Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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7	
8	
9	
10	
11	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2013

Additional Science 2 AS2HP

Unit 6

H

Thursday 23 May 2013 9.00 am to 10.30 am

For this paper you must have:
- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

Time allowed
- 1 hour 30 minutes

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 90.
- 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 1(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.

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

Biology Questions

1 This question is about enzymes.

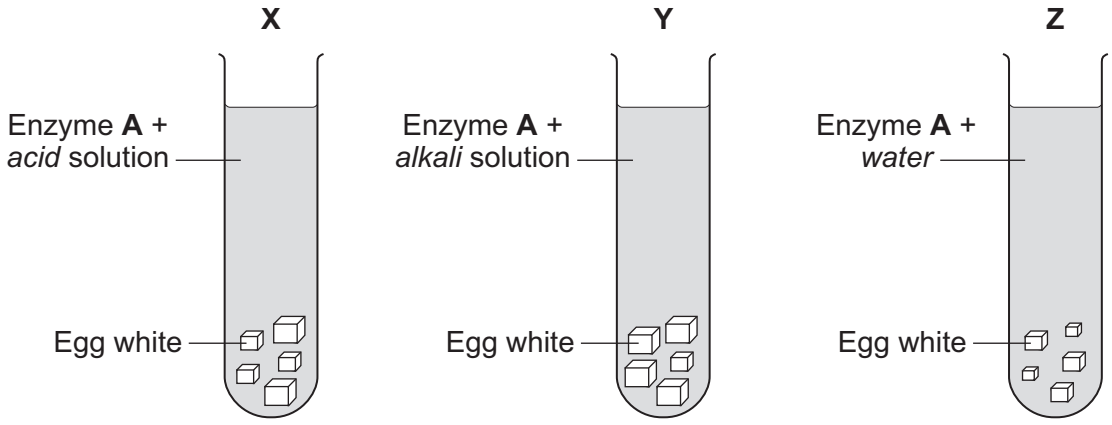
1 (a) Students investigated the effect of pH on two enzymes, **A** and **B**, from the human digestive system.
Enzymes **A** and **B** digest protein.

Egg white is made from protein.

The students:
- put 5 cm^3 of a solution of enzyme **A** into test tube **X**
- added 10 cm^3 of an acid solution
- put five cubes of hard-boiled egg white into the test tube
- recorded how long it took for all the egg white to be digested.

The students repeated the experiment in test tube **Y**, using alkali solution instead of acid solution.
The students repeated the experiment in test tube **Z**, using water instead of acid solution.

The diagram shows how the investigation was set up.



Give **one** way the students could improve their investigation.

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(1 mark)

1 (b) The students recorded how long it took for all the egg white in each tube to be digested.

The students repeated their investigation using enzyme **B**, instead of enzyme **A**.

The table shows the results.

	Time for all the egg white to be digested in minutes		
Enzyme	**Acid**	**Alkali**	**Neutral (water)**
A	60	300	180
B	300	50	60

1 (b) (i) Enzymes **A** and **B** were made in different parts of the human digestive system.

Where, in the human digestive system, was each enzyme made?

Enzyme **A** .....

Enzyme **B** .....

(2 marks)

1 (b) (ii) Give a reason for your answer for enzyme **A** in part **(b)(i)**.

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(1 mark)

Question 1 continues on the next page

1 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Microorganisms make enzymes. Some of these enzymes can be used in the home and in industry.

How are enzymes used in the home and in industry?

In your answer you should:
- write about different types of enzymes
- describe the reactions the enzymes are used for
- describe how the products of the reactions are used in the home and in industry.

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(6 marks)

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Chemistry Questions

2 A student investigated the reaction of hydrochloric acid with calcium carbonate.

2 (a) The equation for the reaction is:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

2 (a) (i) What is the name of the solution produced in the reaction?

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(1 mark)

2 (a) (ii) What is the name of the gas produced in the reaction?

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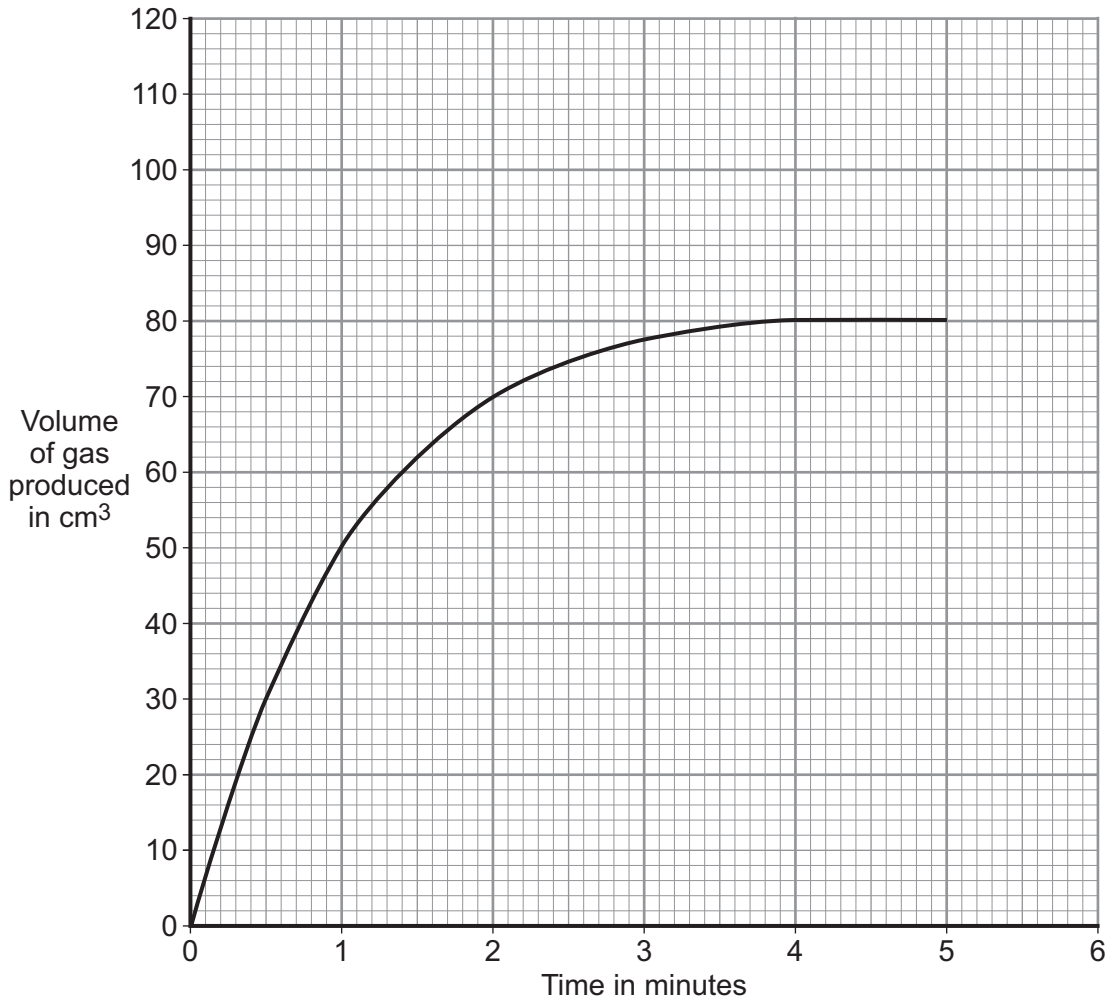
(1 mark)

2 (b) The student measured the volume of gas produced in the reaction every half minute.

The graph shows the student's results.



2 (b) Use the graph to describe how the **rate** of this reaction changes with time.

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(3 marks)

2 (c) (i) The student repeated the investigation.

This time the temperature used was 10 °C higher. All other variables were the same.

Sketch **on the graph** the results you would expect.

(2 marks)

2 (c) (ii) Explain, in terms of particles, why the change in temperature affects the rate of reaction.

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(3 marks)

10

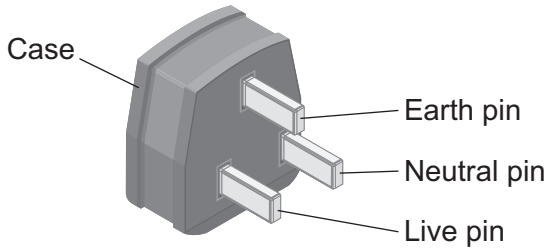
Turn over for the next question

Physics Questions

3 Most electrical appliances are connected to the mains using a cable and a three-pin plug.

3 (a) **Diagram 1** shows a three-pin plug.

Diagram 1



3 (a) (i) Why is the case of the plug made from plastic?

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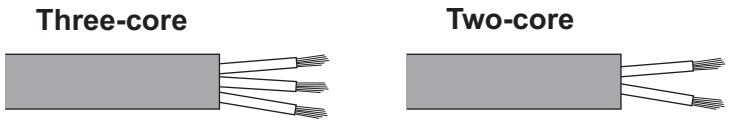
(1 mark)

3 (a) (ii) **Diagram 2** shows a three-core cable and a two-core cable.

Diagram 2



Name the **two** wires which are in both types of cable.

Wire 1 .....

Wire 2 .....

(2 marks)

3 (b) An engineer is designing an electric lawnmower. The lawnmower will be double insulated.

The electric motor of the lawnmower will need a current of 12 A. The electric motor will be connected to the 230 V mains electricity supply.

The engineer is choosing the cable that will connect the motor to a three-pin plug.

Information about five cables is shown in the table.

	Cable 1	**Cable 2**	**Cable 3**	**Cable 4**	**Cable 5**
Structure	Three-core	Two-core	Two-core	Two-core	Two-core
Maximum power rating in watts	3000	3000	3000	2500	2500
Type of plastic used for cable covering	Flexible	Rigid	Flexible	Flexible	Rigid

3 (b) (i) Use the information in the table to decide which cable is the most suitable to use for the lawnmower.

Justify your answer.

To gain full marks for this question your answer must include a calculation.

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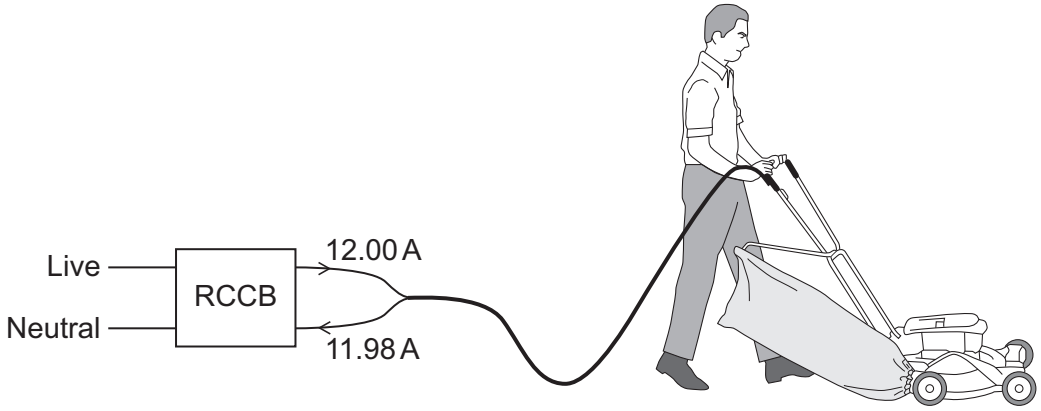
(4 marks)

Question 3 continues on the next page

3 (b) (ii) Electric lawnmower manufacturers recommend using a Residual Current Circuit Breaker (RCCB) when connecting a lawnmower to the mains electricity supply.

The diagram shows the current in the live and neutral wires when there is a problem with the lawnmower.



The RCCB would stop someone getting an electric shock from a faulty circuit in the lawnmower.

Explain how.

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(2 marks)

9

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Biology Questions

4 Cells in muscle fibres respire quickly when muscles are working.

4 (a) (i) Complete the word equation for aerobic respiration.

glucose + ... → ..... + water (+ energy)

(2 marks)

4 (a) (ii) When muscles work hard, the muscle cells may respire anaerobically. Anaerobic respiration is different from aerobic respiration.

Name the product of anaerobic respiration in muscle cells.

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Describe how the product of anaerobic respiration is removed from the body.

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(3 marks)

4 (b) There are two types of muscle fibre, 'slow-twitch' and 'fast-twitch'.

The table shows information about the two types of muscle fibre.

Information	Type of muscle fibre	
	Slow-twitch	**Fast-twitch**
Resistance to fatigue	High	Low
Number of mitochondria	High	Low
Blood supply	High	Low
Percentage in leg muscles of 100 m runner	16	84
Percentage in leg muscles of 10 000 m runner	84	16

In the Olympic Games:
- after a 100 m race a runner breathed deeply for three minutes, to recover
- after a 10 000 m race a runner breathed deeply for only 30 seconds, to recover.

Explain the difference between the recovery times of these two runners.

Use information from the table and your knowledge of respiration.

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(4 marks)

9

5 The picture shows an albino squirrel.

Albinos have no pigment (colour) in the skin, eyes or hair.

Albinos have an inherited disorder called albinism.

5 (a) A squirrel that is heterozygous for albinism is **not** albino.

Suggest why.

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(2 marks)

5 (b) Albinism is caused by a change in the squirrel's DNA (deoxyribonucleic acid).

5 (b) (i) Describe the overall structure of DNA.

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(1 mark)

5 (b) (ii) Albinos cannot make the enzyme tyrosinase. Enzymes are made from protein.

A change in the squirrel's DNA prevents tyrosinase being made.

Explain why.

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(3 marks)

6

Turn over for the next question

6 Before 1995, green iguanas lived on Guadeloupe, an island in the Caribbean Sea.

Green Iguana

In 1995 many trees were washed into the sea near Guadeloupe.
A few green iguanas floated on the trees to the island of Anguilla, a distance of 270 km.
The green iguanas started to breed on Anguilla.

Scientists believe that over the next few hundred years, as a result of natural selection, the green iguanas on Anguilla could become a new *species.*

6 (a) What does *species* mean?

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(1 mark)

6 (b) How could the population of iguanas on Anguilla become a new species?

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(4 marks)

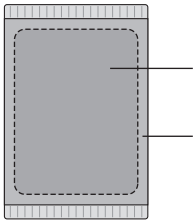
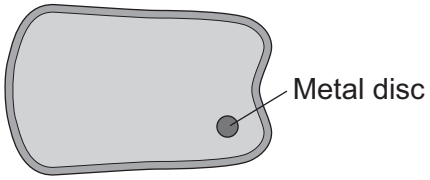
5

Turn over for the next question

Chemistry Questions

7 People sometimes use hand warmers to keep their hands warm in cold weather.

There are two types of hand warmer.

Disposable hand warmer	Reusable hand warmer
	
The hand warmer stays warm for 10 hours.	The hand warmer stays warm for 30 minutes.
The maximum temperature reached is 45 °C.	The maximum temperature reached is 54 °C.
The contents are: • Iron filings (small pieces of iron) • Water • Salt (catalyst) • Vermiculite (a mineral that holds water)	The contents are: • Sodium ethanoate • Water • Metal disc (to start crystallisation) Reusable hand warmers are regenerated by putting into boiling water, then cooling.

7 (a) Name the type of reaction that gives out energy in both hand warmers.

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(1 mark)

7 (b) The disposable hand warmer has a sealed airtight outer bag. To use the hand warmer the outer bag is removed. Air gets to the iron filings inside the inner bag. The iron reacts with oxygen from the air to produce iron(III) oxide (Fe_2O_3).

7 (b) (i) Explain why the iron in the inner bag is in small pieces and **not** large pieces.

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(2 marks)

7 (b) (ii) Complete and balance the symbol equation for this reaction.

..... + ... → ..... Fe_2O_3

(2 marks)

7 (c) A walker wants to buy a hand warmer for use in the winter.

Evaluate the use of both types of hand warmer.

In your answer you must compare the two types of hand warmer.

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(4 marks)

9

Turn over for the next question

8 Silver bromide is a salt used in photographic film.

The information below shows the solubility of different salts.

Soluble salts	**Insoluble salts**
Most bromides	Silver bromide and lead bromide
All sodium salts	
All nitrates	

Describe how you could prepare a sample of silver bromide from two salts.

In your answer you should:

- use the information about soluble and insoluble salts to name the reactants you would use
- describe how you would separate silver bromide from the reaction mixture.

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(4 marks)

4

9 Sodium can be produced by the electrolysis of molten sodium chloride.

9 (a) Sodium chloride melts at 801 °C.

Calcium chloride is added to sodium chloride to lower the melting point to 700 °C.

9 (a) (i) Suggest **one** advantage of lowering the melting point of sodium chloride for electrolysis.

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(1 mark)

9 (a) (ii) Why must sodium chloride be molten for electrolysis to take place?

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(1 mark)

9 (b) (i) When sodium chloride is electrolysed, sodium is produced at the negative electrode.

Complete the half equation for the production of sodium.

..... + e^- → .....

(1 mark)

9 (b) (ii) Complete the sentence.

The process occurring at the negative electrode is called ..... .

(1 mark)

9 (b) (iii) Describe what happens at the positive electrode when molten sodium chloride is electrolysed.

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(3 marks)

7

Physics Questions

10 Radioactive substances give out radiation from the nuclei of their atoms.

10 (a) (i) Radium-226 (Ra-226) decays by the emission of an alpha particle.

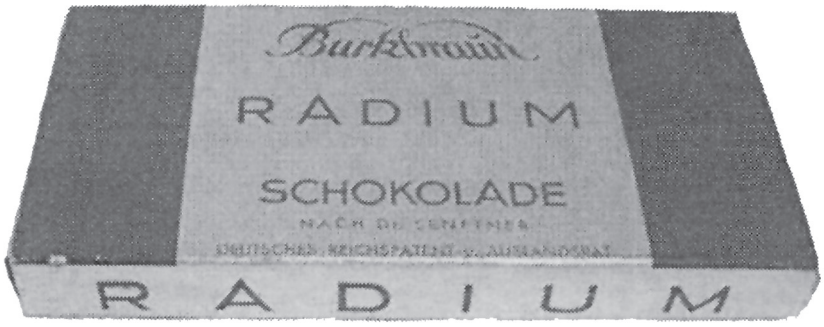
The decay can be shown by the nuclear equation below.

Complete the nuclear equation by writing the correct numbers in each of the two boxes.

$$^{226}_{88}\text{Ra} \longrightarrow \square\ \square + \text{Rn} + \text{alpha particle}$$

(2 marks)

10 (a) (ii) Before people knew about the dangers of nuclear radiation, radioactive substances were used in some everyday products, including chocolate.



Radium-226 was used in the chocolate.

The chocolate was harmful when it was eaten, but **not** harmful if it was not eaten.

Explain why.

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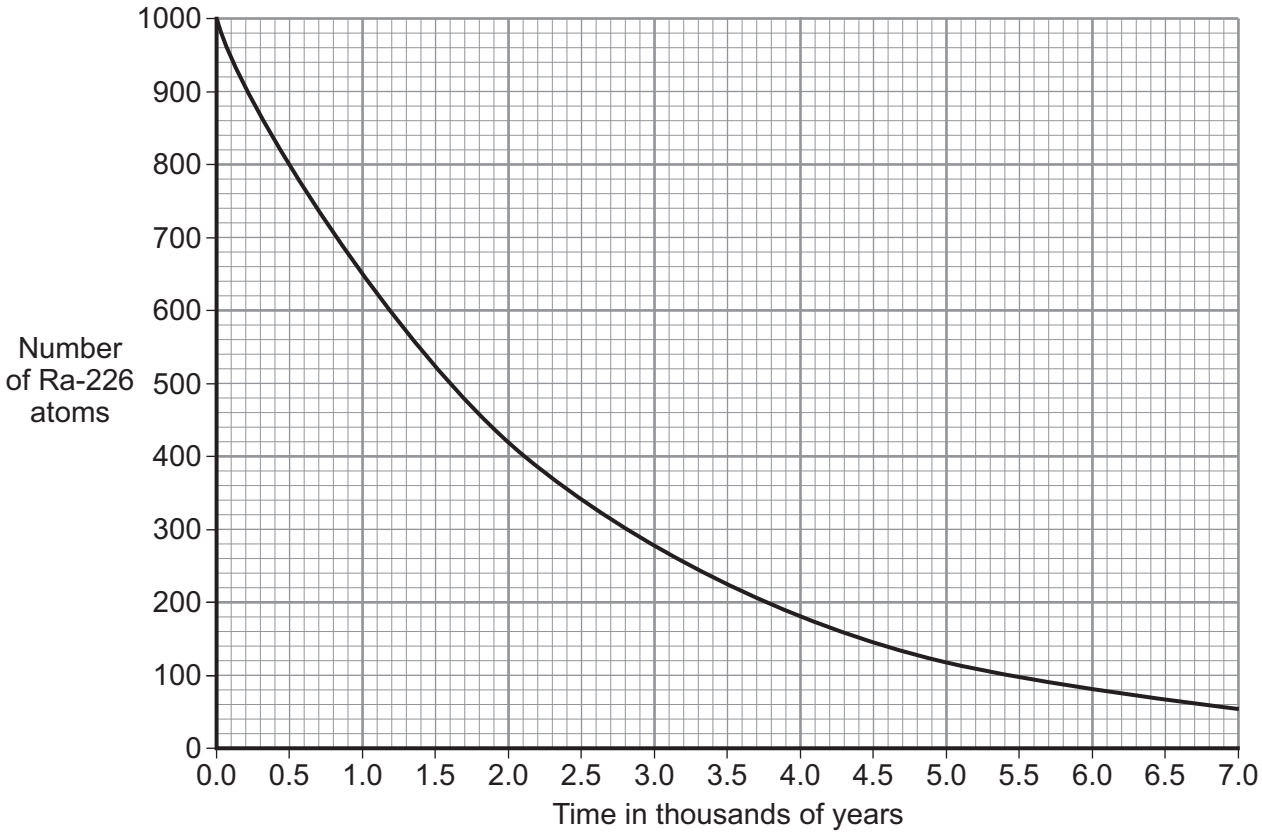
(3 marks)

10 (b) The graph shows how the number of atoms in a sample of radium-226 varies with time.



What is the half-life of radium-226?

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Half-life = ... years

(2 marks)

Question 10 continues on the next page

10 (c) Medical tracers are used to check the function of organs in the body.

The medical tracer contains a radioactive substance which emits nuclear radiation. A sensor outside the body is used to detect the nuclear radiation.

The table shows information about three radioactive substances.

Radioactive Substance	Nuclear radiation emitted	Half Life
Caesium-137	Gamma	30.2 years
Radon-210	Alpha	2.4 hours
Technetium-99	Gamma	6.0 hours

Using information from the table, suggest which radioactive substance would be most suitable as a medical tracer.

Justify your answer.

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(3 marks)

10

Turn over for the next question

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11 A star goes through a life cycle. Energy is released in stars by nuclear fusion.

11 (a) How are stars formed?

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(2 marks)

11 (b) (i) Why is a star stable during the main sequence period of its life cycle?

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(1 mark)

11 (b) (ii) Describe the life cycle of a star that is much bigger than the Sun **after** this bigger star has left the main sequence.

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(4 marks)

11 (c) Read the following blog from the internet.

> "*During the main sequence period of the life cycle of a star every element in the Universe is made. At the end of the main sequence every star explodes. This distributes the elements throughout the Universe, which makes amazing things, like our planet!*"

State **two** scientific ideas in the blog that are **not** correct and describe how they should be changed.

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(4 marks)

11

END OF QUESTIONS

There are no questions printed on this page

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