

# 11.1 Spectroscopic Identification

## Question Paper

Course	DPIB Chemistry
Section	11. Measurements & Data Processes
Topic	11.1 Spectroscopic Identification
Difficulty	Easy

**Time allowed:** 20  
**Score:** /10  
**Percentage:** /100

**Question 1**

Which of the following statements about propanal,  $\text{CH}_3\text{CH}_2\text{CHO}$ , and propanone,  $\text{CH}_3\text{COCH}_3$  is **not** correct?

The compounds have:

- A molecular ion peaks at different mass to charge ratios
- B different fragmentation patterns in the mass spectrum
- C absorption in the infrared spectrum due to the carbonyl group
- D a different fingerprint region in the infrared spectrum

[1 mark]

**Question 2**

Nitrogen trichloride has the formula  $\text{NCl}_3$ . A sample was found to contain only  $^{14}\text{N}$ , and chlorine atoms with mass numbers 35 and 37.

Which of the following is an **incorrect** ion and mass/charge ratio responsible for the molecular ion peaks found in the mass spectrum of nitrogen trichloride?

	ion	$m/e$
A	$\text{N}^{(35}\text{Cl})_3^+$	119
B	$\text{N}^{(35}\text{Cl})_2^{37}\text{Cl}^+$	121
C	$\text{N}^{35}\text{Cl}^{(37}\text{Cl})_2^+$	123
D	$\text{N}^{(37}\text{Cl})_2^+$	125

[1 mark]

**Question 3**

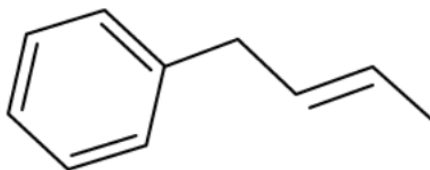
Which of the following cannot be obtained from an infrared spectrum?

- A the molecular mass
- B the presence of C=O bonds
- C the presence of O-H bonds
- D the identity of a compound through comparison with other spectra

[1 mark]

**Question 4**

What is the **index of hydrogen deficiency (IHD)** for the molecule shown below?



- A 1
- B 2
- C 4
- D 5

[1 mark]

**Question 5**

What information can be determined from the infrared spectrum of a molecule?

- A** The number of hydrogens
- B** The number of hydrogen environments
- C** The type of bonds present
- D** The relative molecular mass

[1 mark]

**Question 6**

Which of the following bonds will produce strong absorptions in the infrared part of the electromagnetic spectrum?

- I. C-N
- II. O=O
- III. C=O

- A** I and II only
- B** I and III only
- C** II and III only
- D** I, II and III

[1 mark]

**Question 7**

Which of the following is true about the fingerprint region in the IR spectrum of alcohols?

- A** The fingerprint region is where single bonds can be identified in the IR spectrum
- B** The fingerprint region is unique to every molecule
- C** The fingerprint region does not provide useful information about molecules
- D** A functional group can be identified from the fingerprint region

[1 mark]

**Question 8**

Which of the following statements is correct about spectroscopic techniques for organic molecules?

- A** Information about bond vibrations can be deduced from mass spectroscopy
- B** The values of carbon–hydrogen bond lengths can be found from  $^1\text{H}$  NMR spectroscopy
- C** The number of hydrogen atoms can be determined from infrared spectroscopy
- D** Information about molecular structure can be found from mass spectroscopy

[1 mark]

**Question 9**

In the  $^1\text{H}$  NMR spectrum of 3-methylbutan-1-ol what is the ratio of the peak areas under each signal?

- A 6 : 1 : 2 : 2 : 1
- B 3 : 3 : 1 : 5 : 1
- C 6 : 1 : 5 : 1
- D 3 : 3 : 1 : 2 : 3

[1 mark]

**Question 10**

Which of the following types of spectroscopic identification will involve bond fission in organic molecules?

- A Nuclear magnetic spectroscopy
- B Infrared spectroscopy
- C Mass spectrometry
- D X-ray crystallography

[1 mark]