# U. G. 6th Semester Examination 2022

## CHEMISTRY (Honours)

### Paper Code : CEMH DC-14

### [Physical Chemistry]

Full Marks : 25 Time : Two Hours

*The figures in the margin indicate full marks.*
*Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any ***five*** questions from the following: 1×5=5

(a) A photophysical process which leads to non-radiative decay is called:

(i) fluorescence

(ii) internal conversion

(iii) absorption

(iv) phosphorescence

(b) The zero point vibrational energy for deuterium (D2) gas is:

(i) lower than that for $H_2$

(ii) higher than that for $H_2$

(iii) equal to that for $H_2$

(iv) equal to zero

(c) The bond length of a homonuclear diatomic molecule can be determined by:

(i) IR spectroscopy

(ii) Microwave spectroscopy

(iii) Raman spectroscopy

(iv) NMR spectroscopy

(d) The absorption of infrared radiation by a molecule is accompanied by a change in:

(i) the zero point energy

(ii) the dipole moment

(iii) the nuclear spin

(iv) the electronic state

(e) Molar absorption coefficient depends on:

(i) path length of light

(ii) the intensity of the light used

(iii) the concentration for an absorbing species

(iv) wave length of the light used

(f) A drop of ink put into a glass of water mixes uniformly with the solvent as time progresses. This is due to

(i) gravitational force

(ii) minimization of potential energy

(iii) maximization of entropy

(iv) osmotic pressure of water

(g) Isotherm which has fractional coverage and linearly dependent on pressure at low pressures but almost independent at high pressure is called

(i) BET isotherm

(ii) Langmuir isotherm

(iii) Freundlich isotherm

(iv) Temkin isotherm

(h) A dilute $AgNO_3$ solution is added to a slight excess of NaI solution. A sol of AgI is produced whose surface adsorbs

(i) $I^-$

(ii) $NO_3^-$

(iii) $Ag^+$

(iv) $Na^+$

2. Answer any ***four*** questions: 2×4=8

(a) "Apparently photosensitizers and catalysts play the same role, but they are different" — Explain.

(b) The photochemical dissociation of gaseous HI to form normal $H_2$ and $I_2$ requires radiation of 4040A° or less. Determine the molar heat of dissociation of HI.

(c) Deltas are formed at a place where rivers pour water into sea – comment.

(d) Distinguish diethyl ether and ethyl alcohol using NMR spectroscopy.

(e) The wave number of vibration of $^1H^{35}Cl$ molecule is 2991 $cm^{-1}$. Calculate the force constant of the HCl bond.

(f) Explain zeta potential with proper diagram.

[P.T.O.]

(g) Adsorption of gas on a solid surface is an exothermic process — justify.

(h) A liquid A has half the surface tension and twice the density of liquid B at a certain temperature. If in a capillary the rise is 10 cm for A, what will be the rise of B in the same tube at the same temperature?

3. Answer any ***two*** questions : 2×6=12

(a) (i) What information can be obtained from the plot of absorbance vs molar concentration?

(ii) The percentage transmittance of an aqueous solution of a dye at 450 nm and 25ºC is 30% for a $2\times10^{-3}$ M solution in a cm cell. Calculate O.D. and molar extinction co-efficient. Find the concentration of the same dye in another solution in which percentage transmittance is 20% in a 1 cm cell at the same temperature and same wavelength of light. 3+3

(b) (i) Why are Stokes lines more intense than anti-Stokes lines?

(ii) In the near I.R. spectrum of CO there is an intense band at $2144cm^{-1}$. Calculate (I) the fundamental vibrational frequency of CO, (II) the period of vibration, (III) the force constant and (IV) the zero-point energy in cal/mole 2+4

(c) (i) A liquid A has half the surface tension and twice the density of liquid B at a certain temp. If in a capillary, the rise is 10 cm for A, what will be the rise of B at the same temperature.

(ii) Why do electrolytes increase the surface tension of a liquid?

(iii) "Lyophobic colloids flocculate only when the charges on the colloidal particles are completely neutralized by addition of electrolytes" Comment. 2+2+2

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