This question paper contains **8** printed pages] 12/12/14 M

Roll No. | | | | | | | | | | | | |

S. No. of Question Paper : **8577** Physical Sc.

Unique Paper Code : **42171103**

Name of the Paper : **Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons**

Name of the Course : **B.Sc. (Programme)**

Semester : **I**

Duration : **3 Hours** Maximum Marks : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *six* questions in all, *three* questions from each Section.

Use separate answer sheets for Section-A and Section-B.

SECTION–A

1. (*a*) Define Lattice energy ? Write the expression for Born-Landé equation, and explain the terms involved in it. 5

(*b*) Write short notes on any *two* : 4

(*i*) Heisenberg uncertainty principle

P.T.O.

(*ii*) Hund's rule

(*iii*) Pauli exclusion principle

(*c*) Write the electronic configuration of Cr (Atomic No. 24) and Cu (Atomic No. 29). 2

(*d*) Why $BaSO_4$ is insoluble in water ? 1½

2. (*a*) Predict the shape and type of hybridization in each of the following molecules : 4

PCl_5, H_2O, ClF_3, SF_4.

(*b*) Draw the MO diagram for N_2 molecule and calculate its bond order. 4

(*c*) Which is more covalent in the following pairs ? Explain :

(*i*) $FeCl_2$, $FeCl_3$

(*ii*) LiI, CsI

(*iii*) CuCl, NaCl 4½

3. (*a*) Calculate the uncertainty in the position of a particle whose uncertainty in momentum is 3.3×10^{-2} kg m s^{-1} ($h = 6,62 \times 10^{-34}$ Js) 4

(*b*) Calculate the lattice energy of NaCl crystal from the following data by the use of Born-Haber Cycle. Sublimation energy for $Na_{(s)}$ =108.7 kJ/mol Dissociation energy for $Cl_{2(g)}$ = 225.9 kJ/mol , Ionization energy for $Na_{(g)}$ = 489.5 kJ/mol, Electron affinity for $Cl_{(g)}$ = –351.4 kJ/mol, Heat of formation of $NaCl_{(s)}$ = –414.2 kJ/mol. 3

(*c*) What is the physical significance of Ψ^2 ? When do we use $\Psi\Psi^*$ instead of Ψ^2 ? 3

(*d*) Give the possible value of quantum number for an electron in 4*d* & 3*p* orbital. 2½

4. (*a*) What is dipole moment ? The dipole moment of NH_3 is 1.7 D while that of NF_3 is 0.2 D. Explain briefly. 4

(b) What are Eigen functions & Eigen values ? Explain why He_2 molecule does not exist ? 4

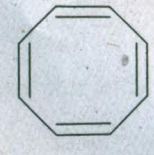
(*c*) Draw the radial distribution curve for 3*s*, 3*p* & 3*d* orbitals. 3

(*d*) Calculate the possible value of *m* for l = 2. 1½

SECTION-B

5. (*a*) Giving suitable explanation, classify the following as aromatic or not aromatic in nature : 4½

(*i*) 

(*ii*) 

(*iii*) 

(*b*) From the following attempt any *three* : 2×3

(*i*) Classify the following as nucleophiles and electrophiles :

$\bar{C}N$, $\overset{+}{N}O$, SO_3, $:CCl_2$

(*ii*) Which of the following cation is more stable and why ?

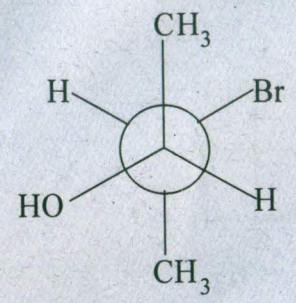
$CH_3—CH_2—\dot{C}H_2$ and $CH_2 = CH—\dot{C}H_2$

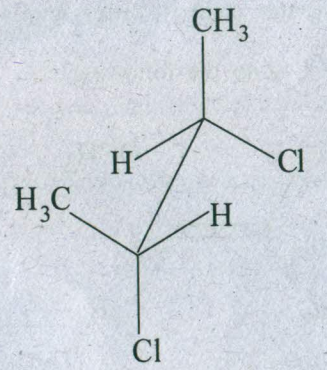
(*iii*) Which of the following free radicals is most stable and why ?

$CH_3\dot{C}H_2$, $(CH_3)_2\dot{C}H$ and $(CH_3)_3\dot{C}$

(*iv*) Draw the chair and boat conformations of cyclohexane and comment on their stability.

(*c*) Giving the steps involved convert the following into Fischer projection (attempt any *one*) : 2

(*i*) 

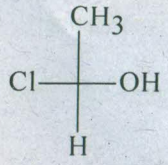
(*ii*) 

6. (*a*) Draw the different conformations of butane; arrange them in increasing order of stability, with explanation. 5

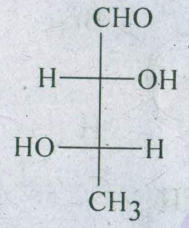
(*b*) Assigning the priority order, explain how will you arrive at R-/S-configuration at each stereocentre in the following : 4½

P.T.O.

(*i*)

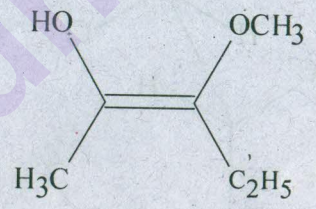


(*ii*)

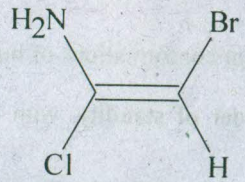


(*c*) Assigning the priority order, explain how will you designate E-/Z-to the following : 3

(*i*)

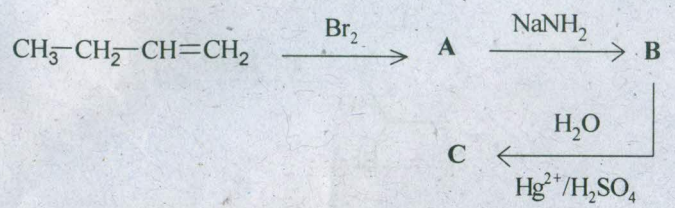


(*ii*)



7. (*a*) What happens when propene reacts with bromine in presence of light. Give suitable mechanism. 4½

(*b*) Complete the following sequence of reactions and identify A-C : 3



(*c*) The peroxide effect (Kharasch effect) is observed only in reaction of alkene with HBr and not with HCl and HI. Explain why ? 3

(*d*) How will you distinguish pent-1-yne and pent-2-yne ? 2

8. (*a*) Complete the following reactions (attempt any *five*) : 1½×5

(*i*) $CaC_2 + H_2O \longrightarrow ? \xrightarrow{HBr} ?$

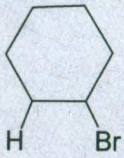
(*ii*) $CH_3-CH_2-CH=CH_2 \xrightarrow[THF]{Hg(OCOCH_3)_2\ ;\ H_2O} ? \xrightarrow{NaBH_4} ?$

(*iii*) $CH_3C \equiv CH \xrightarrow{NaNH_2} ? \xrightarrow{CH_3CH_2Br} ?$

P.T.O.

(*iv*) $3CH_3CH_2—CH=CH_2$

$$\xrightarrow{BH_3} ? \xrightarrow{H_2O_2/NaOH} ?$$

(*v*) 

$$\xrightarrow{\text{alc. KOH}} ?$$

$$\xrightarrow[\text{(Cold)}]{\text{alkaline } KMnO_4} ?$$

(*vi*) $CH_3CH_2CH_2Br + CH_3CH_2Br$

$$\xrightarrow[\text{dry ether}]{2Na} ? + ? + ?$$

(*vii*) $? \xrightarrow[(2)\ Zn/H_2O]{(1)\ O_3} CH_3CH_2CH_2CHO + HCHO$

(*b*) Giving examples, write a short note on the following (any *two*) : 2½×2

(*i*) Hyperconjugation

(*ii*) Erythro and threo stereoisomers

(*iii*) Preparation of alkanes using Grignard reagent.