

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF NATURAL SCIENCES

Semester Final Examination
 Course Number: Chem 4115
 Course Title: Physical and Inorganic Chemistry

Winter Semester: 2023-2024
 Full Marks: 120
 Time: 2 Hours

Please answer according to the order of the questions. Answer all the 4 (FOUR) questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in the brackets.

1. a) Interpret the main postulates of VSEPR theory. Apply the VSEPR theory to predict the shape of molecules containing 2, 3, 4, 5 and 6 electron pair system to the central atom. (15)
 (CO2, PO2)
- b) Explain different types of hybridization with suitable sketches and examples. (8)
 (CO1, PO1)
- c) Discuss the main features of MOT. Draw the molecular orbital diagram of CO and predict its bond order, and magnetic state. (7)
 (CO1, PO1)
2. a) Derive the integrated rate equation for first order reaction. Explain first order reaction will never end and half-life of first order reaction is independent of its initial concentration. (15)
 (CO2, PO2)
- b) Discuss collision theory. Deduce rate constant expression based on collision theory. (8)
 (CO1, PO1)
- c) Run

	[A] (mol dm ⁻³)	[B] (mol dm ⁻³)	Initial rate (mol dm ⁻³ s ⁻¹)
1	0.150	0.25	1.4×10^{-5}
2	0.150	0.50	5.6×10^{-5}
3	0.075	0.50	2.8×10^{-5}
4	0.075	0.25	7.0×10^{-5}

 7
 (CO1, PO1)
 The table represents the data obtained for a reaction between A and B, calculate (i) the order of reaction with respect to A, (ii) the order of reaction with respect to B, (iii) Write the rate equation for the reaction and calculate the rate constant.
3. a) Explain Faraday laws of electrolysis and write down their importance. (15)
 0.5 A of current was passed through a solution of blue vitriol for 10 minutes. Calculate the amount of deposited copper. (CO2, PO2)
- b) Discuss fuel cells. Explain the working principle hydrogen-oxygen fuel cell and write down its advantages. (8)
 (CO1, PO1)

- c) Deduce Nernst equation for electromotive force. (7)
(CO1, PO1)
4. a) Discuss Kohlrausch's Law and write down its three applications. (15)
(CO2, PO2)
- b) Discuss Liquid crystal and its properties. Explain how liquid crystal changes its phase with temperature. (8)
(CO1, PO1)
- c) Draw the molar conductance vs concentration curves for a strong and a weak electrolyte and explain their nature. (7)
(CO1, PO1)