

**Subject: Chains and Rings**

**Code: 2812**

**Session: June**

**Year: 2002**

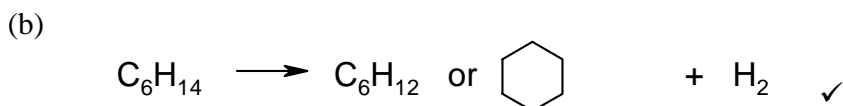
**WORKING Mark Scheme**

<b>MAXIMUM MARK</b>
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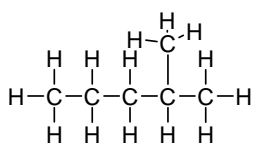
<b>60</b>
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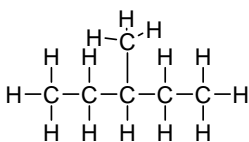
(ii) propane ✓



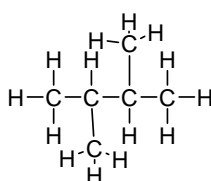
(c)



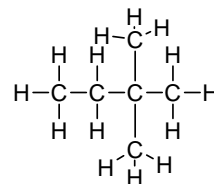
2-methyl pentane



3-methylpentane



2,3-dimethylbutane



2,2-dimethylbutane

Any two correct formulae and names ✓✓✓✓

(d) More efficient/useful or better fuels/burn smoother/added to petrol/  
increase octane rating or number ✓

(e) (i) biofuels are fuels produced from plant/animal waste ✓

(ii) Fossil fuels are non-renewable because they take millions of years to form  
Must specify time  $>10^6$  years ✓

Ethanol is renewable because its feedstock (e.g. sugar, glucose, fruit, carbohydrate) can be  
continuously re-grown/replaced ✓

[Total : 11]

- 2 (a)(i) reaction I  $\text{CH}_3\text{CH}_2\text{OH}/\text{C}_2\text{H}_5\text{OH}$  – not  $\text{C}_2\text{H}_6\text{O}$  ✓
- reaction II  $\text{CH}_2\text{CH}_2/\text{C}_2\text{H}_4$  ✓

- (ii) reaction I nucleophilic ✓ substitution ✓
- reaction II elimination/dehydrohalgenation ✓

- (b) Reagent:  $\text{NH}_3$  ✓
- Conditions: ethanol/alc/heat in sealed tube/high T & P ✓

(c) (i)

<b>Alkene</b>	$\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$ ✓	$\text{CH}_3\text{CH}=\text{CHCH}_3$ ✓
<b>Name</b>	But-1-ene ✓	But-2-ene ✓

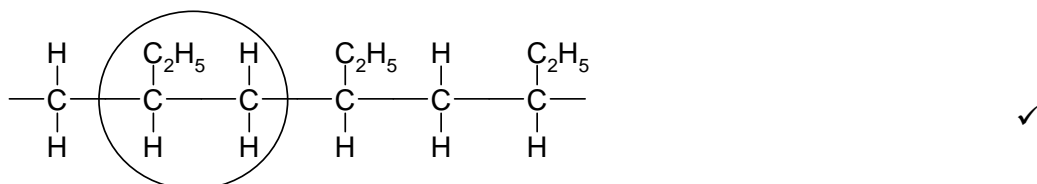
- (ii) 1 mark for identifying but-2-ene as having *cis-trans* isomers ✓

1 mark for labelling **both** correctly ✓

- (iii) (C=C) double bond ✓

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

(d) (i)



- (ii) addition ✓

- (iii)  $\text{C}_2\text{H}_5\text{CH}=\text{CH}_2$  / but-1-ene – not butene, by relating back to their answer for (c) (i) ✓

[Total : 18]

5

3

- (a) name/formula of propan-1-ol ✓ name/formula of propan-2-ol ✓  
also accept the ether, C<sub>2</sub>H<sub>5</sub>OCH<sub>3</sub>
- (b) (i) 0.15 ✓
- (ii) 0.3 mol of the alcohol, C<sub>3</sub>H<sub>8</sub>O, reacts with 0.1 mol Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
**hence** Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> is in excess (this mark is only available if first point is made) ✓
- (iii) orange ✓ to green/blue-green/ dark green ✓
- (c) (i) 5.22/58 (mark is for M<sub>r</sub> = 58) ✓  
0.09 ✓
- (ii) 30% e.c.f. c(i) / 0.3 \* 100 ✓
- (d) (i) carbonyl/C=O/a list that includes at least **two** of aldehyde, ketone, carboxylic acid and/or ester ✓
- (ii) OH hydrogen bonded in a carboxylic acid ✓
- (iv) propan-1-ol/CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH (no marks)  
because there is evidence of oxidation to a carboxylic acid ✓

[Total : 12]

6

4.

(a)(i) Empirical formula: 3.2(25) : 9.7 : 3.2(25) ✓

CH<sub>3</sub>O ✓

(ii) Molecular formula C<sub>2</sub>H<sub>6</sub>O<sub>2</sub> ✓

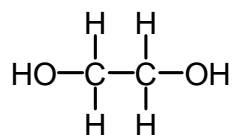
Alternative method:

%	C	:	H	:	O
	38.7 x 62/100		9.7 x 62/100		51.6 x 62/100
	24		6		32
÷ Ar	2		6		2

∴ (molecular) formula = C<sub>2</sub>H<sub>6</sub>O<sub>2</sub> gets all two marks, but must also state that the empirical formula is CH<sub>3</sub>O to get the third mark.

(b) Shows hydrogen bonds in alcohol ✓

(c) ethane-1,2-diol



✓

(d) hydrogen bonds ✓

[6]

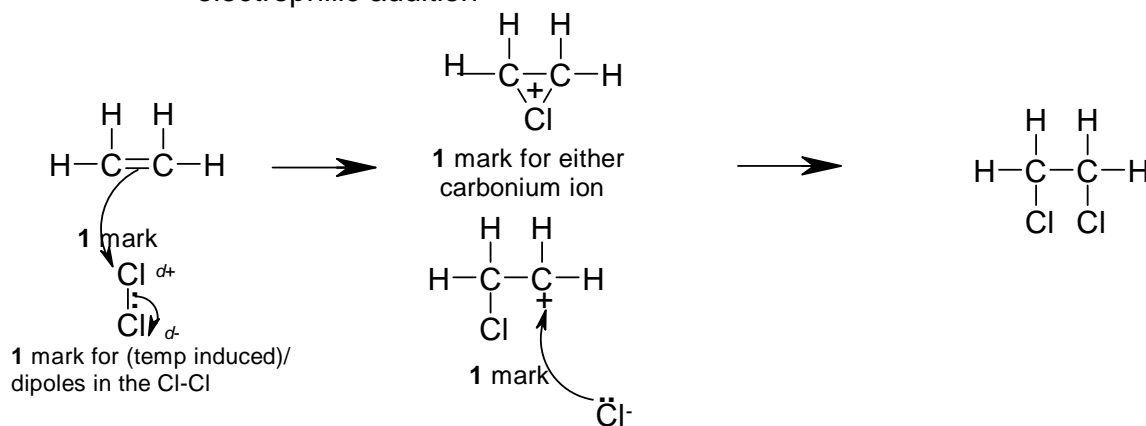
7

5. **chlorine and methane** 6 available marks

free radical substitution		✓
Initiation	$\text{Cl}_2 \rightarrow 2\text{Cl}\bullet$	✓
Propagation 1	$\text{CH}_4 + \text{Cl}\bullet \rightarrow \text{HCl} + \text{CH}_3\bullet$	✓
Propagation 2	$\text{CH}_3\bullet + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\bullet$	✓
Termination	Any two free radicals	✓
Homolytic fission		✓

**chlorine and ethene** 6 available marks

electrophilic addition ✓



marking points for the mechanism:

- curly arrow from the C=C bond to the Cl<sub>2</sub>
  - correct dipoles on the Cl-Cl bond or curly arrow showing movement of bonded pair of electrons
  - intermediate carbonium ion/carbocation
  - curly arrow from Cl<sup>-</sup> to the intermediate
- ✓✓✓✓

Heterolytic Fission ✓

1 mark is available in this question for the quality of the written communication. SPAG plus correct use of at least four of the following terms: *free radical, substitution, initiation, propagation, termination, homolytic fission or equivalent term, electrophilic, addition, heterolytic fission or equivalent term, carbonium ion, carbocation, photochemical, photodissociation.*

Show the QWC mark at the end by either ✓QWC or ✕QWC [13]