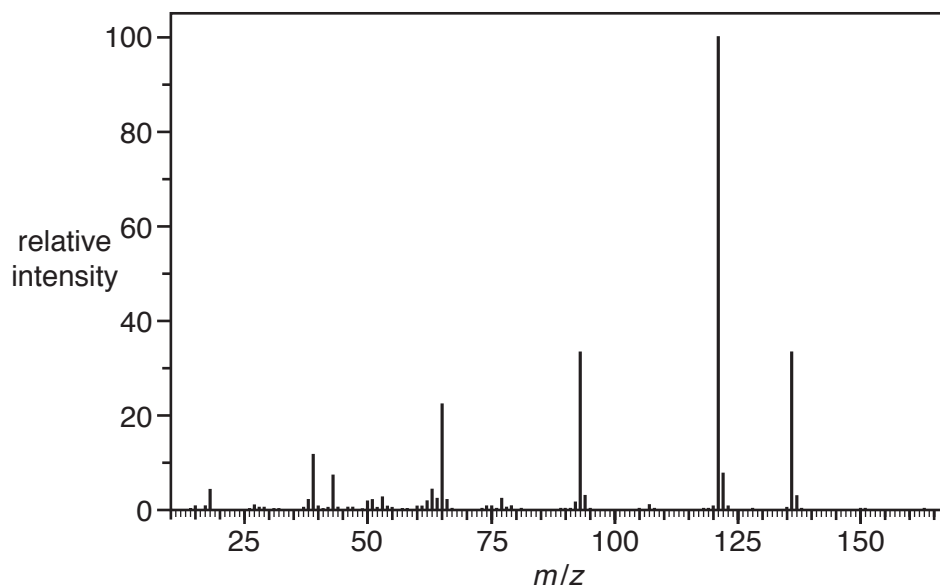


- 1 A chemist analyses a naturally occurring aromatic compound.

The percentage composition and mass spectrum of the compound are shown below.

Percentage composition by mass: C, 70.58%; H, 5.92%; O, 23.50%.

Mass spectrum

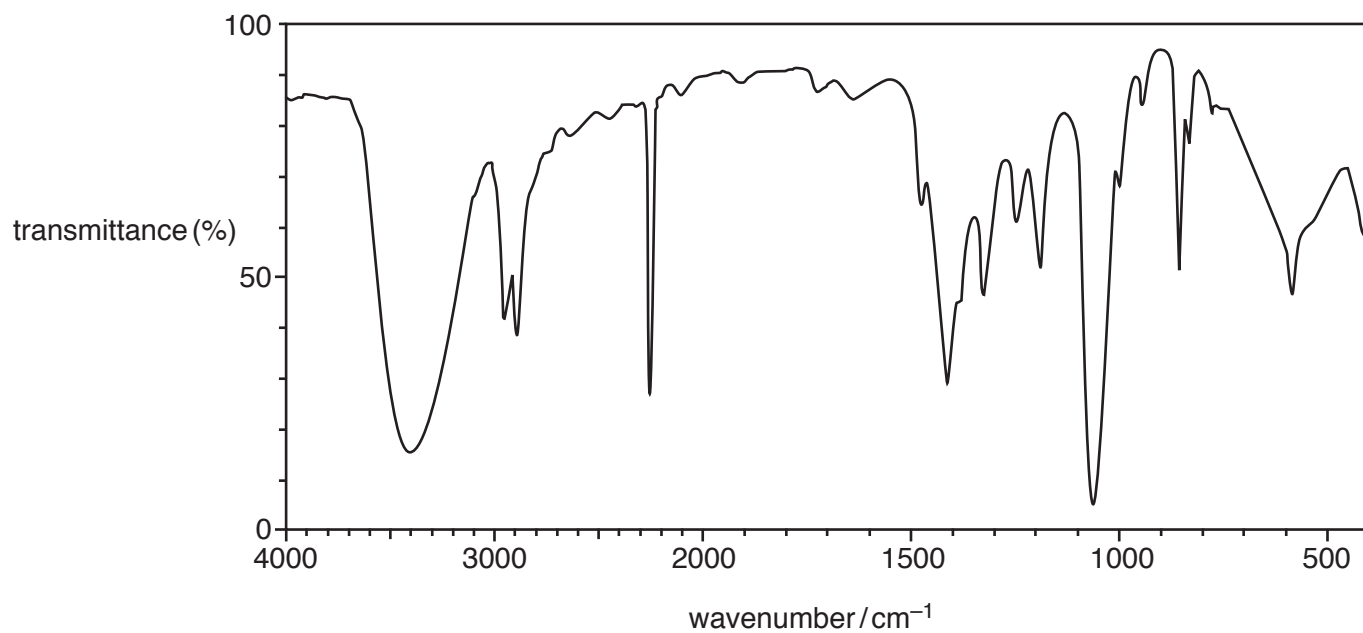


Determine the molecular formula of the compound.

Show your working.

molecular formula = ... [3]

2 Which compound could have produced the IR spectrum below?

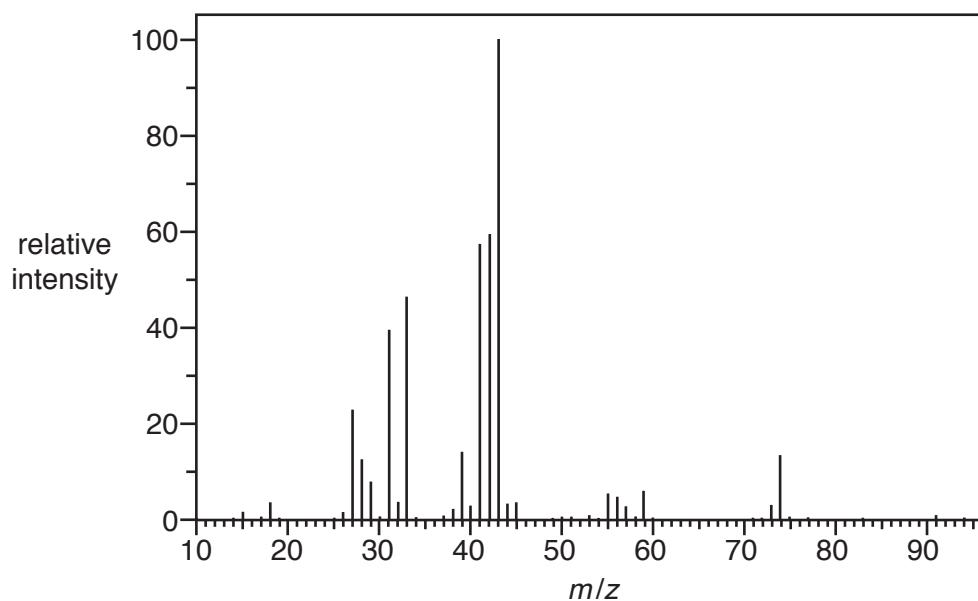


- A** $\text{CH}_3\text{CH}_2\text{OH}$
- B** CH_3CHOHCN
- C** CH_3COOH
- D** CH_3CONH_2

Your answer ☐

[1]

- 3 The mass spectrum of $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ is shown below.



Which ion is responsible for the peak with the greatest relative intensity?

- A** CHCH_2OH^+
- B** $\text{CH}_3\text{CH}_2\text{CH}^+$
- C** $(\text{CH}_3)_2\text{CH}^+$
- D** CH_3CO^+

Your answer

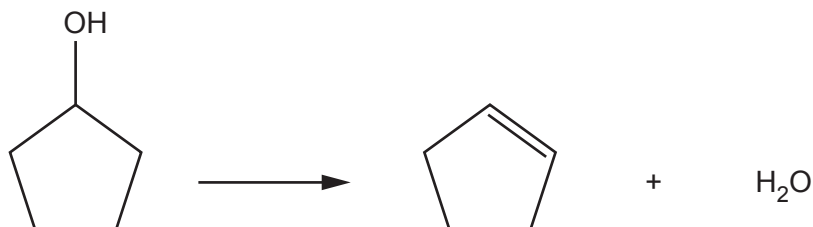
[1]

Cyclopentanol can be reacted to form cyclopentene.

Cyclopentene is a liquid with a boiling point of 44 °C and a density of 0.74 g cm⁻³.

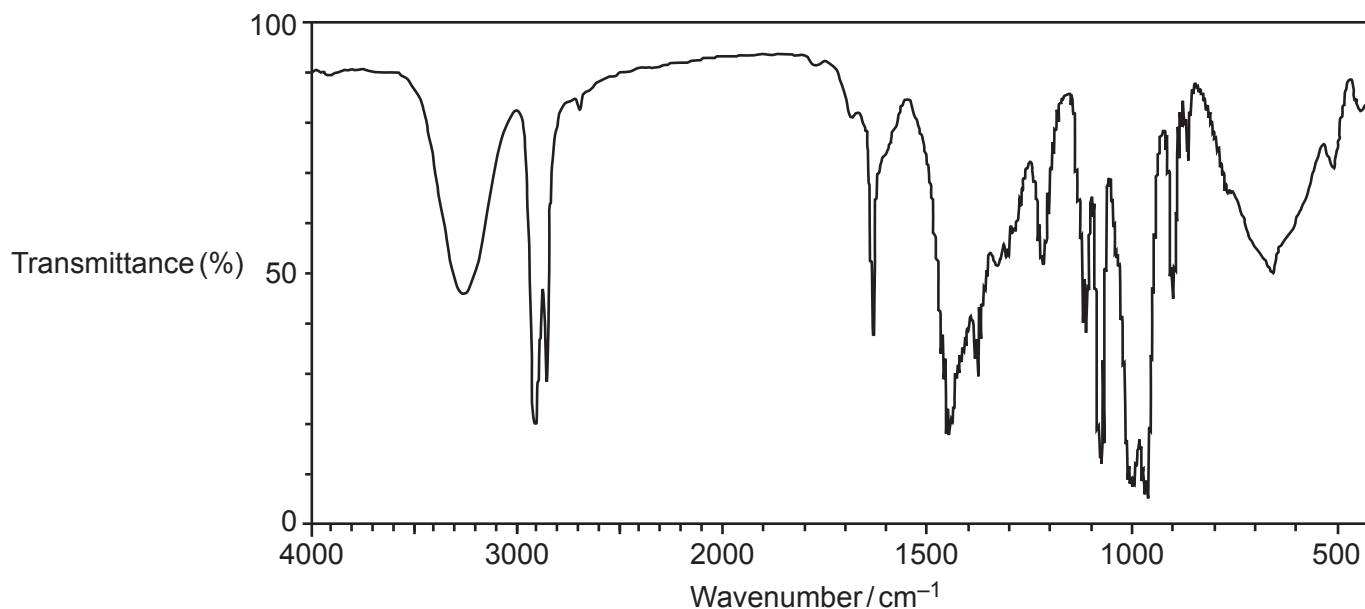
A student plans to prepare 4.00 g of cyclopentene by reacting cyclopentanol (boiling point 140 °C) with an acid catalyst.

Equation



The expected percentage yield of cyclopentene is 64.0%.

- 4 The organic layer in the distillate was analysed by IR spectroscopy. The IR spectrum is shown below.



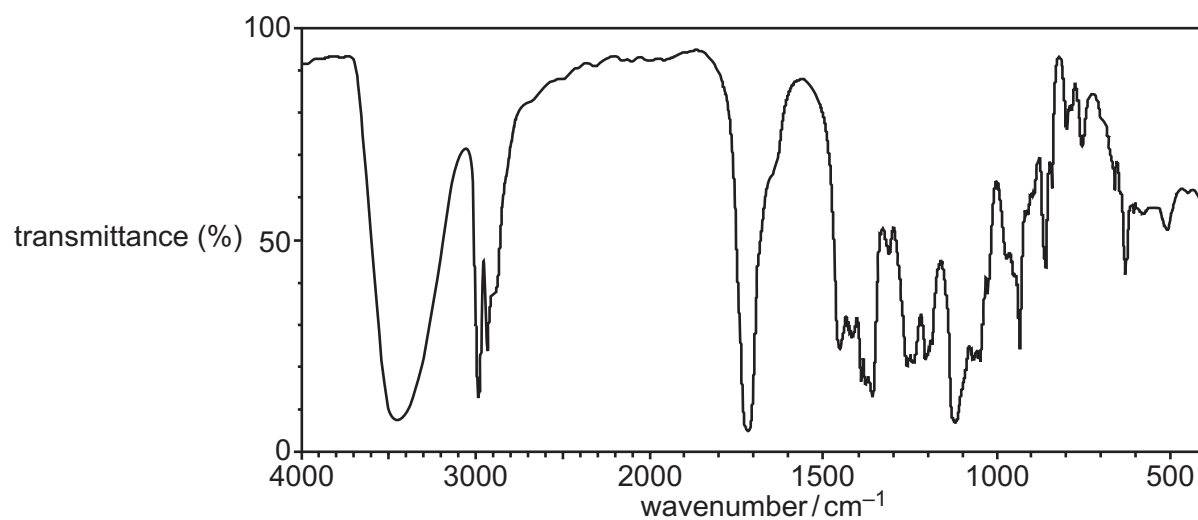
Explain how the IR spectrum of the organic layer suggests that cyclopentene has been formed and that the reaction is incomplete.

.....

.....

.....

5 Which compound could have produced the IR spectrum below?



- A** $(\text{CH}_3)_2\text{CHCHO}$
- B** $(\text{CH}_3)_2\text{CHCOOH}$
- C** $\text{CH}_3\text{CH}(\text{OH})\text{CH}=\text{CH}_2$
- D** $\text{CH}_3\text{COCH}(\text{OH})\text{CH}_3$

Your answer

[1]

- 6 Which peak would be in the mass spectrum of propanal, $\text{CH}_3\text{CH}_2\text{CHO}$, but **not** in the mass spectrum of propanone, CH_3COCH_3 ?
- A** $m/z = 15$
- B** $m/z = 29$
- C** $m/z = 43$
- D** $m/z = 58$

Your answer

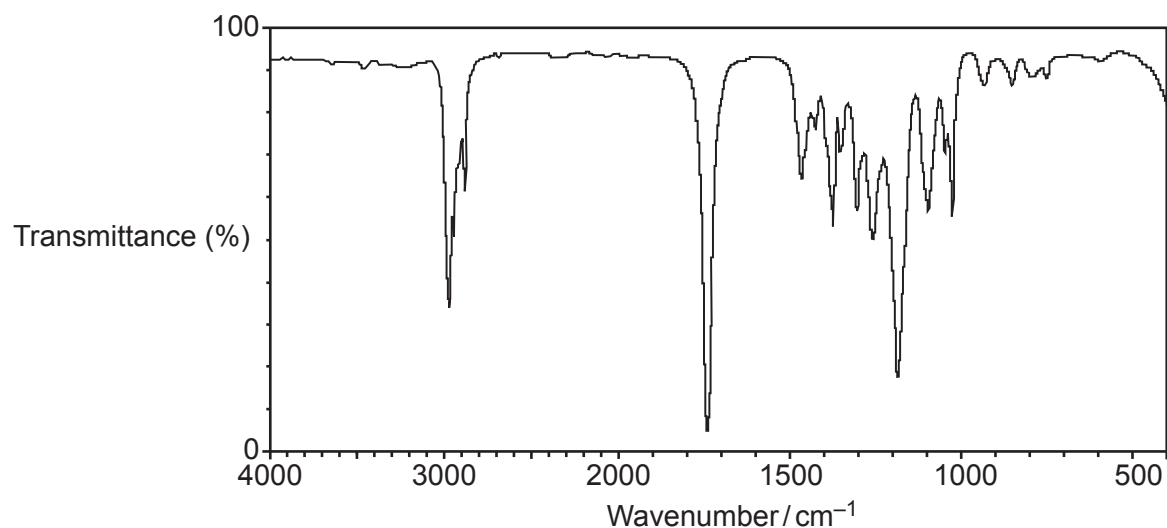
[1]

- 7 Which statement about absorption of radiation is correct?
- A** Infrared radiation can result in the breakdown of the ozone layer.
 - B** Ultraviolet radiation can cause some polymers to photodegrade to benefit the environment.
 - C** Ultraviolet radiation is linked to global warming.
 - D** Ultraviolet radiation is used in modern breathalysers to measure ethanol in the breath.

Your answer

[1]

- 8 The infrared spectrum of an organic compound is shown below.



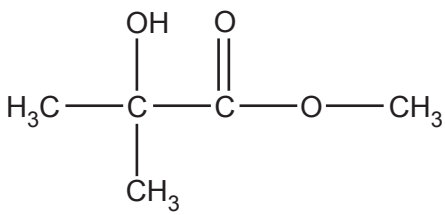
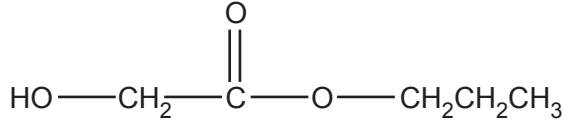
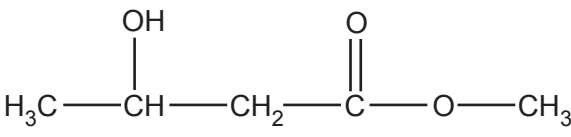
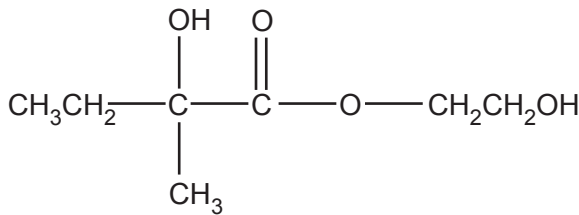
Which compound could have produced this spectrum?

- A** $\text{H}_2\text{C}=\text{CHCH}_2\text{CH}_2\text{OH}$
- B** $\text{CH}_3\text{COOCH}_2\text{CH}_3$
- C** $\text{H}_2\text{NCH}_2\text{COOCH}_3$
- D** $(\text{CH}_3)_2\text{CHCONH}_2$

Your answer ☐

[1]

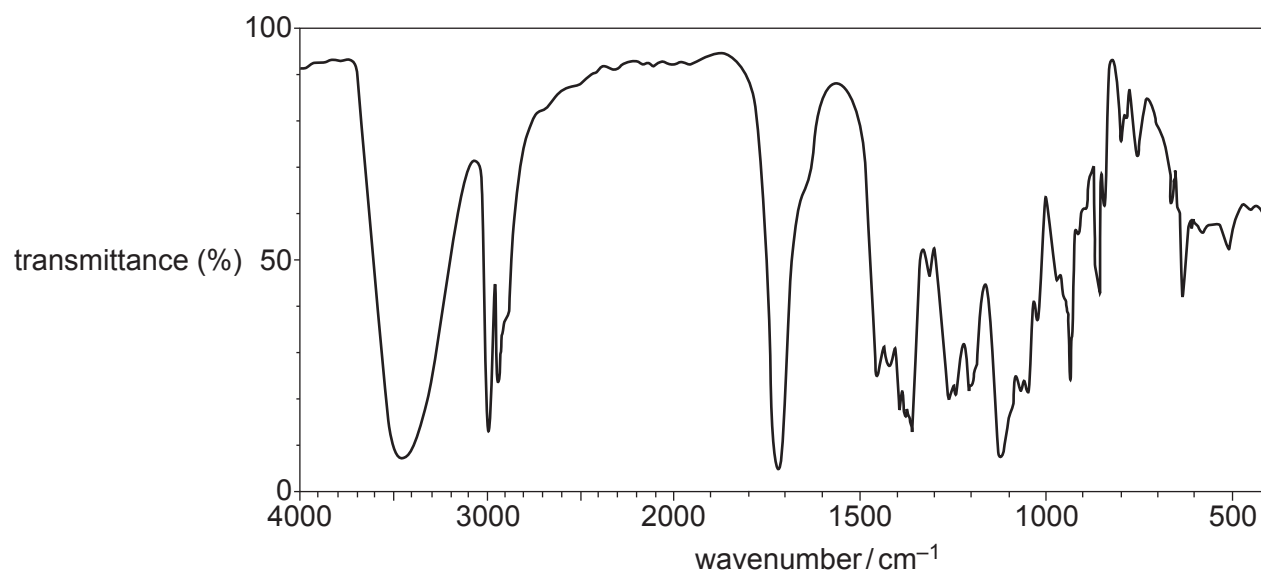
- 9 Which ester is most likely to produce a mass spectrum with a fragment ion at $m/z = 43$?

A	
B	
C	
D	

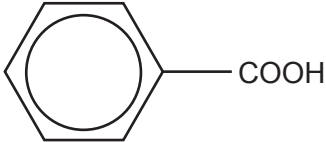
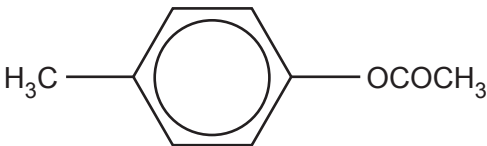
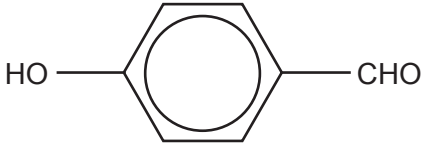
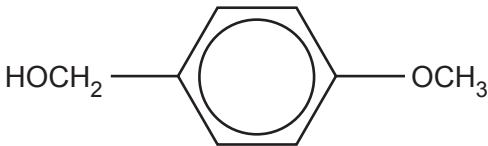
Your answer

[1]

- 10 The infrared spectrum of an organic compound is shown below.



Which compound could have produced this spectrum?

A	
B	
C	
D	

Your answer

[1]

11 Which statement gives a valid scientific reason for global warming?

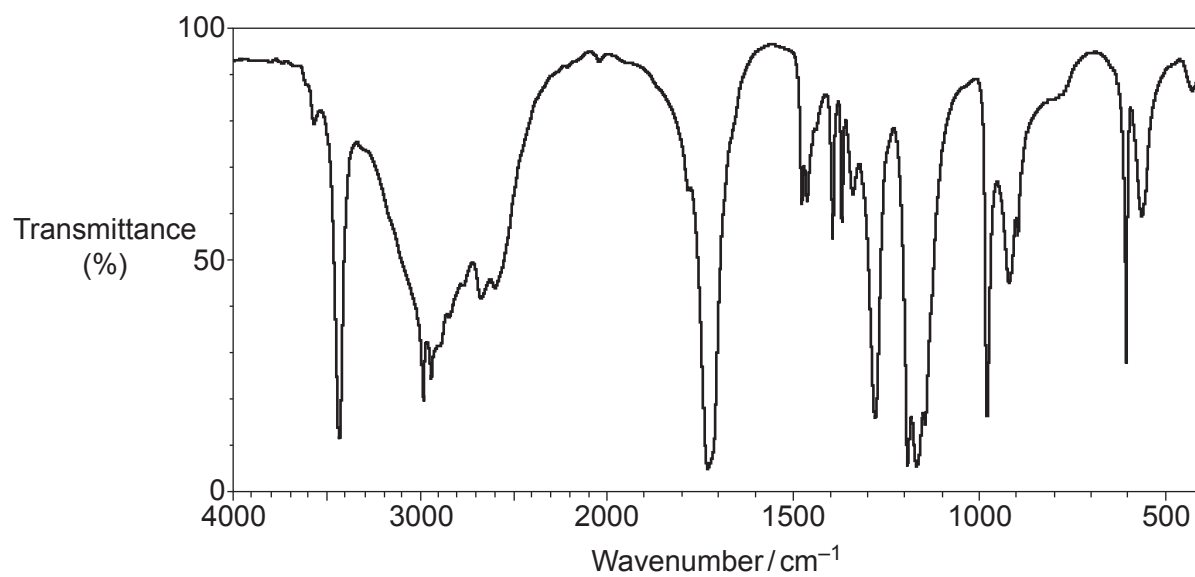
- A** Infrared radiation causes bonds in CH_4 molecules to vibrate more.
- B** Infrared radiation causes O_2 molecules to vibrate more.
- C** Ultraviolet radiation causes bonds in CO_2 to vibrate more.
- D** Ultraviolet radiation causes bonds in CFC molecules to break.

Your answer

☐

[1]

12 Which compound could have produced the IR spectrum shown below?

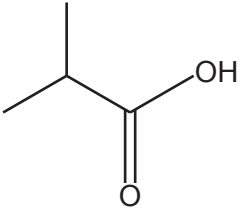
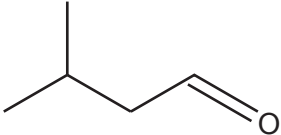
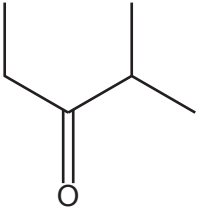
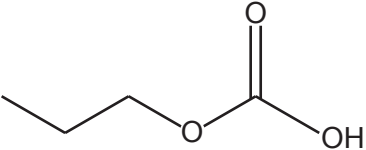


- A** HOCH_2CHO
- B** $\text{CH}_3\text{CH}_2\text{COOH}$
- C** $\text{CH}_3\text{CH}_2\text{COOCH}_3$
- D** $(\text{CH}_3)_2\text{C}(\text{OH})\text{COOH}$

Your answer ☐

[1]

- 13 Which molecule does **not** produce a mass spectrum containing a peak at $m/z = 29$?

A	
B	
C	
D	

Your answer

[1]

14 Which process does **not** involve infrared radiation?

- A** Catalytic ozone depletion
- B** Monitoring toxic gases in the air
- C** Measuring ethanol in breathalyser tests
- D** Global warming

Your answer

[1]