

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A335/02**

Harnessing Chemicals  
(Higher Tier)

**Friday 19 June 2009  
Morning**

**Duration: 45 minutes**

Candidates answer on the question paper  
A calculator may be used for this paper

**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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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**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.

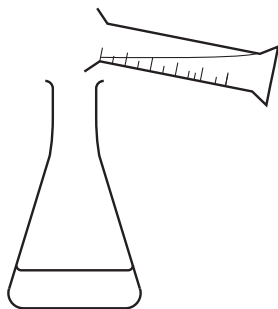
Answer **all** the questions.

- 1 Farmers add fertilisers to their soil to increase the size of their crop. Some fertilisers contain nitrogen in the form of the soluble salt, ammonium sulfate.

Ally follows a standard procedure to make ammonium sulfate.

The diagrams below show the steps in this procedure.

**step 1**



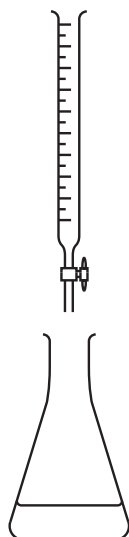
- add 25 cm<sup>3</sup> of ammonia solution to a conical flask

**step 2**



- fill the burette with sulfuric acid

**step 3**



- add the acid to the ammonia solution until the mixture is neutral

**step 4**



- pour the mixture into an evaporating dish
- evaporate until crystals start to form

- (a) Sulfuric acid is a solution.  
What piece of apparatus should Ally use in **step 2** when filling the burette to reduce the risk of spillage?

..... [1]

- (b) In **step 3** Ally needs to check that the mixture is neutral.

What should she do? .....

.....

What will she observe? .....

..... [2]

- (c) Ally wants to produce **large** crystals of ammonium sulfate.

What should she do in **step 4**? .....

.....

Why does this work? .....

..... [2]

- (d) Ammonium nitrate is another ammonium salt used in fertilisers.  
This is also used in disposable cold packs.



A chemical reaction begins when the pack is squeezed. This makes the pack feel cold.

What **type** of reaction is this?

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

**endothermic**

**exothermic**

**neutralisation**

**precipitation**

[1]

[Total: 6]

2 The chemical industry in Britain produces a wide range of products.

(a) Some of these products are bulk chemicals while others are fine chemicals.

(i) What is the **difference** between a bulk and a fine chemical?

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

(ii) Sulfuric acid is an example of a bulk chemical.

What is its formula? ..... [1]

(b) Complete the sentences about the production of chemicals using a **batch** process.

Choose words from this list.

**constant      equipment      labour      seasonal**

The demand for some chemicals is ..... and so the manufacturer chooses to use a batch process so that the equipment can be used to make other chemicals when the demand is low.

The ..... costs are high for a batch process. The cost of ..... is low in comparison to a continuous process. [3]

(c) One of the plastics made in Britain is poly(ethene),  $(C_2H_4)_n$ , where n represents any number.

How many atoms in total would a molecule of poly(ethene) contain if the value of n is 1000?

Please show your working.

total number of atoms = ..... [1]

(d) Many organic chemicals are produced by the chemical industry.

(i) The table shows some examples of types of organic compounds.

Draw a straight line from each **formula** to the **type of organic compound**.

formula	type of organic compound
$\text{CH}_3\text{CH}_2\text{OH}$	hydrocarbon
$\text{CH}_3\text{CH}_2\text{CH}_3$	carboxylic acid
$\text{CH}_3\text{COOH}$	alcohol

[3]

(ii) What term is used for the group of atoms that give an organic compound its chemical properties?

..... [1]

(e) The chemical industry aims to be as sustainable as it possibly can.

Suggest **two** ways it can do this.

.....

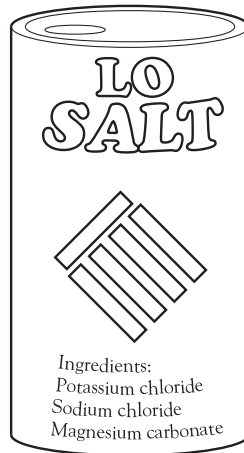
.....

.....

..... [2]

[Total: 13]

3 Low-sodium salt is an example of a complex formulation.



Kai wants to make a 100 g sample of low-sodium salt by mixing the three ingredients.

The school already has the sodium chloride and magnesium carbonate that he needs but has run out of potassium chloride.

Kai is given a catalogue from which to order more of the potassium chloride.

mass of potassium chloride in kg	cost in £		
	technical grade	laboratory grade	analytical grade
0.5	not available	9.36	15.30
5	not available	53.00	123.00
25	192.15	not available	not available

(a) Why is the cost of potassium chloride different for the three grades?

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

(b) Kai orders **0.5 kg** of the **laboratory grade** potassium chloride.

He mixes ...

... 66 g of potassium chloride

... 33 g of sodium chloride (cost of 28 p)

... 1 g of magnesium carbonate (cost of 4 p).

(i) Calculate the cost of 66 g of the potassium chloride used.  
Please show your working.

cost of potassium chloride = ..... [2]

(ii) Suggest a reason why it is cheaper for Kai to buy 100g of low-sodium salt than to make it himself?

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

(c) Low-sodium salt is an example of a solid mixture.

State two **other** examples of a solid mixture.

1 .....  
2 ..... [2]

[Total: 6]

## 4 Insoluble salts can be made by precipitation.

The table below shows the solubility of different salts.

soluble	insoluble
all sodium and potassium salts  most bromides, chlorides, iodides  all nitrates  most sulfates	most carbonates  lead and silver bromides, chlorides and iodides  barium sulfate, calcium sulfate and lead sulfate

(a) What does **precipitation** mean in the preparation of insoluble salts?

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

(b) Which of the following salts can be made by precipitation?

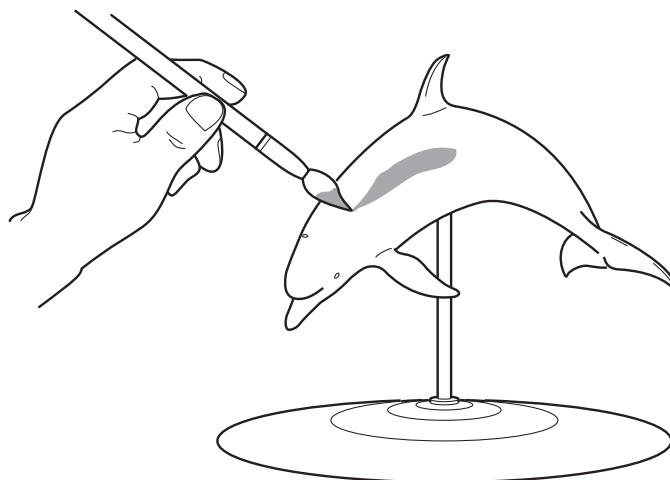
Put ticks (✓) in the boxes next to the **two** correct answers.

- sodium sulfate
- barium chloride
- calcium nitrate
- copper carbonate
- lead sulfate
- potassium carbonate

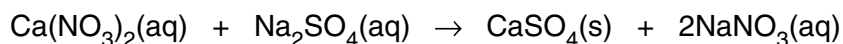
[2]



- (c) Calcium sulfate is an insoluble salt which can be used to make Plaster of Paris.



Matthew wants to make calcium sulfate,  $\text{CaSO}_4$ .  
He plans to make the calcium sulfate by mixing a solution of calcium nitrate,  $\text{Ca}(\text{NO}_3)_2$  with a solution of sodium sulfate,  $\text{Na}_2\text{SO}_4$ .



- (i) Solid calcium nitrate is an oxidising agent.  
Draw the hazard symbol for an oxidising agent in the box below.



[1]

- (ii) The relative formula mass of  $\text{CaSO}_4$  is 136.  
Calculate the relative formula mass of  $\text{Na}_2\text{SO}_4$ .  
(relative atomic masses: Ca = 40, Na = 23, O = 16, S = 32)  
Please show your working.

relative formula mass = ..... [1]

- (iii) Matthew dissolves 8.2 g of  $\text{Ca}(\text{NO}_3)_2$  in water. He adds this solution to an excess of  $\text{Na}_2\text{SO}_4$ .  
What mass of  $\text{CaSO}_4$  should be produced?  
(relative formula mass of  $\text{Ca}(\text{NO}_3)_2$  is 164)  
Please show your working.

mass = ..... [2]

(iv) Why is an excess of sodium sulfate used?

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

(v) Matthew filters the reaction mixture to separate the calcium sulfate from the sodium nitrate produced. He rinses the calcium sulfate with distilled water. Explain why he rinsed the calcium sulfate.

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

[Total: 11]

**END OF QUESTION PAPER**

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