Total number of printed pages–4

1A (Sem–1/ITEP) CHE01 MN

2025

CHEMISTRY

(Minor)

Paper : CHE0100104–N

(Chemistry–I)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×5=5

   (a) Write Schrödinger wave equation for hydrogen atom.

   (b) What is critical micelle concentration ?

   (c) Mention the number of radial nodes in $4p$ orbital.

   (d) Write the electronic configuration of Cu^{2+}.

   (e) Draw the structure of the most stable conformer of *n*-butane.

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

(a) Explain the physical significance of φ and φ^2.

(b) Define hybridization and write its type.

(c) What is the effective nuclear charge felt by a $2p$ electron of a fluorine atom ?

(d) State Aufbau Principle. Why a $4s$ orbital is filled earlier than a $3d$ orbital ?

(e) Write *two* differences between inductive effect and resonance effect.

(f) What is the significance of Van der Waal's constant a and b ?

(g) Write *two* characteristics of Born-Lande equation.

(h) What is coefficient of viscosity ? Write its unit.

3. Answer ***any four*** of the following questions : 5×4=20

(a) Describe the utility of Born-Haber cycle for calculating the lattice energy of *NaCl*.

(b) Define normalized and orthogonal wave function. Give the significance of radial and angular distribution function of *H*-atom.

(c) Draw different conformers of ethane and write their stabilities.

(d) What is surface tension ? Write the SI unit of surface tension. Discuss the effect of temperature and pressure on the surface tension of a liquid.

(e) What is Boyle's temperature ? Show that Boyle's temperature, $T_B = a/Rb$ where a and b are Van der Waals constants.

(f) Explain the significance of all the four quantum numbers.

(g) Discuss the factors affecting ionization energy.

4. Answer ***any one*** of the following questions : 10

(a) Define critical temperature, critical pressure and critical volume. Derive the expressions for these critical constants in terms of Van der Waals constants a and b. 3+7=10

(b) (i) What is surfactant ? Describe the cleaning action of detergent. 5

(ii) Explain the effect of various solutes on the viscosity of a liquid. 5

(c) (i) Write the postulates of Bohr's theory. How Bohr's theory explain the spectrum of *H*-atom. 2+3=5

(ii) Derive the Bohr's equation for the energy of electron in *H*-like atom. 5