11.1 Spectroscopic Identification

Question Paper

Course	DP IB Chemistry
Section	11. Measurements & Data Processes
Topic	11.1 Spectroscopic Identification
Difficulty	Medium

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

Question 1

Which alcohol is **not** likely to have a fragment at *m/e* at 43 in its mass spectrum?

A. $(CH_3)_2CHCH_2OH$

B. $CH_3CH(OH)CH_2CH_2CH_3$

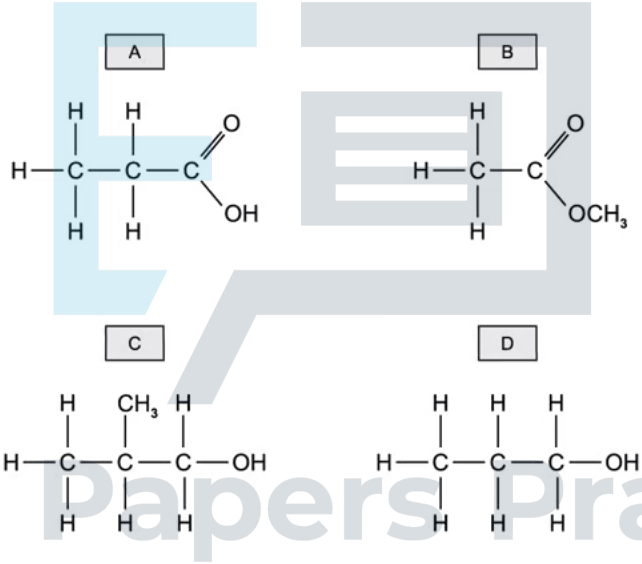
C. $CH_3CH_2CH_2CH_2OH$

D. $CH_3CH_2CH(OH)CH_3$

[1 mark]

Question 2

Which of the compounds shown below is likely to have a fragment at *m/e* = 45 in its mass spectrum?



[1 mark]

Question 3

Chlorine has two isotopes ^{35}Cl and ^{37}Cl. Assuming in the molecule $C_4H_6Cl_4$ there is only one hydrogen and one carbon isotope, how many molecular ion peaks will be seen in its mass spectrum?

A. 5

B. 4

C. 3

D. 2

[1 mark]

Question 4

Bromine exists as two isotopes ^{79}Br and ^{81}Br, which are found in almost equal abundance.

Which of the following statements is correct?

A. ^{79}Br is more reactive than ^{81}Br

B. The mass spectrum of C_3H_7Br has two molecular ion peaks at 122 and 124

C. The atomic radius of ^{79}Br is less than the atomic radius of ^{81}Br

D. The first ionisation energy of ^{79}Br is less than the first ionisation energy of ^{81}Br

[1 mark]

Question 5

Which alcohol is likely to have a fragment ion at *m/e* = 31 in its mass spectrum?

A. $CH_3)_2CHCH_2OH$

B. $CH_3CH(OH)CH_2CH_2CH_3$

C. $CH_3CH_2CH_2C(OH)(CH_3)_2$

D. $CH_3CH_2CH(OH)CH_3$

[1 mark]

Question 6

Which pair of compounds would you expect to both have a singly charged peak at *m/e* = 29 in the mass spectrum?

A. propan-1-ol and propanal

B. propanal and propanone

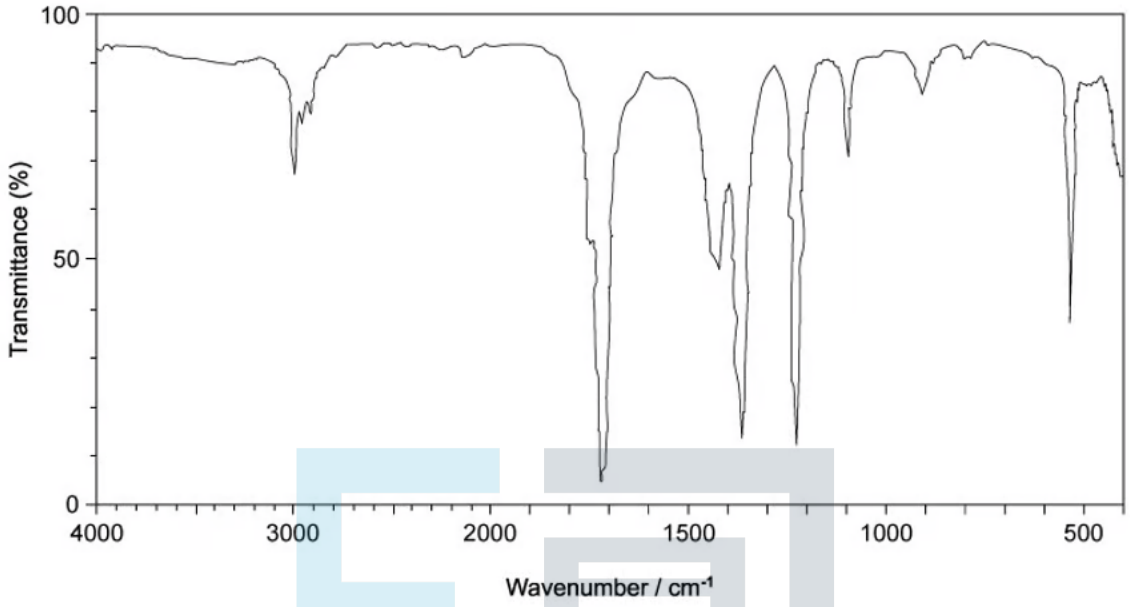
C. propan-2-ol and propanal

D. propan-1-ol and propan-2-ol

[1 mark]

Question 7

The infrared spectrum of a compound is shown below.



Use the infrared absorptions, in wavenumbers, to identify the compound

bond	wavenumber range/ cm^{-1}
O–H (alcohol)	3750 – 3200
C–H (alkane)	2962 – 2853
C–H (aldehyde)	2900 – 2820 and 2775 – 2700
C=O (aldehyde or ketone)	1740 - 1680

Which compound is shown by the infrared spectrum?

A. propan-1-ol

B. propan-2-ol

C. propanal

D. propanone

[1 mark]

Question 8

Which of the ketones listed would **not** be expected to have a peak in its mass spectrum at *m/e* = 57?

A. hexan-3-one, $CH_3CH_2CH_2COCH_2CH_3$

B. pentan-3-one, $CH_3CH_2COCH_2CH_3$

C. 3-methylbutanone, $(CH_3)_2CHCOCH_3$

D. butanone, $CH_3CH_2COCH_3$

[1 mark]

Question 9

Which of the following statements about the mass spectrum of CH_3Br is correct?

A. There is one peak for the molecular ion with an *m/e* value of 44.

B. There is one peak for the molecular ion with an *m/e* value of 95.

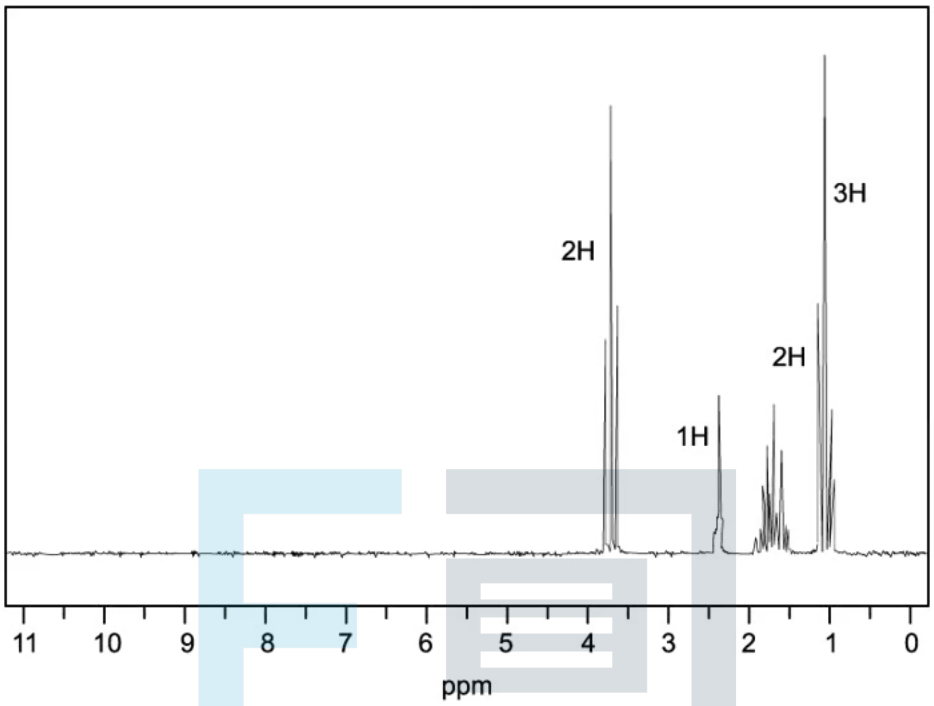
C. The last two peaks have abundances in the ratio 3:1 and occur at *m/e* values of 94 and 96.

D. The last two peaks are of equal size and occur at *m/e* values of 94 and 96.

[1 mark]

Question 10

Below is a ^1H NMR spectrum for an unknown organic compound. The relative areas under the peaks are labelled



Which of the following compounds could give this spectrum?

A. propan-1-ol, $CH_3CH_2CH_2OH$

B. propan-2-ol, $CH_3CH(OH)CH_3$

C. methyoxyethane, $CH_3OCH_2CH_3$

D. pentan-2-one, $CH_3CH_2CH_2COCH_3$

[1 mark]