'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 1st Semester Examination, 2021

GE1-P1-CHEMISTRY

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
All symbols are of usual significance.

Use separate answer scripts for SECTION-A (Inorganic) and SECTION-B (Organic)

SECTION-A

INORGANIC CHEMISTRY

GROUP-A

1. Answer any ***two*** questions from the following: 1×2 = 2

(a) The state of hybridization in $SOCl_2$ is

(i) sp^2 (ii) sp^3 (iii) sp^3d (iv) sp

(b) Which of the following has the least bond angle?

(i) H_2O (ii) PH_3 (iii) CH_4 (iv) NH_3

(c) For 5*s*-orbital, the magnetic quantum number has the value:

(i) 2 (ii) 4 (iii) – 1 (iv) 0

GROUP-B

2. Answer any ***two*** questions from the following: 5×2 = 10

(a) (i) Find the de Broglie wavelength of an electron with a speed of 1.00×10^6 m/s. 3+2
(electron mass = 9.11×10^{-31} kg ; $h = 6.626\times10^{-34}$ kg.m^2/s)

(ii) Write down the differences between orbit and orbitals.

(b) (i) Write down the Heisenberg's uncertainty principle and explain briefly. (2+2)+1

(ii) Define lattice energy.

(c) (i) NH_3, BCl_3 and BrF_3 have comparable molecular formula but shapes are different. — Explain. 3+2

(ii) What is the significance of negative ion in the energy expression of hydrogen atom?

GROUP-C

3. Answer any ***one*** question from the following: 10×1 = 10

(a) (i) Draw the molecular shape of PF_3 and predict the bond angle on the basis of VSEPR theory. (2+1)+2+2+2+1

(ii) Why H_2O is bent but XeF_2 is linear?

(iii) Explain why $CaCl_2$ is soluble in water but CaF_2 is not.

(iv) Arrange NaF, CsI and CaO in order of increasing lattice energy.

(v) Draw the resonating structures of carbonate ion.

(b) (i) Draw the Molecular Orbital (M.O.) diagram of N_2 molecule and calculate the bond order. (2+1)+2+(1+2)+2

(ii) An electron has the quantum numbers $n = 4$, $l = 1$, $m_l = 0$ and $m_s = +\frac{1}{2}$. Is the electron in a 4*s*, 4*p* or 4*d* atomic orbital?

(iii) What is radial distribution function? Draw radial probability distribution curves for '2*s*' and '2*p*' orbital.

(iv) What is solvation energy and lattice energy?

SECTION-B

ORGANIC CHEMISTRY

GROUP-A

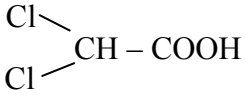
1. Answer any ***three*** questions from the following: 1×3 = 3

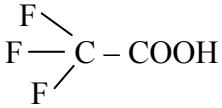
(a) Optical isomerism is exhibited by

(i) *n*-Butanol (ii) Isopropyl alcohol

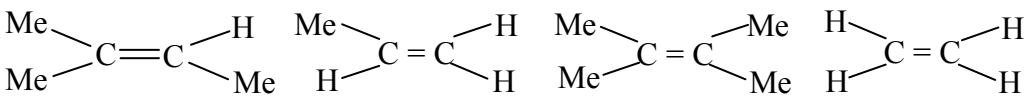
(iii) 2-Phenyl ethanol (iv) 1-Phenyl ethanol

(b) Which one is more acidic in nature

(i) F – CH_2 – COOH (ii) 

(iii)  (iv) 

(c) Arrange the following alkenes in decreasing order of stability:

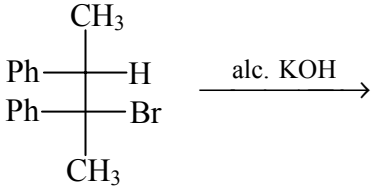


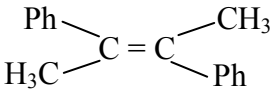
(I) (II) (III) (IV)

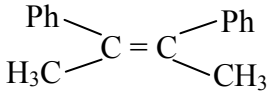
(i) III > II > I > IV (ii) III > I > II > IV

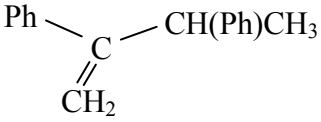
(iii) III > II > IV > I (iv) IV > II > I > III

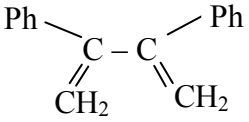
(d) The major product of the following reaction



(i) 

(ii) 

(iii) 

(iv) 

(e) In Fischer projection formula,

(i) all bonds are staggered

(ii) all bonds are eclipsed

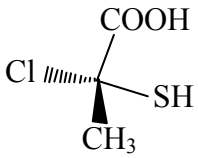
(iii) all bonds are skewed

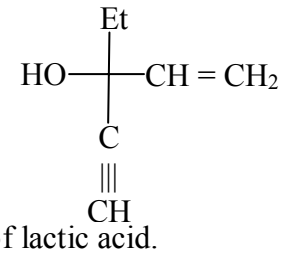
(iv) half of bonds are staggered and half bonds are skewed.

GROUP-B

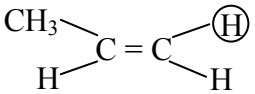
2. Answer any ***one*** question from the following: 5×1 = 5

(a) (i) Give R/S designation: 2+3





(ii) Discuss about the streochemistry of lactic acid.

(b) (i) $CH_3 - C \equiv C - \textcircled{H}$ vs.  2+3

Compare the acidity of the marked Ⓗ atom.

(ii) Distinguish E1cB elimination reaction from E2 elimination reaction. Write down the mechanism using suitable examples.

GROUP-C

3. Answer any ***one*** question from the following: 10×1 = 10

(a) (i) Predict the product. Justify for your answer. 2+2+2+4

$$H_3C - C \equiv C - CH_3 \xrightarrow[\text{quinoline}]{\text{Pd / BaSO}_4,\ H_2}$$

(ii) Show resonating structures of phenol. From these structures find which positions of benzene ring are electron rich.

(iii) What do you know about anti-Markownikoff's Rule?

(iv) Predict the possible product(s)

$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3-NH_2 \xrightarrow[0^\circ C]{NaNO_2,\ \text{dil HCl}}$$

(b) (i) Starting from acetylene how could you synthesis the following: 2+2+(1+2)+ $1\frac{1}{2}+1\frac{1}{2}$

$$CH_3-C\equiv C-H$$

(ii) 2-Methyl but-2-ene reacts with HBr to yield 2-bromo-2-methyl butane. — Justify.

(iii) Define conformation. Show all the conformational isomers of *n*-butane in Newman projection (by 60° rotation per transition) with their name.

(iv) Do the following conversion:

$$CH_2=CH_2 \longrightarrow CH_3-CHO$$

(v) What will be product of ozonolysis of 2-butyne.

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