Solutions

Each answer shows the steps, then the **result**.

2.1

- the number of different carbon (chemical) environments in the molecule

2.2

- 2 peaks (the two CH_3 carbons are equivalent; the C=O is the second)

2.3

- **two** peaks: the two end CH_3 carbons are in one environment and the two middle CH_2 carbons in another

2.4

- tetramethylsilane, **TMS**, $Si(CH_3)_4$

3.1 B

- Equivalent carbons in the same environment give a single peak

3.2 C

- Propan-1-ol has three different carbon environments
- 3 peaks

3.3

(a)

- propanone, CH_3COCH_3 – the C=O gives the downfield peak and the two equivalent CH_3 give the other

(b)

- the two equivalent methyl carbons share one peak and the C=O gives the second, so two peaks fit

3.4

- ethanoic acid has two different carbon environments – the CH_3 carbon and the COOH carbon; each gives one peak, so there are two peaks

3.5

(a)

- propan-1-ol: **three** peaks
- propan-2-ol: **two** peaks, because the two CH_3 carbons are equivalent

(b)

- the number of peaks is different, so the isomer can be identified from its spectrum

3.6

- two peaks means only two carbon environments among four carbons, so the molecule must be very symmetrical
- 2-methylpropan-2-ol, $(CH_3)_3COH$: three equivalent CH_3 carbons and one C bonded to OH