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GSQ/M-20 **1752**

CHEMISTRY

Paper XIX (CH-305)

Physical Chemistry

Time : Three Hours] [Maximum Marks : 32

Note : Attempt *Five* questions in all, selecting *two* questions from each Section. Q. No. **1** is compulsory. Use of log tables and non-programmable calculator is allowed.

Compulsory Question

1. (a) Why is molality preferred over molarity ? **1**

(b) Why quantum yield of photosynthesis of HCl decreases if the vessel contains small traces of oxygen ? **1**

(c) Why is camphor preferred as a solvent for measuring the molecular weight by Rast method ? **1**

(d) Write down Reduced Phase Rule equation. **1**

(e) How many photons are present in one Einstein of energy ? **1**

(f) What is spin multiplicity ? **1**

(g) What is Born-Oppenheimer approximation ? **1**

(h) What is Eutectic point and Eutectic temperature ? **1**

Section A

2. (a) Why there was a need for the branch "Statistical Thermodynamics" ? **2**

(b) Derive Maxwell-Boltzmann Distribution Law. **3**

(c) Write the Stirling's approximation formula for 'N' number of particles. **1**

3. (a) What is Luminiscence ? Explain various types of Luminiscence with examples. **4**

(b) What is 'Chemical Actinometer' ? Briefly explain working of uranyl oxalate actinometer. **2**

4. (a) What are 'Photoinhibitors' ? Give example. **1**

(b) Draw well labelled Jablonski diagram. Depict radiative and non-radiative transitions, IC, ISC. What should be the type of multiplicity for fluorescence and for phosphorescence ? **4**

(c) What should be the type of excited state for a chemical reaction to occur and why ? **1**

5. (a) Calculate the value of Einsteins in kilojoules for orange light with λ = 600 nm. **2**

(b) Explain why photosynthesis of HCl has very high quantum yield while that of HBr is very small. **3**

(c) What is 'Quantum Efficiency' ? **1**

Section B

6. (a) What is a 'Colligative Property' ? Give example. **1**

(b) Why do we observe abnormal molecular masses of solute in certain cases when determined using colligative properties ? **3**

(c) Calculate the osmotic pressure at 0ºC of a 5% solution of urea (ml. wt. = 60) and R = 0.82 litre atm/deg/mol. **2**

7. (a) How are invariant, univarinat and vibariant systems represented in a phase diagram ? **2**

(b) Draw well labelled 'Water System'. Why melting point curve has a negative slope ? **3**

(c) Is it possible to have a quadruple point on the phase diagram of one-component system ? **1**

8. (a) Why equimolar solutions of NaCl and cane sugar do not have the same osmotic pressure ? **1½**

(b) Latent heat of fusion of water (ice) is 1436.3 cal per mol. Calculate the molal freezing point depression constant of water. **2**

(c) What is the cause of elevation in boiling point ? Derive expression for elevation in boiling point of a non-volatile solute. **2½**

9. (a) Derive Phase Rule thermodynamically. **2**

(b) State and explain the following terms :

(i) Phase

(ii) Component

(iii) Degrees of freedom

(iv) Stable and Metastable equilibrium. **2½**

(c) Find out the number of components present in the following systems : **1½**

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

(ii) Silver(s) $\rightleftharpoons$ Solution of silver and lead (l) + Vapour of silver and lead (g)

(iii) Dissociation of ammonium chloride in a closed vessel.