UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DTC 1033
COURSE	: GENERAL CHEMISTRY
SEMESTER/SESSION	: 1 - 2023/2024
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).
(Avogadro constant: 6.02×10^{23}) (4 marks)

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})
(Relative atomic mass: Na=23) (5 marks)

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)

QUESTION 2

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

i) Magnesium, Mg (proton number of magnesium atom is 12) (5 marks)

ii) Argon, Ar (proton number of argon 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.

Lithium (Li) + fluorine (F) $\longrightarrow$ lithium fluoride (LiF) (4 marks)

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 Br_2 molecules. (4 marks)

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

i) $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ (4 marks)

ii) $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$ (4 marks)

iii) $2O_3(g) \rightleftharpoons 3O_2(g)$ (4 marks)

d) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ (5 marks)

At equilibrium,

$[HI] = 1.75$ mol dm^{-3}, $[H_2] = 1.125$ mol dm^{-3}, $[I_2] = 0.125$ 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 SO_2 = 0.050 atm

Partial pressure of O_2 = 0.025 atm

Partial pressure of SO_3 = 1.00 atm

Solve the value of K_p for the following reaction (5 marks)

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

b) Based on Brönsted-Lowry concept, compute the definition of acid and base. (4 marks)

c) Label each species as an acid, base, conjugate acid and conjugate base based on Brönsted-Lowry concept in the following equations.

i) $HCl(aq) + NaOH(aq) \rightleftharpoons NaCl(aq) + H_2O(l)$ (4 marks)

ii) $HCl(aq) + NH_3(aq) \rightleftharpoons Cl^- + NH_4^+(aq)$ (4 marks)

d) Predict the pH of

i) 0.02 mol dm^{-3} hydrochloric acid acid, HCl (4 marks)

ii) 0.01 mol dm^{-3} sodium hydroxide, NaOH solution (4 marks)

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

Appendix 1

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

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

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

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

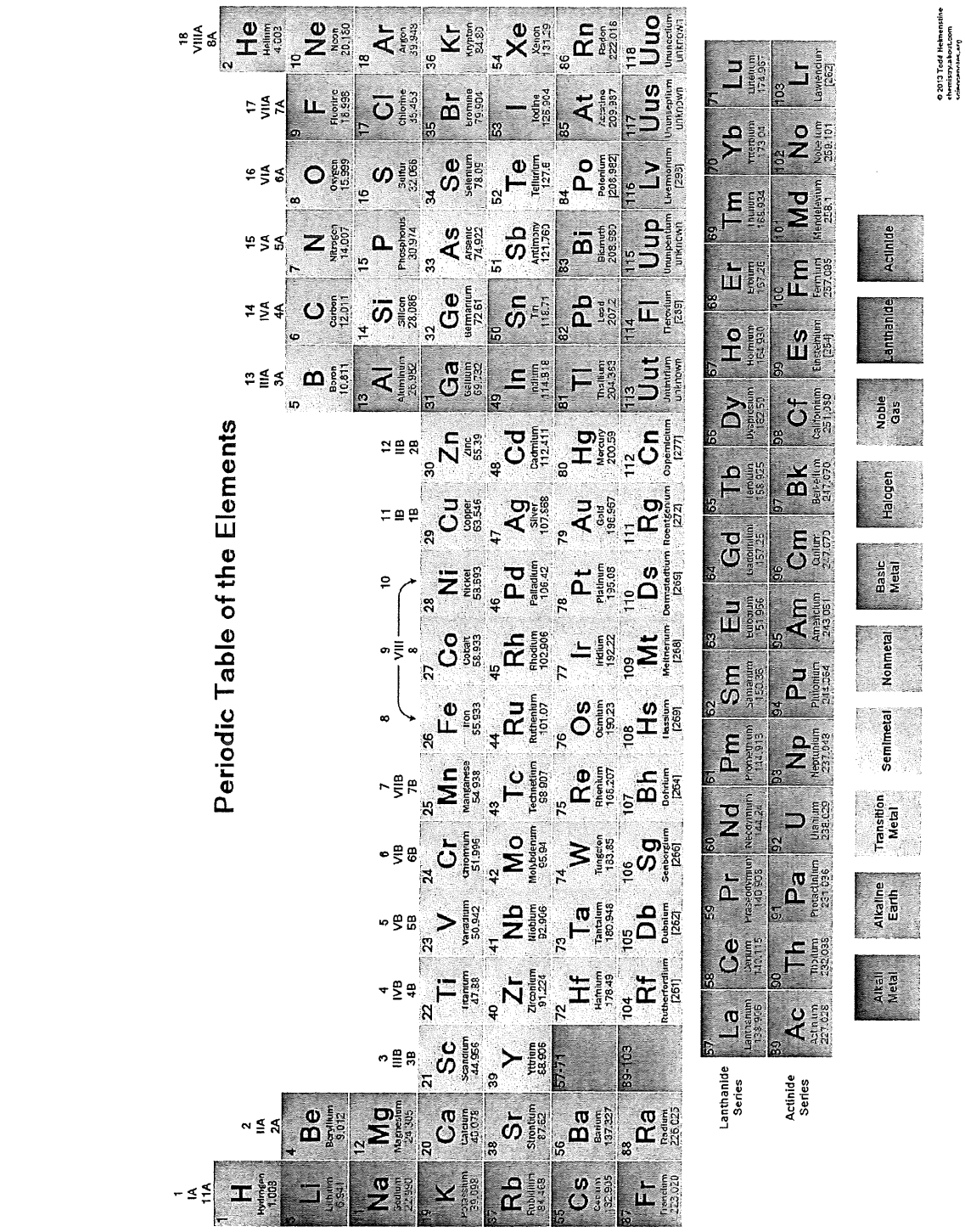
$$Mass = no.\ of\ moles\ X\ \text{Molecular weight}$$

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

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

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

APPENDIX 2


Periodic Table of the Elements
Lanthanide Series
Actinide Series
Alkali Metal
Alkaline Earth
Transition Metal
Semimetal
Nonmetal
Basic Metal
Halogen
Noble Gas
Lanthanide
Actinide
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