

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Tuesday 22 October 2019

Morning (Time: 1 hour 20 minutes)

Paper Reference **WCH13/01**

Chemistry

International Advanced Subsidiary Level

Unit 3: Practical Skills in Chemistry I

Candidates must have: 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 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- There is a Periodic Table 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.

Turn over ►

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Answer ALL the questions.

Write your answers in the spaces provided.

1 A series of tests is carried out on a solid compound **A** and an aqueous solution **B**.

(a) Compound **A** contains one cation and one anion.

Complete the inferences.

(i) A flame test is carried out on **A**.

(1)

Observation	Inference
Yellow flame colour	The formula of the cation in A is

(ii) A small amount of solid **A** is placed in a test tube and heated strongly.
A glowing splint is held in the mouth of the test tube.

(2)

Observation	Inference
The glowing splint relights	The gas formed is The formula of the anion in A could be

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(b) A series of tests is carried out on aqueous solution **B**.

Complete the inferences.

(i) A piece of magnesium ribbon is added to 5 cm³ of **B** in a test tube.

A lighted splint is held over the mouth of the test tube.

(2)

Observation	Inference
Bubbles of gas are given off	The gas is
The gas burns with a squeaky pop The formula of the cation in B is

(ii) Silver nitrate solution acidified with dilute nitric acid is added to another 5 cm³ of **B** in a test tube.

(2)

Observation	Inference
White precipitate forms	The name or formula of the precipitate is
 The name or formula of solution B is

(Total for Question 1 = 7 marks)



2 Tests are carried out to identify three organic liquids, **C**, **D** and **E**.

(a) A spatula measure of phosphorus(V) chloride, PCl_5 , is added to each liquid in separate test tubes.

Any gas given off is tested with damp blue litmus paper.

Observation		
C	D	E
Misty fumes are given off	Misty fumes are given off	No change
Damp blue litmus paper turns red	Damp blue litmus paper turns red	

Identify, by name or formula, the misty fumes produced by liquids **C** and **D**.

(1)

(b) 2 cm^3 of aqueous sodium carbonate, $\text{Na}_2\text{CO}_3(\text{aq})$, is added to each liquid in separate test tubes.

Any gas given off is tested with limewater.

Observation		
C	D	E
Bubbles of a colourless gas are given off	No change	No change
Limewater turns cloudy		

Identify, by name or formula, the gas produced by liquid **C**.

(1)



(c) Each of the compounds **C**, **D** and **E** contains three carbon atoms and one functional group, which is on the end of the carbon chain.

(i) Using this information and the results from parts (a) and (b), deduce the structures of **C** and **D**.

(2)

Structure of C	Structure of D

(ii) The mass spectrum of **E** has a molecular ion peak at $m/z = 58$.

Using this information and the information in (c), deduce the structure of **E**.

(1)

Structure of E

(iii) Give a chemical test and its positive result to confirm the identity of the functional group in **E**.

(2)

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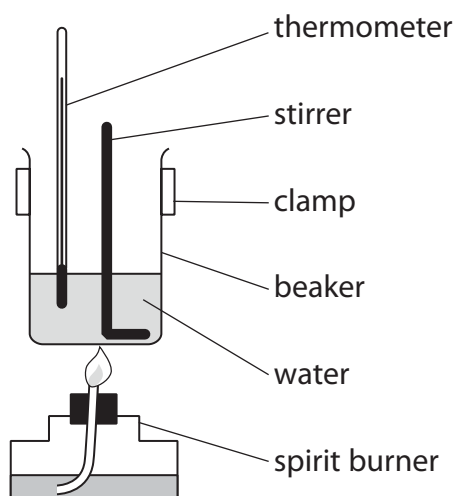
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- (d) The apparatus shown was used to find the enthalpy change of combustion of one of the liquids **C**, **D** or **E**.



- (i) List all the measurements you would make in carrying out this experiment. (3)

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- (ii) Give **two** ways, other than changing the measuring instruments or repeating the experiment, in which the accuracy of the results using this apparatus could be improved. (2)

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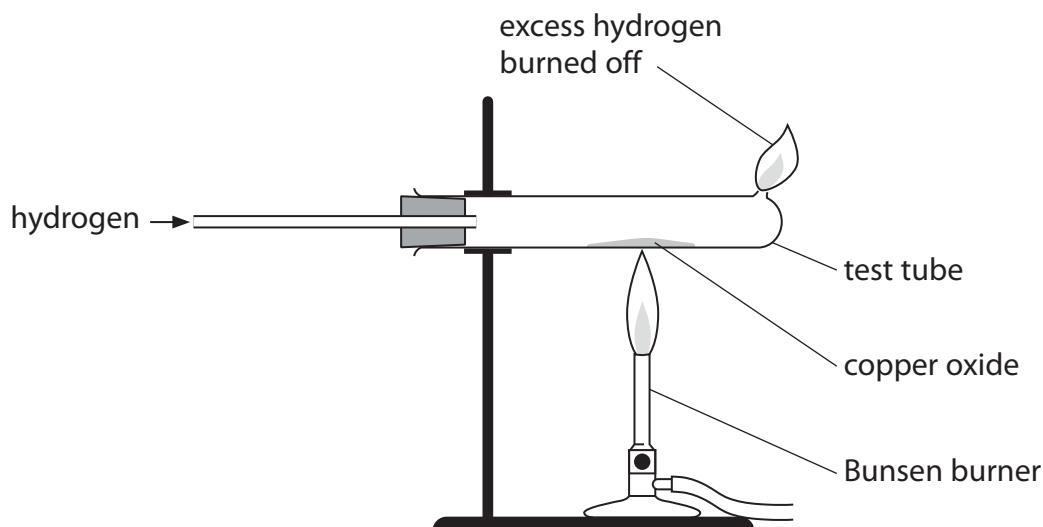
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(Total for Question 2 = 12 marks)



3 An experiment is carried out to determine the formula of an oxide of copper.

A sample of the copper oxide is reduced to copper by hydrogen gas using the apparatus shown.



Procedure

Step 1 Weigh the empty test tube.

Step 2 Place two spatula measures of copper oxide in the test tube and reweigh.

Step 3 Pass hydrogen into the test tube and, after a delay of a few seconds, light the gas at the hole at the end of the test tube.

Step 4 Start heating the copper oxide.

Step 5 After the copper oxide has been completely reduced, turn off the Bunsen burner, but continue to pass hydrogen over the product until it has cooled down.

Step 6 Weigh the test tube and copper.

(a) Give a reason why, in Step 3, there should be a delay of a few seconds before lighting the hydrogen at the end of the test tube.

(1)



(b) (i) Complete the table of results.

(1)

Measurement	Mass / g
Mass of test tube	40.27
Mass of test tube and copper oxide	43.42
Mass of test tube and copper	42.79
Mass of copper in copper oxide	
Mass of oxygen in copper oxide	

(ii) Use these results to calculate the formula of this copper oxide.

You must show your working.

[A_r values: Cu = 63.5 O = 16.0]

(3)



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(c) The experiment was repeated. However, in Step 5, both the Bunsen burner and the hydrogen supply were turned off while the apparatus cooled.

(i) State how the appearance of the solid in the test tube changes as the apparatus cools.

(1)

(ii) Explain how this change in the procedure affects the calculated formula of the copper oxide.

(2)

(Total for Question 3 = 8 marks)



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Results

Number of titration	1	2	3
Final burette reading / cm ³	12.20	24.10	11.75
Initial burette reading / cm ³	0.00	12.20	0.05
Volume of NaOH used / cm ³	12.20	11.90	11.70

(ii) Using appropriate titrations, calculate the mean titre in cm³. (1)

(iii) Calculate the number of moles of H₂X in the 250.0 cm³ of solution. (3)

(iv) Calculate the molar mass of H₂X, using your answer in (b)(iii) and the mass of H₂X given. Give your answer to an appropriate number of significant figures. (2)



(c) The maximum uncertainty **each** time a burette is read is $\pm 0.05 \text{ cm}^3$.

(i) Calculate the percentage uncertainty in measuring the 11.70 cm^3 of sodium hydroxide used in titration 3.

(1)

(ii) The percentage uncertainties in the three titrations are similar.

Suggest how the percentage uncertainty in a burette measurement could be reduced, without changing the apparatus.
Justify your answer.

(2)

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(Total for Question 4 = 14 marks)



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5 Limonene, an oil, can be extracted from oranges in four steps.

- (a) In Step 1, grated orange peel is added to some distilled water. The mixture is heated under reflux for about 10 minutes.

Draw a labelled diagram of the apparatus used to reflux the mixture.

(3)



(b) In Step 2 the mixture from Step 1 is distilled. The distillate contains a mixture of limonene and water.

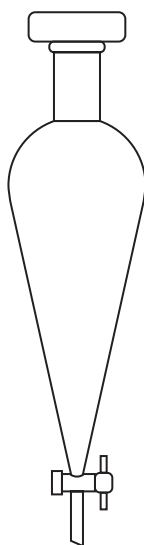
In Step 3 the limonene and water mixture from Step 2 is poured into a separating funnel and pentane is added.

Limonene is much more soluble in pentane than in water.

The density of pentane is 0.626 g cm^{-3}

(i) Complete the diagram of the separating funnel by drawing the aqueous and pentane layers and labelling them.

(1)



(ii) Describe how the separating funnel is used to obtain the pentane layer.

(2)

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(c) In Step 4 the pentane is allowed to evaporate in a fume cupboard, leaving limonene.

150 mg of limonene is produced from 23.0 g of orange peel.

Calculate the percentage of limonene, by mass, extracted from the orange peel.

(1)

(d) 0.001 mol of limonene decolourised 0.32 g of bromine, Br₂.

Explain what these results tell you about the structure of limonene.

[Use $M_r(\text{Br}_2) = 160$]

(2)

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER = 50 MARKS



