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- (c) **Stage 1:** consider the groups joined to right hand carbon of the C=C bond

Extended response

Maximum of 5 marks for answers which do not show a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

Consider the atomic number of the atoms attached

M1 can be scored in stage 1 or stage 2

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C has a higher atomic number than H, so CH₂OH takes priority

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Stage 2: consider the groups joined to LH carbon of the C=C bond

Both groups contain C atoms, so consider atoms one bond further away

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C, (H and H) from ethyl group has higher atomic number than H, (H and H) from methyl group, so ethyl takes priority

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Stage 3: conclusion

The highest priority groups, ethyl and CH₂OH are on same side of the C=C bond so the isomer is Z

Allow M5 for correct ECF conclusion using either or both wrong priorities deduced in stages 1 and 2

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The rest of the IUPAC name is 3-methylpent-2-en-1-ol

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- (d) Moles of maleic acid = $10.0 / 116.0 = 8.62 \times 10^{-2}$

AND mass of organic product expected = $(8.62 \times 10^{-2}) \times 98.0 = 8.45$ g

Or moles of organic product formed = $6.53 / 98.0 = 6.66 \times 10^{-2}$

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% yield = $100 \times 6.53 / 8.45$

OR = $100 \times (6.66 \times 10^{-2}) / (8.62 \times 10^{-2})$

= $77.294 = 77.3\%$

AND statement that the student was NOT correct

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[10]

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- (a) Percentage of oxygen by mass = $100 - 40.9 - 4.5 = 54.6$

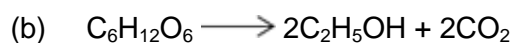
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	C	H	O
%			
Divide by A_r	$\frac{40.9}{12}$	$\frac{4.5}{1}$	$\frac{54.6}{16}$
	= 3.41	= 4.5	= 3.41
Divide by smallest =	$\frac{3.41}{3.41} = 1$	$\frac{4.5}{3.41} = 1.32$	$\frac{3.41}{3.41} = 1$
Nearest whole number ratio =	1×3	1.32×3	1×3
	= 3 : 3.96 : 3		
Nearest integer ratio =	3	4	3

Empirical formula $C_3H_4O_3$

Empirical formula mass = 88 = molecular formula mass

Therefore, molecular formula is same as the empirical formula - $C_3H_4O_3$



(c) Advantage – ethanol is produced at a faster rate

Disadvantage – more energy is used / required in the reaction

(d) Air gets in / oxidation occurs

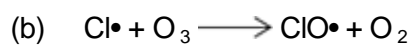
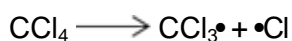
(e) Alcohol OH absorption in different place ($3230\text{--}3550\text{ cm}^{-1}$) from acid OH absorption ($2500\text{--}3000\text{ cm}^{-1}$)

The C=O in acids has an absorption at $1680\text{--}1750\text{ cm}^{-1}$

[10]

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(a) UV light



(c) M_r of $\text{CF}_3\text{Cl} = 104.5$

$$\text{Moles freon} = 1.78 \times 10^{-4} \times 10^3 / 104.5 = 1.70 \times 10^{-3}$$

$$\text{Number of molecules} = 1.70 \times 10^{-3} \times 6.02 \times 10^{23} = 1.02 \times 10^{21}$$

$$\begin{aligned} \text{Molecules in } 500 \text{ cm}^3 &= (1.02 \times 10^{21} \times 500 \times 10^{-6}) / 100 \\ &= 5.10 \times 10^{15} \end{aligned}$$

Allow answer in the range 5.10 – 5.13×10^{15}

Answer must be given to this precision

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[7]

8

B

[1]

9

D

[1]

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(a) 2,2,4-trimethylpentane

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(b) 5

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(c) $\text{C}_{20}\text{H}_{42} \longrightarrow \text{C}_8\text{H}_{18} + 2\text{C}_3\text{H}_6 + 3\text{C}_2\text{H}_4$

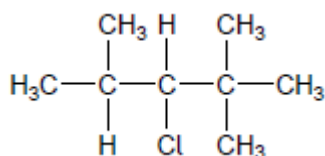
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(d) Mainly alkenes formed

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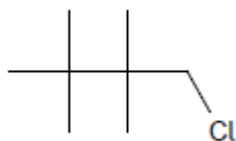
(e) 4 (monochloro isomers)

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(f)



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(g) $\text{C}_8\text{H}_{17}^{35}\text{Cl} = 96.0 + 17.0 + 35.0 = 148.0$
and $\text{C}_8\text{H}_{17}^{37}\text{Cl} = 96.0 + 17.0 + 37.0 = 150.0$

Both required

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$$M_r \text{ of this } C_8H_{17}Cl = \frac{(1.5 \times 148.0)}{2.5} + \frac{(1.0 \times 150.0)}{2.5} = 148.8$$

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(h) $\frac{24.6}{12} \quad \frac{2.56}{1} \quad \frac{72.8}{35.5} = 2.05 : 2.56 : 2.05$

$$\text{Simplest ratio} = \frac{2.05}{2.05} : \frac{2.56}{2.05} : \frac{2.05}{2.05}$$

$$= 1 : 1.25 : 1$$

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$$\text{Whole number ratio } (\times 4) = 4 : 5 : 4$$

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