(c) Write down the rate of the following reaction 2

$PCl_3 + Cl_2 \longleftrightarrow PCl_5$

(d) A certain first order chemical reaction required 120 seconds for the concentration of the reactant to drop from 2.00 M to 1.00 M. Find the rate constant and the concentration of reactant [A] after 80 seconds. 4

7. (a) Write down the characteristics of chemical equilibrium. 2

(b) What is the percent by volume of ethanol in the final solution when 85 mL of ethanol is diluted to a volume of 250 mL with water. 4

(c) Give the definition of reversible and irreversible reaction with appropriate example. 2

(d) At 298k N_2O_4 dissociates into NO_2. The partial pressure of N_2O_4 is 0.8 atm and equilibrium constant Kp is 0.008 atm. Find out the value of Kc and partial pressure of NO2 for the dissociation of N_2O_4. 4

8. (a) What is phase rule? Depict the phase diagram of the H_2O system and explain the terms therein. 4

(b) Define fuel cell. Construct a fuel cell and write down anode cathode reactions of fuel cell. Why this cell is environmentally friendly cell? 4

(c) What is the Cell Potential of the electrochemical cell in which the cell reaction is: Pb2+ + $Cd \rightarrow Pb + Cd^{2+}$? Given that $E^{o}cell = 0.277$ volts, temperature = 25°C, $[Cd^{2+}] = 0.02$ M, and $[Pb^{2+}] = 0.2$ M. 4

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University of Barishal

Department of Computer Science and Engineering

1st Year 1st Semester B.Sc. (Hons) Final Examination, Admission Session: 2022-2023

Course Code: CHEM-1107, **Course Title:** Chemistry

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

Answer any five (05) Questions

1. (a) What is electronic configuration? Establish the de Broglie's equation for revolving electron. 3

(b) What conclusions did Rutherford draw from his experiment that led to the formation of his atomic model? Explain in brief. 3

(c) On what quantum number orbital is determined? Depict the structure of five d-orbitals. 3

(d) The velocity of revolving electron of hydrogen atom is 7.34×10^{7} cms^{-1} and the radius is 4.76×10^{-8} cm. In which energy level is the electron revolving? 3

2. (a) Define Aufbau principle. Apply that rule to write electronic configuration of Cr, Cu^{2+}, O^{2-} and Fe^{3+}. 2

(b) Define modern periodic law. How does the electronegativity of elements vary across a period and down a group in the periodic table? Explain with an appropriate example. 4

(c) "The 1st ionization energy of Nitrogen is higher than that of Oxygen "Describe the statement. 2

(d) Why many gases diatomic whereas inert gases are monoatomic? Write down the application of Noble gases. 4

3. (a) How does a covalent bond differ from a coordination bond? Give two examples of coordination bond-containing compounds. 3

(b) Explain the geometry of CH_4, NH_3 and H_2O according to VSEPR theory 3

(c) What is ionic character of covalent compound. Demonstrate with suitable example. 3

(d) Depict the structure of the following compounds
PCl_5, IF_7, XeF_4 and SiH_4 3

4. (a) Briefly describe the conjugate acid base pair with suitable example. 3

(b) Despite being hydrides of the same group of elements, H_2O is liquid at ambient temperature whereas H_2S is gaseous. Describe the rationale behind it. 3

(c) Establish the Henderson–Hassel Balch equation for a basic buffer solution. 3

(d) The Ka of propionic acid is 1.34×10^{-5}. What is the pH of a solution containing 0.5 M propionic acid, C_2H_5COOH, and 0.5 sodium propionate, C_2H_5COONa. What happens to the pH of this solution when volume is doubled by the addition of water? 3

5 (a) Give a demonstration of how a covalent bond breaks and list the effects of each kind of rupture. 3

(b) Define alkyl free radical and Briefly illustrate the stability train for methyl, ethyl, iso-propyl and iso-butyl free radical. 3

(c) Briefly explain aldol condensation reaction with appropriate mechanism. 3

(d) Write down two named reactions for the preparation of alkane. 3

6. (a) Provide a rate law statement as well as the rate law's mathematical expression. 2

(b) Show that the initial concentration of the reactants has an inverse relationship with the half-life of a second order chemical reactions. 4

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