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B.Sc./6th Sem (H)/CHEM/23(CBCS)

2023

6th Semester Examination

CHEMISTRY (Honours)

Paper : C 14-T

[Physical Chemistry-V]

[CBCS]

Full Marks : 40

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.*

**Group - A**

Answer any *five* questions :  $2 \times 5 = 10$

1. Define quantum yield.
2. Out of the two solutions,  $K_2Cr_2O_7$  and  $KH_2PO_4$  which one can be quantitatively estimated by spectroscopic method using Lambert-Beer's law in the visible range of radiation? Give appropriate explanation for your answer.
3. Write differences between adsorption and absorption.
4. Calculate the work done to broken a water drop of 1 mm radius into a million droplets [Given,  $\gamma(\text{water}) = 72.75 \text{ erg cm}^{-2}$ ].
5. What is Zeta potential?

P.T.O.

( 2 )

6. The  $C = O$  bond length in  $CO_2$  is 120 pm. Calculate the moment of inertia of  $CO_2$  (Given masses of C and O are  $1.9 \times 10^{-27} \text{kg}$  and  $2.5 \times 10^{-27} \text{kg}$  respectively).
7. In a spectrometer operating at 1 T, the NMR frequency of  $F^{19}$  is 40.06 MHz. Calculate the magnetogyric ratio of  $F^{19}$ .
8. Predict the ESR spectrum of the  $\dot{N}H_2$  radical.

### Group - B

Answer any **four** questions :  $5 \times 4 = 20$

9. (a) Derive an expression for the vapour pressure over curved liquid surface.  
(b) State Jurin's law.  
(c) Define work of adhesion.  $3+1+1$
10. (a) Photobromination of cinnamic acid to dibromocinnamic acid was carried out in blue light of wave length 440 nm at  $35^\circ\text{C}$  using light intensity of  $1.5 \times 10^{-3} \text{J/s}$ . An exposure of 20 minutes produces a decrease of 0.075 mili mole of bromine. The solution absorbs 80% of the light passing through it. Calculate the quantum yield of the reaction.  
(b) What is photosensitized reaction?  $3+2$
11. (a) Suggest a mechanism for the photochemical

decomposition of HI by which you can show that quantum yield for the reaction is 2.

- (b) Write differences between IC and ISC. 3+2
12. (a) Write short note on Gibb's adsorption isotherm.  
(b) Plot and explain adsorption isobars for Chemisorption and Physisorption. 3+2
13. (a) Compare between Lyophilic sols and Lyophobic sols.  
(b) Write short note on origin of charge and stability of lyophobic colloids. 2+3
14. (a) What is Tyndal effect?  
(b) In the surface tension measurement of an aqueous solution of surfactant, change of surface tension with the concentration of the surfactant attains a plateau after micelle formation. — Explain.  
(c) State Franck Condon principle. 2+2+1

### Group - C

Answer any **one** question : 10×1=10

15. (a) Explain the principle of NMR spectroscopy.  
(b) Draw and explain energy level diagram and allowed transition an Unpaired electron coupling with two equivalent nuclei of spin  $I = 1/2$ .

P.T.O.

(c) If there is +1.0% errors in the determination of the rotational constant ( $\bar{B}$ ) B, of a diatomic molecule, calculate the percentage error in its bond length measurement.

(d) State and explain mutual exclusion principle.

3+2+3+2

16. (a) What is Morse potential?

(b) How classical mechanics explain the origin of Raman spectrum?

(c)  $\text{CO}_2$  is green house gas but  $\text{O}_2$  is not. — Explain.

(d) The vibrational energy levels of  $\text{CO}$  molecules is given by the expression —

$$E_v (\text{in } J) = 4.3 \times 10^{-20} \left( v + \frac{1}{2} \right) - (2.5 \times 10^{-22}) \left( v + \frac{1}{2} \right)^2$$

Calculate the force constant.

2+3+2+3