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V—37—2017

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

OCTOBER/NOVEMBER, 2017

CHEMISTRY

Paper XIII

(Physical Chemistry and Inorganic Chemistry)

(Sunday, 12-11-2017)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

- N.B. :—*
- (i) Use same answer-book for Section A and Section B.
 - (ii) Use of logarithmic table and non-functional calculator is allowed.
 - (iii) Attempt *All* questions.

Section A

(Physical Chemistry)

1. Answer any *five* of the following : 5×2=10
- (a) What are the limitations of Nernst's distribution law ?
 - (b) State and explain Henry's law.
 - (c) Explain the kinetics of dimerization of anthracene.
 - (d) What is third order reaction ? Give its any *two* examples.
 - (e) Discuss the kinetics of decomposition of HI.
 - (f) Explain the transition $\sigma \rightarrow \sigma^*$ and $n \rightarrow \sigma^*$ with energy level diagram.
 - (g) What is the effect of isotopic substitution on rotational spectra of diatomic molecules ?

P.T.O.

2. Answer any *two* of the following : 2×5=10

- (a) Derive the kinetic expression for third order reaction.
- (b) Discuss the quantum theory of Raman scattering.
- (c) The microwave spectrum of gaseous diatomic molecule consists of a series of equally spaced lines separated by 4.00 cm^{-1} . Calculate the bond length. The reduced mass of molecule is $10.6 \times 10^{-27} \text{ kg}$.
($h = 6.6 \times 10^{-34} \text{ Js}$, $c = 3 \times 10^8 \text{ m/s}$, $\pi = 3.14$)

3. Answer any *one* of the following : 1×7=7

- (a) Derive an expression for the energy of transition from $J \rightarrow J + 1$ level in the rotational spectrum of simple diatomic rigid rotator. Draw energy level diagram.
- (b) (i) Discuss any *three* applications of distribution law.
- (ii) An organic compound behaves normal in liquid A. It was distributed between two immiscible liquids A and B in contact. The following are concentrations in the two layers :
- | | | | |
|---------------------------|---|-------|-------|
| Concentration in liquid A | : | 0.151 | 0.196 |
| Concentration in liquid B | : | 2.421 | 4.121 |
- Determine molecular state of organic compound in liquid B.

Section B

(Inorganic Chemistry)

4. Solve any *three* of the following : 3×3=9

- (a) Give the method of preparation of organotitanium compound (any *three*).
- (b) Write any *three* applications of organoaluminium compounds.
- (c) Give the chemical properties of Nickel tetracarbonyl.

- (d) What is the action of the following on organolithium compound ?
- (i) Alkyl halide
 - (ii) Carbon monoxide
 - (iii) SnCl_4
- (e) Explain the structure of $\text{Ni}(\text{CO})_4$.
5. Solve any *two* of the following : 2×2=4
- (a) What are organometallic compounds ? Give example.
 - (b) How is ethyl lithium prepared from :
 - (i) alkyl chloride
 - (ii) dialkyl mercury.
 - (c) Give the agriculture uses of organotin compound.
 - (d) What are mononuclear carbonyls ? Give its characteristic.