ALKENES MS

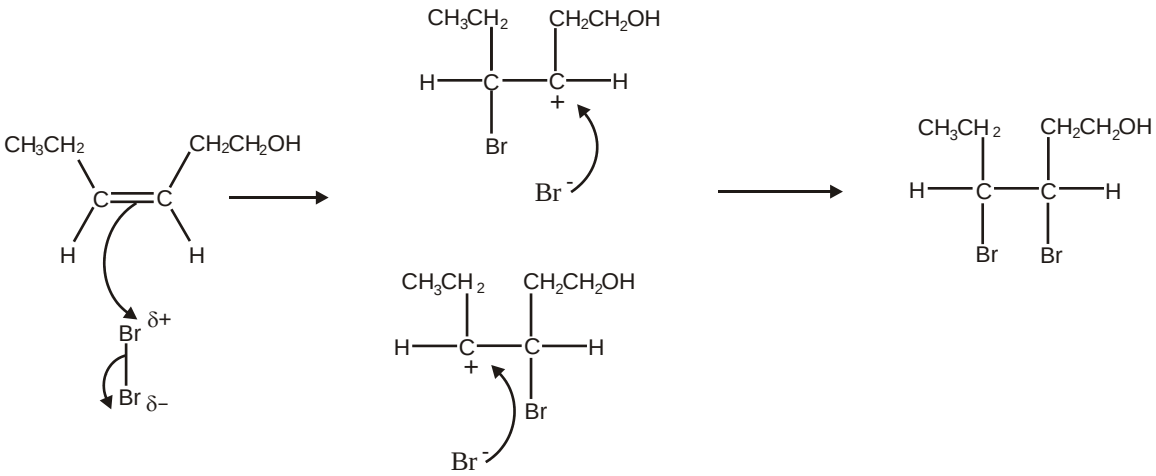
1. H_2 1

Ni/Pt/Pd (catalyst) 1

[2]

2. (i) decolourises 1

(ii)



curly arrow from C=C bond to bromine 1

dipoles on Br_2 or curly arrow to show movement of bonded pair of electrons 1

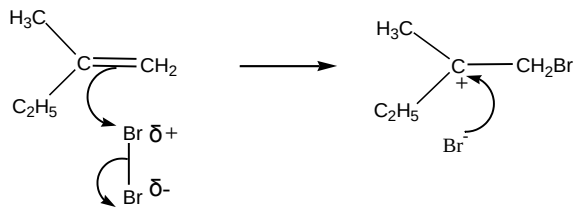
intermediate carbonium ion/carbocation 1

curly arrow from lone pair on the Br- ion to carbonium ion ($Br^{\delta-}$ loses 1 mark) 1

[5]

3. (i) electron/lone pair acceptor 1

(ii)



curly arrow from π-bond to $Br^{\delta+}$

Dipoles on the Br–Br bond
and
curly arrow from Br–Br bond to $Br^{\delta-}$ } 1

Curly arrow from Br^- to C^+ 1

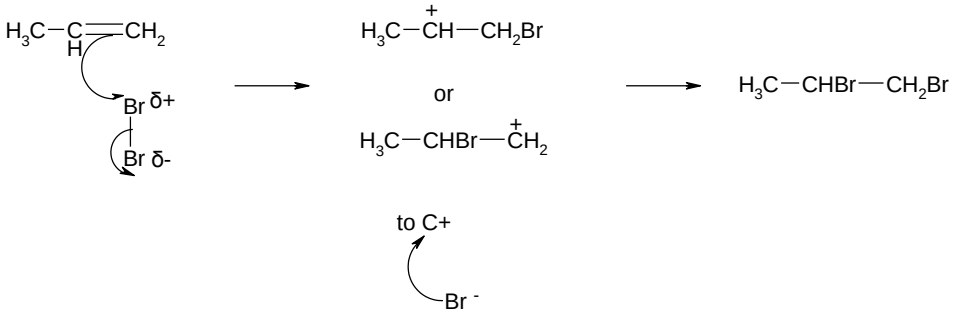
1

1

[4]

4. (i) decolourises/not clear/not discolours 1

(ii)



curly arrow from C=C to $Br^{\delta+}$ 1

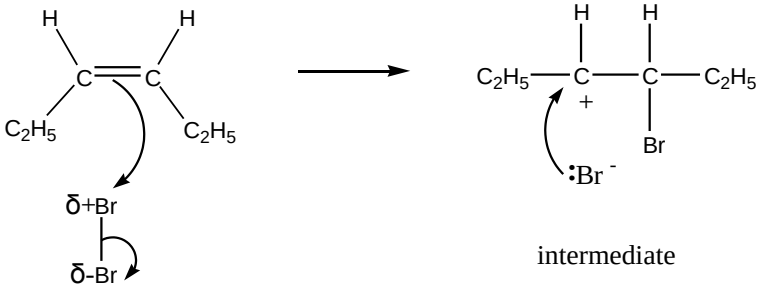
dipole on Br-Br **and** curly arrow showing movement of bonded pair of electrons 1

correct intermediate/carbonium ion/carbocation **and** curly arrow from Br^- to C+ 1

1, 2-dibromopropane as product 1

[5]

5. (a)



intermediate

curly 1

dipoles shown correctly on the Br–Br and curly arrow from the Br–Br bond towards the Br^{δ} 1

correct intermediate shown 1

curly arrow from the lone pair or the negative charge on the Br^- to the C+ 1

(b) (i) Hs are diagonal to each other in the *trans*/ difference clearly shown in a diagram 1

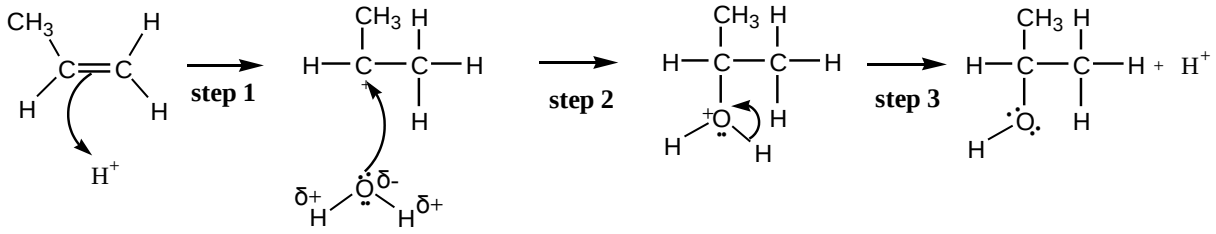
(ii) (the product is saturated hence) there is no restricted rotation/single bonds allow rotation/because C=C prevents rotation 1

[6]

6. (a) (i) phosphoric acid/H^+/sulphuric acid 1

(ii) lone/electron pair of electrons acceptor 1

(b) (i)



Step 1	curly arrow from π-bond to H^+	1
Step 2	curly arrow from lone pair on the $O^{\delta-}$ to C+	1
Step 3	curly arrow from O—H bond to O+	1

(ii) catalyst … no marks because it is **not** consumed/used up in the reaction/owtte 1

[6]

7. (a) (i) 24.7/12 : 2.1/1: 73.2/35.5

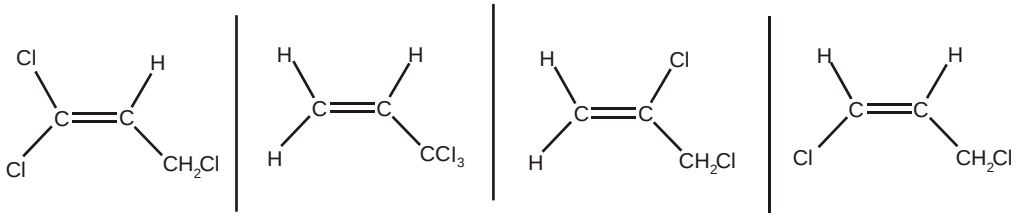
2.06 : 2.1 : 2.06 1

CHC*l* 1

(ii) (CHC*l* = 12 + 1 + 35.5 =) 48.5 1

48.5 × 3 = 145.5 1

(b) (i) Any two from 2



1,1,3 -trichloro 3,3,3 -trichloro 2,3,3 -trichloro 1,3,3 -trichloro

(ii) 1, 2,3-trichloropropene

(trichloropropene scores 1 mark ✓)

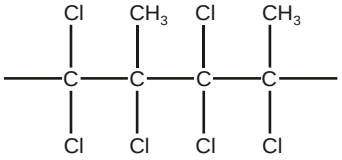
3 marking points:

- *correct numbers 1, 2,3*
- *trichloro*
- *propene/prop-1-ene*

any two gets 1 mark

2

(c) (i) 2



1 mark if backbone contains 4 carbons with 'end-bonds' and a reasonable attempt has been made e.g used the wrong isomer…. max = 1 mark

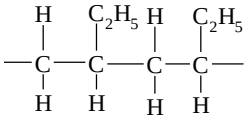
(ii) non-biodegradable 1

toxic fumes evolved <u>when burnt</u> 1

HC*l* or C*l*• or chlorinated organic compounds such as $COCl_2$ also evolved when burnt 1

[13]

8.



1 mark is available if the backbone consists of 4 C atoms and a reasonable attempt has been made ✓✓

[2]

9. **margarine**

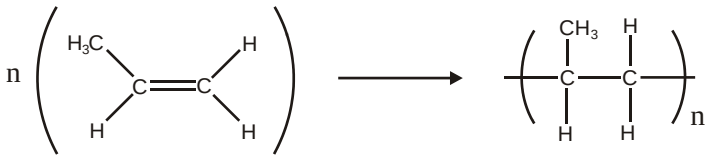
Ni catalyst 1

hydrogen/ hydrogenated 1

unsaturated vegetable oil/fat 1

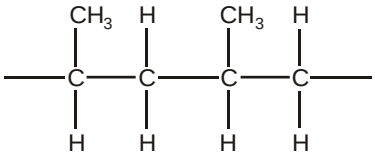
poly(propene)

equation



1

two repeat units



1

(Ziegler) catalyst / high temp/heat/use of an initiator

Problems with disposal

non-biodegradable/don't decompose/not broken down by bacteria etc 1

when burnt produces toxic fumes 1

Future methods of disposal

recycling (to produce new polymers) 1

incineration for energy (production) 1

cracking/owtte (to produce useful organic molecules)

use gas scrubbers to reduce toxic fumes

any two

max = 9

QWC

Answer is well organised/structure and using at least three of:

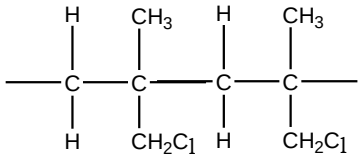
catalyst, hydrogenation, addition polymerisation, Ziegler, incineration, feedstock, recycling, non-biodegradable, initiator, monomer, unsaturated.

in the correct context. 1

[10]

10. (a) 3-chloro(-2-)methylprop-1-ene/1-chloro(-2-)methylprop-2-ene 1

(b)



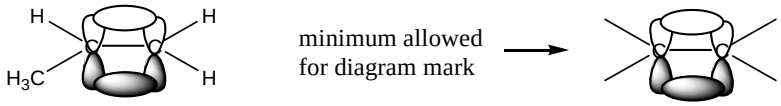
Backbone of 4 carbons and a reasonable attempt gets 1 mark.

2

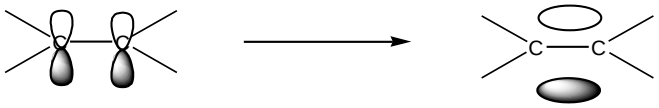
[3]

11. **Bonding:** π-bond formed by overlap of (adjacent) p-orbitals/π-bond labelled on diagram 1

diagram to show formation of the π-bond 1



or



Shape/bond angles:

tetrahedral around the CH_3 1

bond angle = 109°28/ (109-110°) 1

trigonal planar around each C in the C=C 1

bond angle = 120° (118-122°) 1

Cis-trans

cis & *trans* correctly labelled eg but-2-ene 1

require a double bond because it restricts rotation 1

each C in the C=C double bond must be bonded to two different atoms or groups 1

QWC Allow mark for well constructed answer and use of **three** terms like: orbital, tetrahedral, trigonal, planar, rotation, spatial, stereoisomers, geometric 1

[10]