

Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Q1.

The outer layers of some golf balls are made from a polymer called polyisoprene.

The isoprene monomer is a non-cyclic branched hydrocarbon that contains 88.2 % carbon by mass.

The empirical formula of isoprene is the same as its molecular formula.

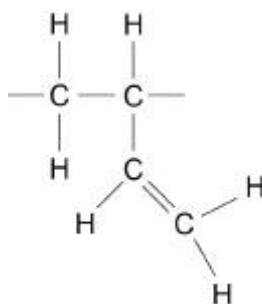
- (a) Deduce the molecular formula of isoprene and suggest a possible structure.

Molecular formula _____

Structure

(4)

- (b) The insides of some golf balls are made from a mixture of three other polymers.
The repeating unit for one of these polymers is shown.



Draw the skeletal formula of the monomer used to make this polymer.

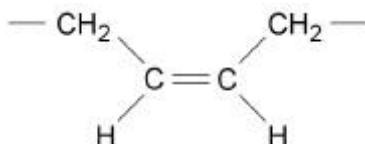
Give the IUPAC name of the monomer.

Skeletal formula of monomer

IUPAC name _____

(2)

- (c) A second polymer in the mixture has a repeating unit with the structure shown.



The third polymer in the mixture is a stereoisomer of this polymer.

Draw the structure of the repeating unit of the third polymer.

Give a reason why this type of stereoisomerism arises.

Repeating unit

Reason _____

(2)

- (d) Golf balls recovered from lakes and ponds can be used again even after being in water for several years.

Explain why these golf balls do not biodegrade.

(1)

(Total 9 marks)

Q2.

Aqueous NaBH_4 reduces aldehydes but does not reduce alkenes.

- (a) Show the first step of the mechanism of the reaction between NaBH_4 and 2-methylbutanal. You should include two curly arrows.

Explain why NaBH_4 reduces 2-methylbutanal but has no reaction with 2-methylbut-1-ene.

First step of mechanism

Explanation _____

(5)

- (b) A student attempted to reduce a sample of 2-methylbutanal but added insufficient NaBH_4 . The student confirmed that the reduction was incomplete by using a chemical test.

Give the reagent and observation for the chemical test.

Reagent _____

Observation _____

(2)

(Total 7 marks)

Q3.

Ethanal reacts with potassium cyanide, followed by dilute acid, to form 2-hydroxypropanenitrile.

- (a) Name the mechanism for the reaction between potassium cyanide and ethanal.

(1)

- (b) The 2-hydroxypropanenitrile formed by the reaction in part (a) is a mixture of equal amounts of two isomers.

State the name of this type of mixture.

Explain how the structure of ethanal leads to the formation of two isomers.

Draw 3D representations of the two isomers to show the relationship between them.

Name _____

Explanation _____

3D representations

(5)

- (c) 2-Hydroxypropanenitrile can be used in the synthesis of the monomer, acrylonitrile, $\text{CH}_2=\text{CHCN}$

Suggest a suitable reagent and conditions for the conversion of 2-hydroxypropanenitrile into acrylonitrile.

Reagent _____

Conditions _____

(2)

- (d) Draw a section of the polymer polyacrylonitrile, showing three repeating units.

