

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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6	
7	
8	
TOTAL	



General Certificate of Secondary Education
Higher Tier
March 2013

Science B

SCB3HP

Unit 3 Making My World a Better Place

H

Written Paper

Friday 8 March 2013 9.00 am to 10.00 am

For this paper you must have:

- a ruler.
- You may use a calculator.

Time allowed

- 1 hour

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(c) should be answered in continuous prose. In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.



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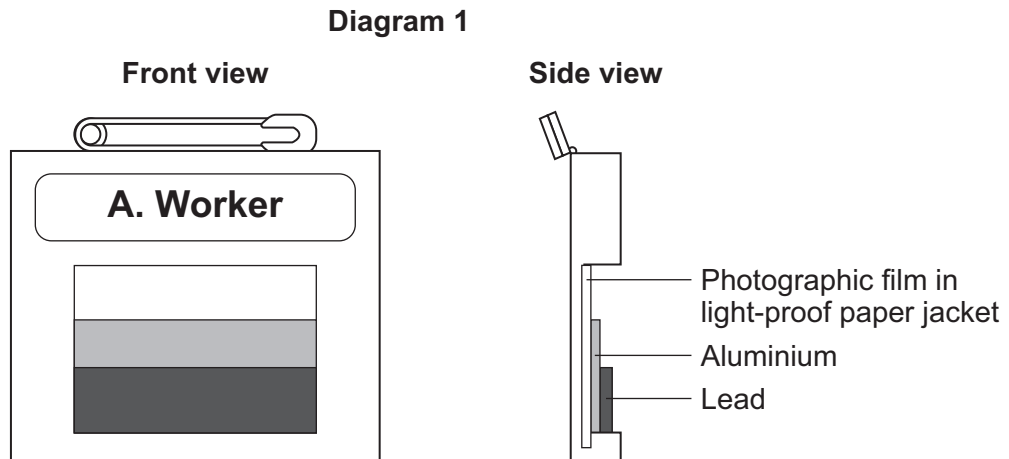
SCB3HP

Answer **all** questions in the spaces provided.

1 (a) Hospital workers who might be exposed to radiation wear film badges.

The film badges detect radiation.

Diagram 1 shows the structure of one of these badges.



1 (a) (i) Which type of radiation is the same as a helium nucleus?

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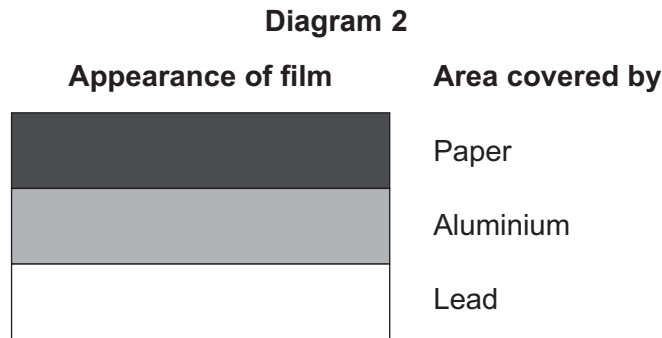
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(1 mark)



1 (a) (ii) After a few months, the photographic film inside a worker's badge is developed. When the film is developed it appears darker where the radiation has hit the film.

Diagram 2 shows what the developed film looked like.



The darkening of the film is caused by only one of the three types of radiation. Use the information in **Diagram 2** to explain why.

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(3 marks)

1 (b) (i) Atomic radiation causes ionisation. What property of atomic radiation causes ionisation?

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(1 mark)

1 (b) (ii) Give **one** advantage of using ionising radiation in the treatment of cancer.

.....

(1 mark)

1 (b) (iii) Give **one** disadvantage of using ionising radiation in the treatment of cancer.

.....

(1 mark)

7

Turn over ►



2 Most houses have boilers in them to heat up the house and to heat up water.
Incomplete combustion of the fuel in a boiler can produce carbon monoxide and soot.

2 (a) Faulty boilers in the home can be fatal. How does carbon monoxide cause death?

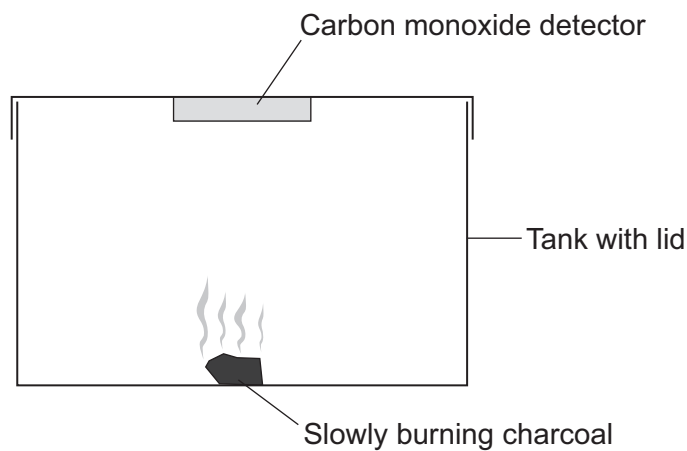
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(1 mark)

2 (b) Give **one** other disadvantage of incomplete combustion in a home boiler.

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(1 mark)

2 (c) Many home owners have carbon monoxide detectors in their homes to protect them from carbon monoxide poisoning. The detector measures the level of carbon monoxide each minute. If this level is above the safe limit then the alarm goes off.

Some students did an investigation to find out what conditions caused the detector's alarm to sound.



They completed seven tests, using different amounts of slowly burning charcoal in the tank with the detector.

Slowly burning charcoal produces carbon monoxide.



The students stopped recording the data after the detector's alarm went off.

The students' results are shown in the table.

Time in minutes	Carbon monoxide detector reading in parts per million						
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7
	No charcoal	1 piece of charcoal	2 pieces of charcoal	3 pieces of charcoal	4 pieces of charcoal	5 pieces of charcoal	6 pieces of charcoal
0	0	0	0	0	0	0	0
1	0	10	8	23	96	22	53
2	0	17	20	75	125	63	101
3	0	22	25	129	144	107	180
4	0	25	32	151	170	145	–
5	0	27	38	–	–	175	–
6	0	34	50	–	–	–	–
7	0	38	48	–	–	–	–
8	0	40	52	–	–	–	–
9	0	39	51	–	–	–	–
10	0	45	52	–	–	–	–
11	0	–	–	–	–	–	–

2 (c) (i) The students were trying to find out what causes the alarm to go off.

Use this data to suggest **two** sets of conditions that would cause the alarm to go off.

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(2 marks)

2 (c) (ii) For tests 4, 5, 6 and 7, use data from the table to suggest the level of carbon monoxide in ppm that makes the alarm go off.

..... ppm
(1 mark)



3 Energy consultants give advice about improving the energy efficiency of buildings.

Payback time can be used to help make decisions about different ways of saving energy.

The table shows the usual payback times for different energy-saving measures.

Energy-saving measure	Cost in £	Saving per year in £	Payback time in years	Total saving over 10 years in £
Loft insulation	300	60	5	300
Draught proofing	40	40	1	360
Hot water tank jacket	20	20	1	180
Thermostatic heating controls	120	20	6	
Cavity wall insulation	525	75		225

3 (a) The equation below can be used to calculate payback time.

$$\text{payback time} = \frac{\text{cost}}{\text{savings per year}}$$

Calculate the payback time for installing cavity wall insulation.

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Payback time years
(2 marks)

3 (b) Calculate the total saving over 10 years for installing thermostatic heating controls.

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Total saving £
(3 marks)



- 3 (d)** Energy efficiency consultants also consider the U-values of insulation when making decisions.

What is a U-Value?

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(1 mark)

- 4 (a)** Nitrous oxide is one of the three main greenhouse gases causing global warming.

Name the **two** other main greenhouse gases.

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(2 marks)

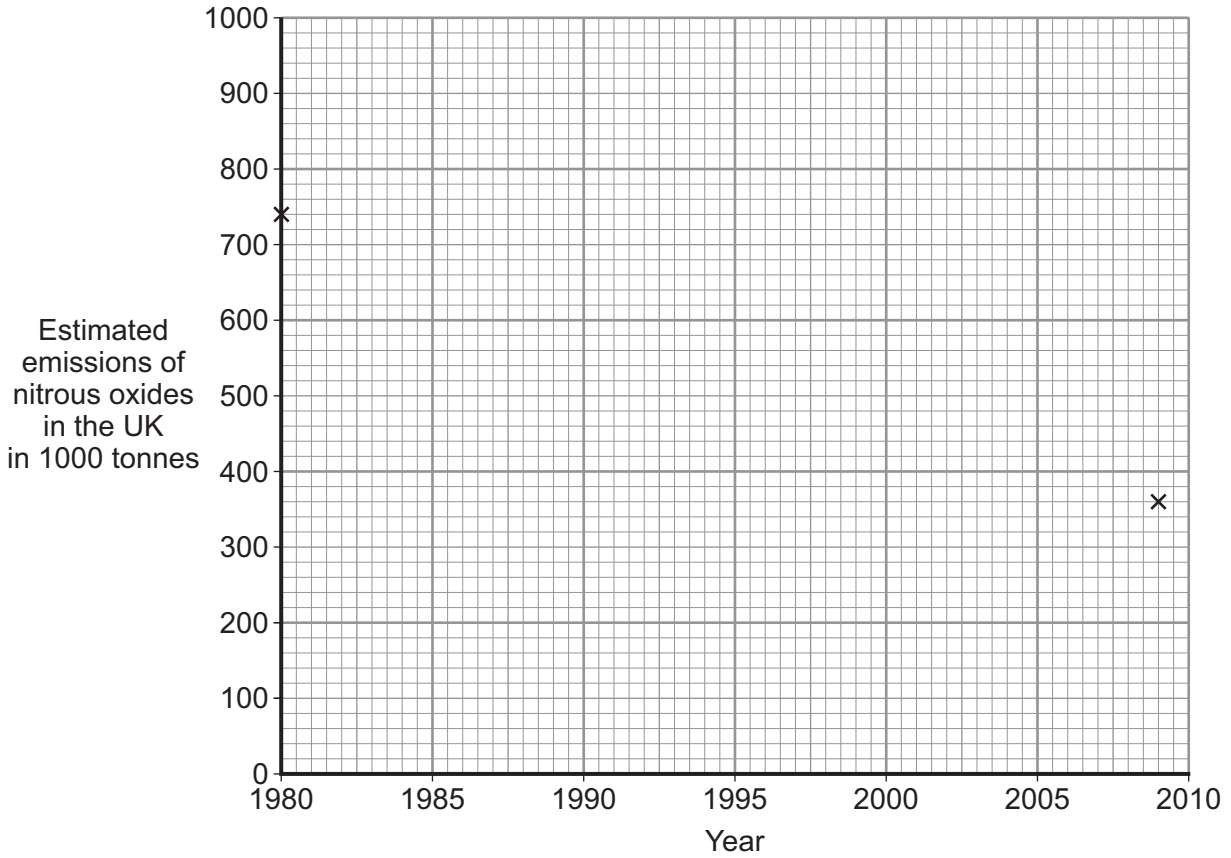
- 4 (b)** The table below shows how emissions of nitrous oxides from road transport have changed from 1980 to 2009.

Year	Estimated emissions of nitrous oxides in the UK (× 1000 tonnes)
1980	740
1985	820
1990	980
1995	900
2000	740
2005	570
2009	360



4 (b) (i) Use the data to plot a graph to show how the nitrous oxide emissions from road transport have changed between 1980 and 2009.

The first and the last points have been done for you.



(2 marks)

4 (b) (ii) Describe the pattern shown in the graph.

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(3 marks)

Question 4 continues on the next page

Turn over ►



4 (b) (iii) Tick (✓) **one** possible reason for the decrease in nitrous oxide emissions from road transport in the last few years.

There has been a decrease in the use of cars from 1990.

All new cars have catalytic converters.

Nitrous oxide is no longer used in fuels.

Leaded fuel is not sold anymore.

(1 mark)

8



Turn over for the next question

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5 (a) The human immune system has many ways of protecting us from infection.

Describe how the body protects us from infection when the skin is cut.

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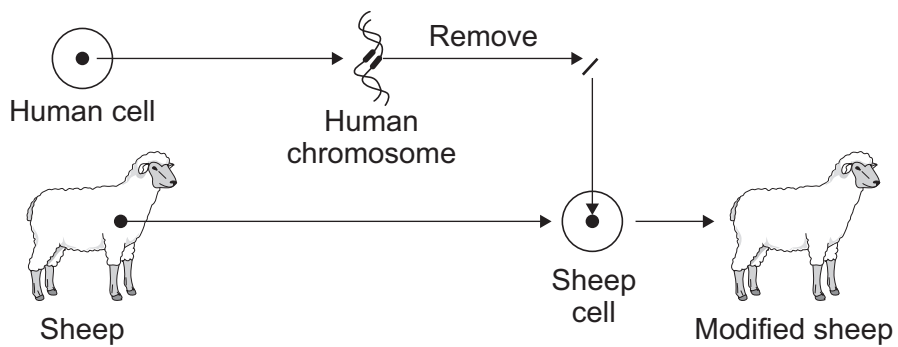
(2 marks)

5 (b) Some people have a genetic disorder and do not make a chemical called antithrombin.

People with this disorder have blood that is too thick.

The disorder can cause heart attacks.

Geneticists have developed a way of modifying sheep cells so that sheep produce human antithrombin in their milk.



5 (b) (i) Use the diagram to describe how the sheep cells are modified to produce human antithrombin.

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(4 marks)



5 (b) (ii) Antithrombin can also be extracted in small quantities from donated human blood.

Suggest an advantage of using genetically modified sheep to produce human antithrombin.

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(1 mark)

5 (b) (iii) Some people might disagree with using genetically modified sheep to make human antithrombin.

Suggest **two** reasons why.

1

2

(2 marks)

9

Turn over for the next question

Turn over ►



6 Scientists try to find ways to reduce the environmental impact of the products we use.
Scientists have developed a biodegradable water bottle.



6 (a) (i) Suggest **one** reason why people may prefer to buy mineral water in a biodegradable plastic bottle.

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(1 mark)

6 (a) (ii) What does biodegradable mean?

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(2 marks)

6 (a) (iii) If the plastic bottle is left in sunlight for a long time, it will crumble into small pieces.

Name the type of degradable plastic the bottle is made from.

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(1 mark)



- 6 (b) Plastic bags cause the deaths of thousands of sea animals every year.



More plastic bags are now made of PVOH (polyvinyl alcohol).

- 6 (b) (i) PVOH has **two** characteristics that make bags less of a problem to sea animals.

Give the **two** characteristics.

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(2 marks)

- 6 (b) (ii) Suggest a different type of plastic with the same properties as PVOH.

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(1 mark)

7

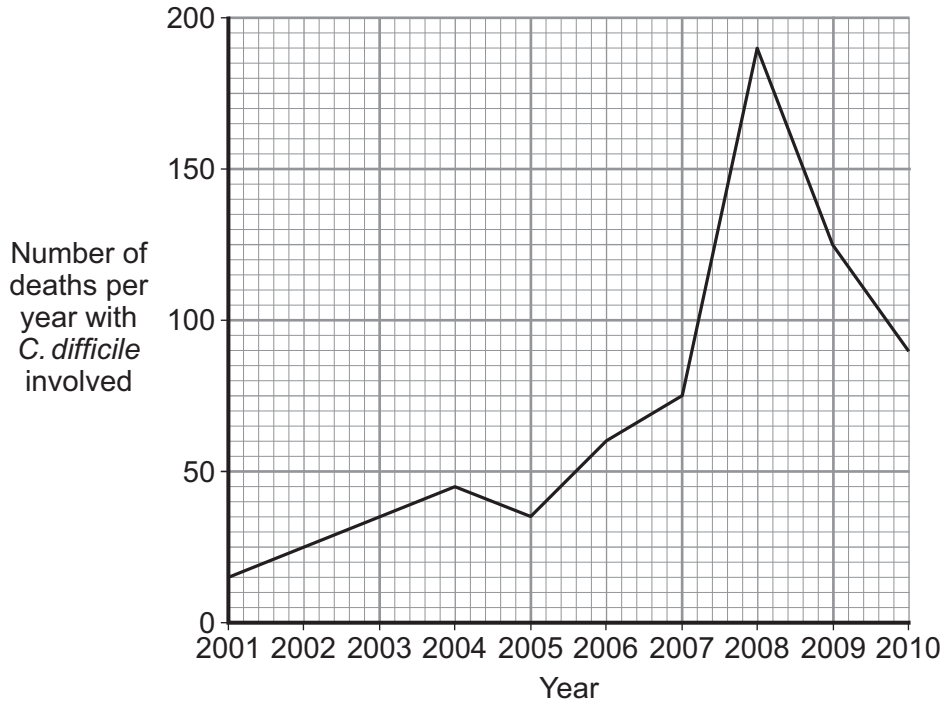
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7 *C. difficile* is a bacterial infection. Infection with *C. difficile* causes severe diarrhoea and can cause death.

The graph shows the number of deaths in the UK where *C. difficile* was involved.



7 (a) The number of deaths involving *C. difficile* increased from 2001 to 2008.

Suggest why.

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(2 marks)



7 (b) There are vaccines to help protect people from some bacterial infections.

Explain how a vaccination protects humans from infection.

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(3 marks)

7 (c) Another common infection is influenza.

Why are antibiotics **not** prescribed to treat influenza?

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(1 mark)

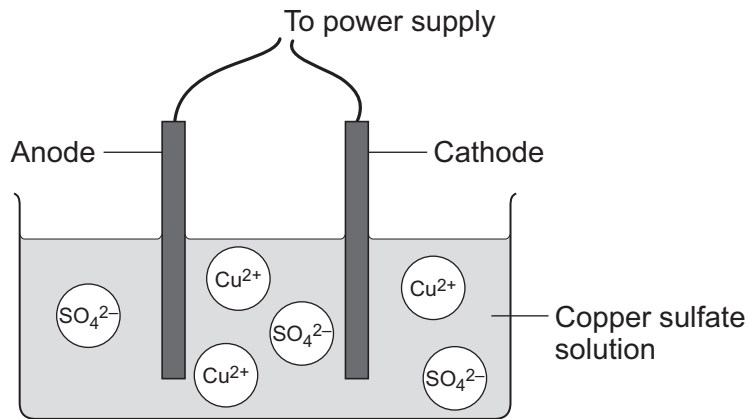
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Turn over for the next question

Turn over ►



8 Electrolysis is a process used to electroplate items with different metals.



8 (a) Describe how the electrical current passes between the anode and the cathode.

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(3 marks)

8 (b) How is copper formed at the cathode?

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(3 marks)

END OF QUESTIONS

6



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