



**Subject: Chains and Rings**

**Code: 2812**

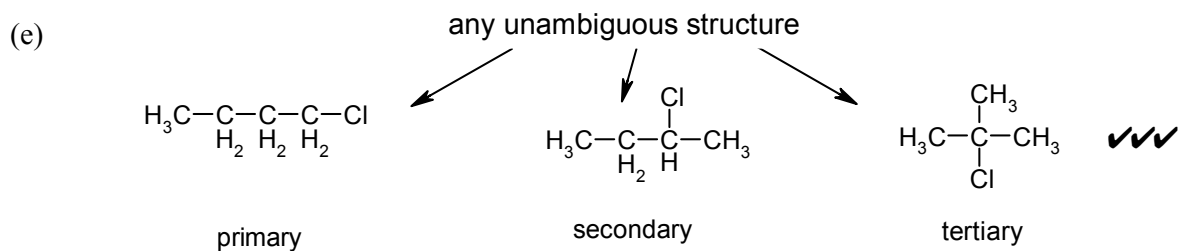
**Session: January**

**Year: 2002**

**WORKING Mark Scheme**

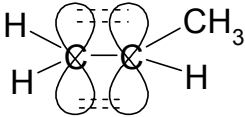
<b>MAXIMUM MARK</b>	<b>90</b>
---------------------	-----------

- 1(a)(i) propan-1-ol ✓
- (ii) butan-2-ol ✓
- (b) C<sub>6</sub>H<sub>14</sub> ✓
- (c) C<sub>3</sub>H<sub>7</sub> (ecf to (b)) ✓
- (d) alkane /C<sub>n</sub>H<sub>2n+2</sub> ✓



[Total : 8]

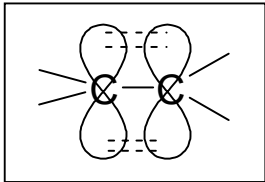
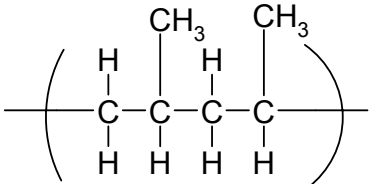
- 2 (a) (i) Fission = bond breaking ✓
- (ii) Cl<sub>2</sub> with methane is homolytic fission ✓
- Cl<sub>2</sub> with ethene is heterolytic fission ✓
- (iii) Homolytic fission Cl<sub>2</sub> → Cl• + Cl• / 2 Cl• / 2Cl ✓
- Heterolytic fission Cl<sub>2</sub> → Cl<sup>+</sup> + Cl<sup>-</sup> ✓
- (b) nucleophile = Cl<sup>-</sup> ✓
- electrophile = Cl<sup>+</sup> ✓
- free radical = Cl•/Cl ✓

- 3 (a) (i)  $C_nH_{2n+2}$  ✓  
 (ii)  $CH_2$  ✓  
 (iii)  $C_{16}H_{34}$  ✓
- (b) (i) shorter chain alkane & alkene ✓  
 clearly stated use: used in fuel/additive to petrol/polymers/ethanol etc ✓  
 not simply “more useful”.
- (ii)  $C_{12}H_{24}$  ✓
- (c) (i) bond angle **a**  $109^\circ 28'$  (allow range  $109 - 110^\circ$ ) ✓  
 bond angle **b** (allow range  $118 - 122^\circ$ ) ✓
- (ii)
- 

The overlap of adjacent p orbitals ✓

Suitable diagram ✓

Minimum allowed

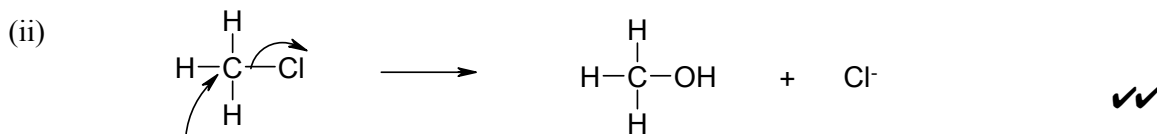

- (iii) (Addition of) bromine ✓  
 which is decolourised by propene/ or converse ✓
- (d) (i)
- 
- 1mark for the backbone of 4C's + the two end bonds  
**not** just the end-bonds ✓✓
- (ii) addition polymerisation ✓
- (e) (i) non-biodegradable or words to that effect/ eye-sore or wtte ✓
- (ii) Advantage: combustion for energy production ✓  
 Disadvantage: produce toxic/harmful/dangerous fumes ✓

[Total : 18]

4



(b) (i) lone pair donor ✓



(c) (i) Faster. ✓  
lone pair not essential

**marking points**

curly arrow showing bonded pair in C-Cl bond move to the Cl

curly arrow from OH⁻ to C

The C-I bond is

weaker/longer. ✓

(ii) Reagent:  $AgNO_3(aq)/Ag^+(aq)$  or some reference to a solution/aq or ethanolic  $AgNO_3/Ag^+$  gets 1 mark ✓✓

(AgCl is) white/milky solid/ppt ✓

(AgI is) yellow solid/ppt ✓

Final mark requires a comparison of either the rate or the extent of the precipitation: AgI(s) ppt first/fastest/heaviest/denser (or vice versa for AgCl) ✓

(d) (i)

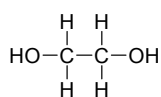
C	H	Br	
12.76/12	2.13/1	85.11/79.9	
1.06	2.13	1.06(5)	✓
1	2	1	✓

(ii) empirical unit (CH<sub>2</sub>Br) has a mass = 93.9 or equivalent working ✓

Molecular formula is ∴ C<sub>2</sub>H<sub>4</sub>Br<sub>2</sub> = 187.8 ✓

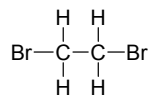
(iii) 1,1-dibromoethane ✓ and 1,2-dibromethane ✓

(e)(i)

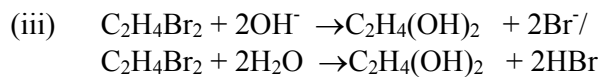


✓

(ii)



✓



✓✓

$\text{C}_2\text{H}_4\text{Br}_2$ ,  $\text{OH}^-$  /  $\text{H}_2\text{O}$  &  $\text{C}_2\text{H}_4(\text{OH})_2$  /  $\text{C}_2\text{H}_6\text{O}_2$  scores 1 mark

(iv) Lowers freezing point of water/ non-corrosive/ has H-bonds/ miscible with water/  
 high boiling point

✓

[Total : 22]

5 (a) (i) catalyst/ speeds up ✓

(ii) *refluxed* =continuous evaporation & condensation or wtte ✓

(iii) CO<sub>2</sub> ✓

(b) (i) CH<sub>3</sub>CO<sub>2</sub>H = 60 ✓

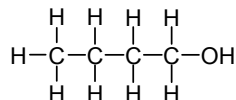
(ii) 0.1 (mol) (6/(i) for ecf) ✓

(iii) 0.1 (mol) ✓

(iv) 7.8/130 = 0.06 {(iv)/(ii) x 100} ✓

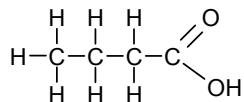
(v) 60% ✓

(c)(i)



✓

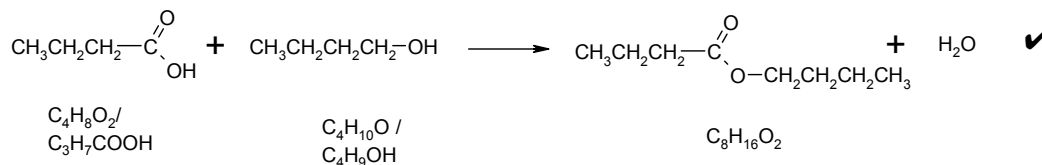
(ii)



✓

or CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CO<sub>2</sub>H /CH<sub>3</sub>(CH<sub>2</sub>)<sub>2</sub>CO<sub>2</sub>H

(iii)



✓

or the equivalent

[Total : 11]

- 6 (a) alcohol/ROH/ OH/hydroxy(l) *not COH/OH* ✓  
 alkene/C=C ✓

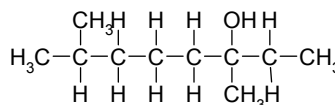
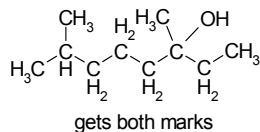
(b) (i) contains **no** double/multiple bonds/single bonds **only** ✓

(ii) Ni/Pt/Pd/Rh ✓

(iii) 1 mark if 1C=C correctly hydrogenated

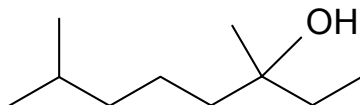
2 marks if both C=C correctly hydrogenated

C<sub>10</sub>H<sub>22</sub>O gets both marks



✓✓

(iv)



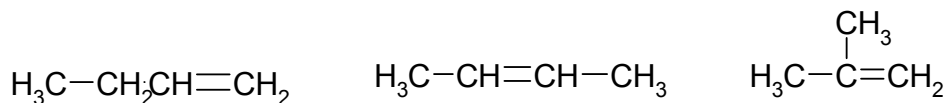
✓

[Total : 7]

7

- (a) Structural isomerism: same **molecular** formula, different structure /displayed formula ✓

1 mark for each structure and name (must have both) ✓✓✓



but-1-ene

but-2-ene

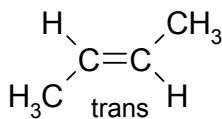
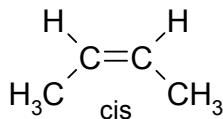
(2-)methylpropene

cyclobutane and methylcyclopropane are valid alternatives.

*If correct structure given but names not included, penalise once only, hence maximum of 2*

**Max of 4 marks for structural isomerism**

*Cis-trans* isomerism: correctly draws and identifies cis/trans isomers of but-2-ene ✓✓



*If but-1-ene shown as part of cis-trans deduce 1 mark*

key features: C=C double bond ✓

which results in restricted rotation ✓

*but* each C in the C=C bond must be bonded to two different atoms/groups ✓

**Max of 5 marks for *cis-trans* isomerism**

**Two** marks available for QWC.

1 mark for structured logical response to the question. ✓

1 mark for correct use of words/terms such as:

restricted rotation

each C in the C=C bond must be bonded to two different atoms/groups

molecular formula

arrangement in space

geometric

Any two gets  
the QWC ✓

(b) Reagents/conditions: water + temperature > 100 °C /steam/H<sub>2</sub>O(g) ✓

phosphoric acid ✓

equation: CH<sub>3</sub>CH=CH<sub>2</sub> + H<sub>2</sub>O → C<sub>3</sub>H<sub>7</sub>OH ✓

possible alcohols: propan-1-ol and propan-2-ol ✓✓