956	22 4B 4A Titanium 47.88	23 4B 5A Vanadium 50.942	24 4B 6A Chromium 51.995	25 4B 7A Manganese 54.938	26 4B 8A Iron 55.845	27 4B 9A Cobalt 58.933	28 4B 10A Nickel 58.693	29 4B 11A Copper 63.546	30 4B 12A Zinc 65.39	31 5B 13A Gallium 69.723	32 5B 14A Germanium 72.63	33 5B 15A Arsenic 74.922	34 5B 16A Selenium 78.96	35 5B 17A Bromine 79.904	36 5B 18A Krypton 83.80	37 5B 19A Rubidium 85.468	38 5B 20A Strontium 87.62	39 5B 3B Yttrium 88.906	40 5B 4A Zirconium 91.224	41 5B 5A Niobium 92.906	42 5B 6A Molybdenum 95.94	43 5B 7A Technetium 98.906	44 5B 8A Ruthenium 101.07	45 5B 9A Rhodium 102.905	46 5B 10A Palladium 106.367	47 5B 11A Silver 107.868	48 5B 12A Cadmium 112.411	49 5B 13A Indium 114.818	50 5B 14A Tin 118.710	51 5B 15A Antimony 121.757	52 5B 16A Tellurium 127.6	53 5B 17A Iodine 126.904	54 5B 18A Xenon 131.29	55 5B 19A Cesium 132.905	56 5B 20A Barium 137.327	57 5B 3B Lanthanum 138.905	58 5B 4A Cerium 140.12	59 5B 5A Praseodymium 140.908	60 5B 6A Neodymium 144.24	61 5B 7A Promethium 144.913	62 5B 8A Samarium 150.36	63 5B 9A Europium 151.964	64 5B 10A Gadolinium 157.25	65 5B 11A Terbium 158.925	66 5B 12A Dysprosium 162.50	67 5B 13A Holmium 164.930	68 5B 14A Erbium 167.256	69 5B 15A Thulium 168.930	70 5B 16A Ytterbium 173.054	71 5B 17A Lutetium 174.967	72 5B 18A Radium 226	73 5B 19A Francium 223	74 5B 20A Radium 226	75 5B 21A Actinium 227	76 5B 22A Radium 226	77 5B 23A Actinium 227	78 5B 24A Radium 226	79 5B 25A Actinium 227	80 5B 26A Radium 226	81 5B 27A Actinium 227	82 5B 28A Radium 226	83 5B 29A Actinium 227	84 5B 30A Radium 226	85 5B 31A Actinium 227	86 5B 32A Radium 226	87 5B 33A Actinium 227	88 5B 34A Radium 226	89-103 5B 35A Actinide Series	89 5B 35A Actinium 227	90 5B 36A Thorium 232.038	91 5B 37A Protactinium 231.036	92 5B 38A Uranium 238.029	93 5B 39A Neptunium 237.048	94 5B 40A Plutonium 244.064	95 5B 41A Americium 243.061	96 5B 42A Curium 247.070	97 5B 43A Berkelium 247.070	98 5B 44A Californium 251.080	99 5B 45A Einsteinium 252.083	100 5B 46A Fermium 257.095	101 5B 47A Mendelevium 258.10	102 5B 48A Nobelium 259.101	103 5B 49A Lawrencium 262	104 5B 50A Rutherfordium 261	105 5B 51A Dubnium 262	106 5B 52A Seaborgium 263	107 5B 53A Bohrium 264	108 5B 54A Hassium 265	109 5B 55A Meitnerium 266	110 5B 56A Darmstadtium 267	111 5B 57A Roentgenium 268	112 5B 58A Copernicium 269	113 5B 59A Nh 270	114 5B 60A Fl 271	115 5B 61A Uup 272	116 5B 62A Lv 273	117 5B 63A Uus 274	118 5B 64A Uuo 276
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