

(i) Printed Pages : 7

Roll No.

(ii) Questions : 7

Sub. Code :

1	1	8	0	4
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Exam. Code :

5	0	1	3
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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, HClO₂, HClO₃, HClO₄ 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

(e) 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. $(\text{NH}_2)_2\text{SO}$
2. NH_4Cl
3. $(\text{NH}_2)_2\text{CO}$
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. $\frac{\Delta H_{\text{evap}}}{T_b}$

2. $\Delta H_{\text{evap}} \cdot T_b$

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