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Reg. No. : ....

Name : ....

First Semester M.Sc. Degree Examination, May 2022

Chemistry/Polymer Chemistry/Analytical Chemistry

CH/CL/PC 213 : PHYSICAL CHEMISTRY — I

(2020 Admission Onwards)

Time : 3 Hours　　　　　　　　　　　　　　　Max. Marks : 75

SECTION – A

Answer **two** among (a), (b) and (c). Each sub question carries **2** marks.

1. (a) What are the properties of an acceptable wave function?

   (b) Show that $\sin 2x$ is an eigen function of the operator d^2/dx^2. What is the eigen value?

   (c) Mention the properties of Hermitian operators.

2. (a) Distinguish physisorption from chemisorption.

   (b) What are micelles?

   (c) List the steps involved in a surface reactions.

3. (a) What are partial molar properties?

   (b) Define activity and activity coefficients

   (c) What is varit Hoff isotherm?

P.T.O.

4. (a) What are chain reactions?

(b) How are shock waves formed?

(c) Write the Hammett equation.

5. (a) Define class.

(b) What are reducible and irreducible representations?

(c) Give the 3×3 matrix representation of any two symmetry elements.

$(10 \times 2 = 20$ Marks$)$

SECTION – B

Answer either (a) or (b) from each questions. Each sub question carries **5 marks.**

6. (a) Normalize the wave function $\psi = A\sin\dfrac{n\pi}{a}x$ for a particle in 10 box of length 'a'.

(b) Commute $[x, p_x]$.

7. (a) Derive Gibbs adsorption isotherm.

(b) Describe any two methods for the determination of fugacity.

8. (a) Derive Gibbs-Duhem equation.

(b) Get the expressions for internal energy and entropy in terms of partition functions.

9. (a) Discuss the kinetics of the thermal decomposition of N_2O_5.

(b) What is relaxation time? How it is related with rate constants in the reaction $A \rightleftharpoons B$?

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10. (a) State and explain 'Great orthogonality theorem' and discuss the important rules related to irreducible representation and their characters.

(b) Using group theory, find the hybridization of BF_3 ,molecule.

$(5 \times 5 = 25 \text{ Marks})$

SECTION – C

Answer **any three** questions. Each question carries **10** marks.

11. Explain the five important postulates of quantum mechanics.

12. Describe how will you determine the surface area by BET adsorption theory.

13. Derive the Maxwell's relation and highlight the significance.

14. Give the basic assumptions of transition state theory of a reaction rate of bimolecular gaseous reaction and derive the Eyring equation.

15. Obtain the raducible representations for NH_3 molecule and from the symmetry types determine the IR and Raman active symmetries,

$(3 \times 10 = 30 \text{ Marks})$

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