

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A
Harnessing Chemicals (Higher Tier)
FRIDAY 18 JANUARY 2008

Afternoon
Time: 45 minutes

Candidates answer on the question paper.

Additional materials (enclosed):

None

Calculators may be used.

Additional materials: Pencil
Ruler (cm/mm)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

Qu.	Max	Mark
1	10	
2	8	
3	10	
4	8	
TOTAL	36	

This document consists of **10** printed pages and **2** blank pages.

Answer **all** the questions.

- 1 Calcium carbonate is an insoluble chemical. It is used in indigestion tablets to neutralise excess stomach acid. This can be produced as a result of eating rich food or simply eating too quickly.



- (a) The exact composition of an indigestion tablet varies with each manufacturer.

This table shows all the ingredients of an indigestion tablet.

ingredient	amount (%)
antacid e.g. calcium carbonate (BP) and magnesium carbonate (BP)	55
sweetener e.g. sucrose and saccharin	40
binder, water repellent, flavour e.g. maize starch, magnesium stearate, peppermint	5

- (i) BP quality calcium carbonate is made by the reaction between two soluble salts.

One salt used is calcium chloride.

What is the name of the second soluble salt used?

Put a tick (✓) in the box next to the **one** correct answer.

potassium chloride

sodium chloride

sodium carbonate

potassium nitrate

[1]

- (ii) Limestone is mostly calcium carbonate.

Suggest why calcium carbonate is **not** extracted from limestone for use in indigestion tablets.

.....

 [2]

- (iii) BP quality calcium carbonate is a fine chemical.

Explain what is meant by the term **fine chemical**.

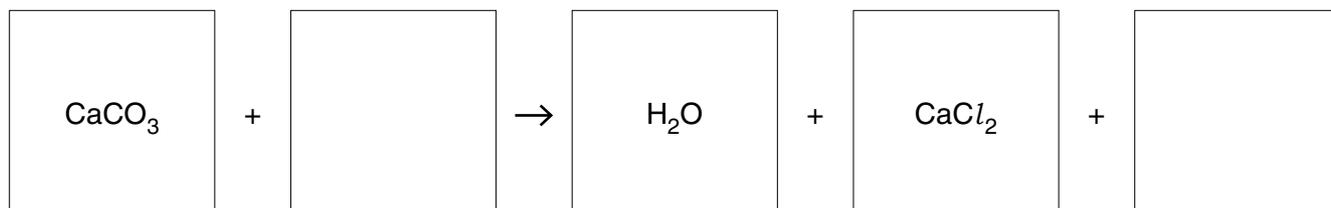
..... [1]

- (b) Calcium carbonate, CaCO_3 , reacts with hydrochloric acid in the stomach to produce calcium chloride, CaCl_2 , water, H_2O , and a gas.

- (i) Name the gas produced in this reaction.

..... [1]

- (ii) Finish the balanced symbol equation for this reaction.



[3]

- (c) Analytical scientists carry out quality assurance checks on the tablets.

The methods used should conform to international standards.

Suggest why this is important.

.....
 [1]

- (d) An indigestion tablet is an example of a useful mixture of solids.

Write down **one** other useful mixture that contains only solids.

..... [1]

[Total: 10]

- 2 It is important in the chemical industry that a reaction proceeds at a suitable rate – not so fast that it is out of control and not so slow that it is inefficient.

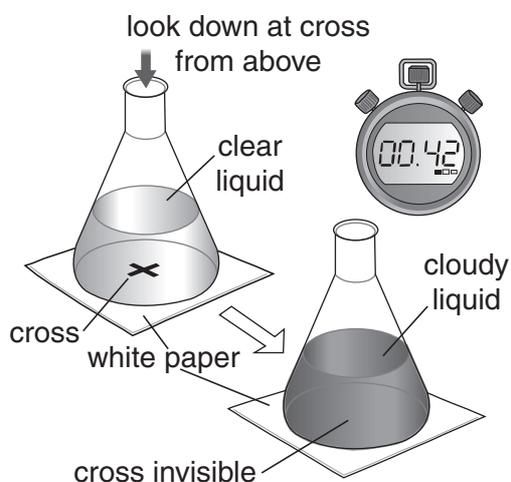
When a solution of sodium thiosulfate reacts with hydrochloric acid a precipitate of sulfur forms. The rate of this reaction can be found by measuring how quickly the mixture turns cloudy.

- (a) Amreet sets up five conical flasks each containing the same amount of sodium thiosulfate.

Each conical flask is warmed to a different temperature.

She adds 10 cm³ of hydrochloric acid to each conical flask.

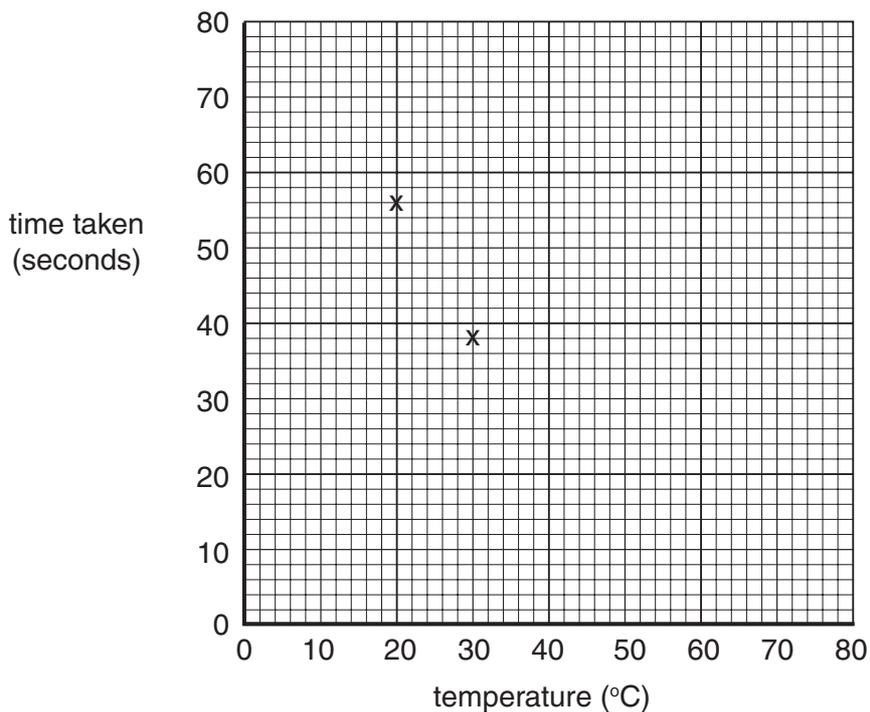
She records how long it takes before she can no longer see the cross on the white paper beneath the flask.



This table shows the time it took for the reaction between sodium thiosulfate and hydrochloric acid to take place at different temperatures.

temperature of reaction (°C)	time taken (seconds)
20	56
30	38
40	27
50	20
60	16
80	7

(i) Plot these results on this grid. The first two have been done for you.



[2]

(ii) Finish the graph by drawing the best line/curve through the points.

[1]

(iii) Use the graph to predict the time taken for the reaction at a temperature of 15°C.

Show on the graph how you found this value.

time = seconds [1]

(b) Explain why the **rate** of reaction increases as the temperature increases.

You should refer to particles in your answer.

.....

.....

.....

..... [3]

(c) Suggest **one** other way to change the rate of this reaction.

..... [1]

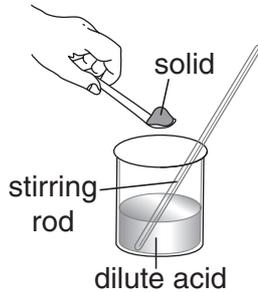
[Total: 8]

3 Alex follows a standard procedure to make copper sulfate.

Copper sulfate is a soluble chemical.

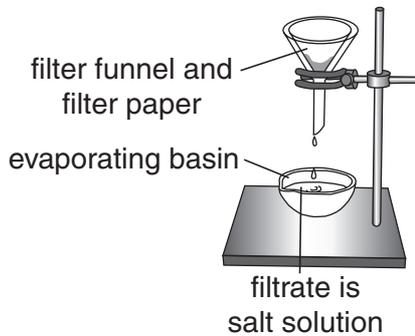
The diagrams below show the steps in the procedure.

step 1



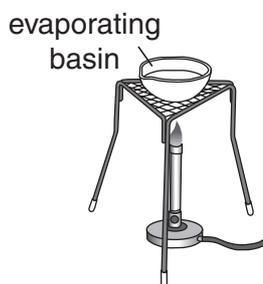
- gently warm 100cm^3 of sulfuric acid in a beaker
- add solid copper oxide to the warm acid
- stir well
- continue until no more dissolves in the acid

step 2



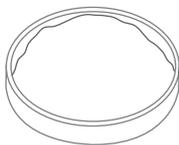
- filter the mixture using a filter funnel and filter paper

step 3



- gently heat the filtrate to evaporate some of the water to obtain a concentrated solution

step 4



- pour the concentrated solution into a labelled Petri dish
- leave to cool and crystallise

step 5



- weigh a labelled sample tube
- scrape the dry crystals into the sample tube
- reweigh the sample tube

- (a) Why is the sulfuric acid warmed in **step 1**?

..... [1]

- (b) Why is the mixture filtered in **step 2**?

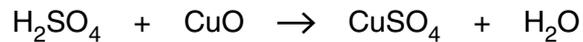
.....
 [1]

- (c) Alex wants to make larger crystals of copper sulfate.

How could the standard procedure be changed to do this?

..... [1]

- (d) The balanced symbol equation below shows the reaction between sulfuric acid and copper oxide to produce copper sulfate and water.



What is the maximum mass (theoretical yield) of copper sulfate, CuSO_4 , that can be made from 20g of copper oxide, CuO ?

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

(relative atomic mass: O = 16; S = 32; Cu = 64)

maximum mass = g [3]

- (e) A chemical company plans to make copper sulfate.

Write about the factors that the chemical company should think about when choosing to use the synthetic route (method).

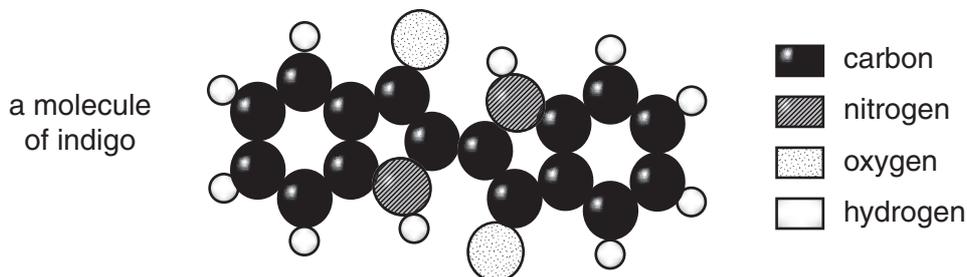
.....

 [4]

[Total: 10]

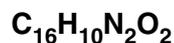
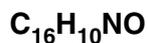
4 Indigo is a blue dye used to colour jeans.

The picture below shows a molecule of indigo.



(a) Select from the list below the chemical formula for indigo.

Put a (ring) around the correct answer.



[1]

(b) Indigo is an organic compound.

(i) Explain what is meant by the term **organic**.

.....
 [1]

(ii) Write down the name of **another** organic compound.

..... [1]

(iii) Indigo was originally obtained from plants such as woad. It is now more common to obtain indigo from non-living sources such as coal and crude oil.

The production of indigo from coal and crude oil is not sustainable.

Explain why it is **not sustainable**.

.....
 [1]

(c) (i) Indigo contains the functional group NH.

What is meant by the term **functional group**?

.....
 [2]

(ii) What is the formula of the functional group in an alcohol?

..... [1]

(d) Jeans are soaked in an aqueous solution of indigo dye to turn them blue.

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

..... [1]

[Total: 8]

END OF QUESTION PAPER

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