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Bachelor of Science (FYUP) 3rd Semester

(2125)

CHEMISTRY

Paper : Basic Concepts in Chemistry–I

Time Allowed : Three Hours] **[Maximum Marks : 67**

Note :— (1) Attempt **four** questions in all, selecting **one** question from each unit I, II, III and question No. 7 is compulsory.

(2) Use of log tables and simple calculator is allowed.

UNIT—I

1. (a) Explain why the solutions of alkali metal in liquid ammonia are blue and good conductors of electricity. 4

(b) Explain the role of solvent in deciding the acid base character. Explain. 4

(c) Discuss Self auto ionization of Liquid Sulphur Dioxide. What are the most effective acids and bases of the solvent system? 4

(d) Discuss the characteristics features of Soft acids and Soft bases. 4

2. (a) Discuss the classification of solvents as

(i) Protonic and Non-Protonic solvents

(ii) Acidic, Basic and Amphoteric solvents. 4

(b) Arrange the following in increasing acid strength and explain in detail:

$HClO$, $HClO_2$, $HClO_3$, $HClO_4$ 4

(c) Why does the acidic character of Hydracids decrease with the increasing electronegativity of non-metal and that of oxyacid increases? 4

(d) Discuss the characteristics features of Hard acids and Hard Bases. 4

UNIT—II

3. (a) Draw the Fischer and Haworth Formula for

(i) Sucrose

(ii) Maltose

(iii) Lactose. 4

(b) How will you convert Glucose to Fructose and vice versa? 4

(c) A freshly prepared solution of Fructose shows Mutarotation. Explain. 4

(d) Differentiate between reducing and non-reducing sugars, providing one structural example of each. Explain the specific chemical feature responsible for this property and, using its structure as a basis, explain why sucrose is a non-reducing sugar. 4

4. (a) Draw the structure of starch and cellulose indicating main points of differences. 4

(b) Draw the Haworth Projection formula of both anomers of Glucose and Fructose. 4

(c) Describe Ruff Degradation for the conversion of Aldohexose to Aldopentose. 4

(d) Compare and contrast the Molisch, Benedict's, and Barfoed's tests. For each test, state its underlying principle, the primary reagent(s) used, and the specific conclusion that can be drawn from a positive result (i.e., what it detects). 4

UNIT—III

5. (a) What are the postulates of quantum mechanics? Based on the postulates of quantum mechanics, derive Schrödinger wave equation. 4

(b) What is the ground state energy for an electron which is confined to a potential well (one-dimensional) bar having a width of 1 nm? 4

(c) What is Compton Effect? What is "Comptons shift"? Write expression for Compton shift and explain the results obtained for scattering angles of 0°, 90°, and 180°. How does it explain the results of Heisenberg's uncertainty principle? 4

(d) What is Hermitian Operator? Prove that Eigen Values of Hermitian Operator are Real. 4

6. (a) Applying de Broglie relationship, derive Schrödinger wave equation.

(b) Briefly describe the spectral distribution of black body radiation. How do the following laws follow from it?

(i) Stefan-Boltzmann's law

(ii) Wien's displacement law 4

(c) Write the expression of the following operator:

(i) $\left(\frac{d}{dx}+x\right)^2$

(ii) $\left(\frac{d}{dx}+\frac{1}{x}\right)^2$ 4

(d) Briefly explain how classical mechanics fails when applied to the following:

(i) Photoelectric effect

(ii) Heat capacity of solids.

How could these phenomena be explained by Planck's quantum theory? 4

COMPULSORY QUESTION

7. (a) Which of the following law gives quantitative relationship between the energy absorbed and the energy emitted by a body?

1. Stefan's law
2. Wien's displacement law
3. Planck's radiation law
4. Kirchoff's law 1

(b) According to Pearson's HSAB concept, which of the following interactions is most favorable?

1. A hard acid reacting with a soft base.
2. A soft acid reacting with a hard base.
3. A hard acid reacting with a hard base.
4. A borderline acid reacting with a soft base. 1

(c) In the Lewis acid-base definition, which species is considered an acid?

1. A proton donor
2. An electron pair donor
3. An electron pair acceptor
4. A proton acceptor 1

(d) In the Lewis acid-base definition, which species is considered a base?

1. A proton donor
2. An electron pair donor
3. An electron pair acceptor
4. A proton acceptor 1

(c) Schrödinger wave equation is applicable to the wave motion of an electron in

1. One Dimension
2. Two Dimension
3. Three Dimension
4. All of the above 1

(f) Which of the following does not act as an acid in Liquid Ammonia?

1. $(NH_2)_2SO$
2. NH_4Cl
3. $(NH_2)_2CO$
4. KNH_2 1

(g) Wave nature of electron was demonstrated by

1. Schrödinger
2. de Broglie
3. Davisson
4. Heisenberg 1

(h) A disaccharide is formed when two monosaccharides are bonded together by a bond

1. glycosidic
2. peptide
3. ionic
4. phosphodiester 1

(i) Trouton constant is defined as

1. $\frac{\Delta H_{evap}}{T_b}$
2. $\Delta H_{evap}.T_b$
3. T_b
4. T_f 1

(j) Do you think the reaction of $CdCO_3$ with Na_2S occurs? 2

(k) Why metal ammonia solutions are used as reducing agents? 2

(l) Which should be the stronger acid, HOCN or HCN? 2

(m) Why is cellulose not digestible by Humans? 2

(n) What do you understand by

a. Linear operator

b. Laplacian operator? 2