63(FY) (Sem-2)/MAJ2/CHMMAJ1024

2024

CHEMISTRY

Paper : CHMMAJ1024

(Fundamentals Chemistry-2)

Full Marks : 50

Pass Marks : 20

Time : Two hours

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

1. Choose the correct answer : 1×5=5

   (i) Which among the following in paramagnetic molecule ?

   (a) C_2

   (b) O_2

   (c) N_2

   (d) F_2

(ii) In which of the following structures, the anion has maximum coordination number ?

(a) $NaCl$

(b) ZnS

(c) CaF_2

(d) Na_2O

(iii) Association of molecules in water is due to

(a) Surface tension

(b) Viscosity

(c) Hydrogen bonding

(d) Optical activity

(iv) Which one of the following is not aromatic ?

(a) Benzene

(b) Tropylium cation

(c) Cyclopentadienyl cation

(d) Cyclopentadienyl anion

(v) Among the following the ortho-para directing group is

(a) $-COOH$

(b) $-CN$

(c) $-COCH_3$

(d) $-NHCOCH_3$

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

(i) Draw the Lewis structures of the following :

(a) CO_3^{2-}

(b) HNO_3

(ii) Why PCl_5 is possible but NCl_5 is not ?

(iii) CH_4, NH_3 and H_2O have same hybridization on central atom, yet their bond angles are different. Why ?

(iv) Why is Wurtz reaction is not preferred for preparation of alkanes containing odd number of carbon atoms ? Illustrate your answer by citing one example.

(v) Out of benzene, *m*-dinitrobenzene and toluene, which will undergo nitration most easily and why ?

(vi) Define surface tension. How is the surface tension of a liquid affected by temperature ?

(vii) What are the element of symmetry present in cubic crystal ?

3. Answer the following questions (***any five***) : 5×5=25

(i) Draw the chair and boat conformation of cyclohexane. Also label axial, equitorial and flag pole hydrogens. Discuss their relative stabilities. Draw the chair conformation of mono-substituted cyclohexane by taking an example of methylcyclohexane. 2+1+2=5

(ii) What is the major product obtained on treatment of prop-1-ene with *HBr* in the presence of organic peroxide ? Write its mechanism. Why anti-Markovnikov rule is applicable only for *HBr* in presence of peroxide but not for *HCl* and *HI* in presence of peroxide. 1+2+2=5

(iii) Draw the molecular orbital energy level diagram for *NO* and *HCl*. Explain why NO^+ is more stable than *NO* whereas CO^+ is less stable than *CO* ? 2+1½+1½=5

(iv) Derive Bragg's equation. The density of lithium atom is $0.5\ gcm^{-3}$ and separation of (100) plane of the metal is 350 pm. Determine whether lattice is fcc or bcc. 3+2=5

(v) Describe how will you determine the coefficient of viscosity of the liquid by Ostwald viscometer. In an experiment with Ostwald viscometer, the times of flow of water and ethanol are 80 sec and 175 sec at 20°C. The density of water = $0.998 g/cm^3$ and that of ethanol = $0.790\ g/cm^3$. The viscosity of water at 20°C is 0·01008 poise. Calcutate the viscosity of ethanol. 3+2=5

(vi) Define limiting radius ratio. Describe how to determine the limiting radius ratio for trigonal site ? The ionic radius of Rb^+ and Br^- are 1.47Å and 1.35Å respectively. Predict the most probable geometry exibit by *RbBr*. 1+2+2=5

(vii) Define dipolemoment. Explain—

(a) Both CO_2 and SO_2 are triatomic but CO_2 has zero dipolemoment whereas SO_2 has dipolemoment.

(b) Out of NH_3 and NF_3 which one has more dipolemoment.

1+3+3=5

(viii) Write the mechanism of chlorination of chlorobenzene. Halogens are electron withdrawing group and yet they direct the incoming group to ortho and para positions. Explain. 3+2=5

4. Answer the following questions (***any one***): 10

(I) (i) What is Lattice energy? Mention the factors on which lattice energy depends. What is Madelung constant? 2+2+1=5

(ii) Derive Born-Lande equation for lattice energy. 5

(II) (i) What do you mean by ozonolysis reactions of alkene? Write the name of the product obtained on ozonolysis of

(a) 1-Phenyl but 1-ene

(b) 2-Ethyl but-1-ene

(c) 3,4-Dimethylhept-3-ene

1+3=4

(ii) Write short notes on ***any one*** :

(a) Witting reaction

(b) Corey House reaction

(c) Diels-Alder reaction

2+2+2=6
