

Chapter 3

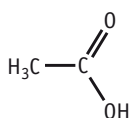
Carboxylic acids and esters

Print out and complete this worksheet to generate a summary for Chapter 3.

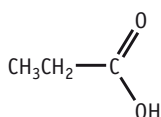
Properties of carboxylic acids

1 Name each of the following carboxylic acids:

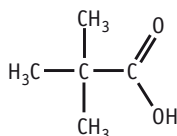
a



b



c



2 A carboxylic acid can be made by oxidising a primary alcohol or an aldehyde. For each of the preparations **a–d**, identify the reagents, the conditions, the apparatus used, the observations that would be made and write a balanced equation.

a Ethanoic acid from a primary alcohol

Reagents:

.....

Conditions:

.....

Apparatus:

.....

Equation:

.....

b Ethanoic acid from an aldehyde

Reagents:

.....

Conditions:

.....

Apparatus:

.....

Equation:

.....

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- c** Benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, from a primary alcohol

Reagents:

.....

Conditions:

.....

Apparatus:

.....

Equation:

.....

- d** Benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, from an aldehyde.

Reagents:

.....

Conditions:

.....

Apparatus:

.....

Equation:

.....

- e** Explain, with the aid of a labelled diagram, why methanoic acid and ethanoic acid are both soluble in water. Describe fully the type of bonding involved.

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- 3** A carboxylic acid can behave as a weak acid and can react to form a salt.

- a** Define an acid.

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- b** Explain what is meant by *weak acid*.

.....

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c Define a salt.

.....

d Write a balanced equation for each of the following reactions:

(i) ethanoic acid + NaOH

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(ii) methanoic acid + NaHCO₃

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(iii) propanoic acid + Mg

.....

(iv) benzoic acid(aq) + CaCO₃(s)

.....

e State the formula of each of the following:

(i) sodium methanoate

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(ii) potassium ethanoate

.....

(iii) calcium ethanoate

.....

(iv) magnesium butanoate

.....

4 A carboxylic acid can react to form an ester.

a State the reagents and conditions for the formation of ethyl ethanoate from ethanoic acid.
Write a balanced equation for the reaction.

Reagents:

.....

Conditions:

.....

Equation:

.....

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b Complete the tables. In each case, a displayed formula and a skeletal formula are required.

(i) methyl ethanoate

Displayed formula	Skeletal formula

(ii) ethyl butanoate

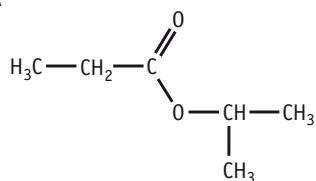
Displayed formula	Skeletal formula

(iii) 2-propyl benzoate

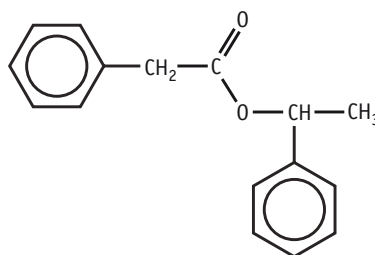
Displayed formula	Skeletal formula

c Identify the carboxylic acid and the alcohol that could be used to make each of the following compounds:

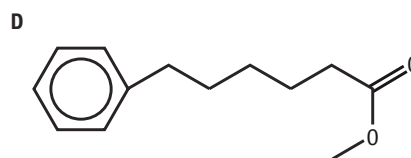
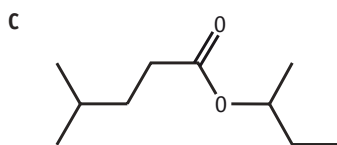
A



B

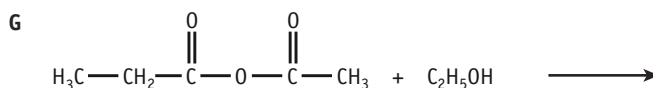
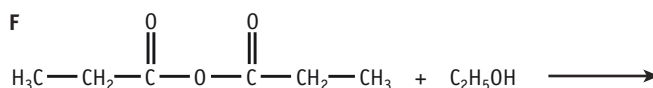
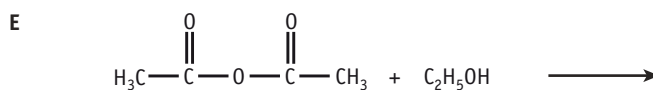


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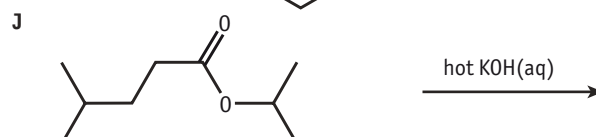
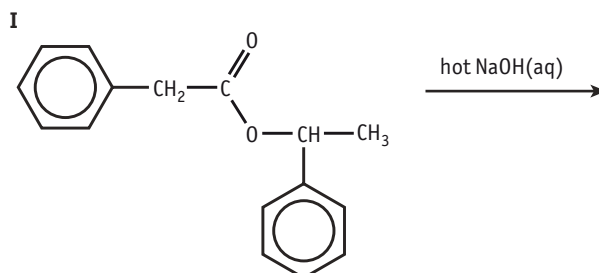
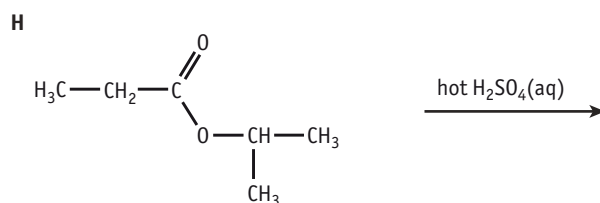
	Carboxylic acid	Alcohol
A		
B		
C		
D		

d An ester can also be prepared by reacting an acid anhydride with an alcohol. Complete the following reactions. Name all the products formed and explain why there is a complication with reaction **G**.



Properties of esters

e An ester can be hydrolysed by either hot aqueous acid or hot aqueous alkali. Write an equation for each of the following hydrolysis reactions:



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f State two uses of esters.

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5 a Explain what is meant by a triglyceride.

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b Explain what is meant by a fatty acid.

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c Give an example of each of the following:

(i) a saturated fatty acid

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(ii) a monounsaturated fatty acid

.....

(iii) a polyunsaturated fatty acid

.....

d Explain the difference between a *cis* and a *trans* fatty acid.

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e Explain how *trans* fatty acids increase the risk of 'bad' cholesterol and heart disease.

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