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Total Pages : 9

End Semester Examination of Semester-I, 2015

Subject : CHEMISTRY (HONS.)

Paper : CEMH-101

Full Marks : 40

Time : 2 Hrs

The figures in the margin indicate the marks corresponding to the question

Candidates are requested to give their answers in their own word as far as practicable.

Illustrate the answers wherever necessary.

Use separate Answer scripts for Group A and Group B

Group A (Organic-20 Marks)

Group A(a)

Answer any one question :

10X1=10

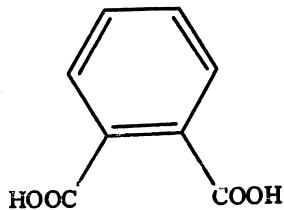
1. Answer any five of the following :

5X2=10

- a) Compare the acidity (Pka) of following dicarboxylic acid with proper reason.



(I)



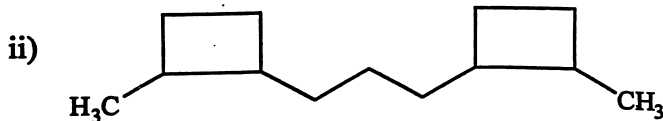
(II)

(2)

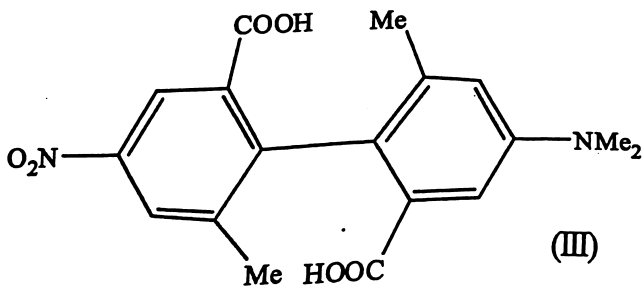
Being a diprotic acid, do you think squaric acid would be more acidic as compared to (I) and (II). Give reason.

2

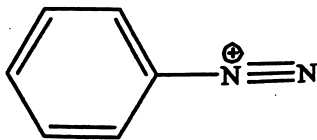
b) State the IUPAC nomenclature of the following compounds. 2



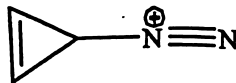
c) Which " $\text{C}_{\text{sp}^2}-\text{N}$ " is shorter bond length in the following compound (III). Give reason. 2



d) Predict the stability order of diazonium cations (IV, V and VI) both in gas phase and in aqueous solution.

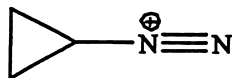


(IV)



(V)

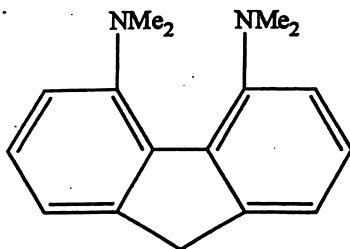
(3)



(VI)

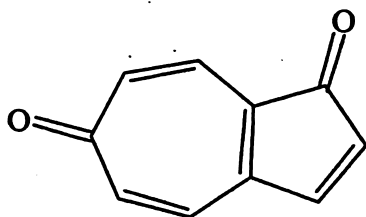
What would be the stability order if thermal decomposition of diazonium ions are considered? Provide a plausible explanation. 2

- e) The compound (VII) is more basic than tetramethylhydrazine. Rationalize. 2



(VII)

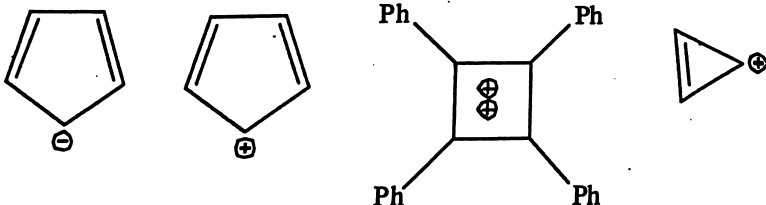
- f) The following compound (VIII) is converted from "diketo"-form to "diol"-form when reacted with 1, 4 cyclohexadiene. Account for the fact. 2



(VIII)

(4)

- g) Discuss the effect of temperature on dipole moment for the following compounds. 2
- i) 1,2 dichloroethane
 - ii) 1,4 dioxane
2. a) An optically active pure sample of S(+)-2-butanol shows specific rotation $[\alpha]_D^{25^\circ} = +13.52^\circ$. What will be the percentage composition of the mixture of enantiomers whose observed rotation is -6.76° ? 3
- b) What is meant by stereogenic centre? Are centres of stereogenicity always centres of chirality? — Explain with suitable example. 3
- c) Predict which of the followings are aromatic anti aromatic or non - aromatic and why? 2



- d) Explain why homolytic bond dissociation energy for a benzylic hydrogen is less than that of a methane hydrogen 2

(5)

Group A(b)

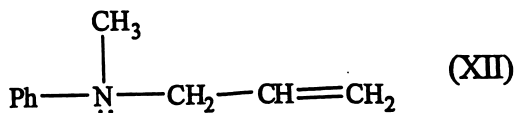
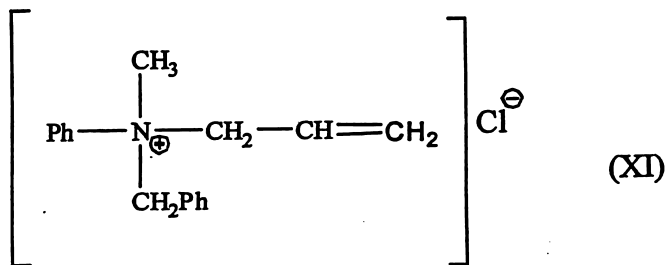
Answer any one question :

1×6

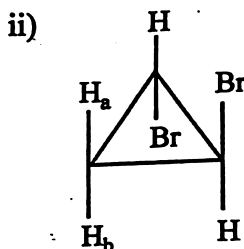
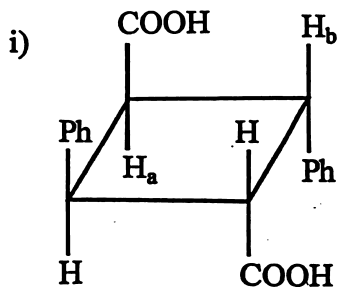
3. Answer any three of the following :

3×2=6

- a) Explain why compound (X) is resolvable but the compound (XI) is not. 2



- b) Mention the topic relationship of the marked hydrogens H_a & H_b . 2



- c) Give example in each case : 2
- i) A cumulene with odd number of double bonds having stereogenic axis.
 - ii) A cyclic molecule having a chirotopic-nonstereogenic centre.

d)

Ring size	Heat of combustion/ CH ₂ (Kcal/mole)
3	166.6
4	164.0
5-15	157.4~158.8

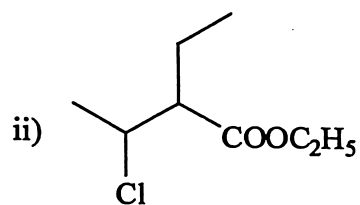
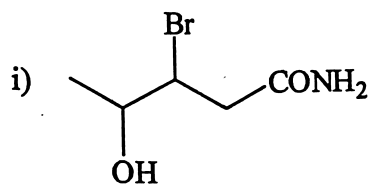
Explain the above observation. Why is the Bayer hypothesis insignificant in context of experimental findings. 2

Group A(c)

4 Answer any two questions : 2x2=4

- 1** a) The conformational energy of an alkyl substituent at C-3 is less in cyclohexanone than that in cyclohexane. Explain the fact.
- b) Phloroglucinol exhibits relatively more kinetic activity than resorcinol which in turn shows more Ketonic activity than phenol. Provide a suitable explanation in favour of the above statement.
- c) Which one of the two diastereomeric 2-bromo-4-t-butyl cyclohexanones is more polar and why?

d) Write down IUPAC name of the following compounds :
1x2=2



Group B (Inorganic-20 Marks)

Group B(a)

Answer any one question :

10x1=10

1. i) What are the postulates made by Bohr to derive an equation for the energies of electron in a hydrogen atom? What are the drawbacks of Bohr's theory?
2+3
- ii) Prove that all Bronsted bases may not be Arrhenius bases.
2
- iii) Applying Bohr's model, calculate the energy emitted when an electron in a hydrogen atom makes a transition from third energy level to first energy level. ($h = 6.63 \times 10^{-34} \text{ Js}$)
3

2. i) What are the limitations of radius ratio rule? 3
ii) What is meant by non-stoichiometric crystal? Write a note on Metal deficiency defect with example. 1+3
iii) How much energy in KJ is released when 1.0 gm of Chlorine atom is converted completely to Cl^- ions in the gaseous state, electron affinity of $\text{Cl}(\text{g}) = 349 \text{ KJ}$. 3

Group B(b)

Answer any one question :

1x6=6

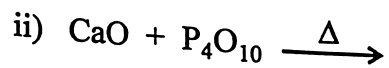
3. i) $\text{Me}_2\text{N-PF}_2$ has two donor centres—N and P. When it reacts with BH_3 and BF_3 separately two different compounds will be formed. Draw the structures of these two compounds and explain. 2
ii) The interionic distance in Chlorine molecule is 1.98 Å. Calculate the Allred-Rochow electronegativity using Slater's rule. 2
iii) How can we obtain proton affinity of NH_4Cl ? 2
4. i) Calculate the heat of formation (ΔH_f) of MgF_2 from its elements using the Born-Haber Cycle. The thermochemical data are as follows:
Sublimation energy of Magnesium, (S) = 146.4 KJ/mol
Dissociation of F_2 , (D) = 158.9 KJ/mol
Ionization energy of $\text{Mg}(\text{g})$, (I) = 2184.0 KJ/mol
Electron affinity of $\text{F}(\text{g})$, (E) = -334.7 KJ/mol
Lattice energy of MgF_2 (v_0) = -2922.5 KJ/mol

- ii) In what solution H_2SO_4 behaves as a base? 1
- iii) Write down the IUPAC name of the elements having atomic numbers 108 and 112. What would be their symbol? 2

Group B(c)

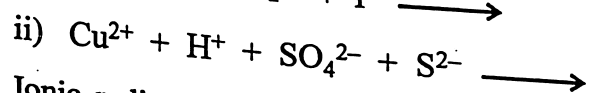
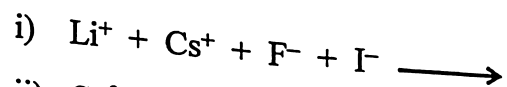
5. Answer any two questions : $2 \times 2 = 4$

i) Discuss the kind of crystal defect observed when ZnO is heated. State the detectable charge. 2



Predict the product and hence explain the above reaction by lux-flood concept. 2

iii) Complete the following reactions according to SHAB Principle. 2



iv) Ionic radius of K^+ is smaller than that of Cl^- though they are isoelectronic — Explain. 2
