Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Optical isomerism

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Name of the Student:_____
Max. Marks : 28 Marks **Time : 28 Minutes**

Q1.

Which compound forms optically active compounds on reduction?

A $CH_3CH_2C(CH_3)=CHCH_3$ ⬭

B $CH_3CH_2C(CH_3)=CH_2$ ⬭

C CH_3COCH_3 ⬭

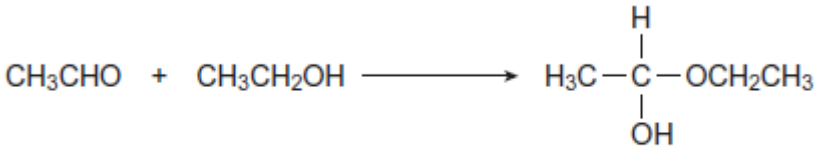
D $CH_3CH_2COCH_3$ ⬭

(Total 1 mark)

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Q2.

Hemiacetals and acetals are compounds formed by the reaction of aldehydes with alcohols, such as the reaction of ethanal with ethanol.



a hemiacetal

(a) (i) Use your knowledge of carbonyl mechanisms to suggest the name of the mechanism of this reaction.

_____

(1)

(ii) Outline how an ethanol molecule reacts with an ethanal molecule in the first step of this mechanism. Include two curly arrows to show the movement of electron pairs.

(2)

(b) The reaction produces a racemic mixture of chiral molecules.

(i) Explain the meaning of the term racemic mixture.

_____

_____

(1)

(ii) State the relationship between two chiral molecules with the same structural formula.

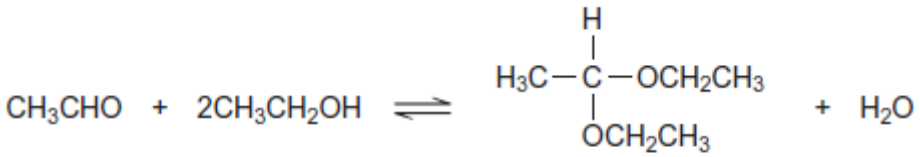
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_____

(1)

(c) In the presence of an acid catalyst such as dry hydrogen chloride, ethanal reacts with an excess of ethanol to form an acetal.

The overall reaction of ethanal with an excess of ethanol forms an equilibrium mixture as shown. All reactants and products are liquids.



an acetal

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A mixture of 0.75 mol of ethanal and 5.00 mol of ethanol was left to reach equilibrium in the presence of dry hydrogen chloride at a given temperature. The equilibrium mixture contained 0.42 mol of the acetal.

(i) Calculate the amount, in moles, of ethanal and of ethanol in this equilibrium mixture.

Amount of ethanal _____ mol

Amount of ethanol _____ mol

Space for working _____

_____

_____

_____

(2)

(ii) In a different experiment using the same reaction as in part **(c)**, an equilibrium mixture was established at a given temperature.
This mixture contained 0.58 mol of ethanal, 3.76 mol of ethanol, 0.37 mol of the acetal and 0.65 mol of water in a total volume of 310 cm^3.

Write an expression for the equilibrium constant K_c for this reaction.
Calculate a value for K_c at this temperature. Give units with your answer.

K_c _____

_____

Calculation _____

_____

_____

_____

_____

_____

_____

(4)

(d) Draw the structure of the acetal ($C_4H_8O_2$) formed by the reaction of ethanal with ethane-1,2-diol.

(1)

(Total 12 marks)

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Q3.

The carbonyl compound CH_3CH_2CHO reacts very slowly with HCN

(a) Name and outline a mechanism for the reaction of CH_3CH_2CHO with HCN

Name of mechanism _____

Mechanism

(5)

(b) The reaction in part (a) produces a pair of enantiomers.

(i) Draw the structure of each enantiomer to show how they are related to each other.

(2)

(ii) State and explain how you could distinguish between the two enantiomers.

_____

_____

_____

_____

(2)

(c) Give the IUPAC name of the product of the reaction in part (a).

_____

(1)

(d) In practice, KCN rather than HCN is added to the carbonyl compound.

Given that K_a for HCN = 4.0×10^{-10} mol dm^{-3}, suggest why the reaction with HCN is very slow.

_____

_____

_____

_____

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(2)

(e) Acrylic fibres are used as a substitute for wool. Acrylics are copolymers of acrylonitrile with other compounds.

Acrylonitrile is the common name for the following compound.

$$H_2C = CH - C \equiv N$$

(i) Acrylonitrile can be formed from propene.

Write an equation for the reaction of propene with ammonia and oxygen to form acrylonitrile and one other product.

_____

(1)

(ii) The term copolymer is used to describe the product obtained when two or more different monomers form a polymer.

Draw the repeating unit of the acrylic copolymer that contains 75% acrylonitrile monomer and 25% chloroethene monomer.

(1)

(iii) Name the type of polymerisation involved in part (ii)

_____

(1)

(Total 15 marks)

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