This question paper contains 8 printed pages]

Your Roll No.....

5176

B.Sc. Prog./Life Science/Physical Science/Ist Sem. B

Paper—CHPT-101

Time : 3 Hours *Maximum Marks : 75*

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

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

Section A

Question No. 1 is compulsory.

Attempt any *two* more from the rest.

1. **Part A :** Attempt any *three* questions. 3×3=9

(*a*) Arrange the following according to their increasing order of the electrical conductance in water and explain :

LiCl, KCl, NaCl.

(*b*) Arrange the following according to their decreasing order of melting points and explain :

LiF, LiI, LiBr, LiCl.

P.T.O.

(*c*) Arrange the following ions according to their decreasing trend of polarizability :

$B\bar{r}$, $C\bar{l}$, $\bar{I}$, $\bar{F}$

and explain.

(*d*) ZnO when heated is yellow in colour but turn white when cooled. Explain.

Part B : Attempt any *three* questions. 3×1½=4½

(*a*) $BeCl_2$ is relatively covalent while $BaCl_2$ is ionic. Explain.

(*b*) NaCl is solube in water while AgCl is not. Explain.

(*c*) $Mg(OAc)_2$ on heating turns to MgO, but $Ba(OAc)_2$ forms $BaCO_3$. Explain.

(*d*) $AlCl_3$, $6H_2O$ is ionic in nature but $AlCl_3$ is covalent ? Explain.

2. Attempt any *three* questions : 3×4=12

(*a*) What is Schrödinger wave equation ? Discuss its applicability for the simplest one-electron *quantum system* (Hydrogen atom) explaining the terms involved.

(*b*) Discuss the physical significance of ψ and ψ^2. What do you understand by normalized and orthogonal wave functions ?

(*c*) Write down and sketch the radial wave functions for $3s$, $3p$, $3d$ orbitals on the same set of axis.

(*d*) Discuss De-Broglie concept of matter waves. How did he derive the famous equation $\lambda = \frac{h}{mV}$?

3. Attempt any *three* questions : 4×3=12

(*a*) Discuss the Born-Haber cycle for estimating lattice energy of NaCl.

(*b*) Discuss the importance of 'Lattice Energy' in relation to 'Hydration Energy' for predicting the stability of ionic compounds.

(*c*) Calculate the heat of formation (ΔH_f) of MgF_2 using Born-Haber cycle. Given :

Sublimation Energy of Mg, (S) = 146.4 kJ $mole^{-1}$.

Ionization Energy of Mg, $I^{(Mg^{++})}$ = 2184.0 kJ $mole^{-1}$

Dissociation Energy of F_2, (D) = 158.9 kJ $mole^{-1}$

Electron affinity of F, $EA(F^-)$ = – 334.7 kJ $mole^{-1}$

Lattice Energy of MgF_2, (U_0) = – 2922.5 kJ $mole^{-1}$

(*d*) Explain, how $BaSO_4$ is insoluble in water and $MgSO_4$ is quite soluble ? How is BaO more soluble than MgO, despite the fact that Barium and Magnesium belong to same family ?

4. Attempt any *three* questions : 3×4=12

(*a*) Discuss the basic features of VSEPR theory, and its limitations.

(*b*) Arrange the following in their increasing bond angles, and explain :

H_2S, H_2Se, H_2O, H_2Te.

(*c*) Draw the MO energy level diagrams of O_2 and N_2 molecules and explain :

(*i*) O_2 is paramagnetic and N_2 is not

(*ii*) O_2 is oxidizing in nature and N_2 is not.

(*d*) Write down the factors which control polarizing power of *cations* and polarizability of anions in ionic compounds.

Section B

Question No. **5** is compulsory.

Attempt any *two* questions from remaining.

5. (*a*) Draw all the staggred conformations of *n*-butane. Which amongst these is most stable ? Give reasons for your answer. 3

(*b*) Giving reasons arrange the following carbanians in increasing order of stability : 2

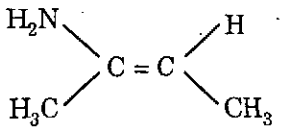
$CH_3\overset{\ominus}{C}H_2, \overset{\ominus}{C}H_3, CH_3\overset{\ominus}{C}HCH_3, (CH_3)_3\overset{\ominus}{C}.$

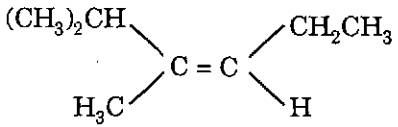
(*c*) How many stereoisomers are possible for 2, 3-dibromobutane ? Write their structures and give their relationship with each other. 5

(*d*) Giving reasons arrange the following molecules in the decreasing order of their acid strength : 3½

CH_3CH_2OH, CH_3COOH, HCOOH, C_6H_5OH.

6. (*a*) Assign E/Z to the following compounds : 3

(*i*) 

(*ii*) 

(*b*) Complete the following reaction. Comment on chirality of A and B : 3

$$CH_3CH = CH_2 + BH_3 \rightarrow A \xrightarrow[H_2O_2]{OH^{\ominus}} B$$

(*c*) Write short notes on any *two* : 3,3

(*i*) Wurtz reaction

(*ii*) Birch reduction

(*iii*) Hydration of alkenes.

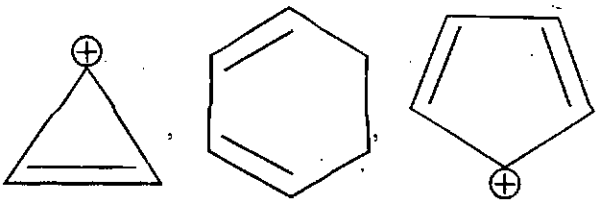
7. (*a*) Deduce the structure of a 5 carbon alkene 'X' from the folloiwng observations : 6

(*i*) 'X' when heated with HBr forms 2-Bromo-2-methylbutane

(*ii*) One of the products of ozonolysis of 'X' is acetaldehyde.

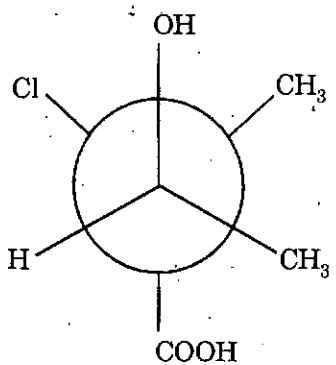
Give chemical reactions involved in both (*i*) and (*ii*) and mechanism involved in (*i*).

(*b*) Which of the following compounds are aromatic, antiaromatic or non-aromatic. Justify your answer in each case : 6

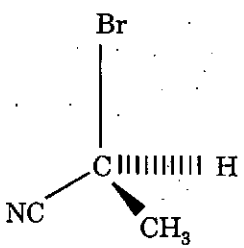


8. (*a*) Write down Fischer projections for the following and assign R/S configuration to each : 8

(*i*)



(*ii*)



(*iii*)