CHEMISTRY ONLINE
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CHEMISTRY

ORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	ALKENES
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	10
TOTAL MARKS	38

Alkenes - 1

1.

(a)

Reagents:

Acidified Potassium Dichromate ($K_2Cr_2O_7$ / H_2SO_4):
The acid provides the acidic medium needed for the reaction.

Procedure:

Add acidified potassium dichromate to each alcohol separately.

Observations:

Butan-2-ol:
The orange color of the dichromate solution changes to green.
This indicates the oxidation of the alcohol to a corresponding aldehyde or ketone. The butan-2-ol would be oxidized to butan-2-one (a ketone).

2-Methylpropan-2-ol:
No immediate change is observed, and the solution remains orange. Tertiary alcohols, such as 2-methylpropan-2-ol, do not readily undergo oxidation with acidified potassium dichromate under the conditions provided.

(3)

(b)

Reagent:

Bromine (Br_2) or Bromine water (Br_2/H_2O)

Procedure:

Shake with bromine or add bromine water to each hydrocarbon separately.

Observations:

Propane:
The bromine color (orange or red or yellow or brown) remains the same, or there is no observed change.
No reaction occurs, and the bromine does not react with propane.

Propene:
The bromine color (orange) goes colorless, or the solution loses its color. This shows that propene reacts with bromine, causing decolorization due to the addition of bromine across the carbon-carbon double bond.

(3)

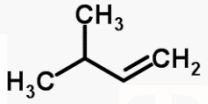
2. A

(1)

3.

(a)

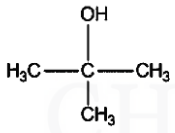
Structure of the alkene:
Structure: 3-methylbut-1-ene
$H_2C=CHCH(CH_3)_2$



(1)

(b)

Name: 2-methylpropan-2-ol
Formula: $(CH_3)_3COH$



(1)

(c)

Structure of the alkene:
Structure for propene $H_2C=CHCH_3$

(1)

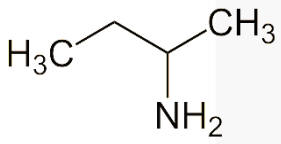
(d)

Structure of the organic product with Mr = 73 made from the reaction between 2-bromobutane and ammonia is as:

Structure:

2-aminobutane

$CH_3CH_2CH(NH_2)CH_3$



(1)

4. A

(1)

5.

(a)

Electrophile: A species that accepts an electron pair or a lone pair, characterized by being electron-deficient or electron-seeking.
It can be an atom, molecule, or ion, excluding those with a positive charge.
Addition: A chemical reaction increasing substituents or converting a double bond to a single bond, where two molecules combine to form one.

(2)

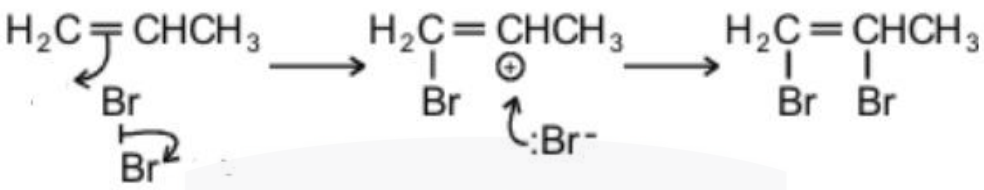
(b)

Bromine, being a non-polar molecule, can react with propene due to the nature of the addition reaction between them.
In the process, the double bond in propene breaks, and bromine adds across the carbon-carbon double bond.
This reaction induces polarity within the bromine molecule as new bonds are formed, making it partially negative at one end and partially positive at the other. This polarization facilitates the interaction between the electrophilic bromine and the electron-rich double bond in propene, allowing for the reaction to occur.

(2)

(c)

Mechanism:



Name of product: 1,2-dibromopropane

(5)

(d)

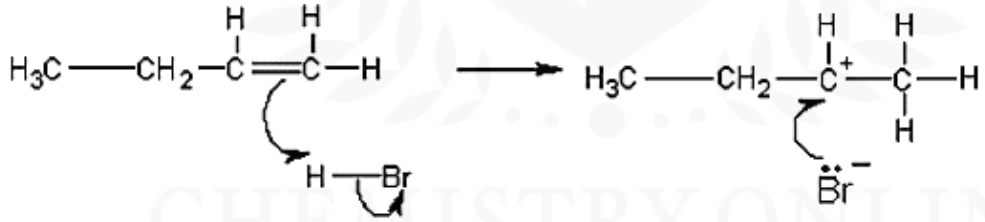
Type of polymerization: addition

(1)

6. C

(1)

7. Mechanism for $CH_3CH_2CH=CH_2 + HBr \rightarrow CH_3CH_2CHBrCH_3$ is as:



(4)

8. D

(1)

9.

(a)

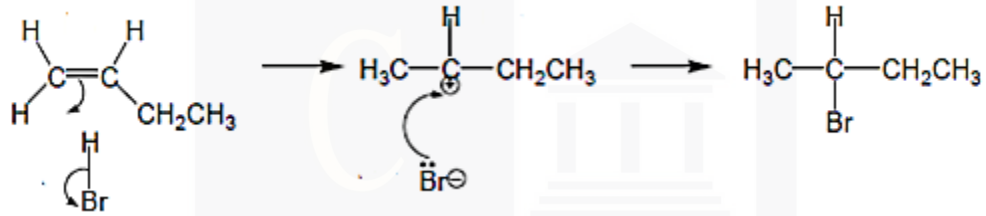
Reagent: HBr/HCl

(1)

(b)

Name: Electrophilic addition

Mechanism:



(5)

(c)

Major Product is a pair of enantiomers:

The major product in this reaction is likely to be 2-butene.

When but-1-ene undergoes hydrogenation, the hydrogen atoms can add to the central carbon of the double bond, resulting in the formation of 2-butene.

Due to the presence of the double bond, 2-butene exists as a pair of enantiomers (stereoisomers that are mirror images of each other but not superimposable).

Minor Product - 1-Bromobutane:

The third isomer, 1-bromobutane, is a minor product.

This compound is likely formed through a side reaction involving the formation of a carbocation. The primary carbocation is less stable than secondary or tertiary carbocations. The hydrogenation process may involve the generation of a primary carbocation, leading to the formation of 1-bromobutane as a minor product.

(3)

10. D

(1)

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