

AS: 2812

January 2001

**Chains and Rings
Mark Scheme**

2

1. (a) (i) OH/hydroxy/hydroxyl/ROH ✓
(ii) $C_nH_{2n+1}OH$ ✓
(iii) $C_7H_{15}OH$ / $C_7H_{16}O$ ✓
- (b) 88. ✓
- (c)(i) 1 mark for plotting the points ✓
1 mark for the line extended to enable b.pt of $C_8H_{17}OH$ to be estimated. ✓
- (ii) I butan-1-ol 115 -125 °C ✓
II $C_8H_{17}OH$ 190 -205 °C ✓
- (ii) Boiling point increases as the M_r increases/ proportional to M_r . ✓

[Total : 9]

3

2 (a) contains carbon and hydrogen **only** ✓

separates due to differences in boiling point ✓

(b) works out/uses $M_r = 156$ ✓

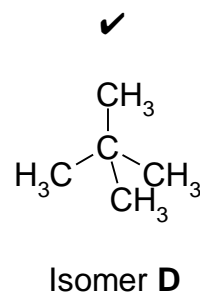
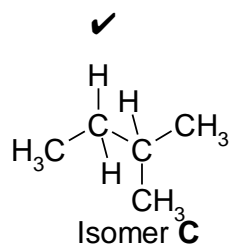
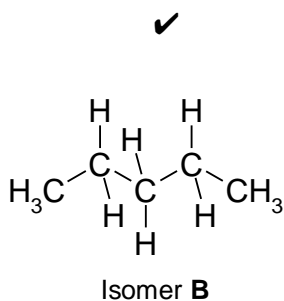
(ii) 132/156 method mark ✓

84.6% C ✓

(c) $C_{11}H_{24} \rightarrow C_9H_{20} \checkmark + C_2H_4 \checkmark$

Ethene ✓

(d) (i) Draw the isomers of pentane.



(ii) **D, C, B** to match as drawn in (d)(i) ✓

(iii) less van der Waals' forces in **D**/ as chain length increases so does b pt./greater the branching~lower the boiling point ✓

(iv) $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ ✓✓

($CO_2 + H_2O$ gets ✓)

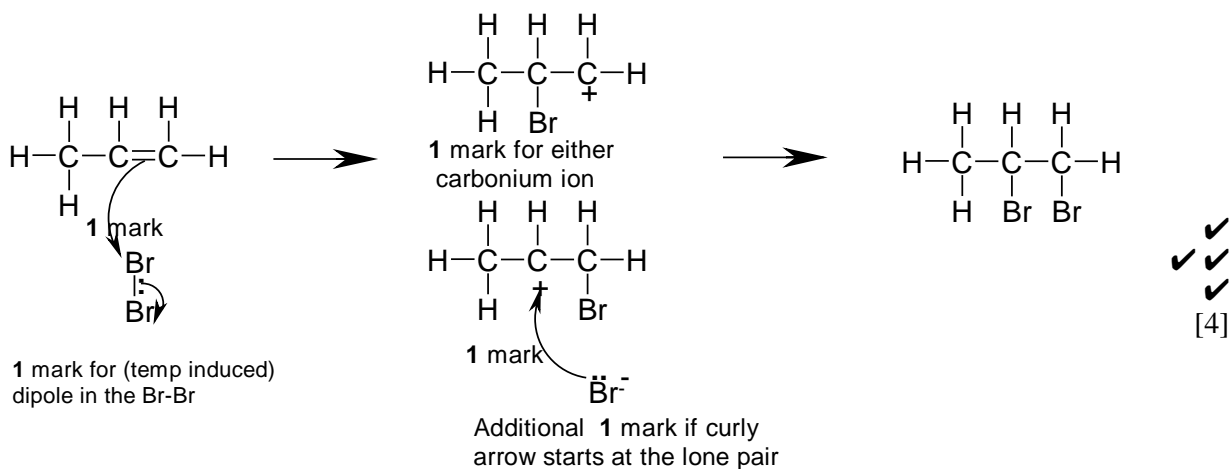
(v) branched chains burn more efficiently/ add it to petrol ✓

[Total : 16]

- 4
- 3 (a) Initiation $\text{Cl}_2 \rightarrow 2\text{Cl}\bullet$ ✓
- Propagation 1 $\text{C}_3\text{H}_8 + \text{Cl}\bullet \rightarrow \text{HCl} + \text{C}_3\text{H}_7\bullet$ ✓
- Propagation 2 $\text{C}_3\text{H}_7\bullet + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{Cl}\bullet$ ✓
- Termination Any two free radicals ✓
- [4]
- (b) (i) Compound **H** = 1,2-dichloropropane ✓
- (ii) 1 mark for each correct structure ✓✓
- $$\begin{array}{c} \text{H} & \text{H} & \text{Cl} \\ | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{Cl} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} \quad \text{or} \quad \begin{array}{c} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{Cl}-\text{C}-\text{C}-\text{C}-\text{Cl} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} \quad \text{or} \quad \begin{array}{c} \text{H} & \text{Cl} & \text{H} \\ | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ | & | & | \\ \text{H} & \text{Cl} & \text{H} \end{array}$$
- (c) (i) water ✓
- (ii) OH^- behaves as a nucleophile ✓
- OH^- has a lone pair of electrons/ seeks out electron deficient areas/attracted to $\text{C}^{\delta+}$ ✓
- (d) (i) reflux is the **continuous** process of **evaporation** followed by **condensation**/ description of what would be seen to indicate that the process is continuous ✓
- (ii) orange ✓
- to green ✓
- (iii) $\text{C}_3\text{H}_7\text{OH}/\text{C}_3\text{H}_8\text{O} + 2[\text{O}] \rightarrow \text{C}_2\text{H}_5\text{COOH}/\text{C}_3\text{H}_6\text{O}_2 + \text{H}_2\text{O}$ ✓✓
- (All three formulae correct gets one mark)
- (e) wavenumber $1680 - 1750 \text{ cm}^{-1}$ ✓
- bond $\text{C}=\text{O}$ ✓
- wavenumber $2500 - 3300 \text{ cm}^{-1}$ ✓
- bond $\text{O}-\text{H}$ ✓

[Total : 19]

4 (a)



5 marking points for **max** of 4 marks

- (b) (i)
- (ii) reagent = H_2 ✓
- conditions = Ni/Pt as catalyst ✓
- (iii) ✓✓
- $$\begin{array}{c} H & H & H \\ | & | & | \\ H-C & -C & -C-H \\ | & | & | \\ H & H & OH \end{array}$$

and

$$\begin{array}{c} H & H & H \\ | & | & | \\ H-C & -C & -C-H \\ | & | & | \\ H & OH & H \end{array}$$
- (c) (i) Addition polymer ✓
- (ii)
- $$\left(\begin{array}{cccc} H & CH_3 & H & CH_3 \\ | & | & | & | \\ -C & -C & -C & -C- \\ | & | & | & | \\ H & H & H & H \end{array} \right)$$
- ✓
- (iii) non-biodegradable or words to that effect ✓
- when burnt they release toxic fumes ✓

[Total : 13]

5 (a) (i) $C_4H_9OH/C_4H_{10}O$

✓



(b) The upper layer because the organic compounds have a **lower density** than water. ✓

(c) (i) CO_2 ✓

(ii) HCl ✓

(d) (i) $51\text{ }^\circ\text{C}$ ✓

(ii) $4/74 = 0.05(4)$ ✓

(iii) $3.75/92.5 = 0.04(1)$ ✓

(iv) 75% (allow 80% if (d) (ii) given as 0.05 / mark ecf for (d)(ii)/(d)(i) *100) ✓

[Total : 9]

6 (a) functional group 1 alkene ✓

test add bromine ✓

observation decolourised ✓

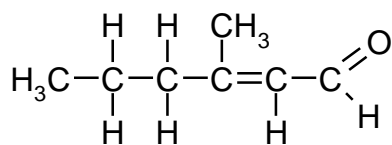
functional group 2 alcohol ✓

test Na/ $\text{PCl}_5/$ RCO_2H ✓

observation bubbles/ H_2 white fumes/ HCl smell ✓

[6]

(b)



Compound F

✓

[1]

[Total : 7]

7

7	Fermentation		✓
	Yeast/enzyme		✓
	Temperature about 30 °C		✓
	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$		✓
	Batch process		✓
	Hydration of ethene.		✓
	Reagent	steam/water at > 100 °C	✓
	Temp/press	300 °C & 70 –100 atm	✓
	Catalyst	phosphoric acid	✓
	$C_2H_4 + H_2O \rightarrow C_2H_5OH$		✓
	Continuous process		✓
	1 mark available for <i>Quality of written communication</i> base the award of the mark on the ability to communicate the essential chemistry		✓

[Total : 12 max = 9]

8	Ethane	saturated/single bonds only/ σ -bond	✓
		tetrahedron	✓
		109° 28'	✓
Ethene	unsaturated/double bonds/contains a π -bond	✓	
	draws or explains overlap of adjacent p-orbitals at right angle to the plane of the molecule	✓	
	trigonal planar	✓	
	approx 120°	✓	

1 mark available for *Quality of written communication* base the award of the mark on the ability to use essential technical language such as *saturated/unstaurated/tetrahedron, trigonal planar/ overlap of adjacent p-orbitals*

[Total : 8]