



Carboxylic acids: knowledge check

1.1 The image shows a molecular model of a carboxylic acid molecule.

Draw a circle around the carboxylic acid functional group and use the words provided to label the parts of the molecule.

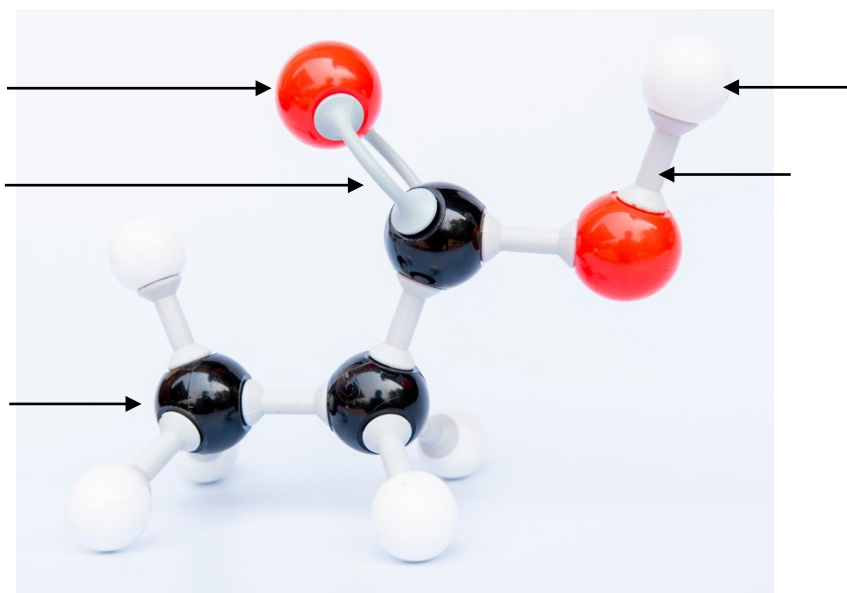
oxygen atom

carbon atom

double covalent bond

single covalent bond

hydrogen atom





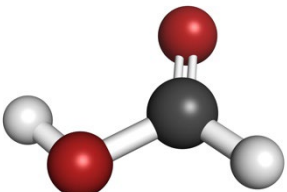
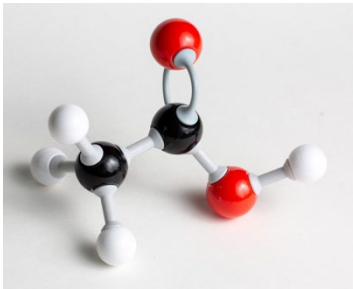
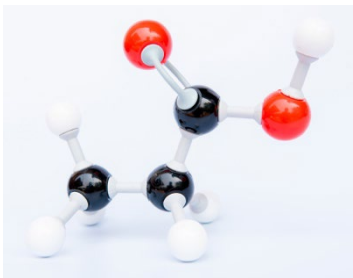
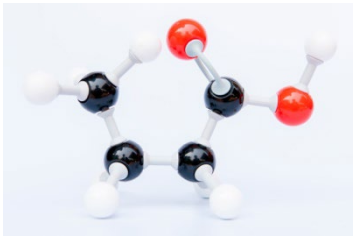
1.2 The table includes images of molecular models of the first four carboxylic acids. Use the names and molecular formulas provided to complete the table. The first row has been completed for you.

propanoic acid

butanoic acid

ethanoic acid

 $\text{C}_3\text{H}_7\text{COOH}$ CH_3COOH $\text{C}_2\text{H}_5\text{COOH}$

Molecular model	Name	Molecular formula
	methanoic acid	HCOOH
		
		
		



1.3 Decide whether each of the following statements is true or false and tick the box.

- (a) Carboxylic acid molecules only partially ionise in water. True ☐ False ☐
- (b) Carboxylic acids are strong acids. True ☐ False ☐
- (c) Solutions of carboxylic acids in water have a pH above 7. True ☐ False ☐
- (d) The functional group of carboxylic acids is -COO . True ☐ False ☐
- (e) The general formula for carboxylic acids is $\text{C}_n\text{H}_{2n+1}\text{COOH}$. True ☐ False ☐

1.4 Carboxylic acids have typical acid properties.

Use the terms provided to complete the sentences describing the typical chemical reactions of carboxylic acids. Some terms may be used more than once.

hydrogen gas fully salt higher
water carbon dioxide gas partially

Hydrochloric acid is a strong acid and _____ ionises in water.

Ethanoic acid is a weak acid and _____ ionises in water.

A solution of ethanoic acid has a _____ pH than a solution of hydrochloric acid with the same concentration.

Carboxylic acids react with:

- metals to form _____ and _____ gas
- bases to form _____ and _____
- carbonates to form _____,
_____ and _____ gas.



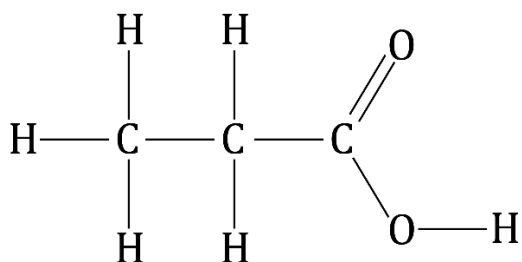
Carboxylic acids: test myself

2.1 Which molecular formula represents a carboxylic acid? Circle the answer.

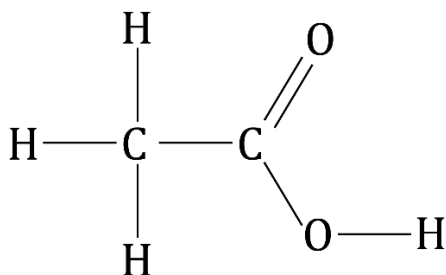


2.2 Which image shows the displayed formula for ethanoic acid? Circle the answer.

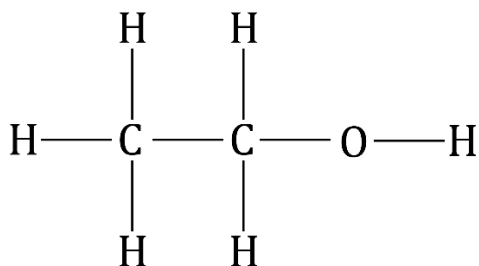
A.



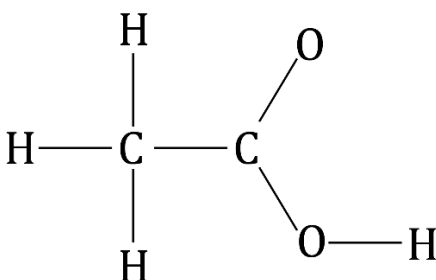
B.



C.



D.





2.3 What type of ions are produced by all carboxylic acids when they ionise?

Hint: These ions are responsible for acidic properties.

oxide ions

carbonate ions

carbon ions

hydrogen ions

2.4 Use the names of the chemicals provided to complete the word equations representing the reactions of ethanoic acid. The names may be used once, more than once or not at all.

ethanol

hydrogen

magnesium ethanoate

oxygen

magnesium propanoate

water

magnesium carbonate

magnesium

(a) ethanoic acid + _____ → magnesium ethanoate +

(b) ethanoic acid + magnesium oxide → _____ +

(c) ethanoic acid + _____ → _____

+ _____

+ carbon dioxide

2.5 Which of the following word equations represents the general reaction between a carboxylic acid and an alcohol?

A. carboxylic acid + alcohol → ester + hydrogen

B. carboxylic acid + alcohol → ester + water

C. carboxylic acid + alcohol → water + hydrogen

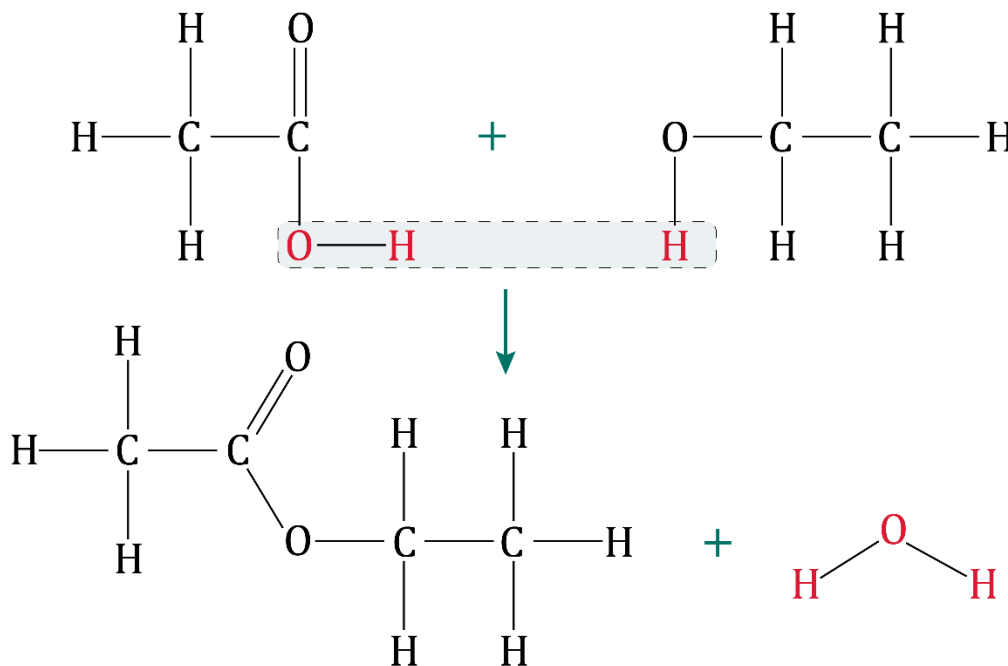
D. carboxylic acid + alcohol → salt + hydrogen



- 2.6** Esters are a homologous series.
Which of the following formulas shows their functional group?

–COOH –OH H₂O –COO–

- 2.7** The image shows the reaction between ethanoic acid and ethanol to form an ester:



What is the name of the ester formed? Circle the answer.

methyl ethanoate

ethyl methanoate

ethyl ethanoate

propyl

ethanoate

- 2.8** Ethanol, CH₃CH₂OH, reacts with an oxidising agent to produce ethanoic acid and a second product.

Use some of the numbers and formulas provided to complete the balanced symbol equation representing this reaction.

CH₃CH₂OH

CH₃CH₂COOH

CH₃COOH

HCOOH

H₂O

CO₂

O₂

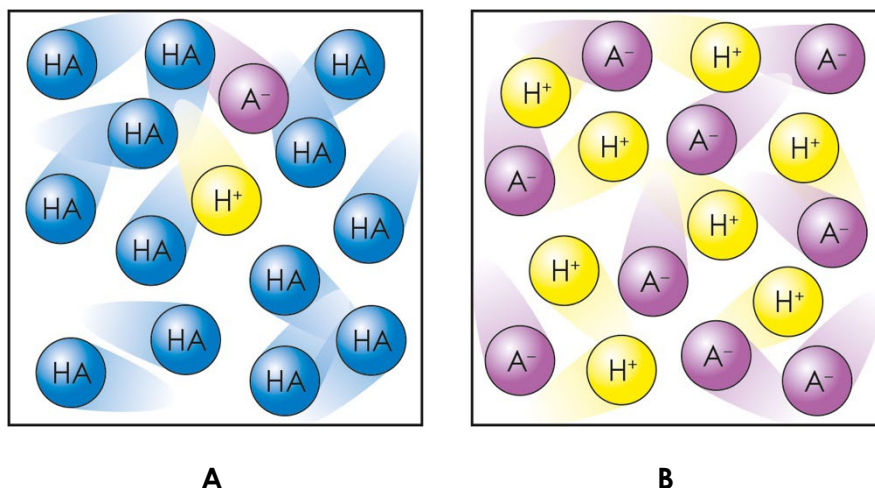
_____ + 2[O] → _____ + _____



Carboxylic acids: feeling confident?

3.1 Diagram **A** represents a weak acid and diagram **B** represents a strong acid.

The formula HA is used to represent the acid molecule in diagram **A**.



(a) What does the H⁺ in each diagram represent?

(b) Which diagram represents the acid that ionises the most?

(c) If the two acids were ethanoic acid and hydrochloric acid, which of the two acids is represented by diagram **A**?

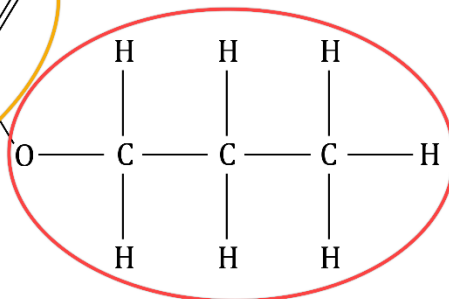
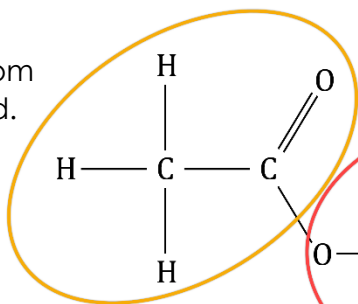
(d) Which diagram represents the acid that would react the fastest with magnesium ribbon?



- 3.2** The diagram shows the displayed formula of an ester. Use this image to answer the questions.

Hint: The name of the alcohol always comes first and ends in '-yl'. The name of the acid comes second and ends in '-oate'.

This part of the molecule came from the carboxylic acid.



This part of the molecule came from the alcohol.

- (a) Name the carboxylic acid used to form this ester.

- (b) Name the alcohol used to form this ester.

- (c) Name the ester shown in the diagram.



Carboxylic acids: what do I understand?

Think about your answers and confidence level for each mini-topic. Decide whether you understand it well, are unsure or need more help. Tick the appropriate column.

Mini-topic	I understand this well	I think I understand this	I need more help
I can identify the functional group and general formula of carboxylic acids.			
I can write the molecular formulae and draw the displayed formulae of the first four carboxylic acids.			
I know that carboxylic acids are weak acids.			
I can describe the reactions of carboxylic acids with metals, bases and carbonates.			
I can describe the reactions of carboxylic acids with alcohols to produce esters and identify the functional group of an ester.			
I can name an ester and identify the displayed formula of ethyl ethanoate.			
I can write an equation for the reaction between ethanol and an oxidising agent.			
Feeling confident? topics	I understand this well	I think I understand this	I need more help
I can describe the difference between strong and weak acids.			
I can name esters.			