1A (Sem–1/ITEP) CHE01 MJ

2025

CHEMISTRY

(Major)

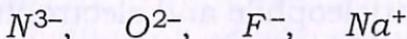Paper : CHE0100104–N

(Chemistry–I)

Full Marks : 45

Time : 2 hours

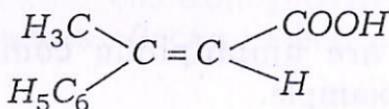**The figures in the margin indicate full marks for the questions.**

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

   (a) Arrange the following in increasing order of ionic radius :

   N^{3-}, O^{2-}, F^-, Na^+

   (b) What is micelle ?

   (c) Designate the following compound whether it has E and Z configuration :

   $$H_3C, H_5C_6 \diagdown C = C \diagup COOH, H$$

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(d) Ethylamine is more basic than acetamide. Why?

(e) Give the electronic configuration of Sn^{4+}.

2. Answer *any five* of the following questions:

$2 \times 5 = 10$

(a) Write de Broglie relation and explain the terms involved in it.

(b) What are enantiomers? Give examples.

(c) Draw the chair and boat conformation of cyclohexane indicating axial and equatorial bonds.

(d) Using Slaters rule, find the Z_{eff} for 3d-electron, 4s-electron and at the periphery of Cr-atom.

(e) What are the factors on which viscosity of liquid depends?

(f) Select nucleophile and electrophile from the following:

$RMgX$, H_2O, CH_3^+, ROH
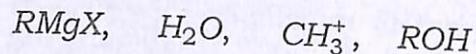
(g) Write *two* characteristics of Madelung constant.

(h) What are amphiphilic compounds? Give example.

3. Answer *any four* of the following questions:

$5 \times 4 = 20$

(a) What are conformers? Draw the chair and boat conformation of cyclohexane indicating axial and equatorial bonds.

$1 + 2 + 2 = 5$

(b) What are virial coefficients? What is the physical significance of virial coefficients?

$2 + 3 = 5$

(c) Define hybridization. Explain the structure of ethylene and acetylene molecules with the help of hybridization.

$1 + 2 + 2 = 5$

(d) Draw the shape of *five* d-orbitals. Write their names.

$3 + 2 = 5$

(e) What is lattice energy? How is it calculated? Discuss the factors affecting lattice energy.

$1 + 2 + 2 = 5$

(f) Write the CGS and SI units of coefficient of viscosity. Explain *one* method used in the laboratory for the determination of coefficient of viscosity of a liquid.

$2 + 3 = 5$

(g) Define electronegativity. Discuss the factors affecting electronegativity.

$1 + 4 = 5$

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

(a) (i) Define critical constants of a gas. Obtain the following relation for Van der Waals' gas :

$$\frac{RT_c}{P_cV_c} = \frac{8}{3}$$

$1+4=5$

(ii) Calculate the pressure exerted by one mole of CO_2 gas in a $1.52\,dm^3$ vessel at $52°C$ using the Van der Waals equation. The Van der Waals' constants are :
$a = 3.59\,atm\,dm^6\,mol^{-2}$
and $b = 0.0427\,dm^3\,mol^{-1}$. 5

(b) How will you convert *threo*- and *erythro*-2,3-butanediol from Fisher projection to Sawhorse and Newmann projection formulae? $5+5=10$

(c) (a) Write *five* postulates of wave mechanics. 5

(b) The electron in a H-atom revolves in second orbit. Calculate—the energy of the electron in this orbit and the radius of the second orbit. Given : mass of electron $= 9.1 \times 10^{-31}\,kg$, charge on electron $= 1.602 \times 10^{-19}\,C$ and $4\pi\varepsilon_0 = 1.11264 \times 10^{-10}\,C^2\,N^{-1}m^{-2}$. 5