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**Thursday 26 January 2012 – Morning**

**GCSE TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A335/02** Harnessing Chemicals (Higher Tier)

Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**Duration:** 45 minutes

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

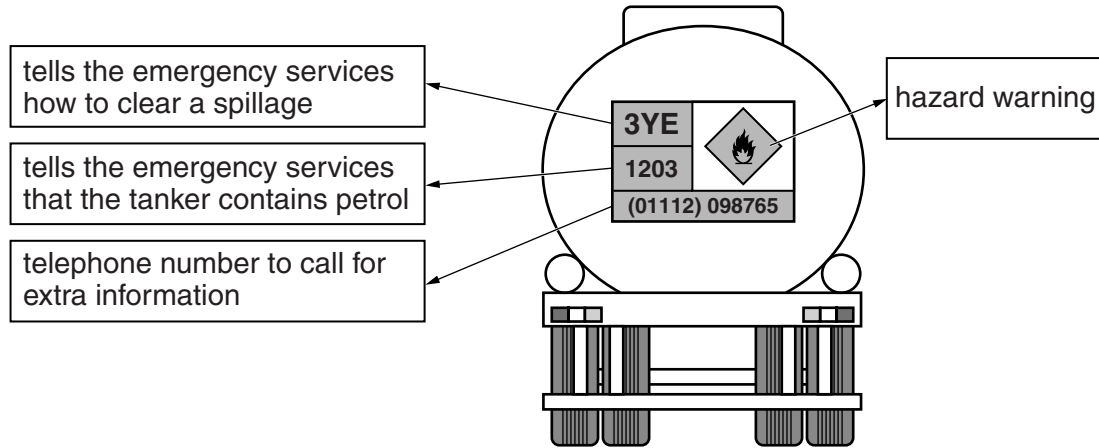
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**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 document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1 Lorries that carry chemicals show warning signs that tell the emergency services how to deal with the chemicals in an accident.



Some of the codes to show the emergency services how to clear a spillage are explained in the table below.

code	safety									put out fire with ...			
	P	R	S	T	W	X	Y	Z	E	1	2	3	4
use breathing apparatus and fire kit	X	X	✓	✓	X	X	✓	✓	evacuate people nearby	water jets	water spray	foam	dry powder
wear chemical suits	✓	✓	X	X	✓	✓	X	X	This tanker carries the code <b>3YE</b> .				
do <b>not</b> wash spill into drains	X	X	X	X	✓	✓	✓	✓					

- (a) Use the information from the table to describe what the emergency services should do if this tanker is involved in an accident.

.....

.....

..... [3]

(b) The Government has strict regulations about transporting chemicals.

Give **two** different reasons why these regulations are necessary.

reason 1 .....

.....

reason 2 .....

..... [2]

[Total: 5]

2 Noor has bought a box of 'LawnFix'.

This is a new product that helps the grass grow better in her garden.

LawnFix is a mixture of three substances, as shown in the table.

substance	formula	percentage in LawnFix
sand	SiO <sub>2</sub>	80%
iron(II) sulfate	FeSO <sub>4</sub>	6%
ammonium sulfate	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	14%

(a) The sand improves the soil. It is not soluble in water.

Ammonium sulfate and iron(II) sulfate help the grass to grow and kill off moss in the lawn. They are both soluble salts.

(i) How many **atoms** are shown in the formula of ammonium sulfate?

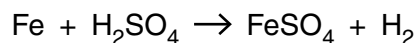
answer ..... [1]

(ii) How many different **elements** are present in a box of LawnFix?

answer ..... [1]

(b) Noor does an experiment to make some iron(II) sulfate.

She dissolves iron (Fe) in dilute sulfuric acid.



Noor uses an excess of iron in her experiment.

(i) Suggest why Noor uses an excess of iron in her experiment.

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

(ii) Describe how Noor removes the excess iron from the solution.

..... [1]

(iii) In Noor's experiment, 2.8 g of iron reacted with the acid.

The relative formula mass of each of the substances in the reaction is given below.

iron	sulfuric acid	iron(II) sulfate	water
56	98	152	18

Work out how many grams of pure iron(II) sulfate Noor should expect to make in her experiment.

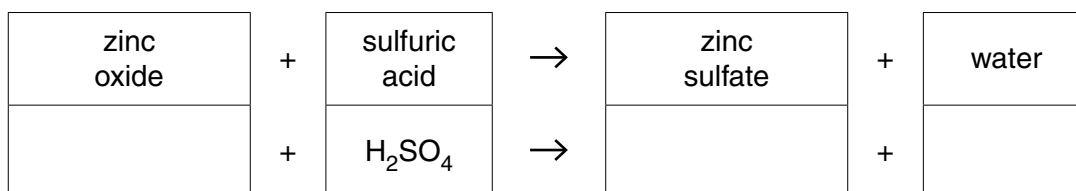
Show your working.

answer ..... g [2]

(c) Sulfuric acid can also be neutralised by other substances.

Complete the equation by putting the correct formula in each box.

One has been done for you.



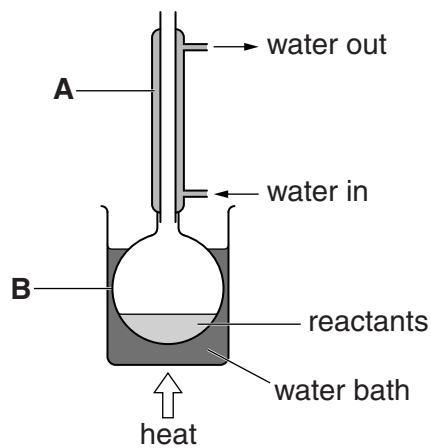
[2]

[Total: 8]

**3** Fruit flavourings often contain esters.

The reaction used to make an ester is very slow.

This apparatus can be used to make an ester.



**(a) (i)** Why is it necessary to heat the reaction in flask **B**?

..... [1]

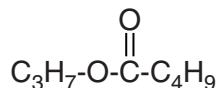
**(ii)** What is the purpose of the apparatus labelled **A** in the diagram?

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

(b) (i) Propyl pentanoate is an ester which is used in pineapple flavouring.

It is made from the reaction of an alcohol with a carboxylic acid.

A molecule of propyl pentanoate can be represented as below.



Which **two** compounds would be used to make propyl pentanoate? Choose from the list below.

Put ticks (✓) in the boxes next to the **two** correct compounds.

$\text{C}_3\text{H}_7\text{OH}$

$\text{C}_4\text{H}_9\text{OH}$

$\text{C}_3\text{H}_8$

$\text{C}_3\text{H}_7\text{COOH}$

$\text{C}_4\text{H}_9\text{COOH}$

$\text{C}_4\text{H}_{10}$

[2]

(ii) An inorganic acid is used as a catalyst in the reaction.

Write down the name of the catalyst which is used.

..... [1]

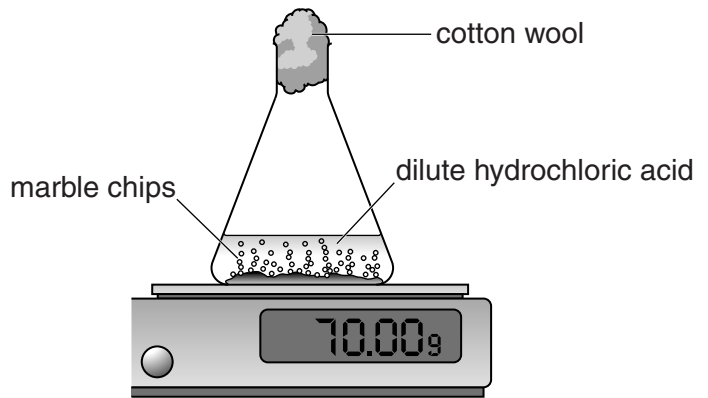
[Total: 6]

- 4 Andy is investigating the reaction between dilute hydrochloric acid and calcium carbonate (marble chips).

He uses 50 ml of the dilute acid and 5.00 g of marble chips.

When the reaction starts, fizzing can be seen as a gas is given off.

When the reaction stops, some marble chips can still be seen in the flask.



Andy measures the mass of the flask and its contents during the reaction.

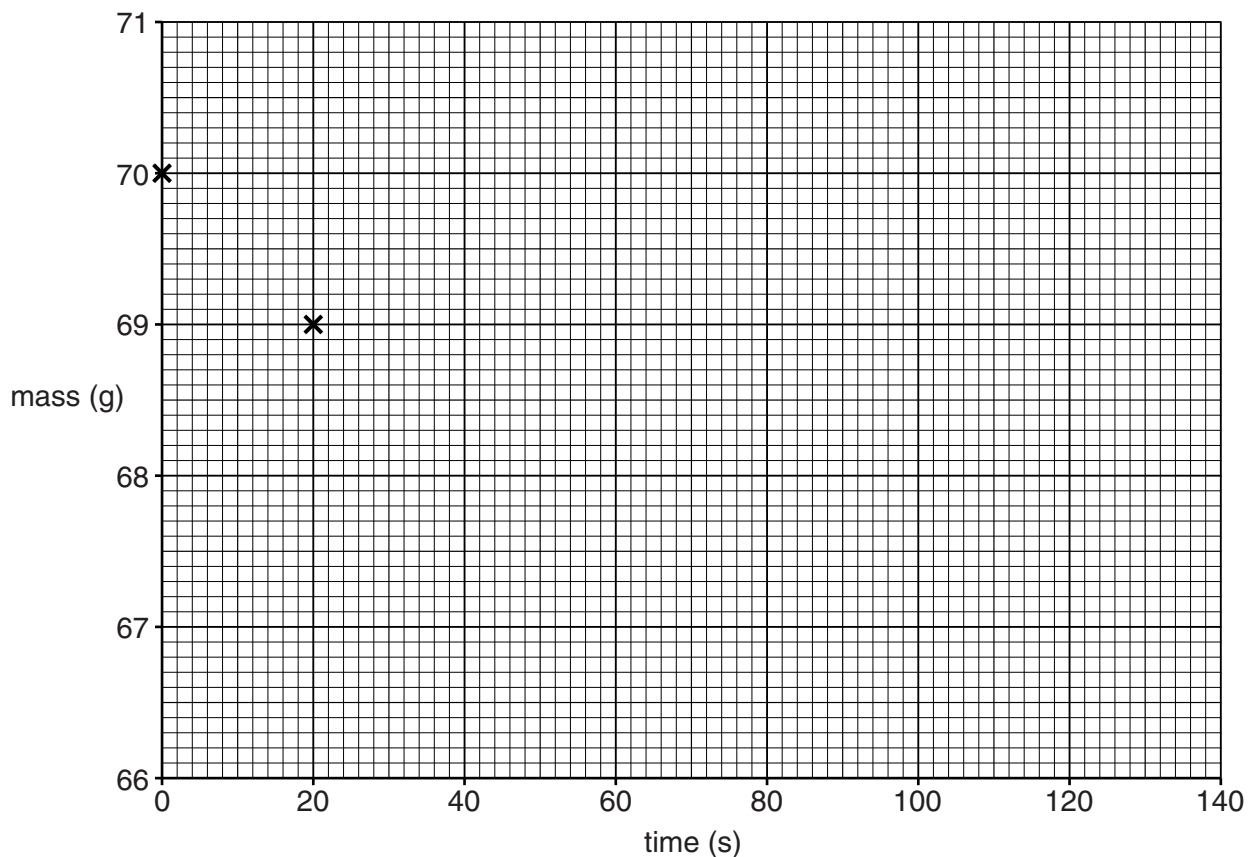
His results are shown in the table below.

<b>time (s)</b>	0	20	40	60	80	100	120
<b>mass (g)</b>	70.00	69.00	68.40	68.00	67.80	67.80	67.80

- (a) (i) Plot these results on this grid.

The first two points have been plotted for you.

[2]



- (ii) Draw the line of best fit.

[1]



(b) Why has the mass decreased during the experiment?  
..... [1]

(c) What is the purpose of the cotton wool in the neck of the flask?  
.....  
..... [1]

(d) Explain why the last three masses in the table are the same.  
.....  
.....  
.....  
..... [2]

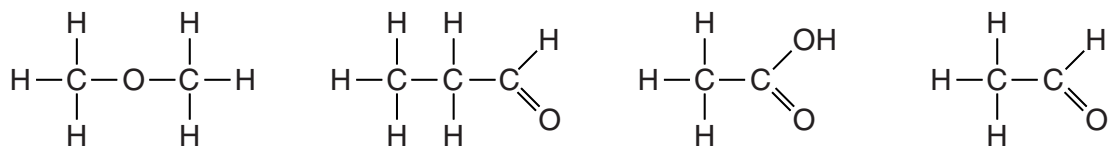
(e) Andy wants to investigate the effect of using powdered marble chips.  
He repeats the experiment with another 50 ml of the same dilute acid but using 5.00 g of **powdered** marble chips.  
He notices that the mass lost is exactly the same but it happens in a much shorter time.  
Why does the reaction take place more quickly than in the first experiment?  
.....  
..... [1]

(f) Andy repeats the experiment again with another 50 ml of the same dilute acid and 10.00 g of powdered chips.  
Explain why the mass lost is still exactly the same as in the first two experiments.  
.....  
.....  
.....  
..... [2]

[Total: 10]

5 The Cativa™ Process is used to manufacture ethanoic acid from methanol and carbon monoxide.

(a) Put a (ring) around the correct structure for ethanoic acid.



[1]

(b) A catalyst is used in the process.

The catalyst is a rare and expensive metal called iridium.

(i) What does a catalyst do in the reaction?

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

(ii) Explain how buying an expensive metal to use as a catalyst can save money in the long term.

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

- (iii) In the past, the metal rhodium was used as a catalyst.

<b>catalyst</b>	<b>cost of catalyst (dollars per gram)</b>	<b>yield</b>
iridium	25	94%
platinum	55	0%
rhodium	95	85%

Use the information in the table to suggest why iridium is now used as a catalyst instead of rhodium.

.....

..... [2]

[Total: 7]

**END OF QUESTION PAPER**

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