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Centre Number						Candidate Number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A335/02

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

**Harnessing Chemicals
(Higher Tier)**

FRIDAY 19 JUNE 2009: Morning

DURATION: 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

**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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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.**

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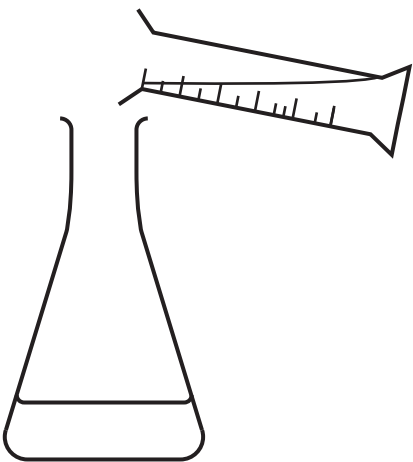
Answer ALL the questions.

- 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



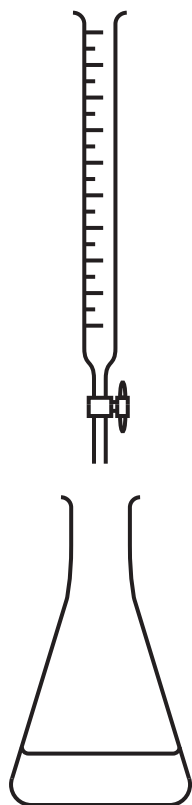
- add 25 cm³ of ammonia solution to a conical flask

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) Another ammonium salt used in fertilisers is ammonium nitrate.

This is also used in disposable cold packs.

When the pack is squeezed a chemical reaction begins which 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.

If the value of n is 1000, how many atoms in total would a molecule of poly(ethene) contain?

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.

<u>FORMULA</u>	<u>TYPE OF ORGANIC COMPOUND</u>
$\text{CH}_3\text{CH}_2\text{OH}$	hydrocarbon
$\text{CH}_3\text{CH}_2\text{CH}_3$	carboxylic acid
CH_3COOH	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 The ingredients of low-sodium salt are potassium chloride, sodium chloride and magnesium carbonate.

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.

<u>MASS OF POTASSIUM CHLORIDE IN KG</u>	<u>COST IN £</u>		
	<u>TECHNICAL GRADE</u>	<u>LABORATORY GRADE</u>	<u>ANALYTICAL GRADE</u>
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 100 g 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.

<u>SOLUBLE</u>	<u>INSOLUBLE</u>
all sodium and potassium salts	most carbonates
most bromides, chlorides, iodides	lead and silver bromides, chlorides and iodides
all nitrates	
most sulfates	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

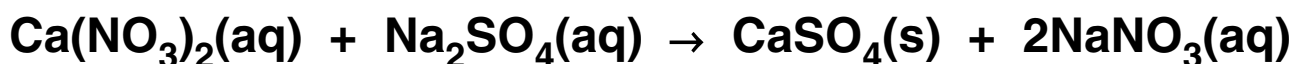
lead sulfate

potassium carbonate

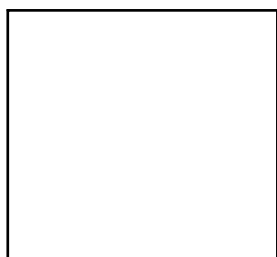
[2]

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

Matthew wants to make calcium sulfate, 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, Na_2SO_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 CaSO_4 is 136. Calculate the relative formula mass of Na_2SO_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 Na_2SO_4 . What mass of 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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