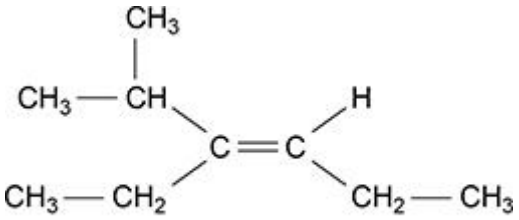
Q1.

(a) Compound **J** is one of a pair of stereoisomers.



Compound **J**

Explain:

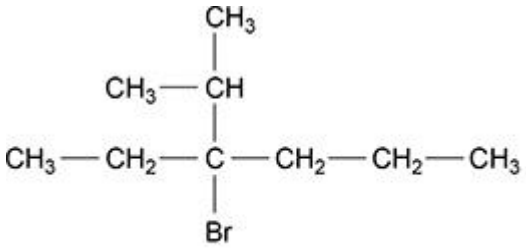
- what stereoisomers are
- how *E*-*Z* stereoisomerism occurs
- how the Cahn-Ingold-Prelog rules can be used to decide whether compound **J** is an *E* or *Z* isomer.

_____

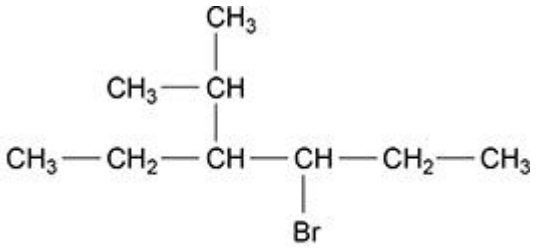
_____

(6)

(b) Compound **J** reacts with hydrogen bromide to form compounds **K** and **L**.



Compound **K**



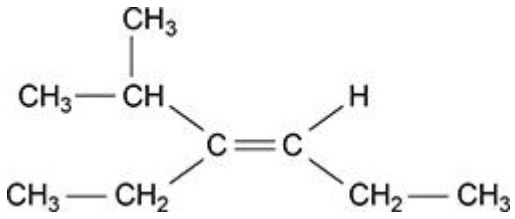
Compound **L**

K is the major product.

Name and outline the mechanism for the formation of **K**.

Name of mechanism _____

Outline of mechanism



(5)

(c) Explain why compound **K** is the major product in the reaction in part (b).

_____

_____

_____

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_____

_____

_____

(3)

(Total 14 marks)

Q2.

This question is about isomerism and the dehydration of alcohols.

Pentan-2-ol has the molecular formula $C_5H_{12}O$

(a) Draw the **displayed** formula of an unbranched position isomer of pentan-2-ol that can be dehydrated to form a single alkene.

(1)

(b) Draw the **skeletal** formula of a chain isomer of pentan-2-ol that can be dehydrated to form a mixture of alkenes.

(1)

(c) Draw the structure of an unbranched functional group isomer of pentan-2-ol.

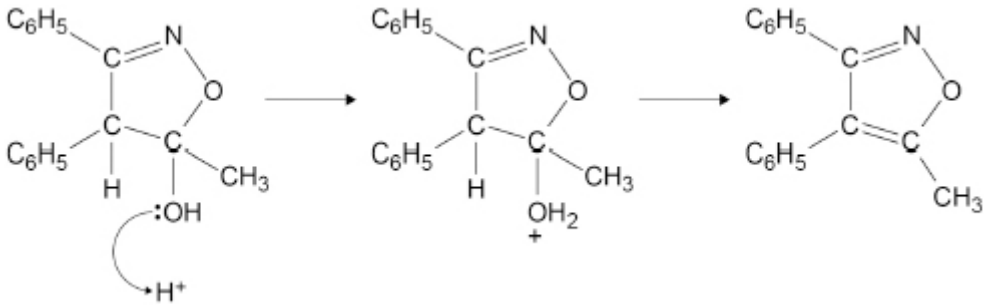
(1)

(d) Another isomer of pentan-2-ol is an alcohol that is **not** dehydrated when heated with concentrated sulfuric acid.

Draw the structure of this isomer.

(1)

(e) An incomplete mechanism for the dehydration of a compound is shown.



Complete the mechanism for this reaction by drawing two curly arrows on the intermediate.

Name the mechanism for this reaction.

_____

(3)

(f) An isomer of the final product can also form in the reaction in part (e).

Draw the structure of this isomer.

(1)

(Total 8 marks)

Q3.

This question is about isomers.

Hex-2-ene has the molecular formula C_6H_{12}

(a) Draw the displayed formula of a **position** isomer of hex-2-ene that exists as *E* and *Z* isomers.

(1)

(b) Draw the displayed formula of a **chain** isomer of hex-2-ene that does **not** exist as *E* and *Z* isomers.

(1)

Butanal has the molecular formula C_4H_8O

(c) Draw the skeletal formula of a **functional group** isomer of butanal that has an absorption in the range 1680–1750 cm^{-1} in its infrared spectrum.

(1)

(d) Draw the skeletal formula of a structural isomer of butanal that has an absorption in the range 3230–3550 cm^{-1} in its infrared spectrum.

(1)

(e) Several saturated halogenoalkanes contain 17.8% carbon, 3.0% hydrogen and 79.2% bromine by mass.

Calculate the empirical formula of these compounds.

Give the IUPAC names of **two** saturated halogenoalkanes that have this empirical formula.

Empirical formula _____

Names of halogenoalkanes

1 _____

2 _____

(4)

(Total 8 marks)