

**Q1.** Samples of 1-chloropropane and ethanoyl chloride can be distinguished by the addition of an aqueous solution of silver nitrate.  
State what you would observe with each sample.

Observation with 1-chloropropane

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Observation with ethanoyl chloride.

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**(Total 2 marks)**

**Q2.** The table shows the structures and names of three compounds with  $M_r = 72.0$

Compound	Formula	Name
<b>1</b>	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$	butanal
<b>2</b>	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	pentane
<b>3</b>	$\text{CH}_3\text{CH}_2\text{COCH}_3$	butanone

(a) Explain why  $M_r$  values, measured to five decimal places, cannot distinguish between compounds **1** and **3** but can distinguish between compounds **1** and **2**.

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**(2)**

(b) A simple chemical test, using either Fehling's solution or Tollens' reagent, can be used to distinguish between compound **1** and compound **3**.

Choose one of these two reagents and state what you would observe with each of compound 1 and compound 3.

Chosen reagent .....

Observation with compound 1.....

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Observation with compound 3.....

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(2)  
(Total 4 marks)

**Q3.**A sample of an alcohol was thought to be contaminated with an alkene. Give a reagent that could be used to confirm the presence of an alkene. State what you would observe.

Reagent .....

Observation .....

(Total 2 marks)

**Q4.**The following pairs of compounds can be distinguished by simple test-tube reactions.

For each pair, give a suitable reagent that could be added separately to each compound to distinguish between them.

Describe what you would observe in each case.

(a) AgBr(s) and AgI(s)

Reagent .....

Observation with AgBr(s).....

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Observation with AgI(s) .....

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(3)

(b) HCl(aq) and HNO<sub>3</sub>(aq)

Reagent .....

Observation with HCl(aq) .....  
.....  
Observation with HNO<sub>3</sub>(aq) .....  
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(3)

(c) Cyclohexane and cyclohexene

Reagent .....  
Observation with cyclohexane .....  
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Observation with cyclohexene .....  
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(3)

(d) Butanal and butanone

Reagent .....  
Observation with butanal .....  
.....  
Observation with butanone .....  
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(3)

(Total 12 marks)

**Q5.(a)** A chemist discovered four unlabelled bottles of liquid, each of which contained a different pure organic compound. The compounds were known to be propan-1-ol, propanal, propanoic acid and 1-chloropropane.

Describe four **different** test-tube reactions, one for each compound, that could be used to identify the four organic compounds.  
Your answer should include the name of the organic compound, the reagent(s) used and the expected observation for each test.

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(8)

(b) A fifth bottle was discovered labelled propan-2-ol. The chemist showed, using infrared spectroscopy, that the propan-2-ol was contaminated with propanone.

The chemist separated the two compounds using column chromatography. The column contained silica gel, a polar stationary phase.

The contaminated propan-2-ol was dissolved in hexane and poured into the column. Pure hexane was added slowly to the top of the column. Samples of the eluent (the solution leaving the bottom of the column) were collected.

- Suggest the chemical process that would cause a sample of propan-2-ol to become contaminated with propanone.
- State how the infrared spectrum showed the presence of propanone.

- Suggest why propanone was present in samples of the eluent collected first (those with shorter retention times), whereas samples containing propan-2-ol were collected later.

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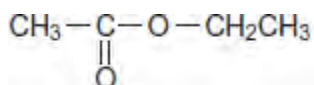
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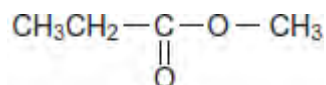
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(4)  
(Total 12 marks)

**Q6.(a)** Ester 1 and Ester 2 were studied by <sup>1</sup>H n.m.r. spectroscopy.

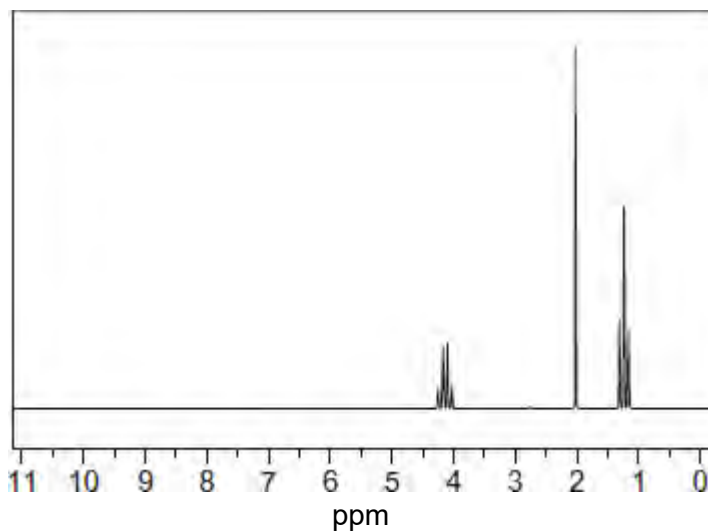


**Ester 1**



**Ester 2**

One of the two esters produced this spectrum.



Deduce which of the two esters produced the spectrum shown. In your answer, explain the position and splitting of the quartet peak at  $\delta = 4.1$  ppm in the spectrum.

Predict the  $\delta$  value of the quartet peak in the spectrum of the other ester.

Use **Table B** on the Data Sheet.

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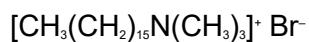
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(4)

(b) Cetrimide is used as an antiseptic.



cetrimide

Name this type of compound.

Give the reagent that must be added to  $\text{CH}_3(\text{CH}_2)_{15}\text{NH}_2$  to make cetrimide and state the reaction conditions.

Name the type of mechanism involved in this reaction.

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(4)

- (c) Give a reagent that could be used in a test-tube reaction to distinguish between benzene and cyclohexene.  
Describe what you would see when the reagent is added to each compound and the test tube is shaken.

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(3)

(Total 11 marks)

**Q7.** Ethanoic acid, propyl ethanoate and propan-1-ol are all colourless liquids. Esters do **not** give a positive result with any of the usual tests for functional groups.

State how you could use chemical tests to show the presence of ethanoic acid and propan-1-ol in a mixture of the acid, the alcohol and the ester.

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**(Total 4 marks)**