

GCSE

ADDITIONAL APPLIED SCIENCE A

AP4 Harnessing Chemicals

Specimen Paper

Candidates answer on the question paper:

Additional materials: ruler (cm/mm), calculator

H **A335/02**

45 mins

Candidate
Name

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Centre
Number

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Candidate
Number

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TIME 45 mins

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers on the dotted lines unless the question says otherwise.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- There is a space after most questions. Use it to do your working. In many questions marks will be given for a correct method even if the answer is incorrect.
- Do not write in the bar code. Do not write in the grey area between the pages.
- **DO NOT WRITE IN THE AREA OUTSIDE THE BOX BORDERING EACH PAGE. ANY WRITING IN THIS AREA WILL NOT BE MARKED.**

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **36**.

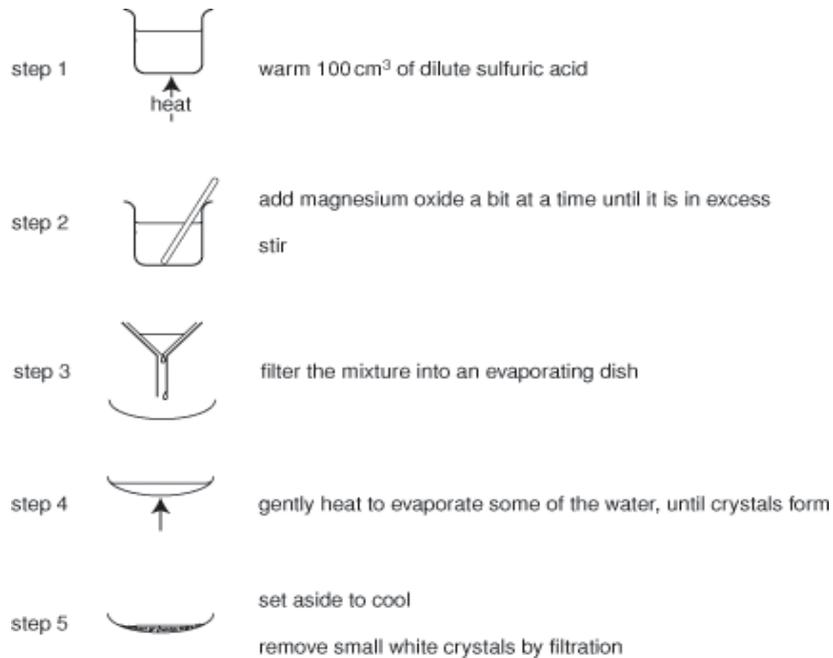
This specimen paper consists of 17 printed pages.

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Answer all questions.

1. Chris follows a standard procedure to make some magnesium sulphate.

The diagrams show the steps in the procedure.



- (a) How will Chris know when all of the sulfuric acid has reacted in **step 2**?

.....
[1]

- (b) The standard procedure says to warm the sulfuric acid in **step 1**.

Suggest why.

.....[1]

(c) Explain why **step 3** is necessary.

.....[1]

(d) Chris wants to make **large** crystals of magnesium sulphate.

Suggest how the standard procedure could be changed to do this.

.....
.....[1]

(e) Chris uses 100 cm^3 of sulfuric acid and 8g of magnesium oxide in the experiment.

A catalogue shows the following for the cost of these chemicals.

sulfuric acid £9.20 per litre

magnesium oxide £40.00 per kilogram
--

(i) What is the cost of the sulfuric acid that Chris uses?

You are advised to show how you work out your answer.

.....[2]

(ii) What is the cost of the magnesium oxide that Chris uses?

You are advised to show how you work out your answer.

.....[2]

(iii) The total cost of carrying out the experiment is greater than the cost of the chemicals used.

Suggest why.

.....
.....[1]

- (f) Chris looks in the catalogue to find out the selling price for the magnesium sulfate she has made.

She finds the following information.

magnesium sulfate technical £1.20 per kilogram
--

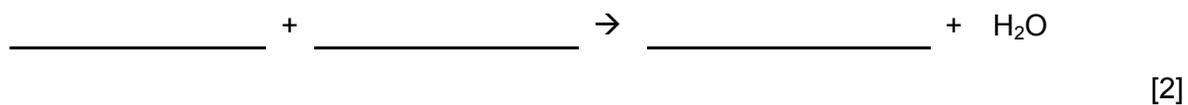
magnesium sulfate laboratory £3.60 per kilogram

magnesium sulfate analytical £22.60 per kilogram
--

Why are the prices different?

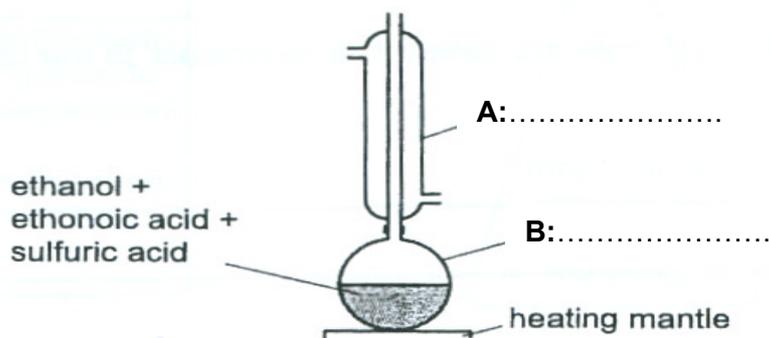
.....
.....[1]

- (g) Finish the symbol equation for the reaction that takes place.



[Total: 12]

2. Sam uses this apparatus to make a perfume.



- (a) Finish the diagram by writing in the names of the two pieces of apparatus **A** and **B**. [2]

- (b) The concentrated sulfuric acid is a catalyst.

Explain what is meant by the term **catalyst**.

.....
[2]

- (c) Ethanol is called a **non-aqueous** solvent.

Explain what this means.

.....[1]

- (d) The reaction produces ethyl ethanoate and water as the only products.

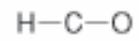
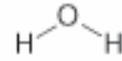
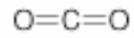
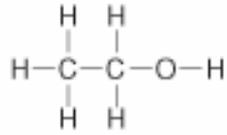
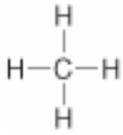
Write a word equation for the reaction that takes place.

.....[2]

(e) Ethanol is an alcohol.

Which one of the following shows the chemical formula for ethanol?

Put a **ring** around the correct answer.



[1]

[Total: 8]

3. The chemical industry manufactures some chemicals on a large scale.

Ethanol is one example.

(a) Name **one** other chemical made on a large scale.

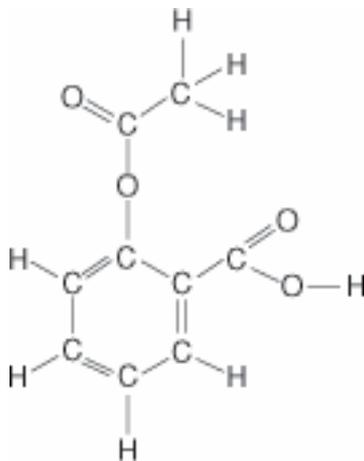
.....[1]

(b) What word is used to describe chemicals made on a **large scale**?

.....[1]

4. Aspirin is used for pain relief.

It has the structure shown below.



- (a) Put a **ring** around the carboxylic acid functional group in this structure. [1]

- (b) What is the relative formula mass of aspirin?

You are advised to show how you work out your answer.

(Relative atomic masses: H = 1, C = 12, O = 16)

[2]

(c) Aspirin can be made from a chemical called salicylic acid.

Salicylic acid has a relative formula mass of 138.

What is the maximum mass of aspirin that can be made from 500 grams of salicylic acid?

You are advised to show how you work out your answer.

[2]

(d) When aspirin is mixed with water it forms a suspension.

What is a **suspension**?

.....
.....[2]

(e) Aspirin can form part of various product formulations.

These formulations undergo rigorous testing.

Suggest **two** reasons why.

1.
2.[2]

[Total: 9]

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GCSE

ADDITIONAL APPLIED SCIENCE A

AP4 Harnessing Chemicals

Specimen Mark Scheme

Maximum mark for this paper is [36]

H

A335/02

45 mins

This specimen mark scheme consists of 3 printed pages.

Question Number	Answer	Max Mark
1(a)	the magnesium oxide stays as a white powder / a white powder remains / the solid is still there / /it doesn't dissolve accept 'the magnesium oxide stops reacting / dissolving'	[1]
1(b)	to speed up the reaction owtte / to increase solubility of magnesium oxide	[1]
1(c)	to remove unreacted magnesium oxide/white powder/any solids	[1]
1(d)	do not heat in step 4 / allow it to cool slowly	[1]
1(e)i	use the fact that 100 cm ³ is 1/10 of a litre; 0.1 x £9.20 = £0.92 / 92 p	[1] [1]
1(e)ii	use the fact that 8g is 8/1000 of a kilogram; 0.008 x £40.00 = £0.32 / 32p	[1] [1]
1(e)iii	cost of energy/heating / (possible) broken glassware / (possible) labour costs	[1]
1(f)	the purity/quality of each is different	[1]
1(g)	$MgO + H_2SO_4 \rightarrow MgSO_4 (+H_2O)$ all three correct =2, any two correct =1	[2]
Total marks		[12]
2(a)	A condenser; B flask	[1] [1]
2(b)	alters rate of reaction; allow 'speeds up' without being used up	[1] [1]
2(c)	does not contain water	[1]
2(d)	ethanol + ethanoic acid; → ethyl ethanoate + water	[1] [1]
2(e)	second formula circled	[1]
Total marks		[8]

<p>3(a)</p> <p>3(b)</p> <p>3(c)</p>	<p>ammonia / sulfuric acid / sodium hydroxide / phosphoric acid accept any correct answer</p> <p>bulk</p> <p>crude oil is non-renewable but sugar cane is; so in the long term we are not able to use crude oil as the raw material to make ethanol; continuous processes are more efficient / batch processes are less efficient; as you don't have to keep setting the process up / as you have to keep setting them up; crude oil route uses more energy; crude oil process gives pure alcohol which will be useful where purity is important/it doesn't need further purifying; sugar cane process gives impure alcohol which may be a disadvantage if purity is important/ produces a market of its own since the impurities give it a pleasant taste</p> <p>ANY five points</p> <p style="text-align: right;">Total marks</p>	<p>[1]</p> <p>[1]</p> <p>[5]</p> <p>[7]</p>
<p>4(a)</p> <p>4(b)</p> <p>4(c)</p> <p>4(d)</p> <p>4(e)</p>	<p>COOH circled</p> <p>$(9 \times 12) + (4 \times 16) + (8 \times 1) =$ 180</p> <p>evidence of using C=12, O=16 and H=1 scores the first mark</p> <p>138 g gives 180 g 500 g gives $\frac{500 \times 180}{138}$ (= 652 g)</p> <p>use ecf from part b i correct answer scores 2</p> <p>aspirin has not dissolved it is a solid; the solid particles are dispersed 'the solid disperses in water' scores 2</p> <p>quality assurance owtte; consumer protection; conformity to national/international standards</p> <p>any two</p> <p style="text-align: right;">Total marks Overall marks</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[2]</p> <p>[1]</p> <p>[1]</p> <p>[2]</p> <p>[9]</p> <p>[36]</p>