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(Total for Question 5 = 6 marks)



P 7 4 4 5 5 A 0 1 1 3 2

(iii) Describe how you would obtain pure dry crystals from the precipitate.

(4)

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(Total for Question 7 = 22 marks)

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- 9 Acidity in wine is mainly due to the dicarboxylic acid tartaric acid, $C_4H_6O_6$.

Sulfur dioxide is added to wine as an antioxidant, to prevent the colour and flavour of the wine from deteriorating. It also inhibits the growth of bacteria.

The concentration of tartaric acid and the concentration of sulfur dioxide present in wine can both be determined by titrations.

- (a) The procedure to find the total amount of tartaric acid in a white wine is shown.

Step 1 Pipette a 20.0 cm^3 sample of the wine into a conical flask.

Step 2 Add anti-bumping granules to the flask, and then place it on a preheated hot plate.

Step 3 Boil the sample to remove any dissolved gases and allow it to cool.

Step 4 Use 0.100 mol dm^{-3} sodium hydroxide solution, NaOH(aq) , in a burette to titrate the sample using a suitable indicator.

- (i) State a precaution you would take in carrying out Step 3.
Justify your answer.

(2)

- (ii) Explain what effect the omission of Step 3 would have on the titre.

(2)

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(ii) Explain how the addition of sodium hydrogencarbonate in Step 2 reduces the loss of sulfur dioxide from the flask.

(2)

(Total for Question 9 = 15 marks)

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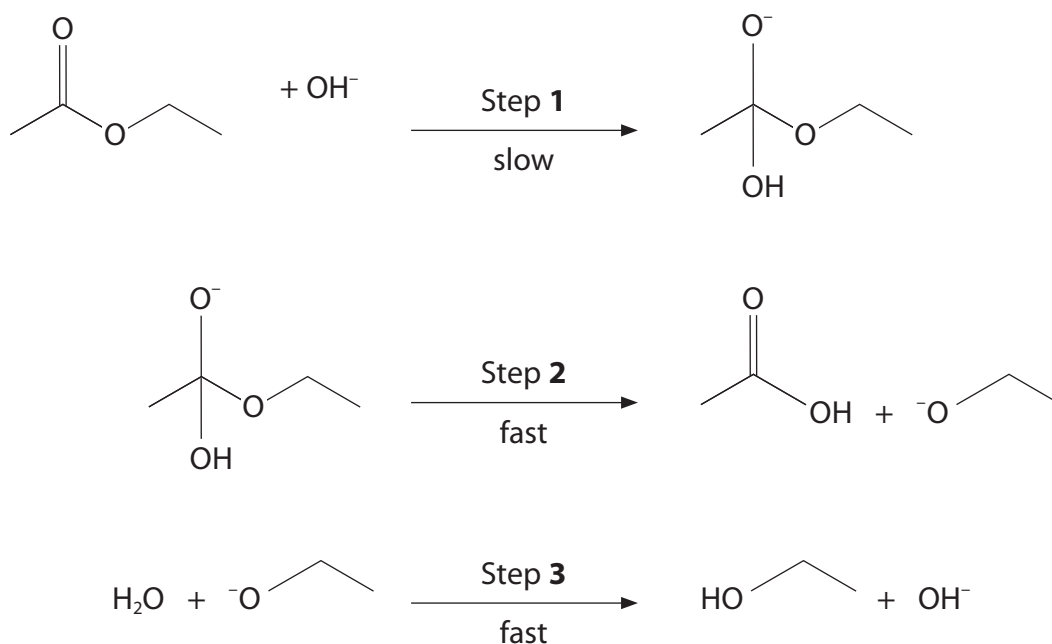
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(c) Ethyl ethanoate can also be hydrolysed under alkaline conditions.

A student researching the mechanism for the reaction found this example.



Deduce a rate equation that is consistent with this reaction mechanism.
Justify your answer.

(2)

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(Total for Question 10 = 14 marks)

TOTAL FOR PAPER = 120 MARKS



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Question Number	Answer	Additional Guidance	Mark
1(a)	An answer that makes reference to the following points: • (the relative isotopic mass is) the mass of an atom (of an isotope) • relative to 1/12 of the mass of a carbon-12 atom or relative to a carbon-12 atom which has a mass of (exactly) 12	Allow weight for mass Do not award reference to average/mean mass Accept divided by 1/12 of the mass of a carbon-12 atom Allow reference to moles such as The mass of one mole of atoms of an isotope relative to 1/12 of the mass of one mole of carbon-12 atoms	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	An answer that makes reference to the following point: • five / 5		(1)

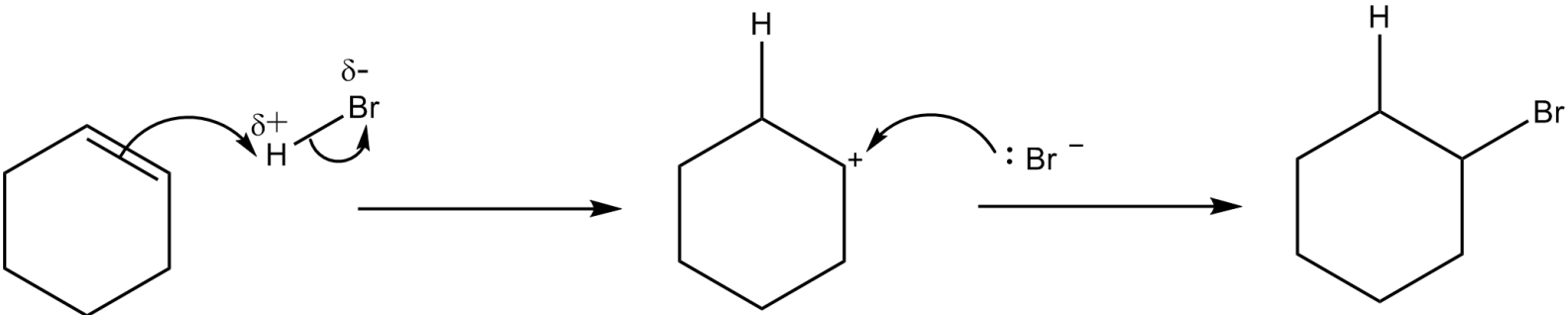
(Total for Question 1 = 3 marks)

Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the following points: • compound A as London forces increase as branching decreases or compound A is unbranched and has greater/more London forces (1) • so surface area/points of contact (of molecules) increases (1)	Allow van der Waals'/dispersion forces/ induced dipole – dipole forces for London forces Allow 'least branching'/'longer chain' for unbranched Allow reference to packing of molecules more closely/closer together Allow compound for molecule Ignore A molecules are more compact Do not award 'more electrons' Do not award M2 if clear reference to covalent bonds being broken/decomposition Accept reverse argument e.g. • compound A, as the other compounds have less London forces as branching increases • so surface area/points of contact (of molecules) decreases	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	- rearrangement of ΔG expression - calculation of T - conversion to $^{\circ}\text{C}$ to 2/3 SF	<u>Example of calculation</u> $T = \Delta H / \Delta S_{\text{system}}$ $(T = (1010 \times 1000) / 878.2)$ $= 1150.1 \text{ (K)}$ M2 subsumes M1 so the numerical value scores (2) $= 877 (^{\circ}\text{C}) / 880 (^{\circ}\text{C})$ Allow $878 (^{\circ}\text{C})$ Do not award an answer below 25°C for M3	(3)

Question Number	Answer	Additional Guidance	Mark
4(b)	An explanation that makes reference to the following points: (calcium nitrate is less thermally stable because) • (both ions have the same charge but) the calcium ion is smaller / has a greater charge density (1) • so polarises (the anion) to a greater extent (1) • and so weaken the N–O bond / bond(s) within the nitrate ion (1)	Allow reverse arguments Ignore ‘calcium atom is smaller’ Do not award references to electronegativity Do not award reference to electron density Allow so more likely to polarise (the nitrate (ion) / calcium ion has more polarising power Allow reference to polarisation of the bond Allow a description of polarisation such as the distortion of the anion electron cloud to a greater extent Do not award reference to breaking of/polarising the ionic bond between the calcium and the nitrate	(3)

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	An answer that makes reference to the following point: • $8\text{Al} + 3\text{NO}_3^- + 5\text{OH}^- + 18\text{H}_2\text{O} \rightarrow 8\text{Al}(\text{OH})_4^- + 3\text{NH}_3$		(1)

Question Number	Answer	Additional Guidance	Mark
7(a)	An answer that makes reference to the following points: • curly arrow from C=C to δ^+ H in HBr • dipole on HBr • curly arrow from H-Br bond to, or just beyond, $\text{Br}^{\delta-}$ • structure of carbocation • lone pair on Br^- • curly arrow (from lone pair on) Br^- to C^+	Finalise use of half arrows once only in points 1, 3 and 6 Ignore drawing of hydrogen atoms on carbocation unless the number of hydrogen atoms is too many 6 points scores (4) 5 points scores (3) 3 or 4 points scores (2) 2 points scores (1) 1 point scores (0)	(4)
			

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	An explanation that makes reference to the following points: - as the weak acid (is being titrated with) a weak base - as no rapid change in pH (to find volume at end-point) - so end-point cannot be determined	(1) Accept pH changes gradually around the end point Allow there is no vertical section in the titration curve (1) so a sharp colour change cannot be observed Allow phenolphthalein would not change colour/ pK_{In} is too high	(3)

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	(replace ammonia with) a strong base such as NaOH / KOH	Allow name or formula of strong base Allow use of a pH probe/pH meter Do not award change of indicator	(1)