

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2006



SCIENCE: SINGLE AWARD B (CO-ORDINATED)
Paper 2
Higher Tier

3463/2H

H

Wednesday 14 June 2006 9.00 am to 9.45 am

For this paper you must have:

- a ruler
- the Data Sheet (enclosed)

You may use a calculator.

Time allowed: 45 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

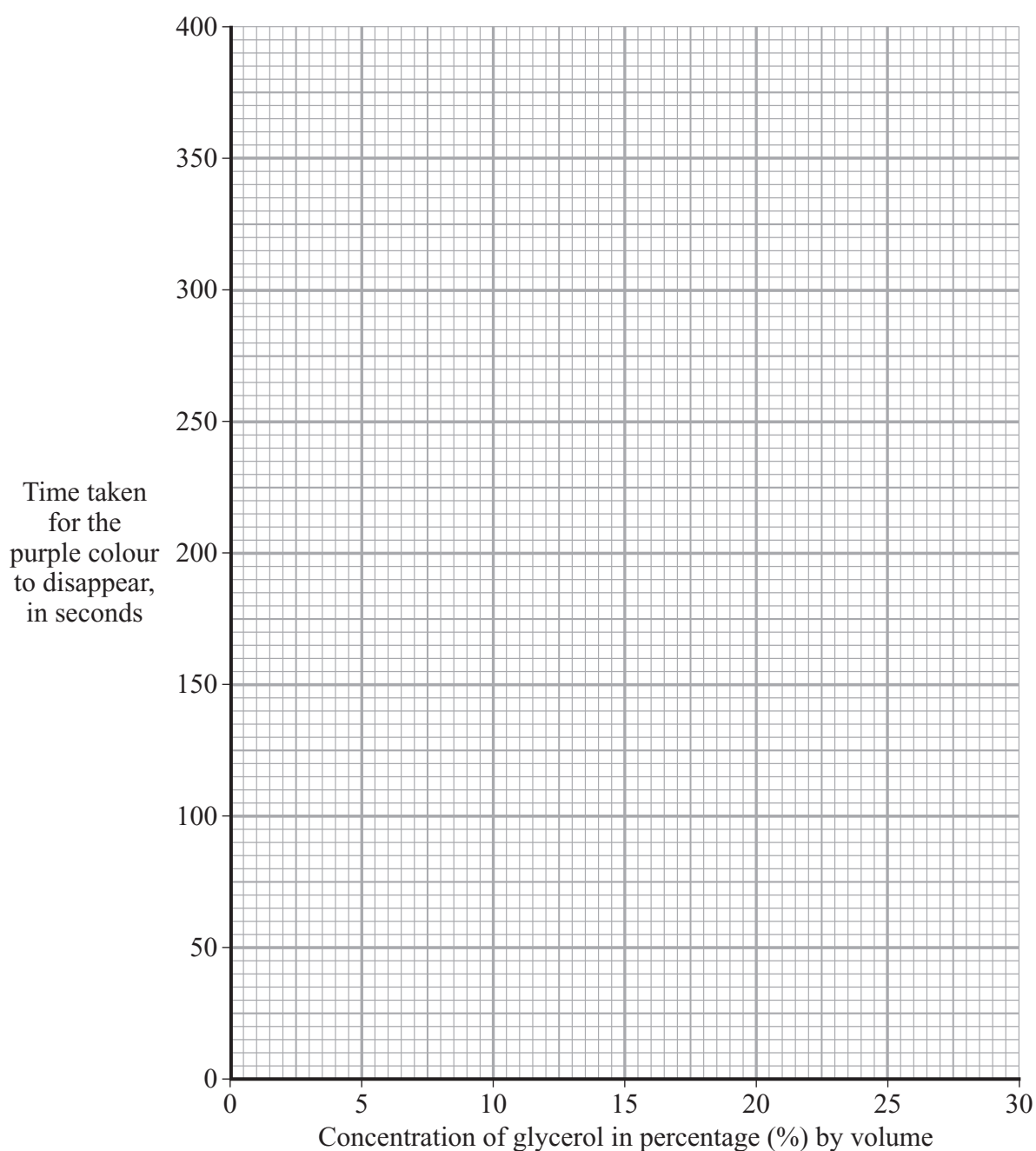
For Examiner's Use			
Number	Mark	Number	Mark
1		4	
2		5	
3		6	
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Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

- 1 Glycerol reacts with a purple solution to form colourless products. The time taken for the purple colour to disappear can be used to measure the rate of this reaction.

A student did some experiments to find out how the concentration of glycerol affects the rate of this reaction. The results are shown in the table.

Concentration of glycerol in percentage (%) by volume	4	10	16	24	30
Time taken for the purple colour to disappear, in seconds	375	150	94	63	50

- (a) Plot these points on the graph and draw a smooth curve through the points.



(3 marks)

(b) The time taken for the purple colour to disappear when the concentration of the glycerol is 10 % is 150 seconds.

(i) Use your graph to estimate the time it would take for the purple colour to disappear when the concentration of glycerol is 20 %.

Time = seconds
(1 mark)

(ii) If the concentration of glycerol is doubled, what happens to the **rate** of reaction?

.....
.....
(1 mark)

(iii) Explain, in terms of particles, why increasing the concentration of glycerol increases the rate of this reaction.

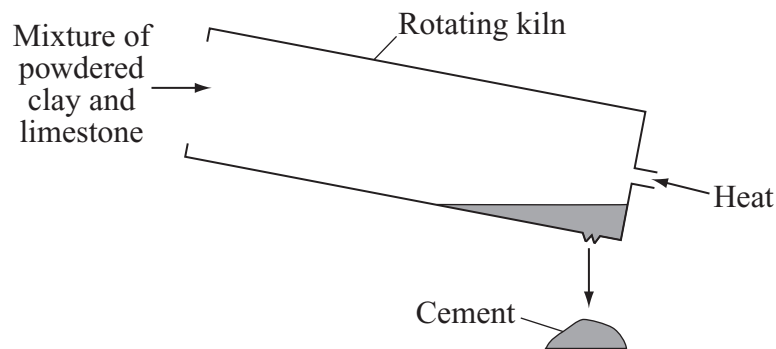
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(2 marks)

7

Turn over for the next question

Turn over ►

- 2 (a) Limestone is an important raw material in the manufacture of cement.



In this process:

- powdered limestone and clay are mixed in a rotating kiln;
- *thermal decomposition* of the limestone takes place to produce calcium oxide;
- the calcium oxide then reacts with the clay to make cement.

- (i) Explain what is meant by the term *thermal decomposition*.

.....

(2 marks)

- (ii) Thermal decomposition of calcium carbonate also produces a gas which turns limewater milky.

Name this gas.
 (1 mark)

- (iii) Suggest why a rotating kiln is used.

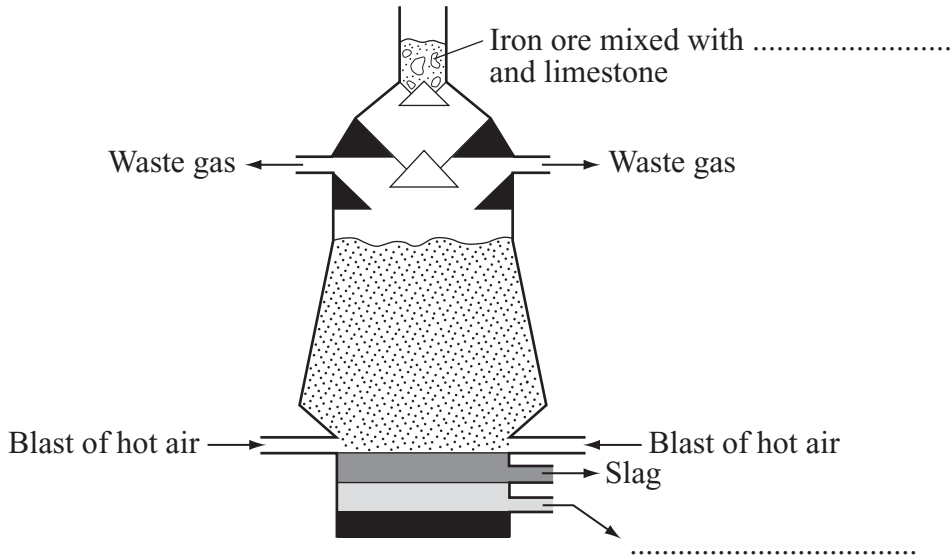
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(1 mark)

(b) Limestone is also used in the extraction of iron in the blast furnace.

The diagram shows a blast furnace.

(i) Complete the diagram by adding the **two** missing labels.



(2 marks)

(ii) The iron ore (iron oxide) is *reduced* in the furnace.

Explain what is meant by the term *reduced*.

.....

(1 mark)

(iii) The slag obtained from the blast furnace can be ground up and used to make a type of cement.

This is different from the method described in part (a) of this question.

Suggest and explain **one** advantage of using blast furnace slag to make cement.

.....

(2 marks)

3 Read the information about plastic-tar and then answer the questions.

Plastic-Tar Roads!

A town in India has made a road from plastic-tar. The town mayor is quoted as saying, ‘using plastic-tar will reduce the problem of plastic waste’.

Roads are usually made from a mixture of bitumen and gravel. Plastic-tar is made by mixing the bitumen and gravel with plastic. This plastic is obtained from household waste material.

Plastic-tar is harder and more waterproof than ordinary tar. This helps it to last longer.

(a) Use your knowledge of plastics to explain why the disposal of plastic waste is difficult, making it a problem for the environment.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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(4 marks)

(b) Suggest **two** advantages of using waste plastic to make plastic-tar.

.....
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.....

(2 marks)

- 4 Argon gas is extracted from the air and stored in cylinders.
This cylinder contains 180 litres (dm^3) of argon gas.



- (a) Air contains 0.9 % of argon by volume.

Calculate the volume of air that would contain 180 litres of argon.

.....
.....

..... litres
(2 marks)

- (b) Welding involves heating metals to high temperatures.
Argon is used to provide an unreactive atmosphere around metals during welding.

- (i) Explain, in terms of electrons, why argon is unreactive.

.....
.....
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(2 marks)

- (ii) Suggest why hot metals need to be protected from the air.

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.....

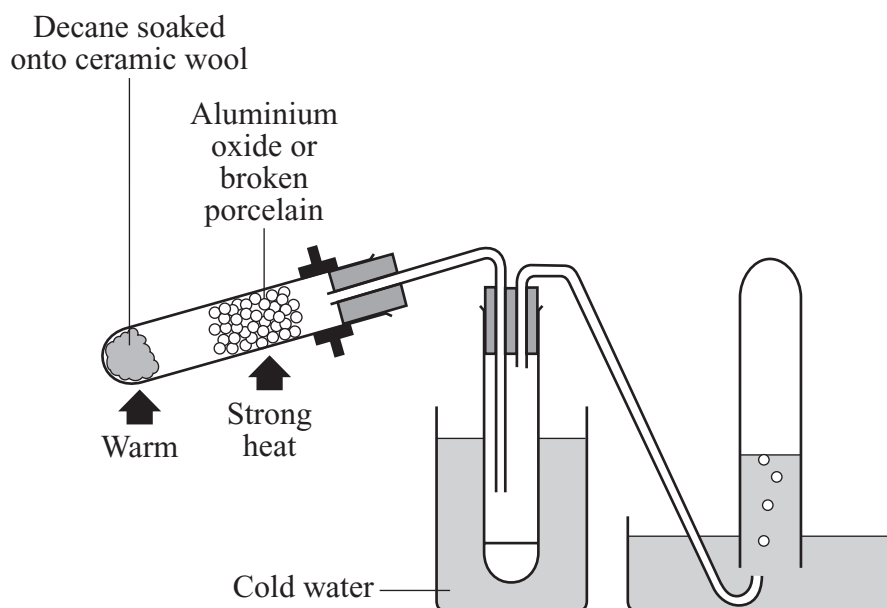
(1 mark)

5

Turn over ►

5 Cracking is an important type of reaction used in the oil industry.

The diagram shows an apparatus that can be used in a school laboratory to show cracking.



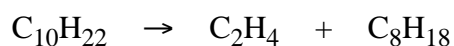
(a) (i) What is the purpose of the broken porcelain or aluminium oxide?

.....
(1 mark)

(ii) Explain why cracking is used in the oil industry.

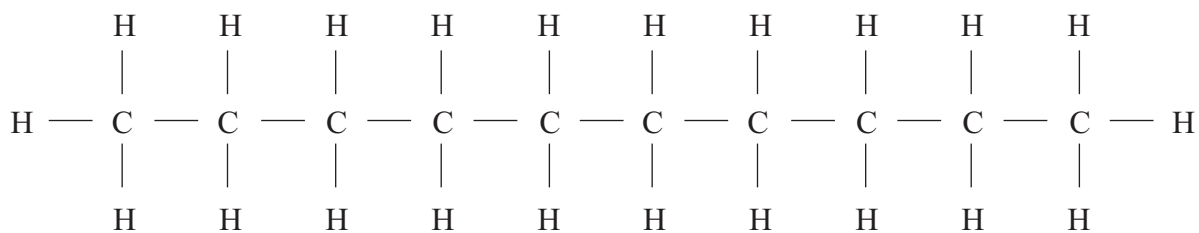
.....
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.....
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(2 marks)

(b) The equation represents a reaction that takes place when decane, $C_{10}H_{22}$, is cracked.



Draw an **X** on the diagram to show where ethene, C_2H_4 , molecules collect. (1 mark)

(c) The diagram below represents a decane molecule.



Draw similar diagrams for:



(1 mark)



(1 mark)

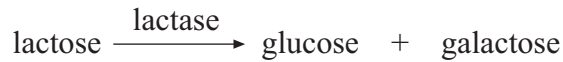
6

Turn over for the next question

Turn over ►

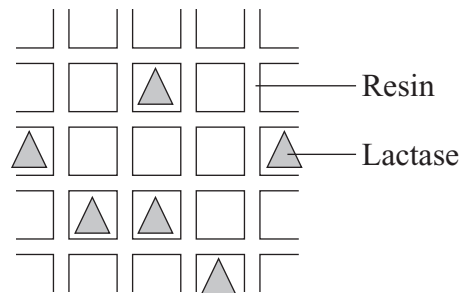
6 Read the information about the use of lactase and then answer the questions.

Lactose is a sugar found in milk. It makes many Thai, Chinese and Afro-Caribbean people ill. One way to help to solve this problem is to use lactase to convert the lactose into the sugars glucose and galactose.



Lactase is expensive so it is *immobilised* when it is used in industry.

Alginate gel can be used to immobilise lactase. Lactase is mixed with alginate gel solution. Drops of the mixture are then allowed to solidify and form alginate beads.



Magnified cross-section
of an alginate bead

A column is filled with the alginate beads. The milk is then poured through the column in a continuous process.

(a) What type of substance is lactase?
(1 mark)

(b) Explain the meaning of the term *immobilised*, using the information above.
.....
.....
.....
.....
(2 marks)

- (c) Suggest **one** reason, other than cost, for immobilising the lactase rather than simply adding it to the milk.

.....
.....

(1 mark)

- (d) Suggest **one** advantage of using a continuous process instead of a batch process.

.....
.....
.....

(1 mark)

5

Turn over for the next question

Turn over ▶

7 The periodic table on the Data Sheet may help you to answer this question about the alkali metals.

(a) The electronic structure of a sodium atom can be represented as:

2, 8, 1

Give the electronic structure of a potassium atom.

.....
(1 mark)

(b) Explain, in terms of electrons, why sodium and potassium have similar properties.

.....
.....
(1 mark)

(c) Both sodium and potassium react with water.

Explain, in terms of electrons, why potassium reacts more violently than sodium.

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.....
.....
(3 marks)

(d) Alkali metal compounds have many uses.

Sodium hydroxide reacts with phosphoric acid to make a salt that is used to inhibit the growth of mould on fruit.

Complete the word equation for this reaction.

phosphoric acid + sodium hydroxide → phosphate +
(2 marks)

7

END OF QUESTIONS