

In context

Subject area: Organic chemistry

Level: 14–16 years (Foundation)

Topic: Carboxylic acids

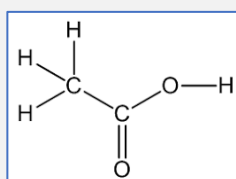
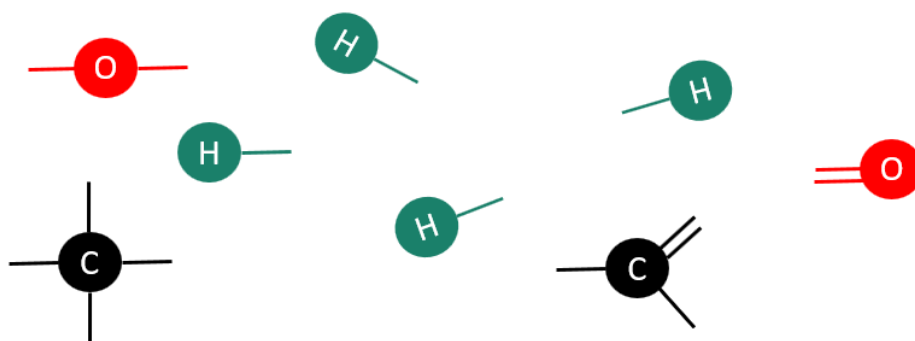
 Source: rsc.li/3o4cneK

1. Ethanoic acid is the second member of the carboxylic acid homologous series.

An ethanoic acid molecule contains two carbon atoms, but also contains four hydrogen atoms and two oxygen atoms.

a) The atoms below can all be joined together to make a molecule of ethanoic acid.

The sticks from each atom are the covalent bonds they make.
Join together these atoms to make a molecule of ethanoic acid.
Draw your molecule in the space below the atoms.

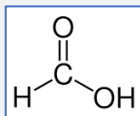


b) The first member of the carboxylic acid homologous series is called methanoic acid.

The numbers of each type of atom in its molecule are in the table below.

Number of carbon atoms	Number of hydrogen atoms	Number of oxygen atoms
1	2	2

- i) Draw the structure of a methanoic acid molecule (use your answer to question 1 to help you).



- ii) What are the molecular formulae of the acids featured above?

Use your previous answers to help you.

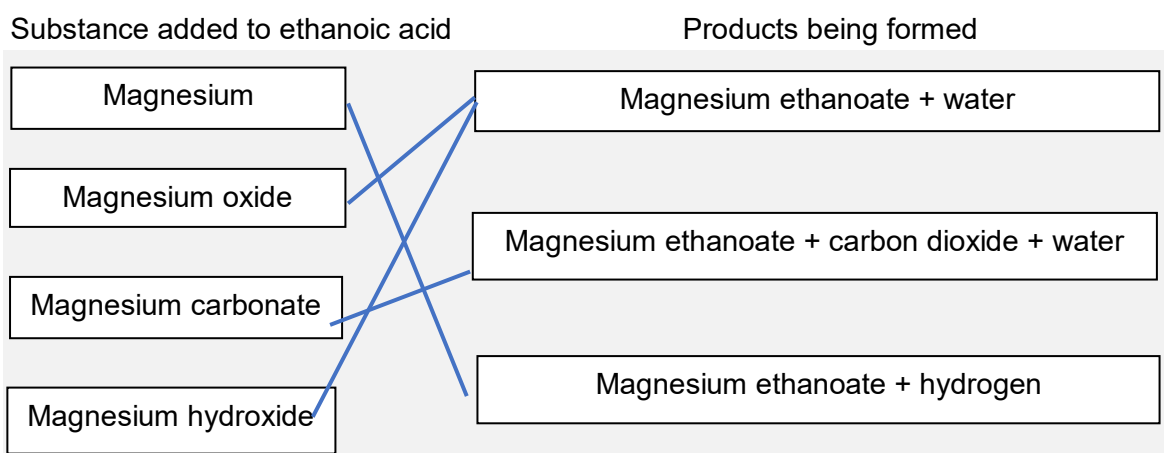
Ethanoic acid	<i>Answer: C₂H₄O₂</i>
Methanoic acid	<i>Answer: CH₂O₂</i>

2. Sean and Michelle would like to carry out different reactions using ethanoic acid.

They add each of the substances below to a sample of ethanoic acid.

Link together, by drawing a straight line, the substance on the left-hand side with its product on the right-hand side.

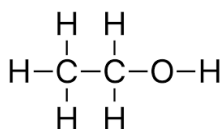
Substance added to ethanoic acid	Products being formed
Magnesium	Magnesium ethanoate + water
Magnesium oxide	Magnesium ethanoate + carbon dioxide + water
Magnesium carbonate	Magnesium ethanoate + hydrogen
Magnesium hydroxide	



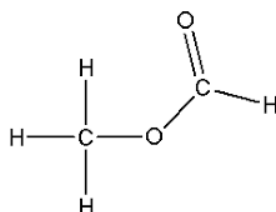
3. Each of the organic molecules below has two carbon atoms.

There is a carboxylic acid, an alcohol, an alkene, an alkane and an ester, but they are muddled up.

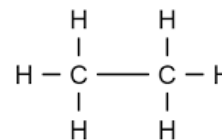
Complete the table by writing each letter (A–E) into the correct box.



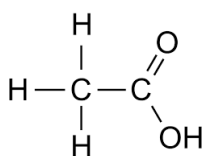
A



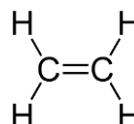
C



E



B



D

carboxylic acid	alcohol	alkene	alkane	ester
<i>Answer: B.</i>	<i>Answer: A.</i>	<i>Answer: D.</i>	<i>Answer: E.</i>	<i>Answer: C.</i>

4. This question is about naming carboxylic acids.

A student has named the carboxylic acids below, but he has made some mistakes.

How many correct answers has he scored out of 5?

For any incorrect answers, add the correct names.

$\begin{array}{c} \text{H}-\text{C}=\text{O} \\ \\ \text{O}-\text{H} \end{array}$ <p>Methanol</p>	Answer: × Methanoic acid.
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{C}=\text{O} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{O}-\text{H} \end{array}$ <p>Pentanoic acid</p>	Answer: × Propanoic acid.
$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{O} \\ \quad \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{O}-\text{H} \end{array}$ <p>Propanoic acid</p>	Answer: × Propanoic acid.
$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C} \\ \quad // \quad \backslash \\ \text{H} \quad \text{O} \quad \text{OH} \end{array}$ <p>Ethanoic acid</p>	Answer: ✓ Ethanoic acid.
$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}=\text{O} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{O}-\text{H} \end{array}$ <p>Butanoic acid</p>	Answer: ✓ Butanoic acid.

Overall score: 2/5