

This question paper contains 8 printed pages]

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S. No. of Question Paper : 7786

Unique Paper Code : 2171101

F-1

Name of the Paper : Organic : Basic Concepts and Stereochemistry [DC-1.1]

Section-A (Organic Chemistry); Section-B (Physical Chemistry)

Name of the Course : Bachelor in Chemistry (Hons.)

Semester : I

Duration : 3 Hours

Maximum Marks : 75

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

Use of non-scientific calculator is allowed.

Answer Section A and Section B on separate answer-sheets.

**Section A**

**Marks : 37.5**

**(Organic Chemistry)**

1. (a) An unsaturated dicarboxylic acid,  $C_4H_4O_4$  exists in two stereoisomeric forms A and B. Isomer B has higher dipole moment and lower melting point than A and undergoes dehydration upon heating, to form cyclic anhydride D. What are the structures of A, B and D ?

Justify your answer.

5

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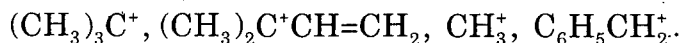
Or

Calculate the specific rotation of glucose, if a solution containing 9 g/100 mL placed in a 20.0 cm polarimeter tube has an observed rotation of  $+20.16^\circ$  at  $25^\circ\text{C}$  (using D line of sodium). What will be the observed rotation of this solution if concentration of glucose is doubled ?

(b) Draw Chair conformations of *cis* cyclohexane-1, 3-diol and discuss their stability.

Which conformation will be optically active ? 5.5

(c) Giving reason, arrange the following carbocations in increasing order of stability : 3



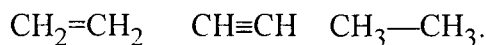
2. Attempt any four : 4×3=12

(a) Cycloalkanes show geometrical isomerism whereas alkanes do not. Justify.

(b) Triethyl amine shows basic nature whereas triphenyl amine does not. Explain why ?

(c) *o*-Nitrophenol is steam volatile while *p*-nitrophenol is not. Explain why ?

(d) Giving reasons, arrange the following hydrocarbons in the decreasing order of their acid strength :

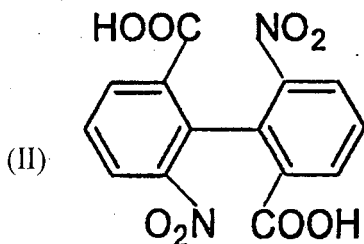
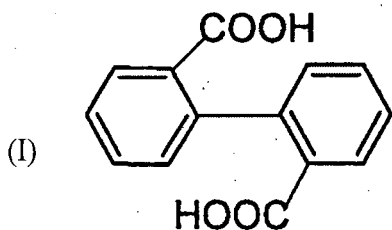


- (e) Write structural formula for (E) (S)-5-bromo-2, 6-dimethylnon-4-ene.
- (f) Draw Fischer projection of *erythro* 3-bromobutan-2-ol and convert it into Newman projection.
- (g) How can a racemic mixture of lactic acid be resolved using the method of diastereoisomeric salt formation ?

3. Attempt any *three* :

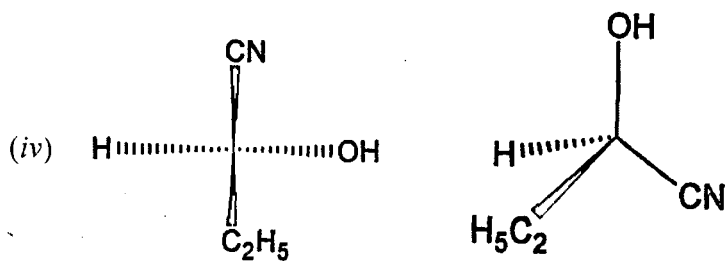
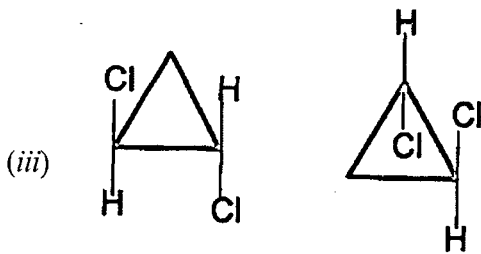
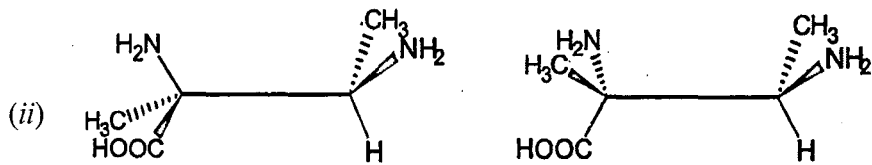
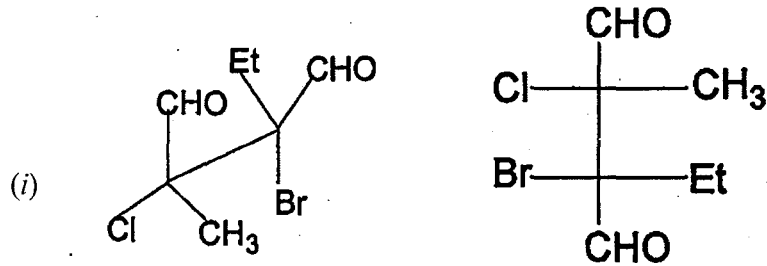
3×4=12

- (a) Diphenic acid (I) does not show optical activity while 6, 6'-dinitrophenyl-2, 2'-dicarboxylic acid (II) is optically active :

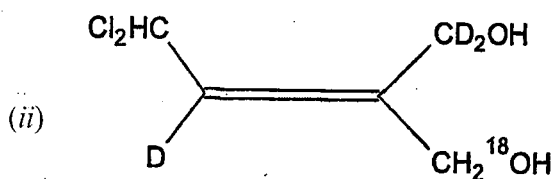
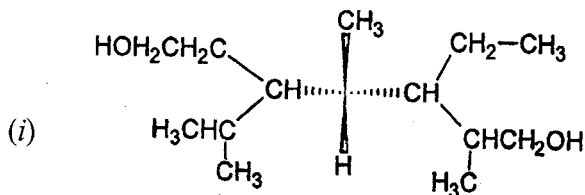


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(b) What is the stereochemical relationship between the following pairs of molecules ?

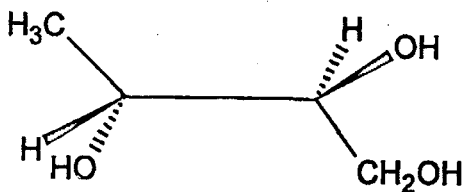


(c) Using CIP rules assign R/S, E/Z configuration to the following molecules :

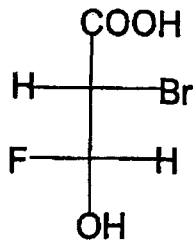


(d) Convert the following as directed :

(i) Sawhorse projection into Fischer projection



(ii) Fischer projection into Newman projection with dihedral angle between COOH and OH group =  $60^\circ$ .



- (e) Chlorine in chlorobenzene is ortho, para directing yet ring deactivating in electrophilic substitution. Explain why.

**Section B****Marks : 37.5****(Physical Chemistry)**

**Instructions :** Attempt *three* questions in all. Question No. 1 is compulsory.

1. Explain any *five* of the following : 5×2.5
- (a) The mean free path of molecules of a gas increases while the number of collision per unit time decreases with lowering of pressure.
- (b) Viscosity of gases increases with increase in temperature whereas viscosity of liquids decreases with increase in temperature.
- (c) van der Waals' constant, '*b*' of a gas is four times its molecular volume.
- (d) Initial slope of compressibility factor, *z* versus *p* curve at a fixed temperature is positive for some of the gases and negative for others.
- (e) Gas with van der Waals' constant, '*a*=0' cannot be liquefied.
- (f) Surface tension of liquid becomes zero at critical temperature.
- (g) Cooling is caused with evaporation.

2. (a) State Maxwell distribution Law of molecular speeds and derive expression for most probable speed and average speed. 4.5
- (b) Calculate molar heat capacity at constant volume of linear  $C_2N_2$  molecule based on Law of Equipartition of Energy and compare its value with the experimental value of  $56.9 \text{ JK}^{-1} \text{ mol}^{-1}$ . 4
- (c) Define surface tension in terms of energy and describe any *one* simple method of its determination. 4
3. (a) Explain why there is a need for the modification of ideal gas equation. Derive van der Waals' equation for  $n$  mole of the gas. 4.5
- (b) Define critical constants. Derive relation of van der Waals' constants, ' $a$ ' and ' $b$ ' in terms of critical temperature,  $T_c$  and critical pressure,  $P_c$  only. 4
- (c) The viscosity of a certain liquid is  $5 \times 10^{-4} \text{ Pa s}$  at 480 K and  $2.5 \times 10^{-4} \text{ Pa s}$  at 960 K. Calculate the activation energy of viscous flow. 4
4. (a) Consider a gas at constant temperature if the pressure is double what effect does it have on :
- (i) number of collision per second made by any *one* molecule

- (ii) the total number of collisions per second occurring in  $1 \text{ m}^3$  of the gas
- (iii) the mean free path of the gas molecule ? 4.5
- (b) State and derive the law of corresponding states. 4
- (c) Show that the excess pressure inside a spherical bubble is given by the following equation and explain all the terms :

$$\Delta P = \frac{2\gamma}{r}$$

Mention the effect of ionic salt on the surface tension of water. 4