

22. Analytical techniques

Starter Quiz · 课前小测

A-Level Chemistry

Name: _____ Score: _____

1. Infrared spectroscopy is mainly used to:

- ☐ identify the functional groups in a molecule
- ☐ find the relative molecular mass
- ☐ count the protons
- ☐ measure temperature

2. Chlorine is 75% ^{35}Cl and 25% ^{37}Cl . What is its relative atomic mass? (use $(35 \times 75 + 37 \times 25)/100$)

3. A strong dip near a wavenumber of 1700 (per cm) indicates a:

- ☐ C=O bond
- ☐ C–C single bond
- ☐ C=C bond only
- ☐ C–H bond

4. The molecular ion peak (the highest m/e) gives the:

- ☐ relative molecular mass of the whole molecule
- ☐ number of carbons
- ☐ colour of the compound
- ☐ boiling point

5. A broad dip around a wavenumber of 3200–3650 (per cm) indicates an:

- ☐ O–H bond in an alcohol
- ☐ C–H bond
- ☐ C=C bond
- ☐ C–Cl bond

6. A gap of 15 between two peaks means the molecule has lost:

- ☐ a CH_3 group
- ☐ a CHO group
- ☐ a hydrogen atom
- ☐ an OH group

7. Infrared spectroscopy identifies bonds by the _____ they absorb.

8. In mass spectrometry, the peak at the highest m/z (the molecular ion) gives the relative molecular _____.

9. How could IR confirm that an alkene has become an alcohol?

- ☐ the C=C dip disappears and an O–H dip appears
- ☐ a new C=O dip appears
- ☐ all dipoles vanish
- ☐ the spectrum does not change

10. An $[\text{M}+2]$ peak about the same height as M^+ (a 1:1 ratio) shows the molecule contains:

- ☐ one bromine atom
- ☐ one chlorine atom
- ☐ one carbon atom
- ☐ no halogen

1. identify the functional groups in a molecule

Each bond absorbs IR at its own wavenumber, so the dips reveal the functional groups present.

2. 35.5

$$A_r = (35 \times 75 + 37 \times 25) / 100 = (2625 + 925) / 100 = 35.5.$$

3. C=O bond

A dip around a wavenumber of 1700 (per cm) is the C=O bond (aldehyde, ketone, acid or ester).

4. relative molecular mass of the whole molecule

The highest-m/e peak (M^+) is the whole molecule, so it gives the M_r .

5. O–H bond in an alcohol

The broad O–H absorption sits in the 3200–3650 (per cm) wavenumber region.

6. a CH_3 group

A loss of 15 mass units corresponds to a CH_3 fragment; a loss of 29 is CHO or C_2H_5 .

7. frequencies

Each bond absorbs a characteristic IR frequency.

8. mass

The M^+ peak equals the M_r .

9. the C=C dip disappears and an O–H dip appears

Losing the C=C and gaining an O–H dip shows the conversion to an alcohol.

10. one bromine atom

One bromine gives a 1:1 $[M+2]:M^+$ ratio; one chlorine gives about 3:1.