Q1.

Alkenes react with bromine (Br_2)

(a) Name and outline the mechanism for the reaction of cyclohexene with Br_2

Name of mechanism

_____

Outline of mechanism

(5)

(b) Explain why there is an attraction between a C=C double bond and Br_2

_____

_____

_____

_____

_____

_____

_____

_____

(3)

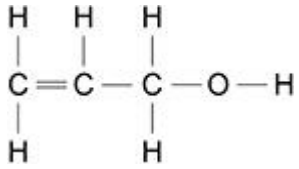
(c) Draw the skeletal formula of the halogenoalkane formed when buta-1,3-diene ($CH_2=CHCH=CH_2$) reacts with an excess of Br_2

(1)

(Total 9 marks)

Q2.

Prop-2-en-1-ol is a natural chemical found in garlic. It is also used in the production of plasticisers.



(a) Prop-2-en-1-ol can be prepared by reacting 3-chloroprop-1-ene with dilute aqueous sodium hydroxide.

Name the mechanism for this reaction.

_____

(1)

(b) Prop-2-en-1-ol can also be formed from $HOCH_2CH_2CH_2OH$ in the presence of an acid catalyst.

$$HOCH_2CH_2CH_2OH \longrightarrow CH_2=CHCH_2OH + H_2O$$

Name and outline a mechanism for this reaction.

Name of mechanism

_____

Outline of mechanism

(4)

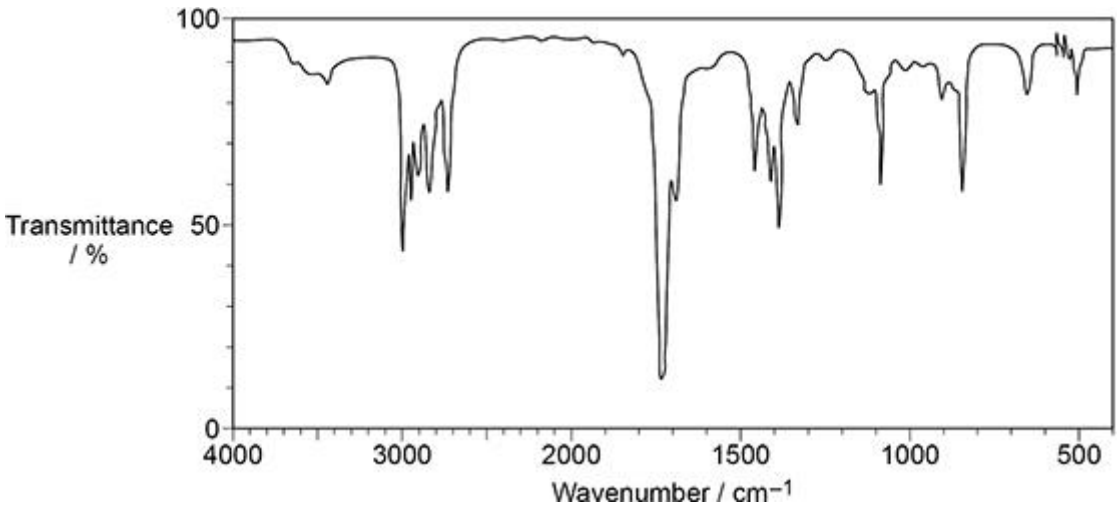
(c) Prop-2-en-1-ol forms an addition polymer.

Draw the repeating unit of poly(prop-2-en-1-ol).

(1)

(d) The figure below shows the infrared spectrum of a functional group isomer of

prop-2-en-1-ol.



This isomer reacts with acidified potassium dichromate(VI) to form a green solution.

Draw the structure of this isomer.

(1)
(Total 7 marks)

Q3.

Which compound reacts with hydrogen bromide to give 2-bromo-3-methylbutane as the major product?

A $(CH_3)_2C=CHCH_3$ ⬭

B $(CH_3)_2C=CH_2$ ⬭

C $CH_2=C(CH_3)CH_2CH_3$ ⬭

D $(CH_3)_2CHCH=CH_2$ ⬭

(Total 1 mark)

Q4.

This question is about poly(chloroethene), commonly known as PVC.

(a) Give an equation, showing structural formulas, for the conversion of chloroethene into poly(chloroethene).

(3)

(b) State what you would observe if bromine water was added to poly(chloroethene). Explain this observation.

Observation

_____

Explanation

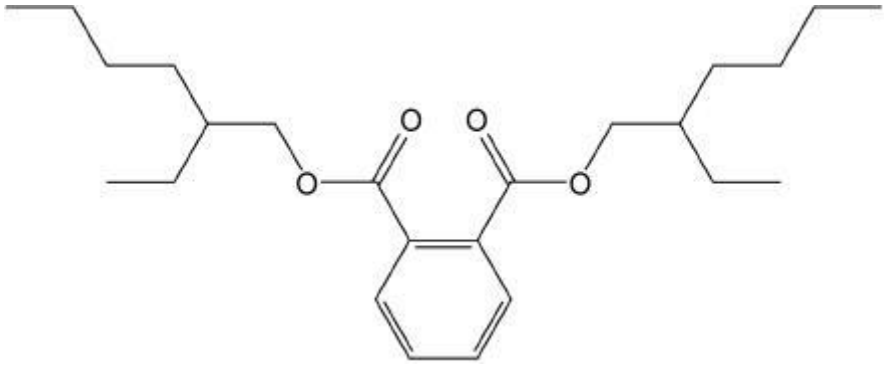
_____

_____

_____

(2)

(c) Plasticisers are often added during the manufacture of PVC. The structure of the plasticiser DEHP is shown.



Deduce the molecular formula of DEHP and state why a plasticiser is added to PVC.

Molecular formula _____

Why a plasticiser is added _____

_____

_____

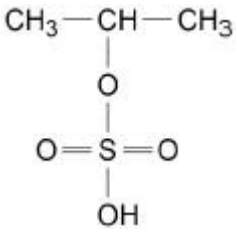
(2)

(Total 7 marks)

Q5.

Propene reacts with concentrated sulfuric acid to form two isomers, E and F.

The structure of **E** is shown.



(a) Name and outline the mechanism for the formation of **E** in this reaction.

Name of mechanism

_____

Mechanism

(5)

(b) Draw the structure of **F**.

(1)

(c) Explain why more of isomer **E** than isomer **F** is formed in this reaction.

_____

_____

_____

_____

_____

_____

(2)

(Total 8 marks)

Q6.

Which statement is **not** correct about $CH_2{=}C(CH_3)CH_2Br$?

A It displays *E-Z* isomerism. ⬭

B It forms an addition polymer. ⬭

C It reacts with electrophiles. ⬭

D It decolourises bromine water. ⬭

(Total 1 mark)

Q7.

Which alkene reacts with hydrogen bromide to give 2-bromo-3-methylbutane as the major product?

A $(CH_3)_2C=CHCH_3$ ⬭

B $CH_3CH_2CH=CHCH_3$ ⬭

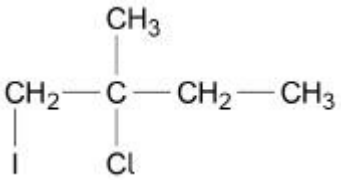
C $CH_3CH_2C(CH_3)=CH_2$ ⬭

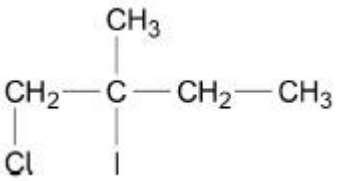
D $(CH_3)_2CHCH=CH_2$ ⬭

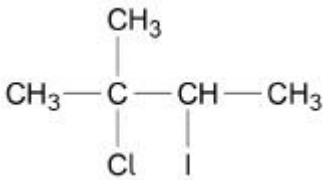
(Total 1 mark)

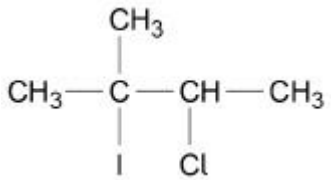
Q8.

Which is the major product of the reaction between 2-methylbut-2-ene and iodine monochloride (ICl)?

A  ⬭

B  ⬭

C  ⬭

D  ⬭

(Total 1 mark)

Q9.

Which statement is correct about poly(chloroethene)?

A It has the empirical formula CHCl ⬭

B It decolourises bromine water. ⬭

C Its brittleness is reduced by plasticisers. ⬭

D Its polymer chain contains alternate single and double bonds. ⬭

(Total 1 mark)

Q10.

2-Methyl but-2-ene reacts with concentrated sulfuric acid to form two different products.

(a) Outline a mechanism for this reaction to show the formation of the major product.

(4)

(b) Draw the structure of the minor product of this reaction.

(1)

(c) Explain why the two products are formed in different amounts.

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q11.

Consider the reaction between propene and hydrogen bromide to form the major product.

Which species is formed in the mechanism of this reaction?

A $CH_3–C^+H–CH_2Br$ ⬭

B $CH_3–CHBr–C^+H_2$ ⬭

C $CH_3–C^+H–CH_3$ ⬭

D $CH_3–CH_2–C^+H_2$ ⬭

(Total 1 mark)

Q12.

Which statement about *E*-1,2-dichloroethene is correct?

A It has the same boiling point as *Z*-1,2-dichloroethene. ⬭

B It forms a polymer with the same repeating unit as *Z*-1,2-dichloroethene. ⬭

C It has the same IR spectrum as *Z*-1,2-dichloroethene in the range 400–1500 cm^{-1}. ⬭

D It has a molecular ion peak different from that of *Z*-1,2-dichloroethene in its mass spectrum. ⬭

(Total 1 mark)

Q13.

Which statement about ethene is correct?

A It has no geometric isomers because there is free rotation around the C=C bond. ⬭

B It reacts with HBr in a nucleophilic addition reaction. ⬭

C It burns in excess oxygen to produce carbon dioxide and water. ⬭

D The C=C bond is twice as strong as the C–C bond in ethane. ⬭

(Total 1 mark)

Q14.

But-1-ene reacts with a reagent of the form HY to form a saturated compound.

(a) Suggest a reagent of the form HY which reacts with but-1-ene.

_____

(1)

(b) Name and draw a mechanism for the reaction in part **(a)**.

Name of mechanism

_____

Mechanism

(5)

(c) Explain how three isomeric products are formed when HY reacts with but-1-ene.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q15.

What is the major product of the reaction between but-1-ene and DBr?
(D is deuterium and represents ^{2}H)

A $CH_2DCH_2CH_2CH_2Br$ ⬭

B $CH_2DCH_2CHBrCH_3$ ⬭

C $CH_3CH_2CHBrCH_2D$ ⬭

C $CH_3CH_2CHDCH_2Br$ ⬭

(Total 1 mark)