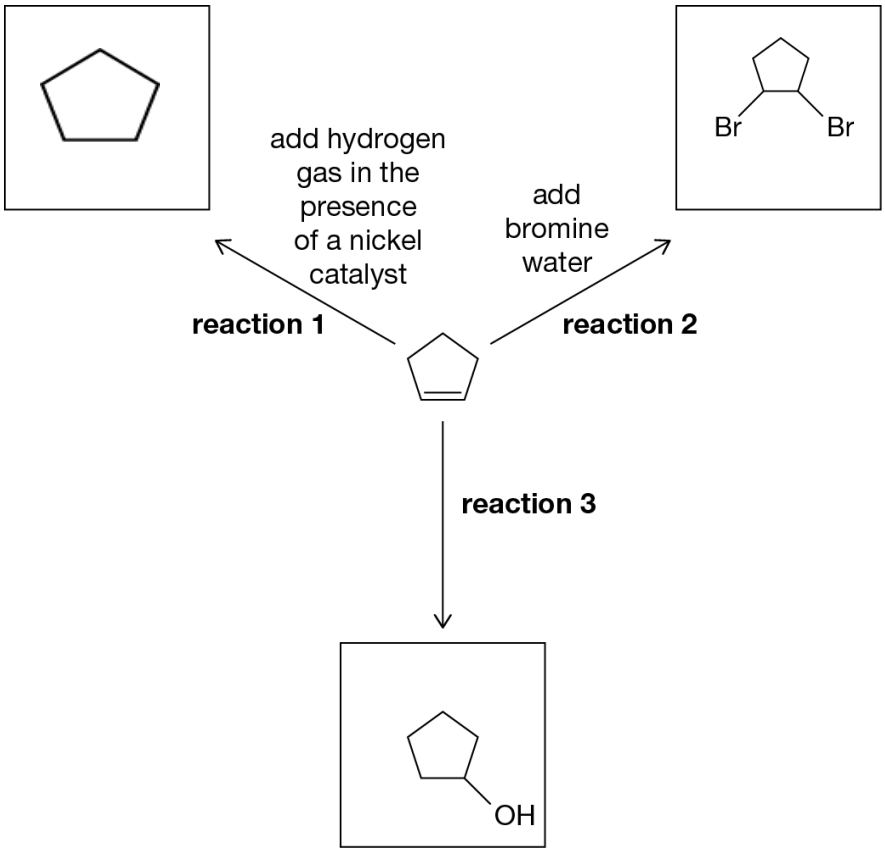
Alkenes Exam Style Questions

1 This question is about the reactions of cyclopentene, C_5H_{10}.



a Draw the skeletal formula of the product made from Reaction **1** and the main product from Reaction **2** in the boxes above. (*2 marks*)

b Give the reagents and conditions needed for Reaction **3** to take place.

Steam and a (phosphoric) acid catalyst.

..... (*1 mark*)

c Name the product of Reaction **3**.

Cyclopentanol

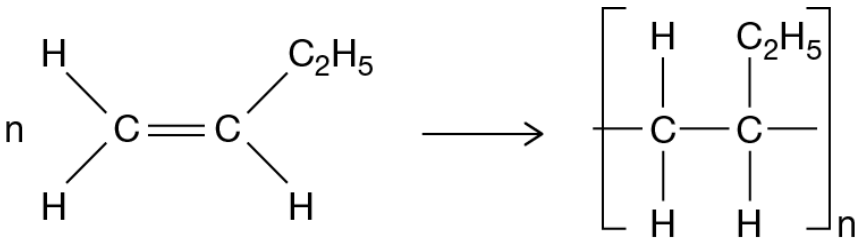
(*1 mark*)

d Reaction **2** demonstrates the test for unsaturation by the addition of bromine. State the colour change you would expect to observe during this reaction.

Colour change from **Orange / brown to colourless.** (*1 mark*)

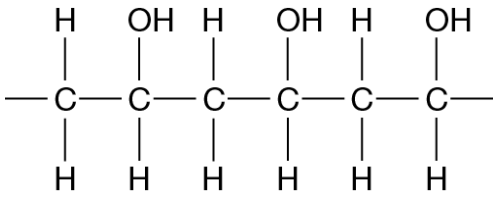
2. Polybut-1-ene is made by the polymerisation of the monomer but-1-ene.

a Write an equation to show this polymerisation reaction.

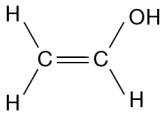


(*2 marks*)

b Polymers that are soluble in water have been developed for use as plastic pouches to hold dishwasher liquid and laundry gels. A portion of one of these polymer chains is shown below:



i Suggest the monomer of this polymer.



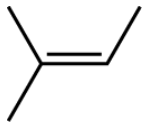
(*1 mark*)

ii Suggest why this polymer is soluble, but polybut-1-ene is insoluble in water.

Soluble polymer has alcohol / OH groups, which can form hydrogen bonds with water molecules

(2 marks)

3. The following alkene will undergo a reaction with hydrogen chloride to produce two possible products.



a Name the alkene.

methylbut-2-ene

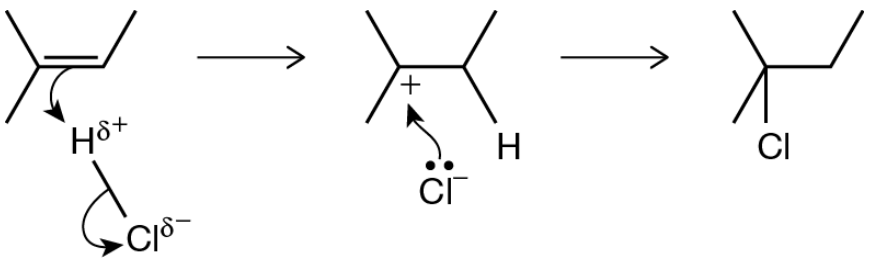
(*1 mark*)

b Name the type of mechanism for the reaction of this alkene with hydrogen chloride.

Electrophilic Addition.

(*2 marks*)

c Draw the mechanism for the reaction that will produce the **major** product.
Use curly arrows, partial charges and charges where relevant.



(*4 marks*)

d Explain, using Markownikoff's rule, why this product is the major product.

The intermediate tertiary carbocation is more stable than a secondary carbocation.

.....

(*1 mark*)

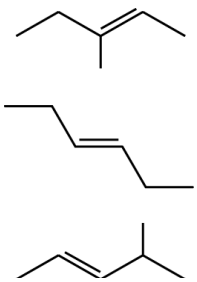
e Name the minor product formed.

2-chloro-3-methylbutane

(*1 mark*)

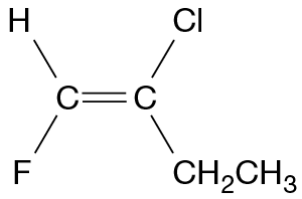
ii There are other aliphatic alkenes, besides hex-2-ene, which also have a molecular formula of C_6H_{12}. Some of these alkenes can show *E*/*Z* stereoisomerism.

Draw the structures of two other **different** alkenes, both with a molecular formula C_6H_{12}, which can both show *E* and *Z* stereoisomers.



(*2 marks*)

e **i** Use the Cahn–Ingold–Prelog priority rules to identify whether the following structure is the *E* or *Z* stereoisomer. Explain your answer.



***E*, because the highest priority groups are opposite each other (across the C=C double bond). Cl has a higher atomic number than C and F has a higher atomic number than H.**

(*2 marks*)

ii Why can this molecule **not** be labelled as either '*cis*' or '*trans*'?

In order to have *cis* or *trans* isomers each C atom of the C=C double bond must have two different substituent groups and for each C atom one of those groups must be hydrogen.

(*1 mark*)