**Analysis topic test solutions**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* D

*Explanation:*

The bombardment by electrons knocks a further electron from the molecule leaving a positive entity.

**Question 2**

*Answer:* B

*Explanation:*

Splitting is due to the impact of protons on adjacent carbon atoms.

**Question 3**

*Answer:* A

*Explanation:*

Ethanol has three hydrogen environments, the OH having no splitting.

**Question 4**

*Answer:* C

*Explanation:*

Propan-1-ol has three carbon environments matching these shifts.

**Question 5**

*Answer:* D

*Explanation:*

Propanone has a RAM of 58 and likely peaks at 15 and 43.

**Question 6**

*Answer:* C

*Explanation:*

The -OH characteristic of alcohols should not be present. This is the band in option C

**Question 7**

*Answer:* B

*Explanation:*

HPLC should be able to determine the concentration of a particular organic substance.

**Question 8**

*Answer:* B

*Explanation:*

The more polar the molecule, the more it should dissolve in the solvent and the lower the retention time. (This assumes the forms of haemoglobin have similar properties in other ways)

**Question 9**

*Answer:* D

*Explanation:*

The goal is to have the indicator change colour as close to the pH of the equivalence point as possible.

**Question 10**

*Answer:* D

*Explanation:*

*n*(NaOH) = 0.012 *n*(acid if diprotic) = 0.006 c = 0.006/0.03 = 0.2M

**SECTION B: Short-answer questions**

**Question 1** (13 marks)

**a.**  **i**. C3H6O2 is also the molecular formula as it would produce a parent molecular ion with m/z 74 2 marks

 **ii**. Base peak is at 43. Could be CH3CO+  1 mark

**b**. propanoic acid methyl ethanoate ethyl methanoate 3 marks



**c**. The molecule will not be propanoic acid due to the lack of broad -OH(acid) absorption. 2 marks

**d**. The molecule is methyl ethanoate. This molecule has no splitting whereas ethyl methanoate would have

 splitting. Ethyl methanoate would have 3 hydrogen environments which is not correct.



**e**.

 2 marks

**Question 2** (8 marks)

**a.** There are at least 4 different substances in the sample. The HPLC resolution of the components is good.

 All are present in similar amounts. 2 marks

**b.** The 4 peaks will be in the same order but they will appear closer together. The retention time of each

 substance is reduced. 1 mark

**c**. Hexan-1-ol is polar but hexane is not. Hexane should be more soluble in the solvent and have the shorter

 retention time. 2 marks

d. You would need to prepare standard solutions of chloropentane. On the first run of a standard you could

 determine the retention time that you need to study. Running the standards would allow you to prepare a

 calibration curve. The actual samples could then be tested and their area plotted on the calibration curve to

 determine the concentration.

**Question 3** (9 marks)

**a**. cyclohexane 1 cyclohexene 3 2 marks

**b.** 3 hydrogen environments – the -OH would be a singlet, the C – H a septet and the CH3 a doublet

**c.**  29 C2H5+ or CHO+  31 CH2OH+ 43 C3H7+ or CH3CO+

**d.**  C=O amide 1630-1680 N-H 3300 – 3500 cm-1 2 marks

**Question 4** (total 10 marks)

**a.** **i**. CH3CH2NH2(aq) + H2O(l) 🡪 CH3CH2NH3+(aq) + OH-(aq) 1 mark

 **ii**. It is accepting a proton, a feature of a base. 1 mark

 **iii**. Write a balanced equation for the reaction between ethanamine and HCl. 1 mark

**b**. The reaction is between a strong acid and a weak base. An indicator changing at a lower pH should be used

 like methyl orange. 2 marks

**c**. Ignore run 1: Mean titre is 23.0 mL

 *n*(HCl) = 0.023 × 0.15 = 0.00345 mol = *n*(ethanamine) c = = 0.173 M 3 marks

**d**. - the burette: HCl 2 marks

 - the pipette: ethanamine