


- 1(a)  
 (i) compound/molecule containing hydrogen and carbon **only** ✓  
 (ii)  $C_{10}H_{22}$  ✓  
 (iii)  $C_5H_{11}$  {ecf from (ii)} ✓  
 (b)(i) (a particle that) contains/has a single/unpaired electron ✓  
 (ii) UV (light) /sunlight/high temp ✓

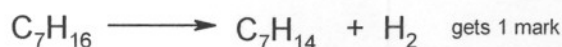
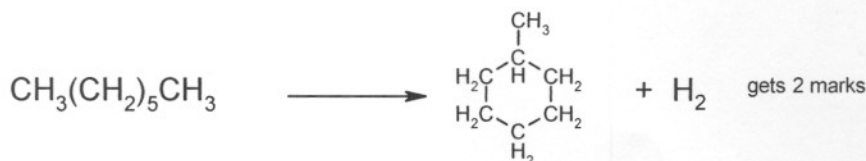
- (iii) homolytic (fission)/ homolysis ✓  
 (iv)  $C_{12}H_{26} + Cl\bullet \longrightarrow \bullet C_{12}H_{25} + HCl$  ✓  
 (the dot for the free radical does not have to be on the C)  
 $\bullet C_{12}H_{25} + Cl_2 \longrightarrow C_{12}H_{25}Cl + Cl\bullet$  ✓  
 (v) six ✓

- (c)(i)  $C_{12}H_{26} \longrightarrow 2C_2H_4 + 1C_8H_{18}$  ✓✓  
 (1 mark for correct formula of octane or ethene)  
 (ii) octane/ ecf from (c) (i) ✓

- (d)(i)  ✓✓

1 mark for correct reagent and 1 mark for correct product.

- (ii) 1 mark for any unambiguous formula of cyclohexane ✓  
 1 mark for  $1H_2$  but check that formula of heptane is correct/equation balanced. ✓



[Total : 16]

2(a)

- (i) *low volatility*, = **high** boiling point/ not easy to vapourise/owtte  
*intermolecular bonds*. = bonds/forces/attractions **between** molecules

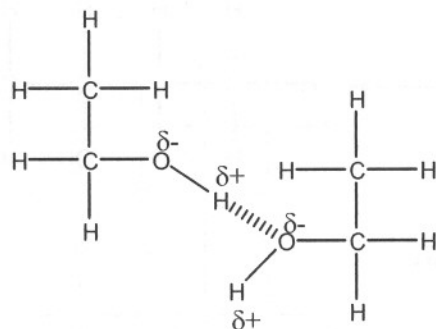
✓

✓

(ii)

type of intermolecular bond = hydrogen bond

✓



dipoles on both O-H bonds

✓

H-bond shown as a 'dashed bond'

✓

- (iii) (The boiling point of glycerol will be *higher* than ethanol because there are)  
 more OH groups ∴ more H-bonds

✓

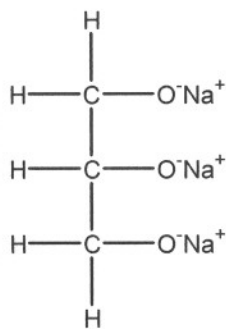


✓✓

charges are not essential

1 mark for correct formula of sodium ethoxide &amp; 1 mark for correct balancing

(c)



charges are not essential for both marks

✓✓

1 mark for partial reaction, 1 mark if all 3 "ONa" are shown as covalent "O-Na"

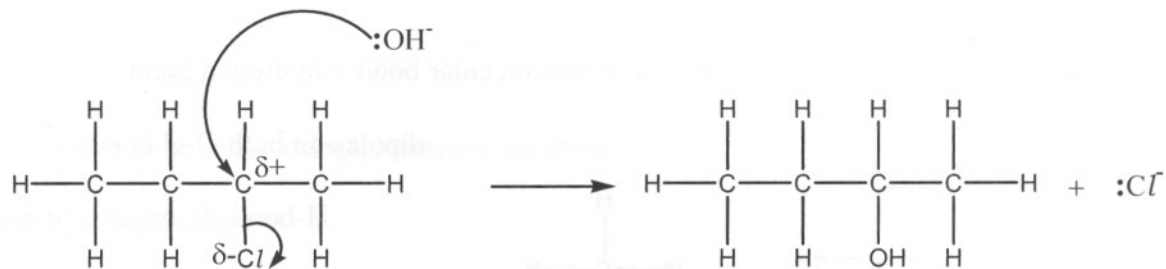
[Total : 10]

3.

(c)

(a)(i) butan-2-ol by name or by formula ✓

(ii)

curly arrow from the O of the  $\text{OH}^-$  to  $\text{C}^{(\delta+)}$  ✓curly arrow from C-Cl bond to Cl **and** correct dipoles ✓

correct products/ allow NaCl ✓

curly arrow from lone pair on  $\text{OH}^-$  ✓

[4]

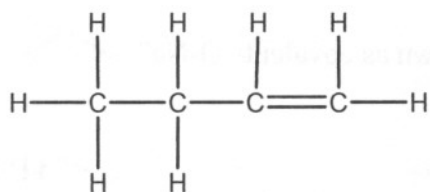
 $\text{S}_{\text{N}}1$  route can still score all 4 marks:curly arrow from C-Cl bond to Cl **and** correct dipoles ✓curly arrow from the O of the  $\text{OH}^-$  to  $\text{C}^+$  ion ✓

correct products/ allow NaCl ✓

curly arrow from lone pair on  $\text{OH}^-$  ✓

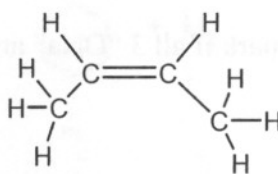
(b) (i) elimination ✓

(ii)



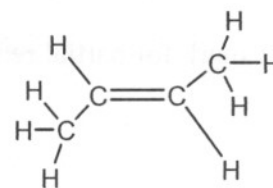
but-1-ene

✓



cis-but-2-ene

✓



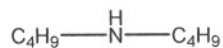
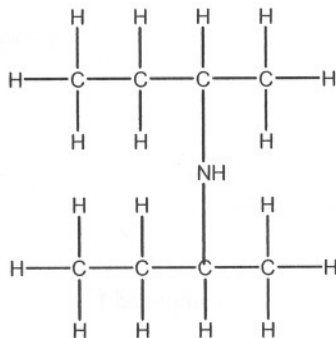
trans-but-2-ene

✓

(c) (i) ethanol ✓

(ii)  $C_4H_{11}N$  ✓

(iii)



any unambiguous structure/ formula  
for the secondary amine

[Total : 12]

4 (a)(i) alkene ✓

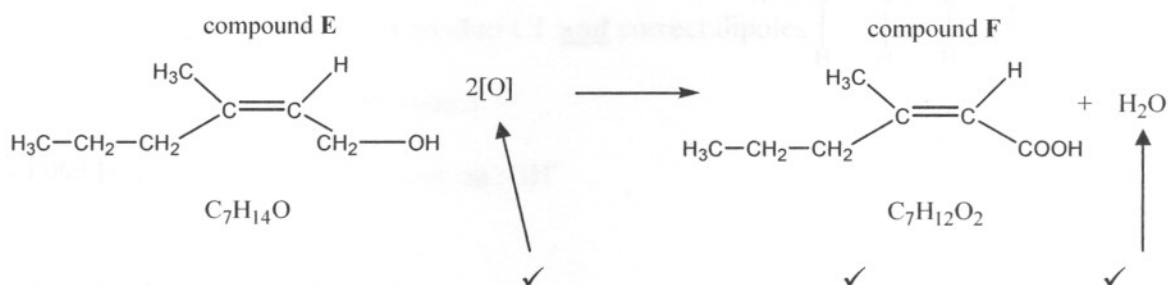
bromine ✓

decolourises ✓

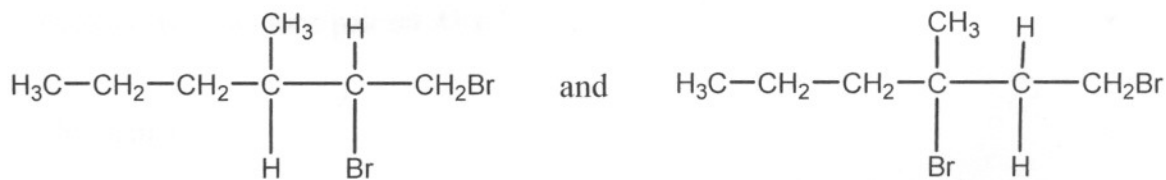
(ii) 3-methylhex-2-en-1-ol/ 1-hydroxy-3-methylhex-2-ene ✓

(b) (i)  $H^+$  ✓ $Cr_2O_7^{2-}$  ✓

(ii)

(iii) carboxylic acid would have an absorption between  $1680 - 1750\text{ cm}^{-1}$  /  $1700\text{ cm}^{-1}$  or  $2500 - 3300\text{ cm}^{-1}$ . ✓

(c)



1,2-dibromo-3-methylhexane

1,3-dibromo-3-methylhexane

 $CH_3CH_2CH_2CH(CH_3)CHBrCH_2Br$  $CH_3CH_2CH_2CBr(CH_3)CH_2CH_2Br$ 

✓

✓

[Total :12]

**margarine**

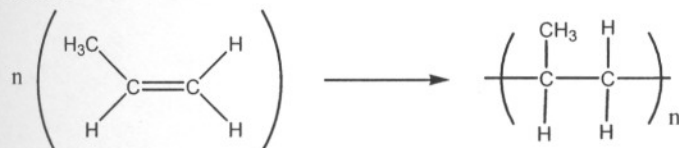
Ni catalyst ✓

hydrogen/ hydrogenated ✓

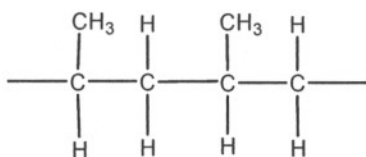
unsaturated vegetable oil/fat ✓

**poly(propene)**

equation



two repeat units



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

**Problems with disposal**

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

when burnt produces toxic fumes ✓

**Future methods of disposal**

recycling (to produce new polymers) ✓

incineration for energy (production) ✓

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. ✓

[Total : 10]