This question paper contains 4+2 printed pages]

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

S. No. of Question Paper : **61**

Unique Paper Code : **217161** **G**

Name of the Paper : **Chemistry-I (CHPT-101)**

Name of the Course : **B.Sc. (Prog.) Physical Science/Life Science/Applied Life Science**

Semester : I

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

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

Attempt any *three* questions.

Question No. **1** carries **13.5** marks and Q. No. **2**,

Q. No. **3**, Q. No. **4** carries **12** marks each.

Use separate answer sheet for Section A and Section B.

Section A

1. (*a*) Write short notes on (any *three*) : 3×2.5

   (*i*) Quantum numbers

   (*ii*) Dipole moment

   (*iii*) LCAO

   (*iv*) Resonance energy.

   (*b*) Arrange the following in order of increasing melting point giving reason : 2×1.5

   (*i*) LiI, LiBr, LiCl, LiF

   (*ii*) NaCl, CuCl.

P.T.O.

(*c*) Give reasons : 2×1.5

(*i*) KI is soluble in ethyl alcohol, whereas KCl is insoluble.

(*ii*) $ZnCl_2$ is more soluble in organic solvents than $MgCl_2$.

2. (*a*) Write Schrodinger wave equation and define each term involved in it. 4

(*b*) Give physical significance of ψ and ψ^2. 2

(*c*) What are Eigen values ? 2

(*d*) Why 1*s* orbital is spherically symmetrical ? 2

(*e*) Normalization of wave function. 2

3. (*a*) Write Born-Lande equation. Give the significance of terms involved in it. 4

(*b*) Calculate the heat of formation of KF from its elements from the following data by the use of Born-Haber cycle : 5

Sublimation energy of potassium (S) = 87.8 kJ mol^{-1}

Dissociation energy of F_2 (D) = 158.9 kJ mol^{-1}

Ionization energy of K(g) (I) = 414.2 kJ mol^{-1}

Electronic affinity for F(g) (E) = –334.7 kJ mol^{-1}

Lattice energy of KF (U_0) = –807.5 kJ mol^{-1}

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

4. (*a*) Draw molecular orbital diagram of CO or N_2. Write its configuration and find its bond order. 4

(*b*) Write the molecular orbital configuration of O_2, O_2^+, O_2^- and O_2^{2-} and arrange them in increasing order of their bond lengths. 3

(*c*) Predict the shapes of the following molecules using hybridization : 4

(*i*) CH_4

(*ii*) $SnCl_2$

(*iii*) ClF_3

(*iv*) XeF_2

(*d*) Calculate the % ionic character of HF (Given EN of H = 2.1, F = 4.0). 1

Section B

(Inorganic Chemistry/Organic Chemistry)

Attempt any *three* questions.

Question No. **1** carries **13.5** marks and Q. No. **2**, Q. No. **3**, Q. No. **4** carries **12** marks each.

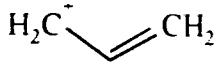
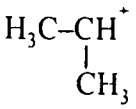
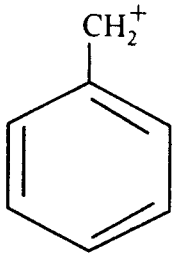
1. (*a*) The rate of nitration of toluene is greater than that of benzene. Explain giving reasons.

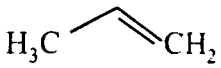
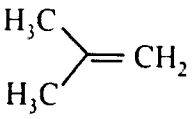
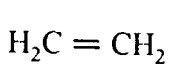
(*b*) Which is more basic Pyrrole or Pyridine ? Explain.

(*c*) Classify the following species as electrophiles or nucleophiles :

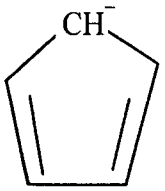
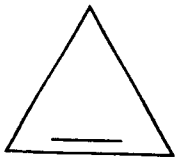
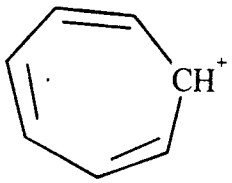
$(CH_3)_2CH^+$, CH_3O^-, $AlCl_3$, NH_3

(*d*) Arrange the following in the order of increasing stability. (Give reasons) :

(*i*)   

(*ii*)   

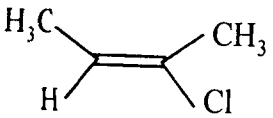
(*e*) What are the conditions for a compound to be aromatic. On this basis explain which of the following compounds are aromatic ? 2,2,2,4,3.5

2. (*a*) Draw the various conformations of 1,2-ethanediol ($HO–CH_2–CH_2–OH$) in Newman projection formulae and explain their relative order of stability.

(*b*) Write the most stable conformation of Methyl cyclohexane. Explain.

(*c*) Which of the following compounds exhibit geometrical isomerism. Assign E/Z configuration to them ?

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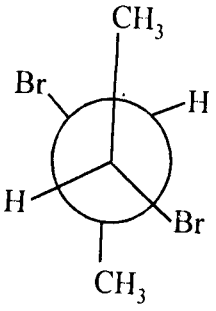
(*d*) Write the tautomers of the following :

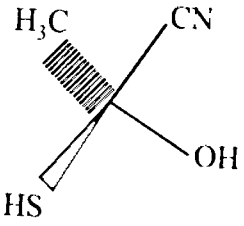
(*i*) CH_3CHO

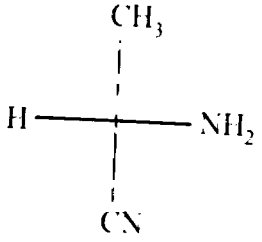
(*ii*) $CH_3CH_2NO_2$

3,4,3,2

3. (*a*) Convert the following in Fischer projection and assign R/S configuration :







(*b*) Differentiate between meso compound and racemic mixture.

(*c*) Give the mechanism of bromination of cis 2-butene. Give the stereochemistry of the product formed.

6,2,4

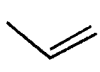
4. (*a*) Write the reactions involved when 1-butene is made to undergo the following reactions :

(1) Hydroboration-oxidation

(2) Oxymercuration-Demercuration

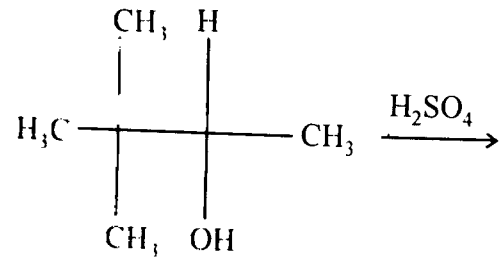
(3) Acid catalysed hydration

(*b*) Complete the reactions : 5

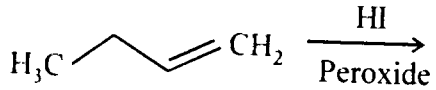
(*i*) H_3C  $CH_2 + O_3 \xrightarrow{CH_2Cl_2} ? \xrightarrow{Zn/H_2O} ?$

P.T.O.

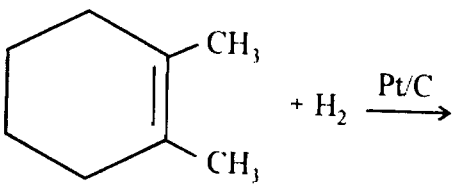
(*ii*)



(*iii*)



(*iv*)



(*c*) Give the chemical method to distinguish between ethane and ethyne. (Reaction also). 6,4,2