

Exercise walk-through

4.5.4

Combined spectra and chromatographic evidence

Pearson Edexcel · International A-Level · Chemistry

Find the temperature boundary

Your turn

$\Delta H = +36.0 \text{ kJ mol}^{-1}$; $\Delta S(\text{system}) = +120 \text{ J mol}^{-1} \text{ K}^{-1}$. Which condition gives positive total entropy?

- A. T below 300 K
- B. T above 300 K
- C. Every temperature
- D. No temperature

Buffer after neutralisation

Your turn

0.0100 mol HA receives 0.00400 mol OH^- . Which HA:A⁻ ratio enters the buffer expression?

- ☐ A. 10:4
- ☐ B. 6:4
- ☐ C. 4:6
- ☐ D. 10:6

Independent structural identification

Your turn

$\text{C}_3\text{H}_6\text{O}$ has two carbon-13 signals, gives iodoform and no Tollens' silver. Which structure fits?

- A. Propanal
- B. Propanone
- C. Propan-1-ol
- D. Ethanoic acid

Exercises 2.1·2.3

2.1 Calculate the accurate mass of $\text{C}_2\text{H}_6\text{O}$ using $\text{C} = 12.0000$, $\text{H} = 1.0078$ and $\text{O} = 15.9949$. [2]

2.2 State the number of carbon-13 environments in propanone and propanal and explain the difference. [3]

2.3 A TLC spot is 4.2 cm above baseline; solvent front is 7.0 cm above it. Calculate R_f and state a condition needed for reference comparison. [3]

3 Exam-style questions

Exercises 2.1·2.3

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2.1 $2(12.0000) + 6(1.0078) + 15.9949 = 46.0417$.

2.2 State the number of carbon-13 environments in propanone and propanal and explain the difference. [3]

2.2 Two in propanone, three in propanal; propanone has equivalent methyl carbons whereas propanal does not.

2.3 A TLC spot is 4.2 cm above baseline; solvent front is 7.0 cm above it. Calculate R_f and state a condition needed for reference comparison. [3]

3 Exam-style questions

2.3 $R_f = 4.2/7.0 = 0.60$, no units. Same solvent/stationary-phase conditions.

Exercises 3.1·3.2

3.1 A $\text{C}_4\text{H}_8\text{O}_2$ sample has an ester carbonyl and proton-NMR sets: 3H singlet, 2H quartet and 3H triplet. Propose a structure and assign each set. Explain one limitation of relying only on integration. [5]

3.2 A forensic sample has one GC peak with the same retention time as a reference drug. Explain why identity and purity are not established, and how GC–MS plus controls strengthen the interpretation. [4]

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3.1 Ethyl ethanoate $\text{CH}_3\text{COOCH}_2\text{CH}_3$. Acyl CH_3 singlet; OCH_2 quartet; terminal CH_3 triplet. Integration gives relative H counts, not unique connectivity; shifts/splitting/formulae are also needed.

3.2 A forensic sample has one GC peak with the same retention time as a reference drug. Explain why identity and purity are not established, and how GC–MS plus controls strengthen the interpretation. [4]

3.2 Different compounds can share retention time; co-eluting components can form one peak. Mass/fragment evidence supplies an additional structural constraint. Matched standards/blanks and sample provenance/contamination controls test the reliability of attribution.