

1 This question is about alcohols.

- (a) Construct an equation for the complete combustion of an unsaturated alcohol with 5 carbon atoms.

..... [1]

- (b) Many alcohols, including ethanol, are soluble in water.

- (i) Explain, with the aid of a diagram, why ethanol is soluble in water.

Include relevant dipoles and lone pairs.

.....
.....
..... [2]

- (ii) The solubility of hexan-1-ol and hexane-1,6-diol in water is shown below in **Table 19.1**.

Alcohol	Solubility in water / g dm ⁻³
hexan-1-ol	5.9
hexane-1,6-diol	500

Table 19.1

Explain the difference in solubility of hexan-1-ol and hexane-1,6-diol.

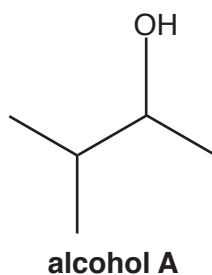
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..... [1]

- [5]

[5]

2 This question is about reactions of organic compounds containing carbon, hydrogen and oxygen.

(a) A chemist investigates two reactions of alcohol **A**, shown below.



(i) What is the systematic name of alcohol **A**?

..... [1]

(ii) What is the structural formula of alcohol **A**?

..... [1]

(iii) The chemist heats alcohol **A** with an acid catalyst to form a mixture containing **two** alkenes.

Draw the structures of the **two** alkenes formed in this reaction.

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[2]

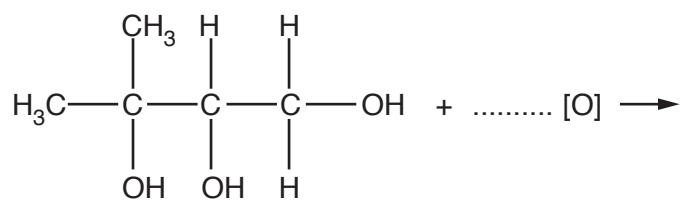
(iv) The chemist heats alcohol **A** with sodium chloride and sulfuric acid.

Construct a balanced equation for this reaction.

Show structures for the organic compounds in your equation.

- (b) Compound **B**, shown below, is refluxed with excess acidified potassium dichromate(VI) to form a single organic product.

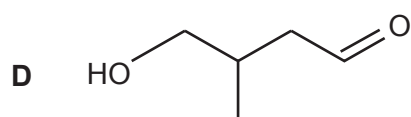
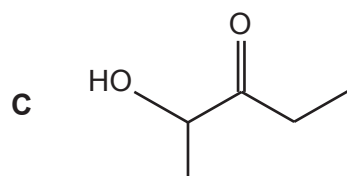
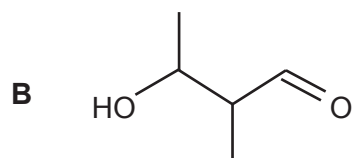
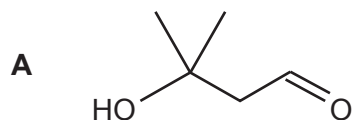
Complete the equation for this reaction.



compound B

[2]

- 3 Which compound can be refluxed with acidified potassium dichromate(VI) to form an organic product with molecular formula $C_5H_8O_2$?



Your answer

[1]

4 Which alcohol reacts with an acid catalyst to form a mixture of stereoisomers?

A 3-methylbutan-2-ol

B pentan-1-ol

C 2-methylhexan-2-ol

D heptan-4-ol

Your answer

[1]

- 5 Alcohols can be used to prepare organic compounds with different functional groups.

$\text{HO}(\text{CH}_2)_4\text{OH}$ can be oxidised to form $\text{HOOC}(\text{CH}_2)_2\text{COOH}$.

- (a) State the reagents and conditions and write an equation for this oxidation.

In the equation, use [O] for the oxidising agent.

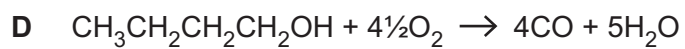
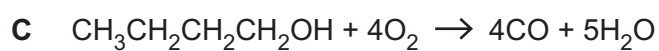
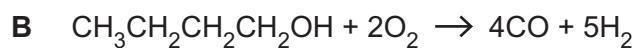
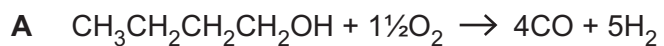
Reagents and conditions:

.....

Equation:

[3]

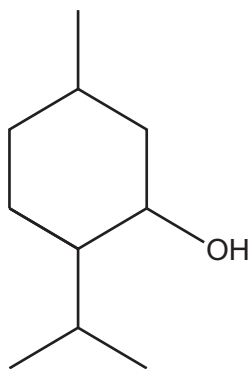
6 What is the correct equation for the incomplete combustion of butan-1-ol?



Your answer

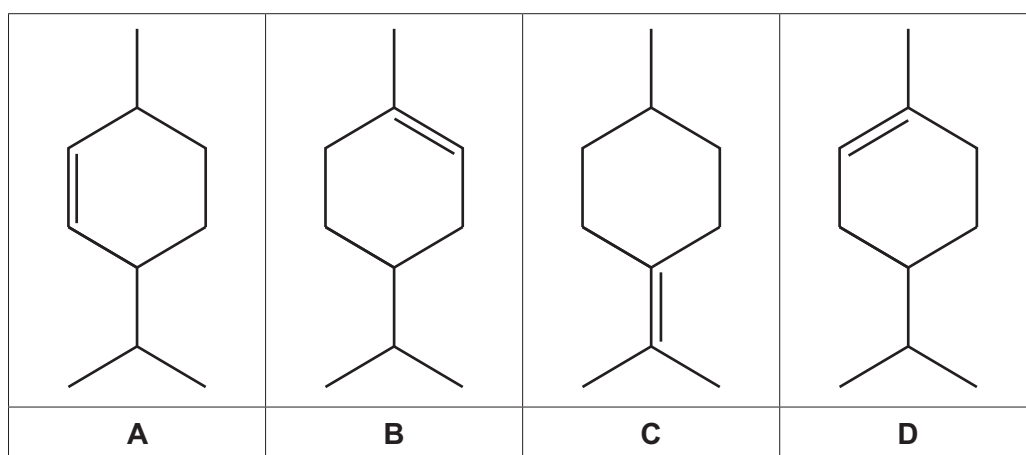
[1]

- 7 Menthol, shown below, is heated with an acid catalyst.



menthol

Which structure could be formed?



Your answer

[1]

- 8(a) Compound **J**, $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH}$, is reacted with acidified potassium dichromate(VI) under reflux to form organic product **M**.

Write an equation for this reaction.

Use [O] to represent the oxidising agent and show the structure of **M**.

[2]

9 This question is about alcohols.

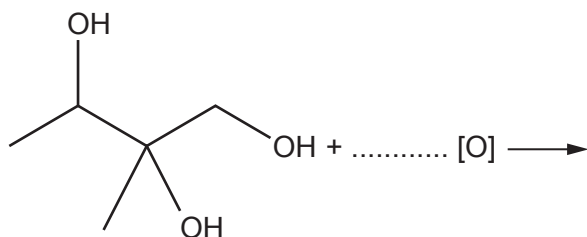
- (a) An **unsaturated** alcohol has 6 carbon atoms and contains **one** C=C bond.

Construct an equation for the complete combustion of this alcohol.

..... [2]

- (b) Compound **C**, shown below, is refluxed with excess acidified potassium dichromate(VI) to form a single organic product and one other product.

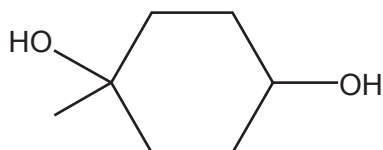
Complete the equation for this reaction.



Compound C

[3]

- (c) Compound **D**, shown below, is refluxed with H_2SO_4 , as an acid catalyst, to form a mixture of three isomers with the molecular formula C_7H_{10} .



Compound D

- (i) Draw the structures of the **three** isomers of C_7H_{10} formed from compound **D**.

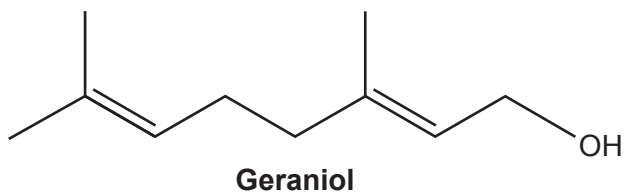
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[3]

- (ii) A student converts compound **D** into a diiodoalkane.

Suggest suitable reagents for this reaction.

- 10 Geraniol, shown below, is a component in many natural oils.



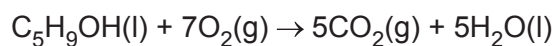
Which pair of reagents identifies both functional groups in geraniol?

- A** Acidified dichromate(VI) and 2,4-dinitrophenylhydrazine.
- B** Bromine water and 2,4-dinitrophenylhydrazine.
- C** Bromine water and acidified dichromate(VI).
- D** Tollens' reagent and aqueous silver nitrate in ethanol.

Your answer

[1]

- 11 4.30 g of the alcohol $\text{C}_5\text{H}_9\text{OH}$, ($M_r = 86.0$), is burned in oxygen.



Which volume of oxygen gas is needed, in dm^3 , for this complete combustion of $\text{C}_5\text{H}_9\text{OH}$, at RTP?

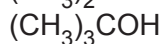
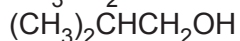
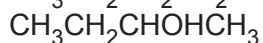
- A** 1.2
- B** 2.4
- C** 5.8
- D** 8.4

Your answer

[1]

12 This question is about reactions of alcohols.

There are 4 structural isomers of $C_4H_{10}O$ that are alcohols:



Alcohols take part in many different types of reaction, including

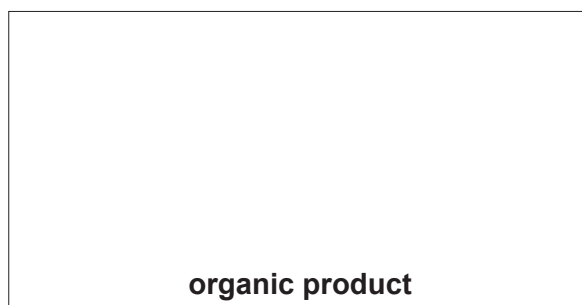
- elimination
- oxidation
-
-

For each type of reaction, choose appropriate reagent(s) and/or catalyst, and show the organic product formed.

(a) Elimination reaction of $CH_3CH_2CH_2CH_2OH$

Reagent(s) and/or catalyst

.....
.....



[2]

(b) Oxidation reaction of $CH_3CH_2CHOHCH_3$

Reagent(s) and/or catalyst

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[2]

(c) Substitution reaction of $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$

Reagent(s) and/or catalyst

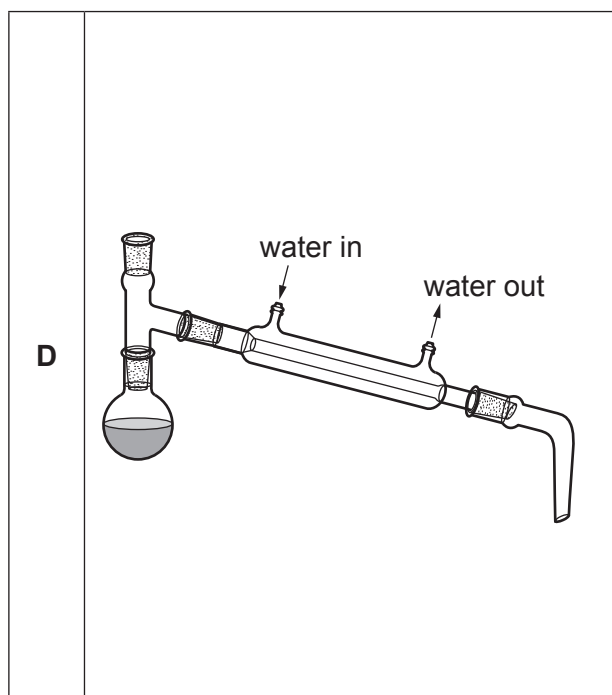
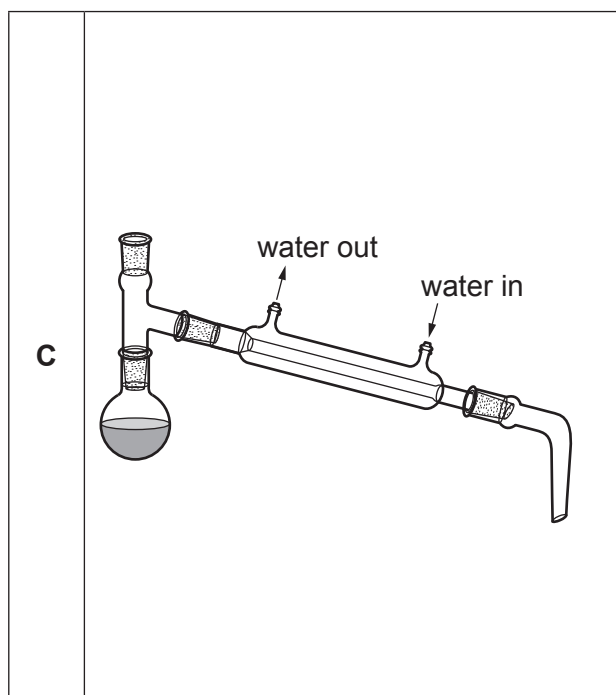
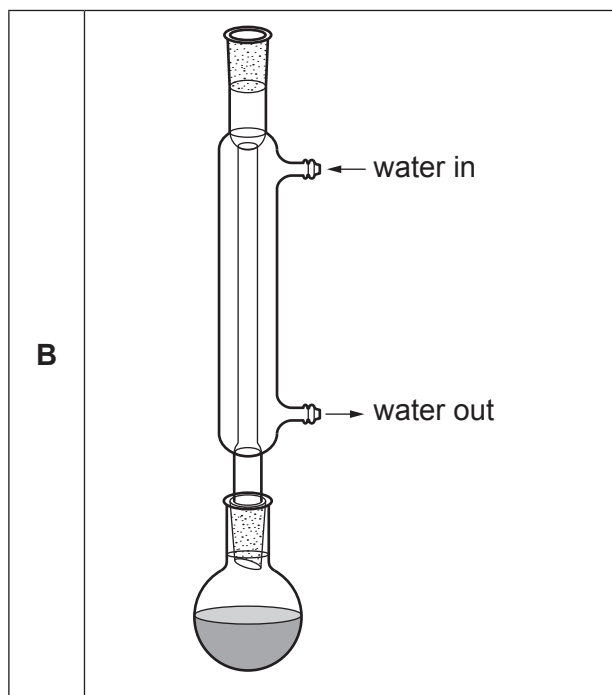
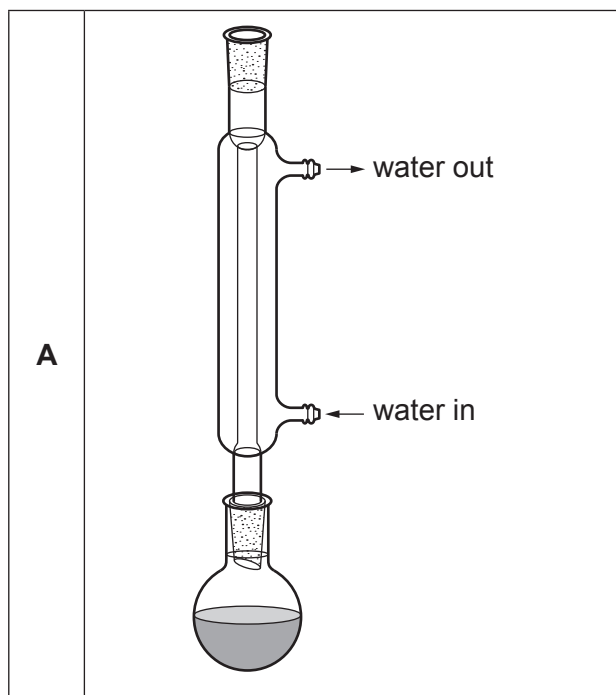
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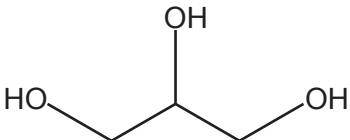
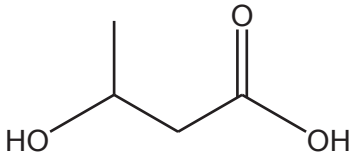
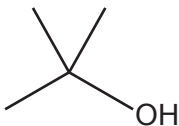
- 13 Which diagram shows the correct way to set up apparatus for converting ethanol to ethanoic acid?



Your answer

[1]

14 Which molecule(s) would form a ketone group when oxidised?

1	
2	
3	

- A** 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer

☐

[1]

15(a) The table below shows the boiling points of propan-1-ol and 1-bromopropane.

	Propan-1-ol	1-Bromopropane
Boiling point/°C	97	71

Propan-1-ol can be reacted to form 1-bromopropane.

(i) Suggest suitable reagents for this reaction.

..... [1]

(ii) The reaction to form 1-bromopropane from propan-1-ol is carried out in a flask.

After the reaction, the flask contains a mixture of an organic layer (density = 1.35 g cm^{-3}) and an aqueous layer (1.04 g cm^{-3}).

Describe how to obtain pure **1-bromopropane** from the mixture.

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..... [4]