



Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
Level 3 GCE**

Centre Number

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Candidate Number

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Wednesday 17 June 2020

Morning (Time: 2 hours 30 minutes)

Paper Reference **9CH0/03**

Chemistry

Advanced

Paper 3: General and Practical Principles in Chemistry

Candidates must have: **Data Booklet**
Scientific calculator
Ruler

Total Marks

Instructions

- Use **black** ink or **black** ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided - *there may be more space than you need.*

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets - *use this as a guide as to how much time to spend on each question.*
- For the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing the points that you make are related or follow on from each other where appropriate.
- A Periodic Table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Check your answers if you have time at the end.

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Answer ALL questions.

1 Aqueous sodium carbonate and aqueous sodium sulfate are both colourless solutions.

(a) Give the reagent and the observation to show the presence of carbonate ions. (2)

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(b) Give the reagent and the observation to show the presence of sulfate ions. (2)

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(Total for Question 1 = 4 marks)

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2 This question is about flame tests for Group 1 and 2 metal ions.

(a) (i) State the colour of the flame produced by separate samples of potassium and strontium ions.

(1)

Potassium ions

Strontium ions

(ii) Give a reason why carrying out a flame test on a mixture of potassium chloride and strontium chloride does not clearly show that two different metal ions are present.

(1)

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(b) In the first stage of the flame test, the nichrome wire is dipped into concentrated hydrochloric acid and then heated in a Bunsen flame.

In the second stage, this nichrome wire is dipped into fresh hydrochloric acid and then into the metal salt to be tested before being reheated in the Bunsen flame.

(i) Give **two** reasons why the wire is made of nichrome and not iron.

(2)

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(ii) Give a reason why the wire is dipped into acid and then heated in the first stage.

(1)

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(iii) State why **fresh** concentrated hydrochloric acid is used in the second stage of the flame test.

(1)

(iv) State why **hydrochloric acid** is used in the second stage of the flame test.

(1)

(c) Explain, with reference to electron transitions, the formation of the colour in a flame test.

(3)

(Total for Question 2 = 10 marks)

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3 This question is about a titration experiment carried out by a group of students to determine the concentration of a solution of ethanoic acid using sodium hydroxide.

- (a) A student weighed about 4.00 g of sodium hydroxide pellets and added them to a beaker containing 50 cm³ of deionised water.

The mixture was stirred with a glass rod to dissolve the pellets and to give a homogenous solution.

The solution was poured through a funnel into a 250.0 cm³ volumetric flask and deionised water was added up to the mark and then the flask was shaken.

- (i) Describe how you would ensure that all the sodium hydroxide was transferred to the volumetric flask.

(2)

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- (ii) A student adds deionised water above the mark and shakes the flask.

State why the procedure has to be restarted rather than using a teat pipette to remove the excess water.

(1)

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(b) Two students each cleaned a burette, then poured sodium hydroxide solution into their burettes.

(i) Student 1 used a funnel to pour sodium hydroxide solution into the burette.

Give **two** steps needed before the student takes the initial burette reading.

(2)

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(ii) Student 2 cleaned the burette by rinsing it with deionised water immediately before filling it with the sodium hydroxide solution.

Give the effect, if any, on the value of the first titre. Justify your answer.

(1)

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(ii) Complete the table, with a tick (✓) or a cross (✗), to show whether or not the indicator would be suitable for use in this titration.

(1)

Indicator	pH range	Tick or Cross
Bromocresol purple	5.2 - 6.8	
Thymol blue	8.0 - 9.6	
Thymolphthalein	8.3 - 10.6	
Alizarin yellow R	10.1 - 13.0	

(d) Each student used a pipette to measure 25.0 cm³ of the ethanoic acid solution into four separate conical flasks and added an indicator.

The results of one student's titrations are shown in the table.

Titration number	1	2	3	4
Final burette reading / cm ³	13.00	25.50	37.90	50.00
Initial burette reading / cm ³	0.25	13.00	25.50	37.90
Titre / cm ³				
Concordant titres (✓)				

(i) Complete the table.

(1)

(ii) The low titre for titration **4** was queried by the teacher. The student had wanted to refill the burette and continue the titration but had been told the measurement uncertainty would increase if this was done.

Calculate the total percentage measurement uncertainty if the burette had been refilled to 0.00, and then a further 0.30 cm³ had been added from the burette, to the conical flask.

The measurement uncertainty for each burette reading is ± 0.05 cm³.

(1)

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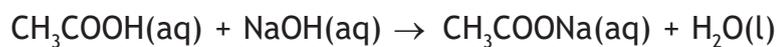
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(e) The teacher carried out the experiment and obtained the following results.

Mass of sodium hydroxide used to make 250.0 cm³ solution = 3.80 g

Volume of ethanoic acid solution = 25.00 cm³

Mean titre of sodium hydroxide = 11.90 cm³



Calculate the concentration of the ethanoic acid solution in **g dm⁻³**.
Give your answer to an appropriate number of significant figures.

(5)

(Total for Question 3 = 18 marks)



- 4 Hess's law can be used to determine enthalpy changes for reactions which cannot be obtained directly.

An example is the reaction of anhydrous copper(II) sulfate with water to form hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

The following outline procedure was carried out.

- Step 1 42.75 g of deionised water was weighed out in a polystyrene cup and the temperature measured.
- Step 2 0.0250 mol of hydrated copper(II) sulfate was added to the water in the polystyrene cup with stirring, making a total of 45.00 g of water.
- Step 3 The temperature change was recorded.
- Step 4 Steps 1 to 3 were repeated using 45.00 g of deionised water and 0.0250 mol of anhydrous copper(II) sulfate.

(a) Calculate the mass of 0.0250 mol of hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

(2)

(b) The reaction of hydrated copper(II) sulfate with water is shown.



Calculate the temperature change that would have given this enthalpy change for the stated experimental procedure.

Give your answer to a measurable number of significant figures and state whether the temperature increases or decreases.

[Specific heat capacity of the solution = $4.18 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$]

(3)



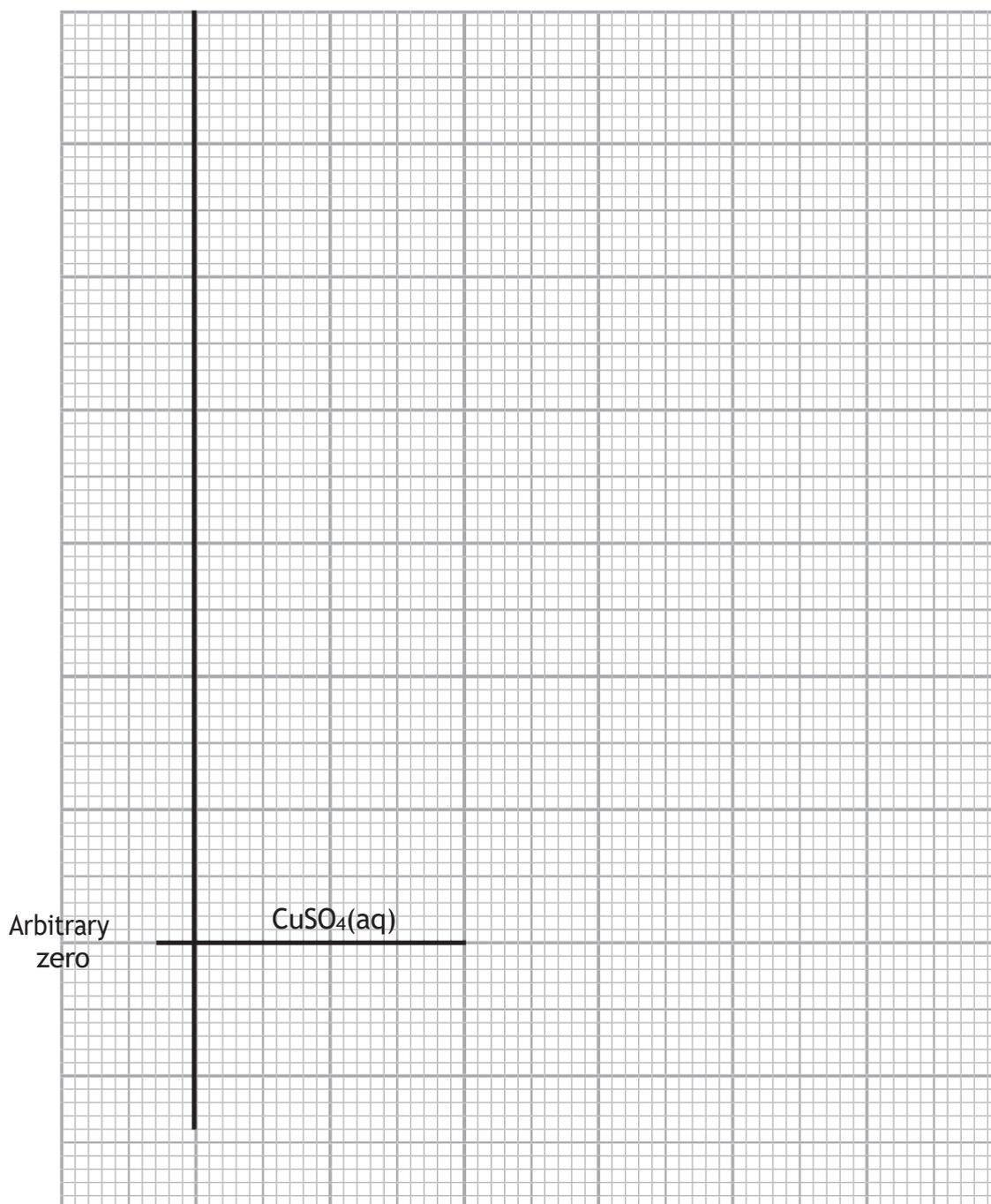
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(c) The reaction of anhydrous copper(II) sulfate with water is shown.

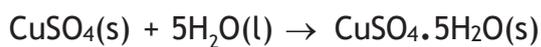


- (i) Draw to scale, on the graph paper, a labelled enthalpy level diagram which shows the enthalpy changes for the reactions of water with hydrated copper(II) sulfate (ΔH_1) and anhydrous copper(II) sulfate (ΔH_2).

(3)



- (ii) Use your enthalpy level diagram in (c)(i) to determine the enthalpy change, $\Delta_r H$, for the reaction



You **must** show your working on the diagram.

(1)

$\Delta_r H$

- (d) State why the enthalpy change for the reaction of one mole of anhydrous copper(II) sulfate with five moles of water to form hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, cannot be measured directly.

(1)

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(Total for Question 4 = 10 marks)

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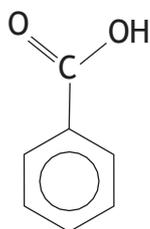
- 5 This question is about extracting benzoic acid from a mixture of benzoic acid, C_6H_5COOH , and phenol, C_6H_5OH .

The following steps were carried out.

- Step 1 A suitable mass of the mixture was placed in a separating funnel and some ether added. The funnel was shaken to dissolve the mixture.
- Step 2 Aqueous sodium hydrogencarbonate was added to the separating funnel, and the contents shaken.
- Step 3 Once the reaction was complete, the two layers were allowed to separate.
- Step 4 The lower aqueous layer was removed and placed in a beaker.
- Step 5 The ether layer in the separating funnel was washed with deionised water and the washings added to the beaker.
- Step 6 Hydrochloric acid was added to the aqueous solution in the beaker to precipitate the benzoic acid.
- Step 7 The impure benzoic acid was filtered under reduced pressure.
- Step 8 The impure benzoic acid was purified by recrystallisation.
- Step 9 The melting temperature of the purified benzoic acid was measured and compared with the literature value of $122^\circ C$.

- (a) Complete the equation for the reaction between benzoic acid and sodium hydrogencarbonate.

(2)



- (b) In Step 2 there is a pressure build-up in the separating funnel.

Describe how you would lower the pressure.

(1)

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(c) State why, in Step **4**, the aqueous layer was the lower of the two layers. (1)

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(d) Give a reason why, in Step **5**, the ether layer was washed with deionised water. (1)

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(e) Explain why the addition of hydrochloric acid in Step **6** results in the precipitation of benzoic acid. (2)

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(f) Draw a diagram of the apparatus used in Step **7** to filter under reduced pressure. (2)

Turn over

- (g) Benzoic acid can be purified in Step **8** because of its high solubility in hot water and low solubility in cold water.

Calculate the maximum number of benzoic acid molecules that can dissolve in 50.0 cm^3 of cold water if the solubility is $1.70\text{ g per }1000\text{ cm}^3$.

(3)

- (h) The melting temperature range of the purified benzoic acid in Step **9** was $116\text{-}121\text{ }^\circ\text{C}$.

Compare this result with the literature value, giving a reason for any differences.

(2)

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(Total for Question 5 = 14 marks)

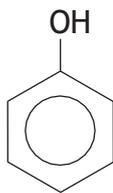


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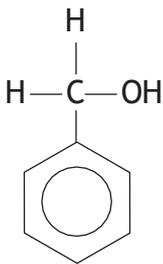
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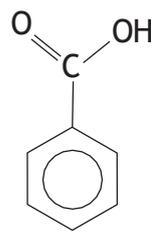
6 This is a question about the analysis of three aromatic substances with -OH groups.



phenol



phenylmethanol



benzoic acid

- (a) Write the equation for the **complete** combustion of phenol.
State symbols are not required.

(2)

- (b) When burned in air, these aromatic compounds undergo **incomplete** combustion.

- (i) Calculate the percentage composition by mass of carbon in both phenylmethanol and benzoic acid.

(3)



Turn over

(ii) Give the expected observation when these aromatic compounds undergo incomplete combustion. (1)

(iii) Identify another **type** of organic compound which will also produce the same observation as in (b)(ii). (1)

(iv) These combustion experiments must be carried out in a fume cupboard.



Explain why the front window of the fume cupboard must be below the safety line even with the exhaust fan switched on. (2)

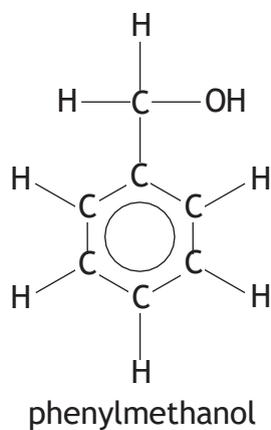
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- (ii) Predict the number of peaks present, and their chemical shifts, in the ^{13}C nuclear magnetic resonance (NMR) spectrum of phenylmethanol. Use the information in the Data Booklet to help you.

(3)



- (iii) Give the formula of a fragment ion, with its m/z value, that you would expect to be present in the mass spectrum of benzoic acid but **not** in the mass spectrum of phenol or the mass spectrum of phenylmethanol.

(2)

(Total for Question 6 = 19 marks)



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(Total for Question 7 = 6 marks)



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8 This is a question about chromium(III) and chromium(VI) compounds.

(a) Describe the observations when aqueous sodium hydroxide is added drop by drop until in excess to a solution of chromium(III) ions.

(2)

(b) The chromium(III) complex, $[\text{Cr}(\text{OH})_6]^{3-}$, can be oxidised to chromate(VI) ions, CrO_4^{2-} , by hydrogen peroxide solution.

(i) Deduce the oxidation half-equation for this reaction, which takes place in alkaline conditions. State symbols are not required.

(2)

(ii) If the solution of chromate(VI) ions is then acidified, the colour of the solution changes to orange as dichromate(VI) ions form.

Write the equation for this change. State symbols are not required.

(1)

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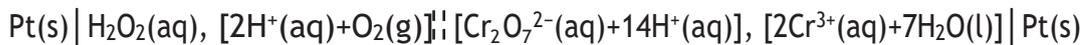
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- (iii) In acidic conditions, dichromate(VI) ions can also be reduced to chromium(III) ions using hydrogen peroxide.

The value of $E^{\ominus}_{\text{cell}} = + 0.65\text{V}$ for which the cell diagram is



Deduce from the cell diagram the oxidation and the reduction half-equations, and thus the overall equation for this reaction.

State symbols are not required.

(3)

- (c) Draw a labelled diagram of the apparatus that you would use to measure the standard emf of a cell with a zinc-zinc(II) electrode system and a chromium(III)-dichromate(VI) electrode system.

Include the **formulae** of all the compounds required and the concentrations of the solutions.

(7)

(Total for Question 8 = 15 marks)



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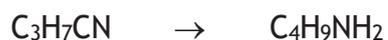
9 This question is about amines.

(a) Phenylamine is an aromatic amine and butylamine is an aliphatic amine.

Phenylamine can be prepared from nitrobenzene.



Butylamine can be prepared from butanenitrile.



Compare and contrast these two preparations of amines.

(3)

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(b) Compare and contrast the basicity of phenylamine and butylamine.

(3)

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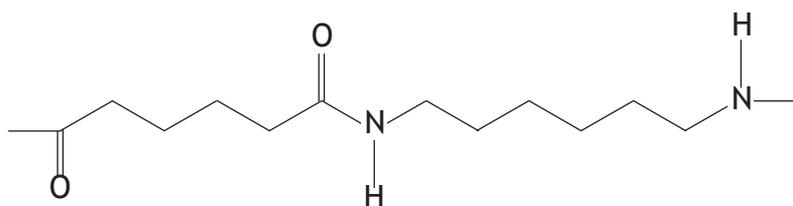
- (c) Write the equation for the reaction between propanoyl chloride and pentylamine. Include the name of the amide formed.

State symbols are not required.

(2)

Name of amide

- (d) A section of a polyamide is shown.



Identify, by name or formula, the amine monomer that reacts to form this polyamide.

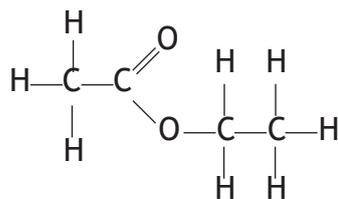
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(Total for Question 9 = 9 marks)

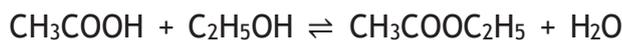




10 Ethyl ethanoate is an ester.

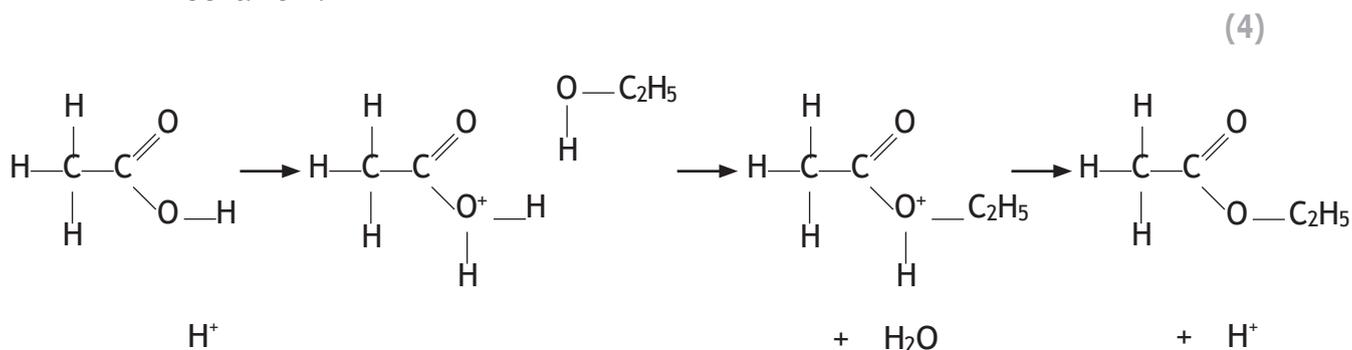


- (a) One method for the formation of ethyl ethanoate is the reaction between ethanol and ethanoic acid, which is catalysed by hydrogen ions.



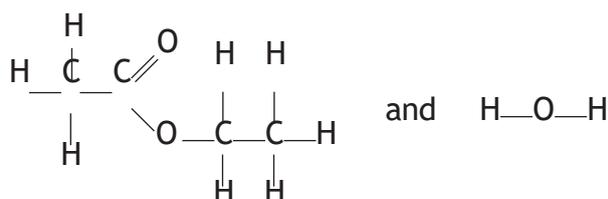
An incomplete simplified mechanism for this reaction is shown.

- (i) Add curly arrows and relevant lone pairs of electrons to complete the mechanism.



- (ii) In an experiment, the oxygen atom in ethanol is replaced by the oxygen-18 isotope, ^{18}O .

The products of the esterification are



Label the ^{18}O oxygen atom in one of the products.
Justify your answer.

(2)

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- (iii) Calculate the standard molar entropy of ethyl ethanoate using your knowledge of Gibbs free energy, ΔG , and the data in the table.

Include sign and units in your answer.

Use $\Delta G = -RT \ln K$ and other appropriate equations.

Quantity	Value
Gas constant, R	$8.31 \text{ J mol}^{-1} \text{ K}^{-1}$
Temperature, T	298 K
Equilibrium constant of esterification reaction, K	4.0
Enthalpy change of esterification reaction, ΔH	-6.0 kJ mol^{-1}
Standard molar entropy of ethanoic acid, S^\ominus	$159.8 \text{ J K}^{-1} \text{ mol}^{-1}$
Standard molar entropy of ethanol, S^\ominus	$160.7 \text{ J K}^{-1} \text{ mol}^{-1}$
Standard molar entropy of water, S^\ominus	$69.9 \text{ J K}^{-1} \text{ mol}^{-1}$

(6)

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(b) Ethyl ethanoate can also be formed by reacting ethanol with ethanoyl chloride, CH_3COCl .

Identify **three** differences in the esterification reaction when ethanoyl chloride is used instead of ethanoic acid.

(3)

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(Total for Question 10 = 15 marks)

TOTAL FOR PAPER = 120 MARKS

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The Periodic Table of Elements

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radium	227.0 Ac* actinium	261.0 Rf rutherfordium	266.0 Sg seaborgium	268.0 Bh bohrium	271.0 Hs hassium	277.0 Mt meitnerium	277.0 Ds darmstadtium	285.0 Rg roentgenium	287.0 Uu unbinilium	289.0 Uub unbibium	291.0 Uuq unquadium	293.0 Uuq unquadium	295.0 Uub unbibium	297.0 Uuq unquadium	299.0 Uuq unquadium	301.0 Uuq unquadium	303.0 Uuq unquadium	305.0 Uuq unquadium	307.0 Uuq unquadium	309.0 Uuq unquadium	311.0 Uuq unquadium	313.0 Uuq unquadium	315.0 Uuq unquadium	317.0 Uuq unquadium	319.0 Uuq unquadium	321.0 Uuq unquadium	323.0 Uuq unquadium	325.0 Uuq unquadium	327.0 Uuq unquadium	329.0 Uuq unquadium	331.0 Uuq unquadium	333.0 Uuq unquadium	335.0 Uuq unquadium	337.0 Uuq unquadium	339.0 Uuq unquadium	341.0 Uuq unquadium	343.0 Uuq unquadium	345.0 Uuq unquadium	347.0 Uuq unquadium	349.0 Uuq unquadium	351.0 Uuq unquadium	353.0 Uuq unquadium	355.0 Uuq unquadium	357.0 Uuq unquadium	359.0 Uuq unquadium	361.0 Uuq unquadium	363.0 Uuq unquadium	365.0 Uuq unquadium	367.0 Uuq unquadium	369.0 Uuq unquadium	371.0 Uuq unquadium	373.0 Uuq unquadium	375.0 Uuq unquadium	377.0 Uuq unquadium	379.0 Uuq unquadium	381.0 Uuq unquadium	383.0 Uuq unquadium	385.0 Uuq unquadium	387.0 Uuq unquadium	389.0 Uuq unquadium	391.0 Uuq unquadium	393.0 Uuq unquadium	395.0 Uuq unquadium	397.0 Uuq unquadium	399.0 Uuq unquadium	401.0 Uuq unquadium	403.0 Uuq unquadium	405.0 Uuq unquadium	407.0 Uuq unquadium	409.0 Uuq unquadium	411.0 Uuq unquadium	413.0 Uuq unquadium	415.0 Uuq unquadium	417.0 Uuq unquadium	419.0 Uuq unquadium	421.0 Uuq unquadium	423.0 Uuq unquadium	425.0 Uuq unquadium	427.0 Uuq unquadium	429.0 Uuq unquadium	431.0 Uuq unquadium	433.0 Uuq unquadium	435.0 Uuq unquadium	437.0 Uuq unquadium	439.0 Uuq unquadium	441.0 Uuq unquadium	443.0 Uuq unquadium	445.0 Uuq unquadium	447.0 Uuq unquadium	449.0 Uuq unquadium	451.0 Uuq unquadium	453.0 Uuq unquadium	455.0 Uuq unquadium	457.0 Uuq unquadium	459.0 Uuq unquadium	461.0 Uuq unquadium	463.0 Uuq unquadium	465.0 Uuq unquadium	467.0 Uuq unquadium	469.0 Uuq unquadium	471.0 Uuq unquadium	473.0 Uuq unquadium	475.0 Uuq unquadium	477.0 Uuq unquadium	479.0 Uuq unquadium	481.0 Uuq unquadium	483.0 Uuq unquadium	485.0 Uuq unquadium	487.0 Uuq unquadium	489.0 Uuq unquadium	491.0 Uuq unquadium	493.0 Uuq unquadium	495.0 Uuq unquadium	497.0 Uuq unquadium	499.0 Uuq unquadium	501.0 Uuq unquadium	503.0 Uuq unquadium	505.0 Uuq unquadium	507.0 Uuq unquadium	509.0 Uuq unquadium	511.0 Uuq unquadium	513.0 Uuq unquadium	515.0 Uuq unquadium	517.0 Uuq unquadium	519.0 Uuq unquadium	521.0 Uuq unquadium	523.0 Uuq unquadium	525.0 Uuq unquadium	527.0 Uuq unquadium	529.0 Uuq unquadium	531.0 Uuq unquadium	533.0 Uuq unquadium	535.0 Uuq unquadium	537.0 Uuq unquadium	539.0 Uuq unquadium	541.0 Uuq unquadium	543.0 Uuq unquadium	545.0 Uuq unquadium	547.0 Uuq unquadium	549.0 Uuq unquadium	551.0 Uuq unquadium	553.0 Uuq unquadium	555.0 Uuq unquadium	557.0 Uuq unquadium	559.0 Uuq unquadium	561.0 Uuq unquadium	563.0 Uuq unquadium	565.0 Uuq unquadium	567.0 Uuq unquadium	569.0 Uuq unquadium	571.0 Uuq unquadium	573.0 Uuq unquadium	575.0 Uuq unquadium	577.0 Uuq unquadium	579.0 Uuq unquadium	581.0 Uuq unquadium	583.0 Uuq unquadium	585.0 Uuq unquadium	587.0 Uuq unquadium	589.0 Uuq unquadium	591.0 Uuq unquadium	593.0 Uuq unquadium	595.0 Uuq unquadium	597.0 Uuq unquadium	599.0 Uuq unquadium	601.0 Uuq unquadium	603.0 Uuq unquadium	605.0 Uuq unquadium	607.0 Uuq unquadium	609.0 Uuq unquadium	611.0 Uuq unquadium	613.0 Uuq unquadium	615.0 Uuq unquadium	617.0 Uuq unquadium	619.0 Uuq unquadium	621.0 Uuq unquadium	623.0 Uuq unquadium	625.0 Uuq unquadium	627.0 Uuq unquadium	629.0 Uuq unquadium	631.0 Uuq unquadium	633.0 Uuq unquadium	635.0 Uuq unquadium	637.0 Uuq unquadium	639.0 Uuq unquadium	641.0 Uuq unquadium	643.0 Uuq unquadium	645.0 Uuq unquadium	647.0 Uuq unquadium	649.0 Uuq unquadium	651.0 Uuq unquadium	653.0 Uuq unquadium	655.0 Uuq unquadium	657.0 Uuq unquadium	659.0 Uuq unquadium	661.0 Uuq unquadium	663.0 Uuq unquadium	665.0 Uuq unquadium	667.0 Uuq unquadium	669.0 Uuq unquadium	671.0 Uuq unquadium	673.0 Uuq unquadium	675.0 Uuq unquadium	677.0 Uuq unquadium	679.0 Uuq unquadium	681.0 Uuq unquadium	683.0 Uuq unquadium	685.0 Uuq unquadium	687.0 Uuq unquadium	689.0 Uuq unquadium	691.0 Uuq unquadium	693.0 Uuq unquadium	695.0 Uuq unquadium	697.0 Uuq unquadium	699.0 Uuq unquadium	701.0 Uuq unquadium	703.0 Uuq unquadium	705.0 Uuq unquadium	707.0 Uuq unquadium	709.0 Uuq unquadium	711.0 Uuq unquadium	713.0 Uuq unquadium	715.0 Uuq unquadium	717.0 Uuq unquadium	719.0 Uuq unquadium	721.0 Uuq unquadium	723.0 Uuq unquadium	725.0 Uuq unquadium	727.0 Uuq unquadium	729.0 Uuq unquadium	731.0 Uuq unquadium	733.0 Uuq unquadium	735.0 Uuq unquadium	737.0 Uuq unquadium	739.0 Uuq unquadium	741.0 Uuq unquadium	743.0 Uuq unquadium	745.0 Uuq unquadium	747.0 Uuq unquadium	749.0 Uuq unquadium	751.0 Uuq unquadium	753.0 Uuq unquadium	755.0 Uuq unquadium	757.0 Uuq unquadium	759.0 Uuq unquadium	761.0 Uuq unquadium	763.0 Uuq unquadium	765.0 Uuq unquadium	767.0 Uuq unquadium	769.0 Uuq unquadium	771.0 Uuq unquadium	773.0 Uuq unquadium	775.0 Uuq unquadium	777.0 Uuq unquadium	779.0 Uuq unquadium	781.0 Uuq unquadium	783.0 Uuq unquadium	785.0 Uuq unquadium	787.0 Uuq unquadium	789.0 Uuq unquadium	791.0 Uuq unquadium	793.0 Uuq unquadium	795.0 Uuq unquadium	797.0 Uuq unquadium	799.0 Uuq unquadium	801.0 Uuq unquadium	803.0 Uuq unquadium	805.0 Uuq unquadium	807.0 Uuq unquadium	809.0 Uuq unquadium	811.0 Uuq unquadium	813.0 Uuq unquadium	815.0 Uuq unquadium	817.0 Uuq unquadium	819.0 Uuq unquadium	821.0 Uuq unquadium	823.0 Uuq unquadium	825.0 Uuq unquadium	827.0 Uuq unquadium	829.0 Uuq unquadium	831.0 Uuq unquadium	833.0 Uuq unquadium	835.0 Uuq unquadium	837.0 Uuq unquadium	839.0 Uuq unquadium	841.0 Uuq unquadium	843.0 Uuq unquadium	845.0 Uuq unquadium	847.0 Uuq unquadium	849.0 Uuq unquadium	851.0 Uuq unquadium	853.0 Uuq unquadium	855.0 Uuq unquadium	857.0 Uuq unquadium	859.0 Uuq unquadium	861.0 Uuq unquadium	863.0 Uuq unquadium	865.0 Uuq unquadium	867.0 Uuq unquadium	869.0 Uuq unquadium	871.0 Uuq unquadium	873.0 Uuq unquadium	875.0 Uuq unquadium	877.0 Uuq unquadium	879.0 Uuq unquadium	881.0 Uuq unquadium	883.0 Uuq unquadium	885.0 Uuq unquadium	887.0 Uuq unquadium	889.0 Uuq unquadium	891.0 Uuq unquadium	893.0 Uuq unquadium	895.0 Uuq unquadium	897.0 Uuq unquadium	899.0 Uuq unquadium	901.0 Uuq unquadium	903.0 Uuq unquadium	905.0 Uuq unquadium	907.0 Uuq unquadium	909.0 Uuq unquadium	911.0 Uuq unquadium	913.0 Uuq unquadium	915.0 Uuq unquadium	917.0 Uuq unquadium	919.0 Uuq unquadium	921.0 Uuq unquadium	923.0 Uuq unquadium	925.0 Uuq unquadium	927.0 Uuq unquadium	929.0 Uuq unquadium	931.0 Uuq unquadium	933.0 Uuq unquadium	935.0 Uuq unquadium	937.0 Uuq unquadium	939.0 Uuq unquadium	941.0 Uuq unquadium	943.0 Uuq unquadium	945.0 Uuq unquadium	947.0 Uuq unquadium	949.0 Uuq unquadium	951.0 Uuq unquadium	953.0 Uuq unquadium	955.0 Uuq unquadium	957.0 Uuq unquadium	959.0 Uuq unquadium	961.0 Uuq unquadium	963.0 Uuq unquadium	965.0 Uuq unquadium	967.0 Uuq unquadium	969.0 Uuq unquadium	971.0 Uuq unquadium	973.0 Uuq unquadium	975.0 Uuq unquadium	977.0 Uuq unquadium	979.0 Uuq unquadium	981.0 Uuq unquadium	983.0 Uuq unquadium	985.0 Uuq unquadium	987.0 Uuq unquadium	989.0 Uuq unquadium	991.0 Uuq unquadium	993.0 Uuq unquadium	995.0 Uuq unquadium	997.0 Uuq unquadium	999.0 Uuq unquadium	1001.0 Uuq unquadium	1003.0 Uuq unquadium	1005.0 Uuq unquadium	1007.0 Uuq unquadium	1009.0 Uuq unquadium	1011.0 Uuq unquadium	1013.0 Uuq unquadium	1015.0 Uuq unquadium	1017.0 Uuq unquadium	1019.0 Uuq unquadium	1021.0 Uuq unquadium	1023.0 Uuq unquadium	1025.0 Uuq unquadium	1027.0 Uuq unquadium	1029.0 Uuq unquadium	1031.0 Uuq unquadium	1033.0 Uuq unquadium	1035.0 Uuq unquadium	1037.0 Uuq unquadium	1039.0 Uuq unquadium	1041.0 Uuq unquadium	1043.0 Uuq unquadium	1045.0 Uuq unquadium	1047.0 Uuq unquadium	1049.0 Uuq unquadium	1051.0 Uuq unquadium	1053.0 Uuq unquadium	1055.0 Uuq unquadium	1057.0 Uuq unquadium	1059.0 Uuq unquadium	1061.0 Uuq unquadium	1063.0 Uuq unquadium	1065.0 Uuq unquadium	1067.0 Uuq unquadium	1069.0 Uuq unquadium	1071.0 Uuq unquadium	1073.0 Uuq unquadium	1075.0 Uuq unquadium	1077.0 Uuq unquadium	1079.0 Uuq unquadium	1081.0 Uuq unquadium	1083.0 Uuq unquadium	1085.0 Uuq unquadium	1087.0 Uuq unquadium	1089.0 Uuq unquadium	1091.0 Uuq unquadium	1093.0 Uuq unquadium	1095.0 Uuq unquadium	1097.0 Uuq unquadium	1099.0 Uuq unquadium	1101.0 Uuq unquadium	1103.0 Uuq unquadium	1105.0 Uuq unquadium	1107.0 Uuq unquadium	1109.0 Uuq unquadium	1111.0 Uuq unquadium	1113.0 Uuq unquadium	1115.0 Uuq unquadium	1117.0 Uuq unquadium	1119.0 Uuq unquadium	1121.0 Uuq unquadium	1123.0 Uuq unquadium	1125.0 Uuq unquadium	1127.0 Uuq unquadium	1129.0 Uuq unquadium	1131.0 Uuq unquadium	1133.0 Uuq unquadium	1135.0 Uuq unquadium	1137.0 Uuq unquadium	1139.0 Uuq unquadium	1141.0 Uuq unquadium	1143.0 Uuq unquadium	1145.0 Uuq unquadium	1147.0 Uuq unquadium	1149.0 Uuq unquadium	1151.0 Uuq unquadium	1153.0 Uuq unquadium	1155.0 Uuq unquadium	1157.0 Uuq unquadium	1159.0 Uuq unquadium	1161.0 Uuq unquadium	1163.0 Uuq unquadium	1165.0 Uuq unquadium	1167.0 Uuq unquadium	1169.0 Uuq unquadium	1171.0 Uuq unquadium	1173.0 Uuq unquadium	1175.0 Uuq unquadium	1177.0 Uuq unquadium	1179.0 Uuq unquadium	1181.0 Uuq unquadium	1183.0 Uuq unquadium	1185.0 Uuq unquadium	1187.0 Uuq unquadium	1189.0 Uuq unquadium	1191.0 Uuq unquadium	1193.0 Uuq unquadium	1195.0 Uuq unquadium	1197.0 Uuq unquadium	1199.0 Uuq unquadium	1201.0 Uuq unquadium	1203.0 Uuq unquadium	1205.0 Uuq unquadium	1207.0 Uuq unquadium	1209.0 Uuq unquadium	1211.0 Uuq unquadium	1213.0 Uuq unquadium	1215.0 Uuq unquadium	1217.0 Uuq unquadium	1219.0 Uuq unquadium	1221.0 Uuq unquadium	1223.0 Uuq unquadium	1225.0 Uuq unquadium	1227.0 Uuq unquadium	1229.0 Uuq unquadium	1231.0 Uuq unquadium	1233.0 Uuq unquadium	1235.0 Uuq unquadium	1237.0 Uuq unquadium	1239.0 Uuq unquadium	1241.0 Uuq unquadium	1243.0 Uuq unquadium	1245.0 Uuq unquadium	1247.0 Uuq unquadium	1249.0 Uuq unquadium	1251.0 Uuq unquadium	1253.0 Uuq unquadium	1255.0 Uuq unquadium	1257.0 Uuq unquadium	1259.0 Uuq unquadium	1261.0 Uuq unquadium	1263.0 Uuq unquadium	1265.0 Uuq unquadium	1267.0 Uuq unquadium	1269.0 Uuq unquadium	1271.0 Uuq unquadium	1273.0 Uuq unquadium	1275.0 Uuq unquadium	1277.0 Uuq unquadium	1279.0 Uuq unquadium	1281.0 Uuq unquadium	1283.0 Uuq unquadium	1285.0 Uuq unquadium	1287.0 Uuq unquadium	1289.0 Uuq unquadium	1291.0 Uuq unquadium	1293.0 Uuq unquadium	1295.0 Uuq unquadium	1297.0 Uuq unquadium	1299.0 Uuq unquadium	1301.0 Uuq unquadium	1303.0 Uuq unquadium	1305.0 Uuq unquadium