KS-5233

M. Sc. (Sem.-I) Examination, Dec.-2024

Chemistry

Paper - 1.3

CHEM-513-T

Physical Chemistry

Time allowed : **Three Hours**

Maximum Marks : **70**
Minimum Marks : **28**

*Note : This question paper contains **two** sections as under:*

Section - A **Max. Marks 20**

This section will have 10 questions, having 02 questions form each unit with no internal choice. Answer in about 20 words. All questions will have equal marks. (10×02=20)

Section - B **Max. Marks 50**

This section will have 10 questions, having 02 questions from each unit, one question to be attempted from each unit. Words limit approximately 400-500 words. Questions may have sub divisions. All questions will have equal marks. (10×05=50)

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SECTION - A

1 (i) Write quantum mechanical operator for momentum $\left(\hat{P}_x\right)$ and total energy $\left(\hat{H}\right)$.

(ii) What will be degenercy for a particle moving in 3-D cubic box, having energy $E_n = \frac{14h^2}{8ma^2}$.

(iii) Write secular determinant for cyclobutadiene.

(iv) In angular momentum (L), what will be the relationship between L^2 and any one of its component L_z ?

(v) Define temperature coefficient.

(vi) Write two general features of fast reaction.

(vii) Name two surface active agents.

(viii) What are reverse micelies ? Explain.

(ix) What is Zieglar-Natta catalyst?

(x) What are the differences between isotactic and syndiotactic polymers?

SECTION - B

UNIT - I

2 ~~(i)~~ Write postulates of quantum mechanics.

(ii) Calculate <x> and <p> for normalized wave function $y = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x}{a}\right)$, where x varies from zero to 'a'.

OR

(i) Discuss first order perturbation theory to Helium atom.

(ii) Write the salient features of the variation mehod for solution of Schrodinger's equation.

UNIT - II

3 (i) Explain Huckel theory of conjugated system.

(ii) Write a short note on "Ladder operator". **7+3**

OR

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(i) What is angular momentum ? For angular momentum vector $(\vec{L})$ prove that $\left[L_x\ L_y\right] = i\hbar\ L_z$

(ii) Write a note on Pauli's exclusion principle.

2+5+3

UNIT - III

4 (i) Discuss activated complex theory and derive expression for rate constant. How it is better than collision theory ?

(ii) Discuss different steps of Chain reactions.

5+2+3

OR

(i) What are enzymes ? Explain and derive an expression for enzyme reactions.

2+5

(ii) Define order of reaction and discuss half-life method of determining order.

1+2

UNIT - IV

5 What is multi molecular theory of BET adsorption isotherm ? Derive BET equation.

3+7

OR

Write note on following :

(i) Factor affecting the CMC of surfactants.

(ii) Laplace equation

(iii) Surface tension

4+4+2

UNIT - V

6 Write note on :

(i) Liquid Crystal polymers

(ii) Conducting Polymers

(iii) Types of polymers

3+3+4

OR

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(i) What are macromolecules ? Explain.

(ii) Discuss osmometry method for determination of molar mass of a polymer.

(iii) Discuss mechanism of free radical polymerizaion.

2+4+4

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