Roll No. .....

Total No. of Questions : **9**] [Total No. of Printed Pages : **8**

(2034)

UG (CBCS) Ist Year Annual Examination

2705

B.Sc. CHEMISTRY

(Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons)

(Core)

Paper : CHEM 101

Time : 3 Hours] **[Maximum Marks : 50**

Note :– Attempt *five* questions in all. Select *one* question from each Section. Q. No. **9** of Section E is compulsory.

Section–A

1. (a) Draw the radial probability distribution curves for 3*s* and 3*d* orbitals.

   (b) State and explain Pauli's exclusion principle.

   (c) What are the limitations of Bohr atomic model ?

   (d) What are the factors responsible for stability of half filled and completely filled orbitals ? 3, 2, 2, 3

2. (a) Calculate the Screening constant S and effective nuclear charge (Z_{eff}) for an electron present in 3*p*-orbital of Phosphorus atom (Z = 15).

(b) Why is the shape of d_{z^2} is different from $d_{x^2-y^2}$?

(c) Why 4*s* orbital is lower in energy than 3*d* orbital ?

(d) Differentiate between orbit and orbital. 3, 3, 2, 2

Section–B

3. (a) Discuss Born-Haber's cycle for finding the lattice energy of NaCl.

(b) Cu^+ and Na^+ are of same size but CuCl is insoluble while NaCl is soluble in water. Explain.

(c) Calculate the percentage ionic character of Cs-F bond of CsF molecule. The electronegativities values of Cs and F are 0.7 and 4.0 respectively.

(d) Discuss the factors which influence the formation of ionic compound. 3, 2, 2, 3

4. (a) Using molecular orbital theory, predict the bond order and number of unpaired electrons in O_2, O_2^-, O_2^+ and O_2^{2+}.

(b) Discuss the shape and hybridization of the following molecules :

(i) XeF_2

(ii) ClF_3

(c) Explain the bond angle trend in PF_3, PCl_3, PBr_3 and PI_3.

(d) Differentiate between bonding and antibonding molecular orbitals. 4, 2, 2, 2

Section–C

5. (a) How will you explain the order of stability of free radicals :

$$(CH_3)_3\dot{C} > (CH_3)_2\dot{C}H > CH_3\dot{C}H_2 > \dot{C}H_3$$

(b) Arrange the following acids in increasing order of acidic strength Cl_3CCOOH, CH_3COOH, $ClCH_2COOH$ and $Cl_2CHCOOH$.

(c) Classify the following as electrophile and nucleophile SO_3, NH_3, $AlCl_3$ and ROR.

(d) What is Huckel's rule ? Explain with examples.

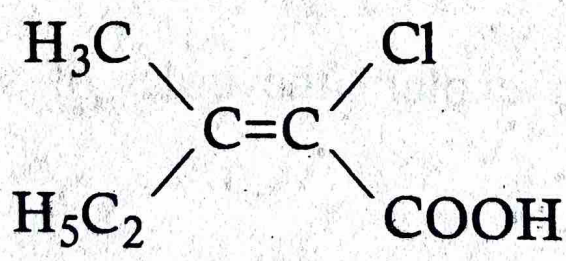
3, 3, 2, 2

6. (a) Draw the various conformations of *n*-butane and explain their relative stability.

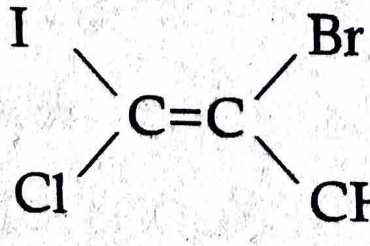
(b) What are diastereoisomers ? Give examples. Differentiate diastereoismers from enantiomers.

(c) Assign E and Z configuration to the following compounds :

(i)



(ii)



(d) What are carbanions ? Give the structure also.

3, 3, 2, 2

Section–D

(a) Give the mechanism of halogenation of methane in the presence of light.

(b) What is Kharasch effect ? Explain the mechanism for addition of HBr to propene in the presence of benzoyl peroxide. Why this effect is not shown by HCl and HI ?

(c) Write short notes on the following :

(i) Wurtz reaction

(ii) Corey House reaction 3, 3, 4

8. (a) Explain the following reactions :

(i) Hydroboration oxidation

(ii) Ozonolysis of Alkene

(b) What is Birch reduction ? Explain the mechanism of this reduction.

(c) Compare the reactivity of alkenes and alkynes towards electrophilic addition reactions. 3, 3, 4

Section–E

(Compulsory Question)

9. Multiple choice questions/True or false/Fill in the blanks : $1 \times 10 = 10$

(i) Which of the following *d*-orbital is directed towards the principle axis ?

(a) d_{xy}

(b) d_{yz}

(c) d_{zx}

(d) $d_{x^2-y^2}$

(ii) Which of the following statements is false redarding *s*-orbitals ?

(a) All *s*-orbitals are spherically symmetrical.

(b) Each orbital has n regions of high probability.

(c) There are $(n-1)$ nodes in ns orbital.

(d) The effective size of *s*-orbital increases as n decreases.

(iii) The covalent character is favoured by :

(a) Small size of the anion

(b) Low charge of the cation

(c) Large size of the anion

(d) The cation having 8 electrons (noble gas configuration)

(iv) Which of the molecule has zero dipole moment ?

(a) NH_3

(b) N_2O

(c) BCl_3

(d) CO_2

(v) Out of SO_3, $SnCl_4$, NH_3 and ROH :

(a) SO_3 and NH_3 are electrophiles

(b) SO_3 and ROH are electrophiles

(c) NH_3 and ROH are electrophiles

(d) SO_3 and $SnCl_4$ are electrophiles

Turn Over

(vi) Enantiomers can be separated by :

(a) Hand-picking method

(b) Chemical method

(c) Biological method

(d) All of these

(vii) In PF_5 molecule, two axial bonds are ..... than three equatorial bonds.

(viii) XeF_2 molecule involves ..... Hybridization.

(ix) Terminal alkynes are acidic in nature.

(True/False)

(x) More alkylated alkenes are more stable.

(True/False)