

Carboxylic acids

Question Paper

Level	O Level
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Organic Chemistry
Sub-Topic	Carboxylic Acids
Booklet	Question Paper

Time Allowed: 46 minutes

Score: /38

Percentage: /100

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- 1 Ethanol, C_2H_6O , was reacted with propanoic acid, $C_3H_6O_2$, in the presence of concentrated sulfuric acid.

Which statement about the organic product of this reaction is correct?

- A It has the formula $C_5H_{10}O_2$.
- B It has the formula $C_5H_{12}O_3$.
- C It is formed by an addition reaction.
- D It is propyl ethanoate.

- 2 Which statement about ethanoic acid is correct?

- A Ethanoic acid can be made by the catalysed addition of steam to ethene.
- B Propanoic acid can react with ethanoic acid to produce an ester.
- C Solutions of 1.0 mol/dm^3 ethanoic acid and 1.0 mol/dm^3 hydrochloric acid will react with magnesium at equal rates.
- D The formula of ethanoic acid is CH_3CO_2H .

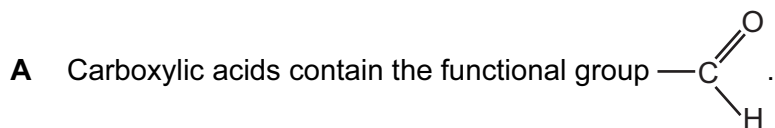
- 3 Two esters have the same molecular formula, $C_3H_6O_2$.

What are the names of these two esters?

- 1 methyl ethanoate
- 2 ethyl propanoate
- 3 ethyl methanoate
- 4 propyl methanoate

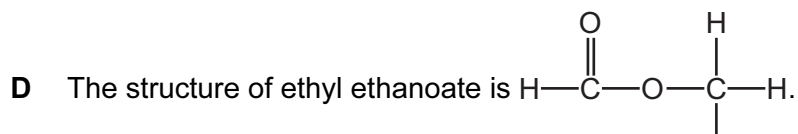
- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

4 Which statement is correct?

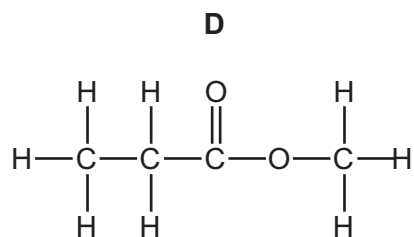
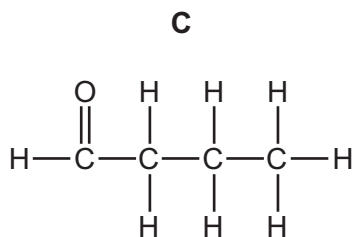
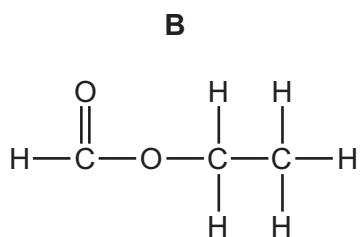
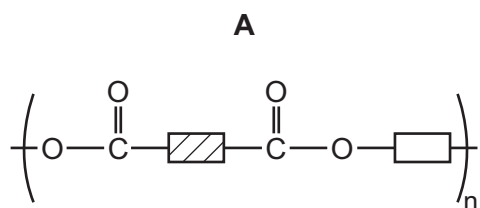


B Ethanoic acid will react and fizz when copper is added.

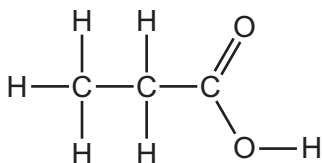
C Ethanol will decolourise acidified potassium manganate(VII).



5 Which of the following has **not** been prepared by reacting a carboxylic acid with an alcohol?



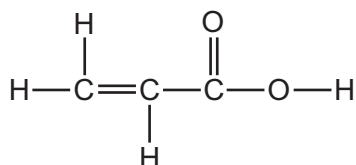
6 The diagram shows the structure of an organic acid.



Which row is correct?

	name of acid	reacts with aqueous sodium carbonate to produce carbon dioxide
A	butanoic acid	no
B	butanoic acid	yes
C	propanoic acid	no
D	propanoic acid	yes

7 A compound has the following structure.

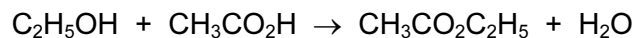


Which reactions will occur with this compound?

- 1 Bromine water will decolourise.
- 2 It will react with an alcohol to form an ester.
- 3 It will react with sodium metal.

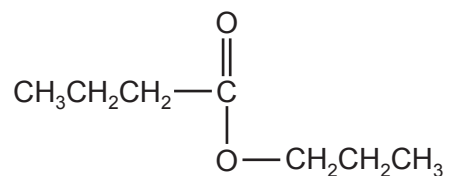
A 1 only **B** 1 and 2 only **C** 1, 2 and 3 **D** 2 and 3 only

- 8 When ethanol reacts with ethanoic acid, the ester ethyl ethanoate is formed.



What is the formula of the ester formed when methanol reacts with butanoic acid, $\text{C}_3\text{H}_7\text{CO}_2\text{H}$?

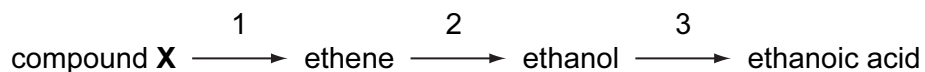
- A** $\text{C}_2\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$
B $\text{C}_3\text{H}_7\text{CO}_2\text{C}_2\text{H}_5$
C $\text{CH}_3\text{CO}_2\text{C}_3\text{H}_7$
D $\text{C}_3\text{H}_7\text{CO}_2\text{CH}_3$
- 9 The diagram shows the structure of an ester.



What are the starting materials for making this compound?

- A** butanol and butanoic acid
B butanol and propanoic acid
C propanol and butanoic acid
D propanol and propanoic acid
- 10 The solubility of the carboxylic acids in water decreases as the size of the carboxylic acid molecules increases.
- Which carboxylic acid is the least soluble in water?
- A** butanoic acid
B ethanoic acid
C methanoic acid
D propanoic acid

- 11 In the manufacture of ethanoic acid, the chemical industry uses the following sequence of reactions.



What are the three processes?

	1	2	3
A	cracking	hydration	oxidation
B	cracking	polymerisation	hydration
C	hydration	polymerisation	oxidation
D	polymerisation	oxidation	hydration

- 12 Shown below are some properties of compound X.

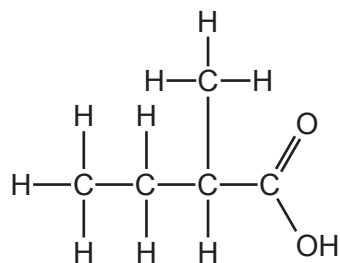
- reacts with potassium carbonate to produce carbon dioxide
- reacts with ethanol to produce a sweet-smelling liquid
- reacts with sodium hydroxide to produce a salt

What is X?

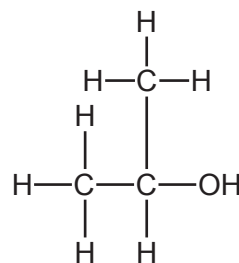
- A ethanol
- B ethanoic acid
- C ethyl ethanoate
- D ethyl methanoate

13 Esters are formed when an alcohol reacts with a carboxylic acid.

Which ester would be formed using the carboxylic acid and alcohol shown?

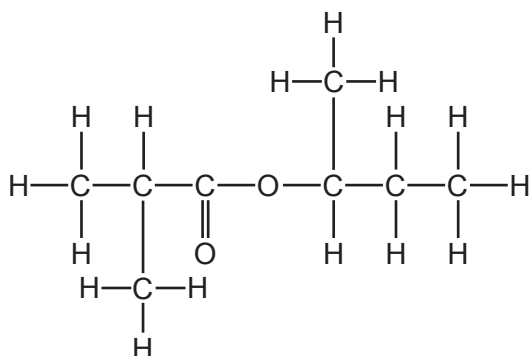


carboxylic acid

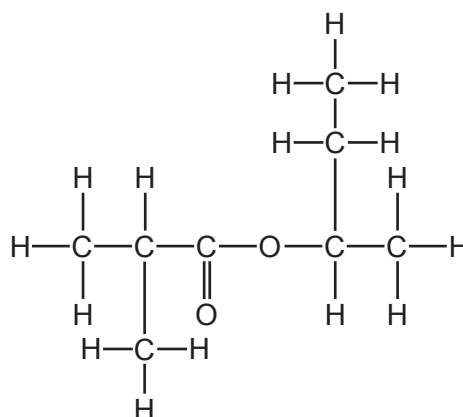


alcohol

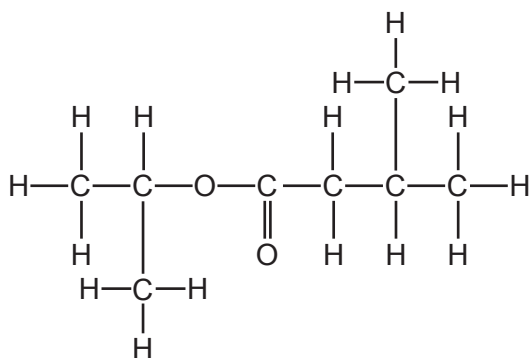
A



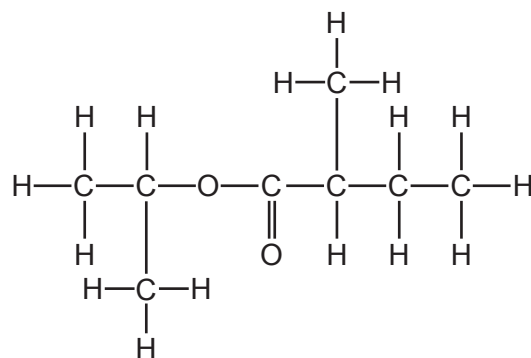
B



C



D



14 For which molecules are the empirical and molecular formulae the same?

1. methanoic acid, HCO_2H
2. ethanoic acid, $\text{CH}_3\text{CO}_2\text{H}$
3. propanoic acid, $\text{C}_2\text{H}_5\text{CO}_2\text{H}$
4. butanoic acid, $\text{C}_3\text{H}_7\text{CO}_2\text{H}$

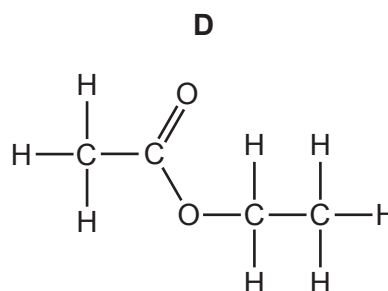
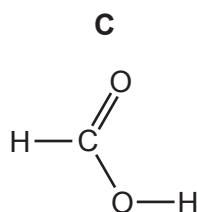
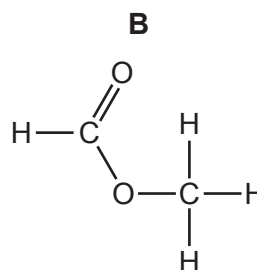
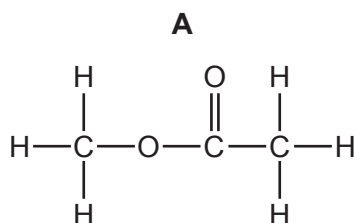
- A** 1, 2 and 3 only
B 1 and 3 only
C 2 and 3 only
D 2, 3 and 4 only

15 A compound Y is thought to be an organic acid.

Which reaction shows that Y is an **organic** acid?

- A** It reacts with an alcohol to form an ester.
B It reacts with magnesium to form hydrogen.
C It reacts with sodium carbonate to form carbon dioxide.
D It turns litmus red.

16 Which compound will react with ethanol to form an ester?



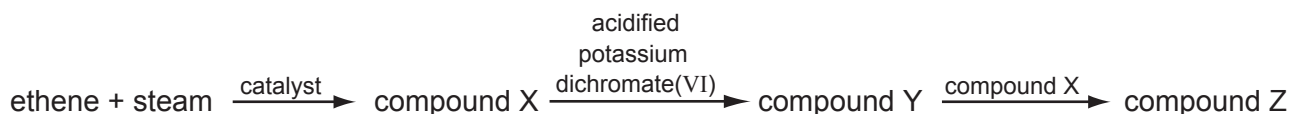
17 What is the name of the ester $\text{CH}_3\text{COOC}_2\text{H}_5$?

- A ethyl ethanoate
- B ethyl methanoate
- C methyl ethanoate
- D methyl methanoate

18 Which statement about ethanoic acid is correct?

- A It contains three carbon atoms per molecule.
- B It contains five hydrogen atoms per molecule.
- C It is insoluble in water.
- D It reacts with ethanol to form a sweet-smelling compound.

19 The diagram shows a reaction scheme.



What is the final compound, Z?

- A a carboxylic acid
- B an alcohol
- C an alkene
- D an ester

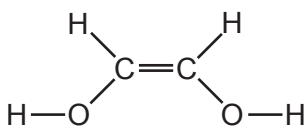
20 How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of carbon, hydrogen and oxygen atoms in the alcohol and carboxylic acid from which the compound was derived?

	carbon atoms	hydrogen atoms	oxygen atoms
A	less	less	less
B	less	same	less
C	same	less	less
D	same	same	same

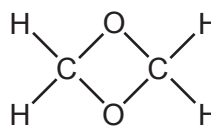
- 21 An aqueous solution of a compound of formula $C_2H_4O_2$ reacts with sodium carbonate, liberating carbon dioxide.

What is the structural formula of the compound?

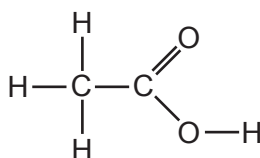
A



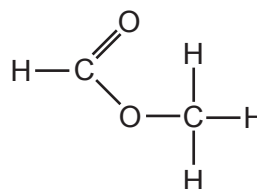
B



C

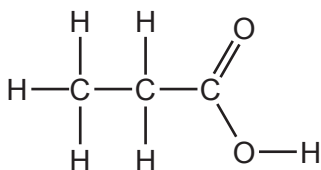


D

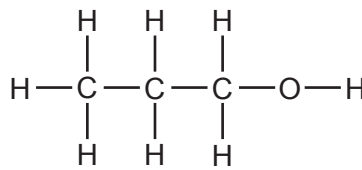


- 22 The diagrams show two organic compounds.

S



T



Which statement about the compounds S and T is correct?

- A** Both S and T react with sodium carbonate.
- B** S and T react together to form the ester ethyl propanoate.
- C** T can be changed into S using acidified potassium dichromate(VI).
- D** They are in the same homologous series.

23 In which reaction is water produced?

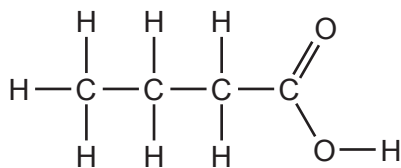
- A manufacture of ethanol from ethene
- B manufacture of margarine from vegetable oils
- C manufacture of poly(ethene) from ethene
- D manufacture of *Terylene* from a carboxylic acid and an alcohol

24 The results of tests on compound Z are shown.

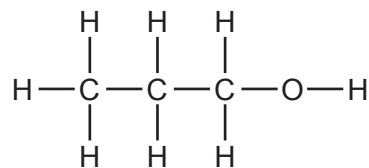
test	result
add bromine water	turns colourless
add aqueous sodium carbonate	carbon dioxide formed

What is compound Z?

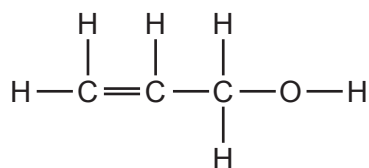
A



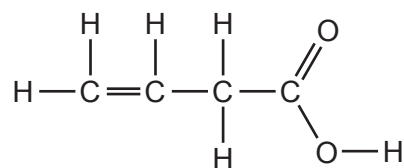
B



C



D

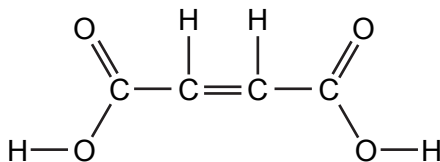


25 Cholesterol is an organic molecule that occurs in the blood stream.

What type of compound is cholesterol?

- A an acid
- B an alcohol
- C an alkane
- D an alkene

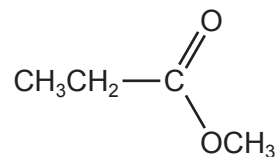
26 The structural formula of butenedioic acid is shown.



Which statement about butenedioic acid is **not** correct?

- A It decolourises aqueous bromine.
 - B Its aqueous solution reacts with sodium carbonate.
 - C Its empirical formula is the same as its molecular formula.
 - D Its relative molecular mass is 116.
- 27 Carboxylic acids react with alcohols to form esters.

Which acid and alcohol react together to form the following ester?

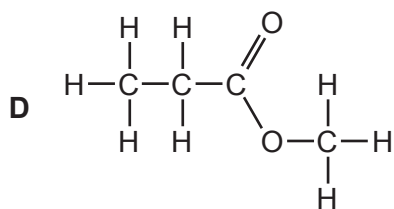
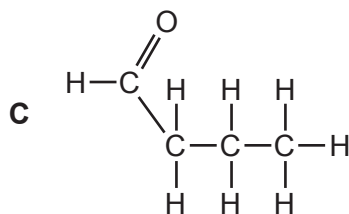
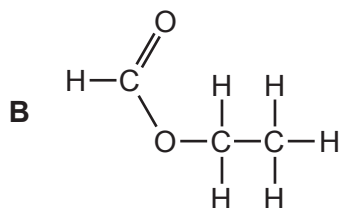
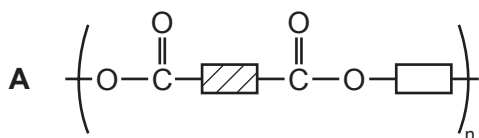


- A propanoic acid and ethanol
- B propanoic acid and methanol
- C ethanoic acid and ethanol
- D ethanoic acid and methanol

28 Which compound has more than two carbon atoms per molecule?

- A ethyl ethanoate
- B ethene
- C ethane
- D ethanoic acid

29 Which of the following has **not** been prepared by reacting a carboxylic acid with an alcohol?



30 What is the empirical formula of ethanoic acid?

- A CH₂O
- B CH₄O
- C C₂H₃O
- D C₂H₄O₂

31 A liquid reacts with each of sodium carbonate, potassium hydroxide and ethanol.

What is the liquid?

- A aqueous ammonia
- B ethanoic acid
- C ethyl ethanoate
- D hydrochloric acid

32 Which formula represents a compound that will react with sodium carbonate to give off carbon dioxide?

- A CH_3OH
- B HCO_2CH_3
- C $\text{CH}_3\text{CO}_2\text{H}$
- D $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$

33 An organic compound, Y, reacts with sodium hydroxide to give a compound with formula $\text{C}_3\text{H}_5\text{O}_2\text{Na}$.

What is compound Y?

- A ethanol
- B propane
- C propanoic acid
- D propanol

34 Compound **X** has the molecular formula C_2H_6O .

- **X** can be made by a fermentation process.
- **X** can be oxidised to **Y**.
- **X** can react with **Y** to form **Z** and water.

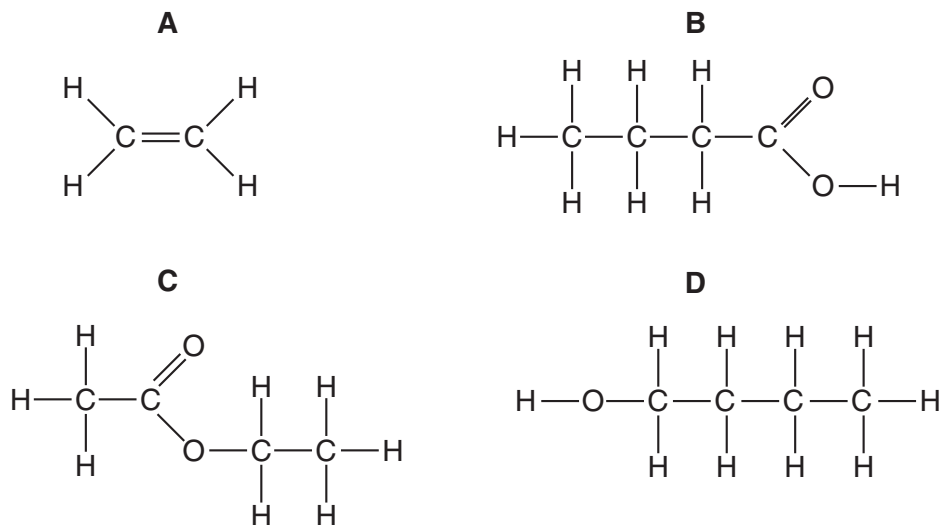
To which homologous series do **X**, **Y** and **Z** belong?

	X	Y	Z
A	alcohols	carboxylic acids	esters
B	alcohols	esters	carboxylic acids
C	carboxylic acids	alcohols	esters
D	carboxylic acids	esters	alcohols

35 What is produced when ethanol is boiled with an excess of acidified potassium dichromate(VI)?

- A** ethane
B ethanoic acid
C ethene
D ethyl ethanoate

36 Which structure shows a compound that reacts with ethanol to give a sweet-smelling liquid?



37 The tables shows the properties of four compounds.

Which compound could be ethanoic acid?

compound	degree of ionisation in water	addition of an aqueous solution of the compound to magnesium
A	high	hydrogen produced
B	high	no reaction
C	low	hydrogen produced
D	low	no reaction

38 What is the general formula of the homologous series of carboxylic acids?

methanoic acid	HCO_2H
ethanoic acid	$\text{CH}_3\text{CO}_2\text{H}$
propanoic acid	$\text{C}_2\text{H}_5\text{CO}_2\text{H}$
butanoic acid	$\text{C}_3\text{H}_7\text{CO}_2\text{H}$

- A** CHO
- B** $\text{C}_n\text{H}_{2n}\text{O}$
- C** $\text{C}_n\text{H}_n\text{O}_n$
- D** $\text{C}_n\text{H}_{2n}\text{O}_2$