

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**General Certificate of Secondary Education**

**APPLIED SCIENCE:**  
**DOUBLE AWARD**



Science for the needs of society

HIGHER TIER

Wednesday **14 JUNE 2006**

Morning

1 hour 30 minutes

Candidates answer on the question paper.

Calculators may be used.

Additional materials:

Pencil

Ruler (cm/mm)

Candidate  
Name

--

Centre  
Number

--	--	--	--	--

Candidate  
Number

--	--	--	--

**TIME** 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

- Write your name, Centre number and candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do not write in the bar code. Do not write in the grey area between the pages.
- **DO NOT WRITE IN THE AREA OUTSIDE THE BOX BORDERING EACH PAGE. ANY WRITING IN THIS AREA WILL NOT BE MARKED.**

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.

FOR EXAMINER'S USE		
1	14	
2	10	
3	13	
4	11	
5	11	
6	11	
<b>TOTAL</b>	<b>70</b>	

**This question paper consists of 15 printed pages and 1 blank page.**

Answer all the questions.

- 1 Sulfur forms in large blocks around some volcanoes.

Local people collect it and sell it to the chemical industry.



Look at the data about sulfur.

sulfur data		<b>A photograph has been removed due to third party copyright restrictions</b>
formula	$S_8$	
melting point	113 °C	
boiling point	445 °C	
density	2 g cm <sup>-3</sup>	

Details: A photograph of some sulfur

- (a) Use the data to answer the following questions.

- (i) The people carry the sulfur as solid blocks.

The daytime temperature near the volcano is around 20 °C.

How does the information show that sulfur is a solid at this temperature?

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

- (ii) When it reaches the chemical factory, the sulfur is heated to 200 °C and transported as a liquid through pipes.

How does the data show that sulfur is a liquid at 200 °C?

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

- (iii) How many atoms are in one molecule of sulfur?

number of atoms ..... [1]

- (b) Finish the sentences about sulfur by putting a **ring** round the correct words.

Sulfur is an example of

**an element      a compound      a composite**

Sulfur is an example of

**a metal      a non-metal      an alloy**

[2]

- (c) The people working near the volcanoes breathe in toxic gases that come from the sulfur.

The boxes show the names and formulae of some hazardous compounds that contain sulfur.

Draw lines to connect the **name** of each compound to the correct **formula**.

name	formula
sulfur trioxide	$H_2SO_4$
sulfuric acid	$H_2S$
hydrogen sulfide	$SCl_2$
sulfur dichloride	$SO_3$

[3]

- (i) Sulfur dioxide is a toxic gas that is made when sulfur burns inside the volcano.

When the sulfur burns it reacts with oxygen.

Write a word and symbol equation for this reaction.

**WORD EQUATION** .....

**SYMBOL EQUATION** ..... [3]

- (ii) Put a **ring** round the part of the body that could be damaged by breathing in sulfur dioxide.

**artery**

**atrium**

**plasma**

**thorax**

[1]

[Total: 14]

[Turn over

2 Genetic engineering produces genetically modified (GM) crops.

The graph shows how the land used for GM crops changed up to 2001.

Look at the graph.



(a) The pattern of land use varies between the types of countries.

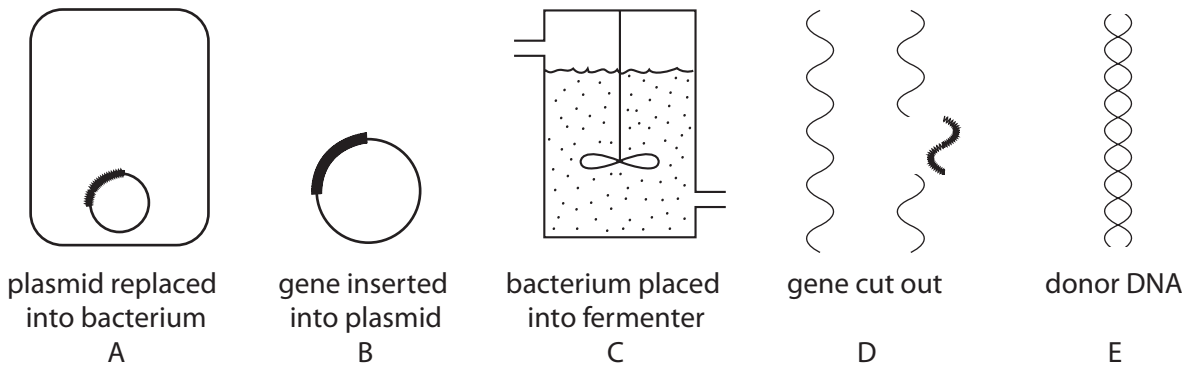
Give one similarity and one difference.

similarity ..... [1]

difference ..... [1]

(b) The diagrams show how genetic engineering can be done in bacteria.

They are in the wrong order.



Write down the letters in the correct order.

The first one has been done for you.

E ..... [3]

(c) Genetic engineering has potential benefits and risks.

Look at the table about genetic engineering.

Put a tick (✓) in the correct box to show if each statement is:

- a benefit
- a risk
- neither a benefit or a risk.

The first one has been done for you.

statement	benefit	risk	neither
medical drugs can be made more cheaply	✓		
produces new treatments for disease			
enzymes are used to insert the gene			
inserted genes may have unknown side effects			
medical drugs can be made more quickly			

[4]

(d) Ethical arguments are sometimes used against genetic engineering.

Give an example of an **ethical** argument against genetic engineering.

.....

.....

..... [1]

[Total: 10]

3 A farmer sets up a tank for new born chicks.

The tank uses a filament lamp under a metal shade to warm the chicks.

The diagram shows what happens in the tank.



(a) (i) Look at the boxes below. Draw lines to show the main way the heat energy is transferred between the different parts.

parts	how the heat energy is transferred
from lamp to chicks	radiation
through the metal parts of the lamp	convection
around the glass tank	conduction

[2]

(ii) The metal parts of the lamp get very hot but the glass tank only gets warm.

Use ideas about energy transfer to explain why.

.....

.....

.....

..... [2]

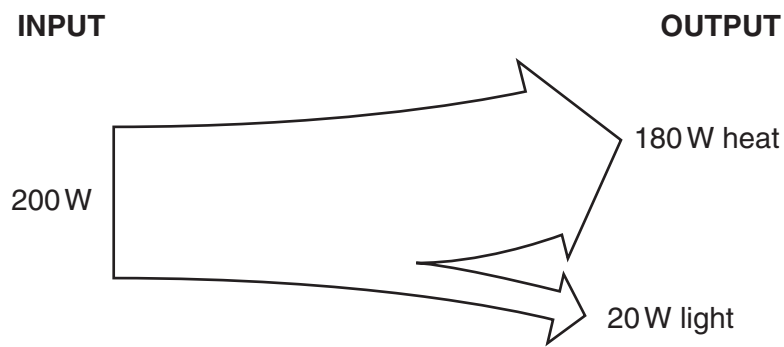
(b) The farmer finds that the chicks near the sides of the tank are too cold.

Suggest ways that the farmer could cut down the amount of heat escaping from the tank.

.....  
.....  
.....  
..... [3]

(c) The farmer wants to know how efficient the lamp is at **heating the tank**.

He finds this diagram showing the power inputs and outputs of the lamp.



Work out the percentage efficiency of the lamp.

efficiency ..... % [2]

(d) The chick tank is inside a large chicken shed.

The farmer buys low energy bulbs for the main lights in his chicken shed.

What are the advantages of using low energy bulbs for lighting?

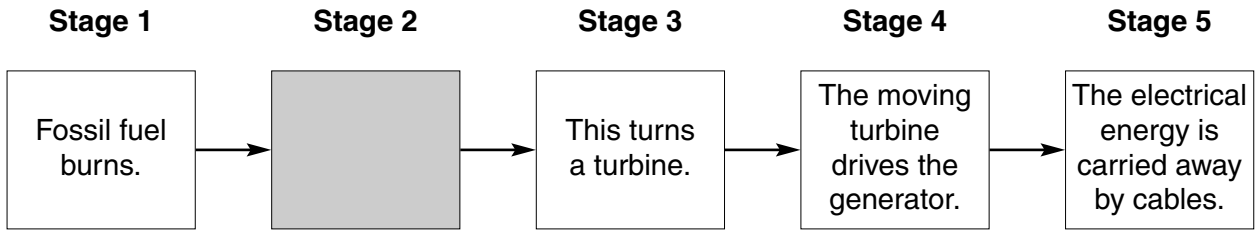
.....  
.....  
..... [3]

(e) Suggest a reason why low energy bulbs would **not** be a good choice for using in the chick tank.

..... [1]

4 Electricity can be generated by burning fossil fuels in power stations.

**Power station flow chart**



(a) Look at the flow chart.

(i) Name **two** fossil fuels that could be used in **Stage 1**.

1. ....

2. ....

[2]

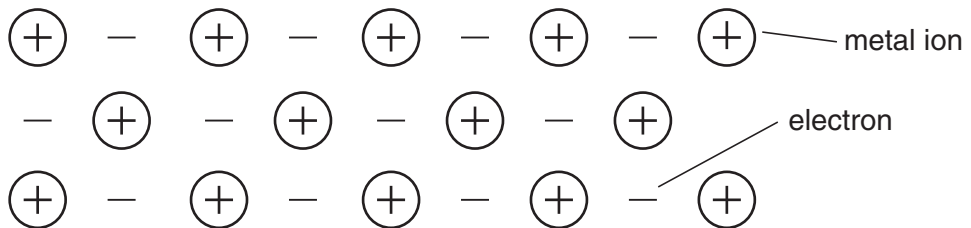
(ii) What happens during **Stage 2**?

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

(b) Metal cables carry the electrical energy from the power station.

Metals have ideal properties to use as electrical cables.

This diagram shows the structure of a metal.



Draw lines to connect the **property** to the correct **reason**.

**metal property**

**reason**

conducts electricity

ions and electrons are held together by many attractive forces

can be made into wires

ions can slide over each other

high melting point

electrons can move

[2]



- (c) The cables are usually made from high grade aluminium or copper.

This information about aluminium and copper comes from a data book.

**An extract has been removed due to third party copyright restrictions**  
Details: An extract from a data book containing information about aluminium and copper, such as their melting point, density, electrical conductivity and cost

Aluminium is used for overhead cables.

Copper is used for underground cables.

Use the information to explain why aluminium and copper are the best choice for each type of cable.

.....  
.....  
.....  
.....  
..... [3]

- (d) Aluminium cables are usually made from aluminium alloy rather than pure aluminium.

- (i) What is an alloy?

- ..... [1]

- (ii) Suggest a scientific reason why aluminium alloy is used instead of pure aluminium.

- ..... [1]

[Total: 11]

5 Joe goes to see his doctor because he is not feeling well.

(a) One of Joe's symptoms is that he feels very tired.

The doctor thinks he may have less red blood cells than normal.

Explain why having less red blood cells causes Joe to feel tired.

.....  
.....  
.....  
..... [3]

(b) The doctor carries out some tests on Joe's blood.

This is what Joe's blood looks like under the microscope.

**An image has been removed due to third party copyright restrictions**

Details: An image of a doctor looking into a microscope and what blood looks like under the microscope

.....

.....

.....

(i) Label the diagram by filling in the boxes. [3]

(ii) Joe's doctor also tests the amount of sugar in the blood.

Put a cross ( X ) somewhere on the diagram to show which part of the blood transports sugar. [1]

(iii) There are two types of blood cells shown on the diagram.

Write down one difference between the structure of the two cells.

..... [1]

(c) The doctor finds out what is causing Joe to feel ill.



Describe two ways of controlling diabetes.

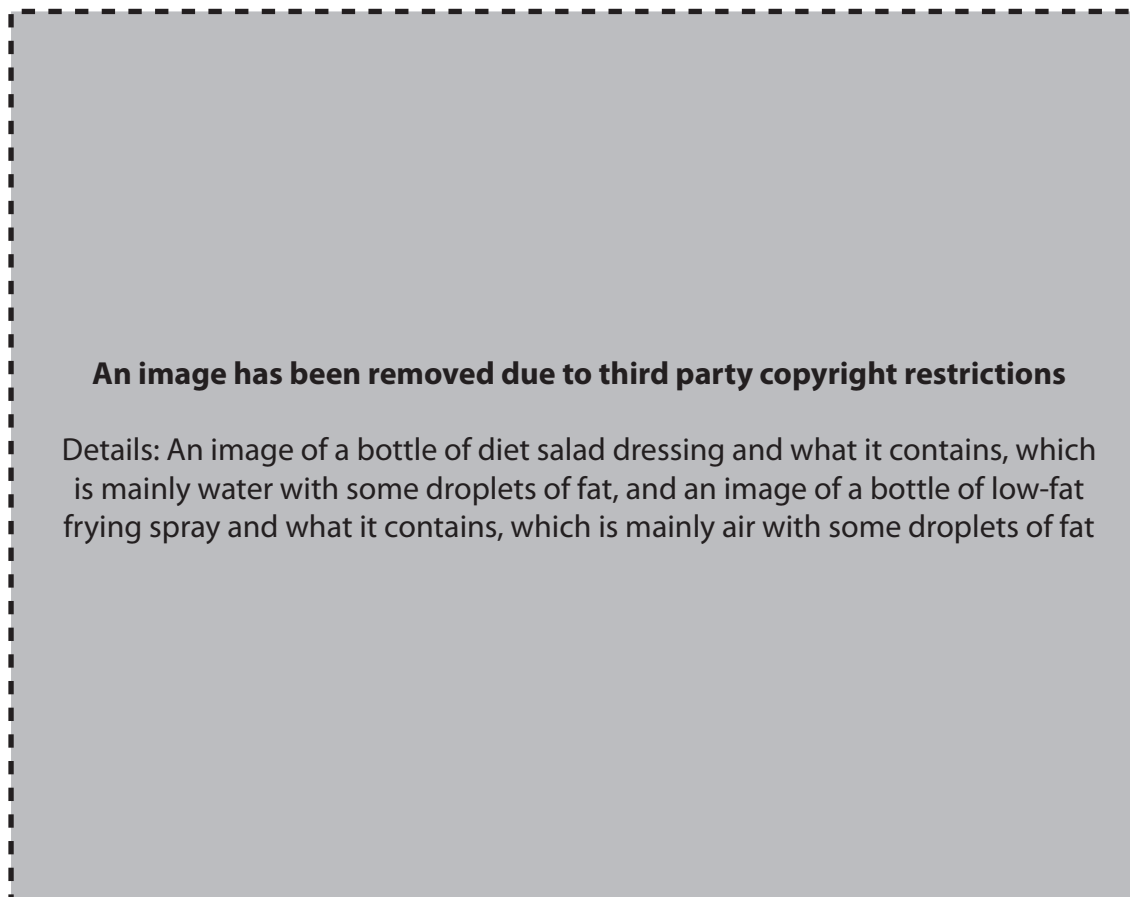
1. ....  
.....
2. ....  
..... [3]

[Total: 11]

6 'Diet Salad Dressing' and 'Low-fat Frying Spray' are 'low-fat' food products.

These products contain small amounts of fat mixed with other substances.

(a) The table shows what 'Diet Salad Dressing' contains.



	type of mixture	dispersed phase	continuous phase
Diet Salad Dressing	emulsion	liquid	liquid
Low-fat Frying Spray			

(i) Fill in the table to show what 'Low-fat Frying Spray' contains. [3]

(ii) The water in 'Diet Salad Dressing' contains dissolved flavourings and salt.

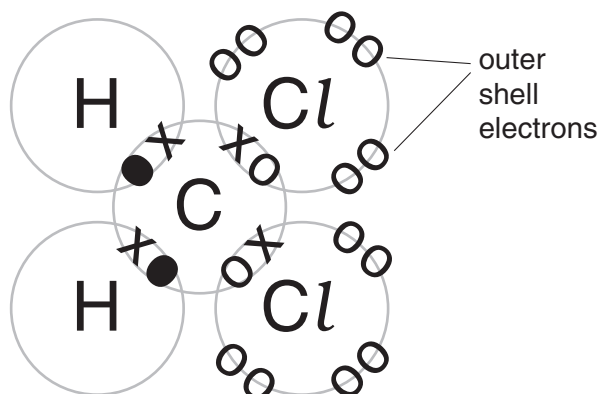
What is the name for a mixture of dissolved substances and water?

..... [1]

(b) Some other sprays contain a gas that forces the contents out of the can.

One gas used in spray cans is dichloromethane,  $\text{CH}_2\text{Cl}_2$ .

This diagram shows the bonding in dichloromethane.

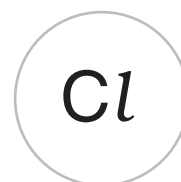


(i) Put a ring round a single bond on the diagram. [1]

(ii) What is the name for this type of bonding?

..... [1]

(iii) Complete the diagrams to show how the **outer** shell electrons are arranged in single atoms of each element in dichloromethane.



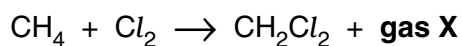
[3]

**Turn over for the remainder of question 6.**

[Turn over

- (c) Dichloromethane can be made by reacting methane with chlorine.

methane + chlorine  $\rightarrow$  dichloromethane + **gas X**



Use the equation to work out the formula of **gas X**.

formula ..... [1]

- (d) Chemicals for use in food are manufactured as fine chemicals.

Suggest a reason why.

..... [1]

[Total: 11]

**END OF QUESTION PAPER**

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