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GSQ/M-21 **1752**

PHYSICAL CHEMISTRY (Theory)

Paper–XIX (CH-305)

Time Allowed : 3 Hours] [Maximum Marks : 32

Note : Attempt **five** questions in all, selecting at least **two** questions from each Unit. Question No. **1** is compulsory.

Compulsory Question

1. (a) Define First law of Photochemistry. 1

   (b) What is Phosphorescence ? 1

   (c) What is Partition function ? Why is it so called ? 2

   (d) State 'Gibb's phase rule'. 1

   (e) Define the term 'Phase'. 1

   (f) Define Raoult's law for solutions containing non-volatile solute. 1

   (g) What are Isotonic solutions ? 1

UNIT–I

2. (a) Give one example of a Photochemical reaction in which the quantum yield is very high. Briefly explain the reason for the same. 3

   (b) For the Photochemical reaction $A \rightarrow B$, 1.0×10^{-5} moles of B are formed on absorption of 6.0×10^{7} ergs at 3600Å. Calculate the quantum efficiency of the reaction. 3

3. (a) What are Photochemical reactions ? How these reactions differ from Thermochemical reactions ? 3

   (b) Calculate the value of an Einstein of energy for radiation of wavelength 4000 Å. 2

   (c) What is 'Resonance fluorescence' ? Give one example. 1

4. (a) What is Photosensitizer ? How does it act ? Explain by giving two suitable examples. 3

   (b) What is Statistical mechanics ? What are the main points of difference between Classical Statistical mechanics and Quantum Statistical mechanics ? 3

5. (a) Discuss the following :

(i) Thermodynamic probability.

(ii) Born-Oppenheimer approximation. 4

(b) Write expression for Maxwell-Boltzmann distribution law taking degeneracy of states into consideration. What do different symbols signify ? 2

UNIT–II

6. (a) Give two examples each of two component systems in which :

(i) the components do not react with each other.

(ii) the component react to form a compound with congruent melting point

(iii) the component react to form a compound with incongruent melting point. 3

(b) What is meant by Triple point of Water ? Why is it different from the normal melting point of Ice ? 2

(c) What is Condensed system ? 1

7. (a) Calculate the number of components and degrees of freedom for the following systems :

(i) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

(ii) $C(s) + O_2(g) \rightleftharpoons CO(g) + CO_2(g)$

(iii) Rhombic sulphur $\rightleftharpoons$ Monoclinic sulphur

(iv) $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$. 4

(b) Draw a labelled phase diagram for lead-silver system. 2

8. (a) What are ideal and non-ideal solutions ? Give one example of each of them. 2

(b) Define the term Colligative properties. How can you justify that Osmotic pressure is a colligative property ? 2

(c) 1.20 g of a substance dissolved in 100 g of water lowered its freezing point by 0.37 °C. Calculate the molecular weight of the substance. Molal depression constant of water is 1.86 °C per molality. 2

9. (a) Define Molal elevation constant. Derive the relationship between elevation in boiling point and molality of the dissolved solute. 4

(b) Differentiate between Molarity and Molality of a solution. Which out of these is the preferred method of expressing Concentration and why ? 2