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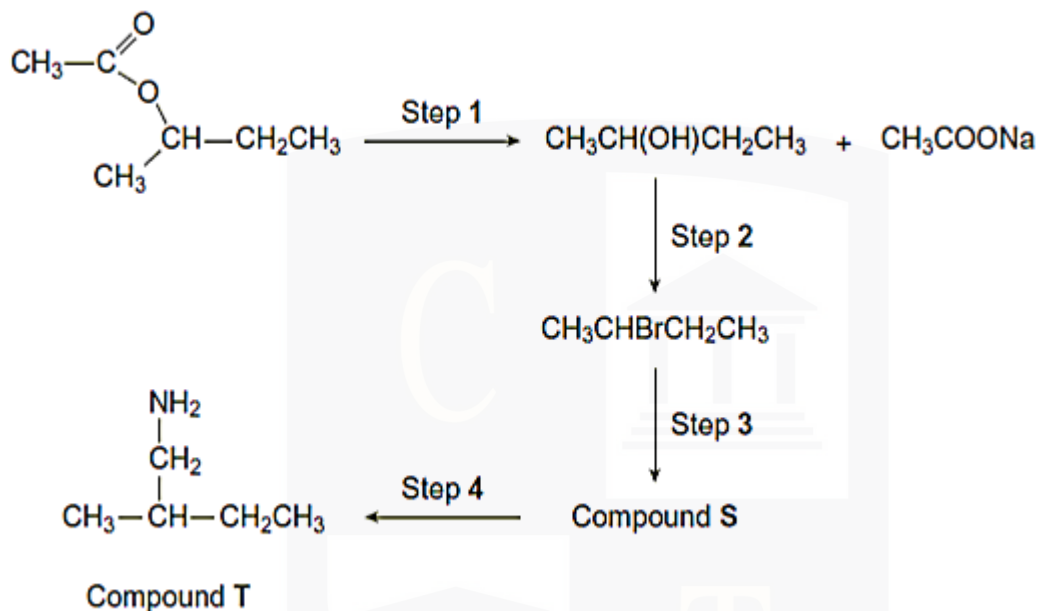
ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	CARBOXYLIC ACIDS
PAPER TYPE:	QUESTION PAPER - 4
TOTAL QUESTIONS	10
TOTAL MARKS	54

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Carboxylic Acids and Derivatives - 4

1. A four-step synthesis of compound T is shown.



(a) Give the reagent and conditions for Step 1.

State how you could obtain a sample of the alcohol from the reaction mixture formed in Step 1.

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(3)

(b) Draw the structure of compound S.

For each of Steps 3 and 4, give a reagent and one condition, other than heat.

(5)

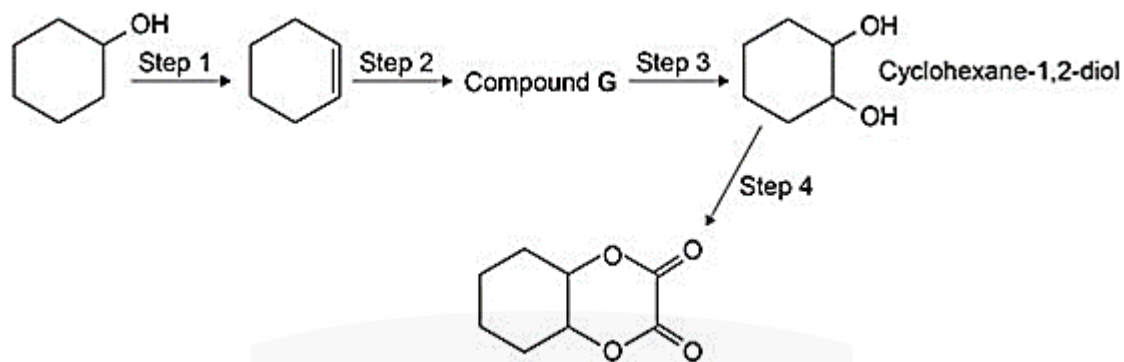
2. Suggest why aqueous ethanol is a suitable solvent when heating the coconut oil with KOH.

Give a safety precaution used when heating the mixture.
Justify your choice.

(3)

3. This question is about making a diester from cyclohexanol.

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(a) State the type of reaction in step 1.

Give the name of the reagent needed for step 1.

(2)

(b) State the reagents needed and give equations for step 2 and step 3. Show the structure of Compound G in your equations.

(4)

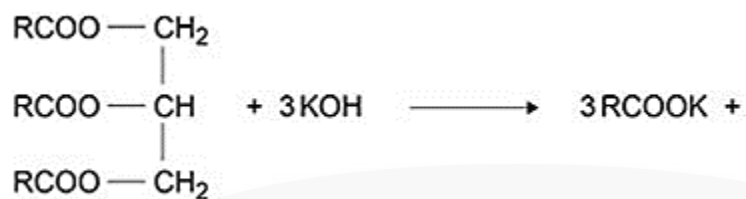
4. Coconut oil contains a triester with three identical R groups.

This triester reacts with potassium hydroxide.

(a) Complete the equation by drawing the structure of the other product of this reaction in the box.

Name the type of compound shown by the formula RCOOK

Give one use for this type of compound.



(3)

(b) The triester in coconut oil has a relative molecular mass, $M_r = 638.0$

In the equation shown at the start of this question, R represents an alkyl group that can be written as $\text{CH}_3(\text{CH}_2)_n$

Deduce the value of n in $\text{CH}_3(\text{CH}_2)_n$

Show your working.

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(3)

(c) A 1.450 g sample of coconut oil is heated with 0.421 g of KOH in aqueous ethanol until all of the triester is hydrolysed.

The mixture is cooled.

The remaining KOH is neutralised by exactly 15.65 cm³ of 0.100 mol dm⁻³ HCl

Calculate the percentage by mass of the triester ($M_r = 638.0$) in the coconut oil.

(6)

5. Butyl ethanoate is used as a solvent in the pharmaceutical industry.

Write an equation for the preparation of butyl ethanoate from an acid anhydride and an alcohol.

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(3)

6. Name and outline a mechanism for the reaction of CH_3COCl with CH_3OH to form an ester.

(5)

7. A student followed the progress of the oxidation of propan-1-ol to propanoic acid by extracting the organic compounds from one sample of reaction mixture.

(a) Give a chemical reagent which would enable the student to confirm the presence of propanal in the extracted compounds.

State what you would observe when propanal reacts with this reagent.

(2)

(b) Give a chemical reagent that would enable the student to confirm the presence of propanoic acid in the extracted compounds.

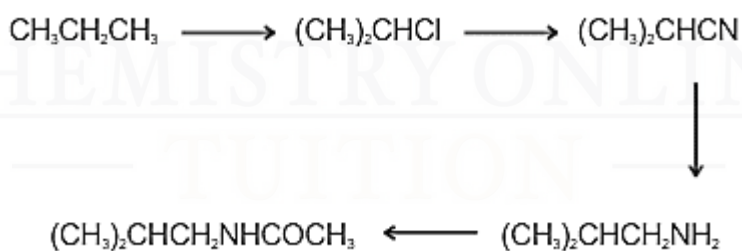
State what you would observe when propanoic acid reacts with this reagent.

(2)

(c) Predict which one of the compounds, propan-1-ol, propanal and propanoic acid will have the highest boiling point. Explain your answer.

(2)

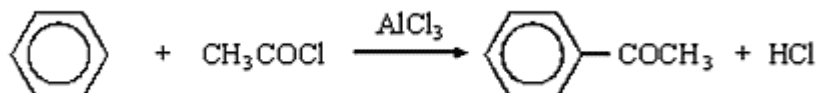
8. Which one of the following types of reaction mechanism is not involved in the above sequence?



- A.** free-radical substitution
B. nucleophilic substitution
C. elimination
D. nucleophilic addition-elimination

(1)

9. An equation for the formation of phenylethanone is shown below.



In this reaction a reactive intermediate is formed from ethanoyl chloride.

This intermediate then reacts with benzene.

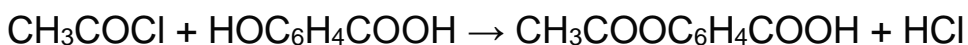
(a) Give the formula of the reactive intermediate.

(2)

(b) Outline a mechanism for the reaction of this intermediate with benzene to form phenylethanone.

(4)

10. Aspirin can be prepared by acylation using either ethanoyl chloride or ethanoic anhydride, as represented by the equations shown below.

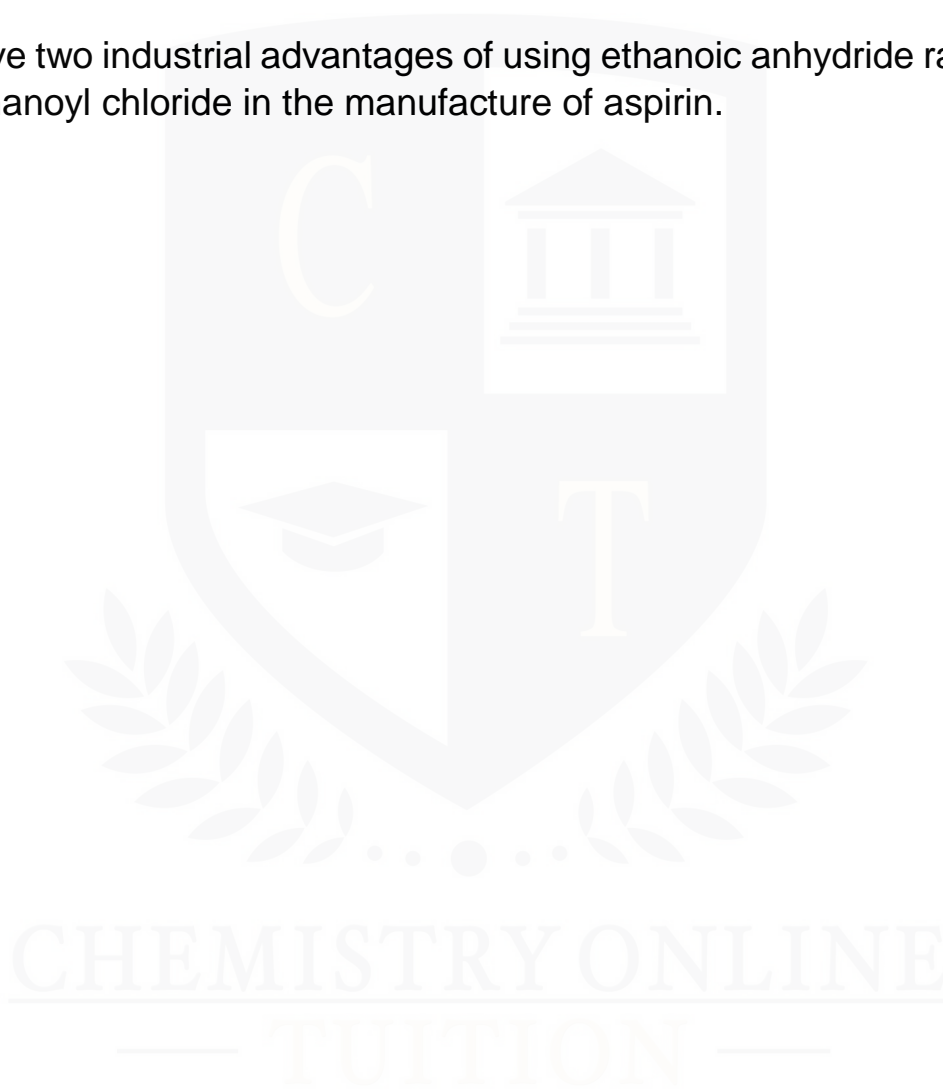


(a) By a consideration of the intermolecular forces involved, explain why the product HCl is a gas but the product CH₃COOH is a liquid at room temperature.

(2)

(b) Give two industrial advantages of using ethanoic anhydride rather than ethanoyl chloride in the manufacture of aspirin.

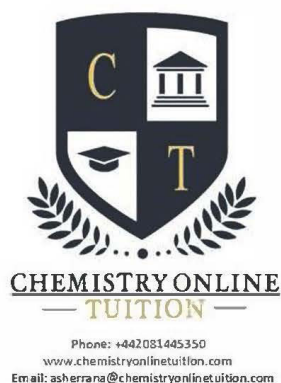
(2)



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