University of Barishal

Department of Computer Science and Engineering

1st Year 1st Semester B.Sc. (Hons) Final Examination, Admission Session: 2021-2022

Course Code: CHEM-1107, Course Title: Chemistry

Time: 3 Hours **Full Marks: 60**

Answer any five (05) Questions from the followings, parts of the same question should be answered consecutively.

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1. (a) State and explain Hund's Multiplicity Principle of electron configuration. 3

   (b) Write down the four quantum number values (n, l, m, s) for the 25th electron of Cu. 2

   (c) What is dual behavior of Electron. Demonstrate the drawbacks of Rutherford's Atomic Model. 3

   (d) Calculate the shortest and longest wavelengths in the hydrogen spectrum of the Lyman series. 4

2. (a) Why group 18 Elements are inert in nature? Write down the application of He, Ar and Ne. 4

   (b) State modern periodic law. Write down the electronic configuration and predict the position (group no. and period no.) for the following elements: Ca (20), Fe (26) and S (16) 4

   (c) Define Electron affinity and Electronegativity of Elements. Why Electron affinity of Chlorine (Cl) is greater than fluorine (F). 4

3. (a) Explain Coordination bond with suitable example. 2

   (b) Draw the structure and mention the hybridization of central atom of the following compound. PCl_5, $CH_2{=}CH_2$, XeF_4 and NH_4^+ 4

   (c) What is Covalent character of ionic compound. Explain with suitable example. 3

   (d) Predict the shape of Silane (SiH_4) Phosphine (PH_3) and Hydrogen Sulfide (H_2S) according to VSEPR theory. 3

4. (a) Define Buffer capacity and buffer solution. 2

   (b) Explain intermolecular hydrogen bonding and intramolecular hydrogen bonding with appropriate example. 4

   (c) "NH_3 is Lewis as well as Bronsted Lowrey's base but not Arrhenius base", explain it. 3

   (d) Calculate the concentration of H^+ ions in a solution having pOH value 9. 3

5 (a) Define attacking reagents in organic reactions and classify attacking reagents according to mode of action with proper example. 4

(b) Illustrate the mechanism of Friedel Craft Alkylation reaction. 4

(c) Fill in the blanks of the following reactions: 4

I. $CH_3\text{-}CH_2\text{-}Cl + CH_3\text{-}Cl \xrightarrow{\text{Dry Ether, Na}}$??

II. $CH_3MgBr + ? \longrightarrow CH_4$

III. $CH_3\text{-}CH(Cl)\text{-}CH_2\text{-}CH_3 \xrightarrow{\text{KOH alc.}}$?

IV. $Ar\text{-}Cl + CH_3COCl \xrightarrow{\text{Anhydrous } AlCl_3} Ar\text{-}COCH_3$

6. (a) State law of mass action. Establish a relationship between Kp and Kc. 4

(b) Derive the equation of Kp for the following reaction: 4

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

(c) What is critical temperature? At 27°C and 1 atm pressure N2O4 is 20% dissociated in the NO2. Calculate the value of Kp under this condition. 4

7. (a) What is Rate of reaction? Differentiate between order and molecularity of a reaction. 4

(b) What is rate law? Show that for first order reactions the half-life period is independent of the initial concentration. 4

(c) Define pseudo-order reaction. From the following data for the decomposition of N2O5 in CCl4 solution at 48°C, show that the reaction is of the first order 4

t(mts)	10	15	20	∞
Vol. of O_2 evolved	6.30	8.95	11.40	34.75

8. Write shorts notes: Any four 4X3=12

i. Nitration of benzene
ii. Chlorination of methane
iii. SN1 reaction
iv. Aldol reactions
v. Reimer-Tiemann reaction