OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
SCIENCE A
Unit 3 Modules B3 C3 P3
HIGHER TIER
WEDNESDAY 20 JUNE 2007

H

A213/02

Morning
Time: 40 minutes

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T43341

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- 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 outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**4**	
2	**5**	
3	**5**	
4	**4**	
5	**4**	
6	**3**	
7	**3**	
8	**5**	
9	**4**	
10	**5**	
TOTAL	**42**	

This document consists of **19** printed pages and **1** blank page.

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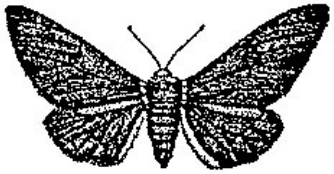
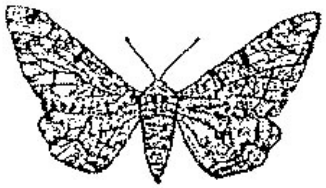
Answer **all** the questions.

1 Some moths come in two forms, grey speckled and black.

Moths are eaten by birds.

An experiment was carried out in a wood in Birmingham to find out which form of moth survived better.





Grey speckled moths and black moths were marked on the underside of their wings and placed on tree bark. They were left and the survivors collected later the same day.

(a) Here are some of the results.

	grey speckled moths	**black moths**
number of moths released	64	164
number of moths recaptured	16	82
percentage recaptured	25	

Calculate the percentage of black moths recaptured. Write the result in the table. [1]

(b) Which is the best explanation for calculating the **percentages** of moths recaptured?

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

It is more scientific to use percentages. ☐

Everyone understands what a percentage is. ☐

Different numbers of moths were released. ☐

Different numbers of moths were recaptured. ☐

[1]

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(c) In Birmingham, more black moths survived than grey speckled moths.
Scientists think that this is due to human activity changing the environment.
Rapid environmental change can cause species to become extinct.

The table shows some other possible **causes of extinction**.

Some extinctions are due to **direct** human activity, some are due to **indirect** human activity, and some are **natural** processes.

For each of the **causes of extinction** in the table, put ticks (✓) in the correct boxes.

causes of extinction	direct	indirect	natural
hunting for food			
expansion of towns			
evolution of new disease			

[2]

[Total: 4]

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2 Giraffes feed on tree leaves.

Giraffes have evolved from ancestors which had shorter necks.

Scientists have proposed two explanations of how this may have happened.

(a) One of the first explanations was suggested by Lamarck.

Lamarck imagined that over generations the habit of continually reaching for the higher leaves produced a lengthening of the neck.

Few scientists now agree with Lamarck's idea.

Put a tick (✓) in the box next to the statement which **best** explains why.

There will be variation in any population.	☐
Only genetic variation can be passed on.	☐
The environment can be a cause of variation.	☐
Some variations make it more likely an individual will survive.	☐

[1]

(b) Charles Darwin came up with an idea to explain how evolution happened.

What did he call this idea? ..... [1]

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(c) Scientists have used Darwin's ideas to produce two competing explanations of the evolution of the giraffe's long neck.

Explanation A:

- when there was little food, giraffes with longer necks survived as they competed for food
- they passed on their characteristics
- over many generations, the neck length of giraffes increased.

Explanation B:

- male giraffes with longer and stronger necks competed better for female mates
- they passed on their characteristics
- over many generations, the neck length of giraffes increased.

Some observations about giraffes are given in the table.

For each **observation**, decide if it can be accounted for by **explanation A** or **explanation B**.

Put ticks (✓) in the correct boxes.

observation	explanation A	explanation B
Only giraffes can reach the high leaves on trees.		
Male giraffes are up to 1 metre taller than females.		
Dead male giraffes with damaged neck bones have been found.		
In drought conditions, when food is scarce, giraffes generally feed on low shrubs.		

[3]

[Total: 5]

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3 Read the following information about squirrels.

Britain's native red squirrels have been fighting a losing battle against the American grey squirrel. Red and grey squirrels feed mainly on nuts and seeds.

Members of a red squirrel conservation group have launched a £1 million scheme to try to keep the red squirrels safe in their last strongholds. (Daily Express 09.11.05)

An item has been removed due to copyright restrictions.

Details:
diagram from an article published in the Daily Express on 09.11.05, showing two maps of England and Wales - the first shows red squirrel distribution in 1945 (red shading over much of the South West, West Midlands, East Angular, Wales and patchy shading over the North East and North West, and the Isle of White), the second shows the current distribution (red shading over the North East, North West and Isle of White, and patchy shading over Wales only).

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Look at the statements about red squirrels and grey squirrels.

A	Grey squirrels are bigger, bolder and more active than red squirrels.
B	Grey squirrels have much higher energy demands than red squirrels.
C	Oak and beech trees have big seeds.
D	Grey squirrels can eat seeds before they are ripe.
E	Willow, birch and rowan trees have small seeds.
F	Red and grey squirrels feed mainly on nuts and seeds.

(a) Which statement, **A**, **B**, **C**, **D**, **E** or **F**, shows competition?

answer ..... [1]

(b) Which **two** statements, **A**, **B**, **C**, **D**, **E** or **F**, may explain why red squirrels are losing the battle and being replaced in most of Britain by grey squirrels?

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

(c) Which **two** statements, **A**, **B**, **C**, **D**, **E** or **F**, explain why conservationists hope that planting willow, birch and rowan trees will help red squirrels?

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

[Total: 5]

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4 Read this article from a website.

How a fatty diet may cause diabetes

Researchers say they have discovered how a high-fat diet may increase the risk of type 2 diabetes.

The study was carried out on mice. The researchers hope their findings will lead to new ways to treat and prevent diabetes in people.

The number of people with diabetes has soared to over two million in the UK.

Of these, 85% have type 2 diabetes. This is linked to obesity.

(from Diabetic Society web site)

(a) In the UK, what **percentage** of the 2 million people with diabetes have **type 1** diabetes?

answer ..... [1]

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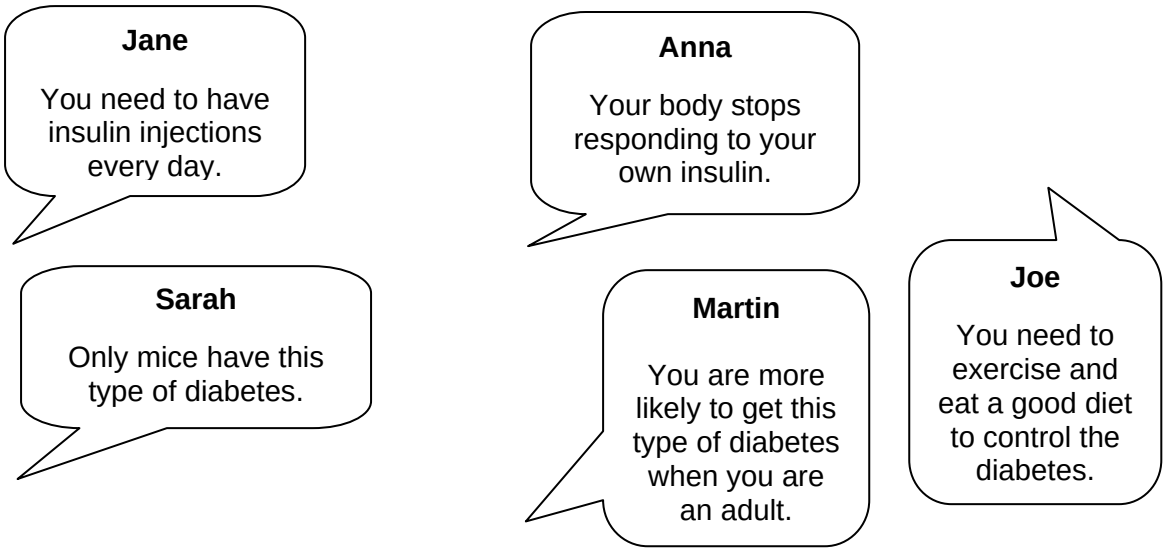
(b) Five people read the website and made these comments about **type 2** diabetes.



Put ticks (✓) in the table to indicate which people are making **true** statements and which people are making **false** statements.

	true	**false**
Sarah		
Martin		
Anna		
Jane		
Joe		

[3]

[Total: 4]

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5 This question is about the molecules that make up living things.

(a) Finish the sentences by choosing the **best** words from the list.

acids

polymers

hydrocarbons

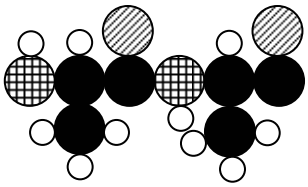
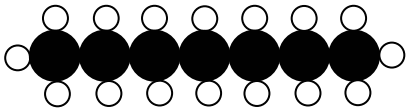
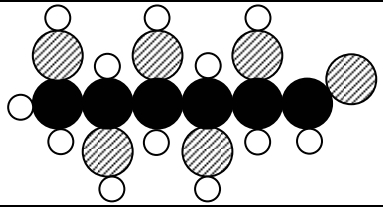
salts

sugars

Starches and proteins are natural .....

Examples of carbohydrates are starches and ..... [2]

(b) Diagrams of three molecules, **A**, **B** and **C**, are shown below.

molecule **A**		**key** carbon atoms hydrogen atoms nitrogen atoms oxygen atoms
molecule **B**		
molecule **C**		

(i) Which molecule, **A**, **B** or **C**, is a carbohydrate? ..... [1]

(ii) Which molecule, **A**, **B** or **C**, is part protein? ..... [1]

[Total: 4]

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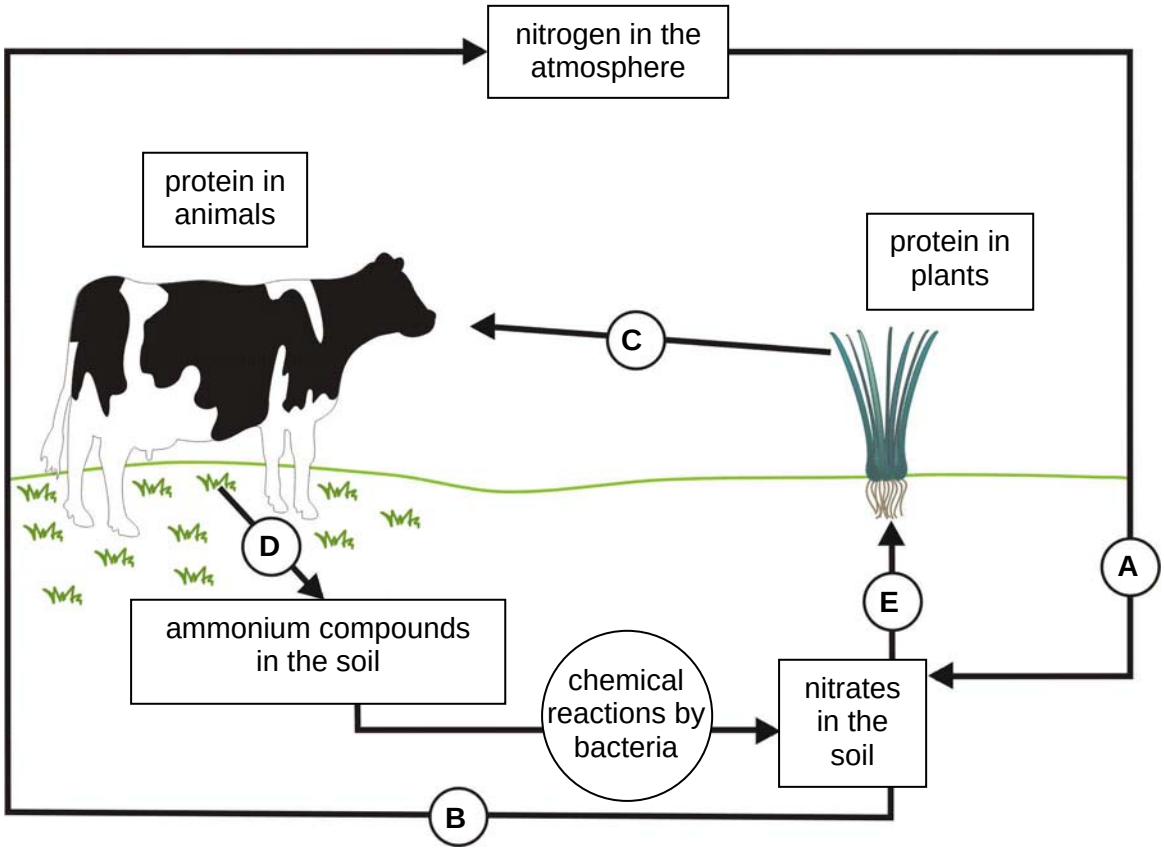
6 This question is about the nitrogen cycle.

A simplified diagram of the nitrogen cycle is shown below.



Processes in the nitrogen cycle are shown by the circles labelled **A**, **B**, **C**, **D** and **E**.

Match these with the descriptions given below. One has been done for you.

description of process	letter
excretion by animals	
bacteria in the soil carry out chemical reactions to convert nitrogen to nitrates	
growing plants absorb nitrates and use the nitrogen to make proteins	
animals eat plants and take in proteins	C
nitrates are broken down by bacteria	

[3]

[Total: 3]

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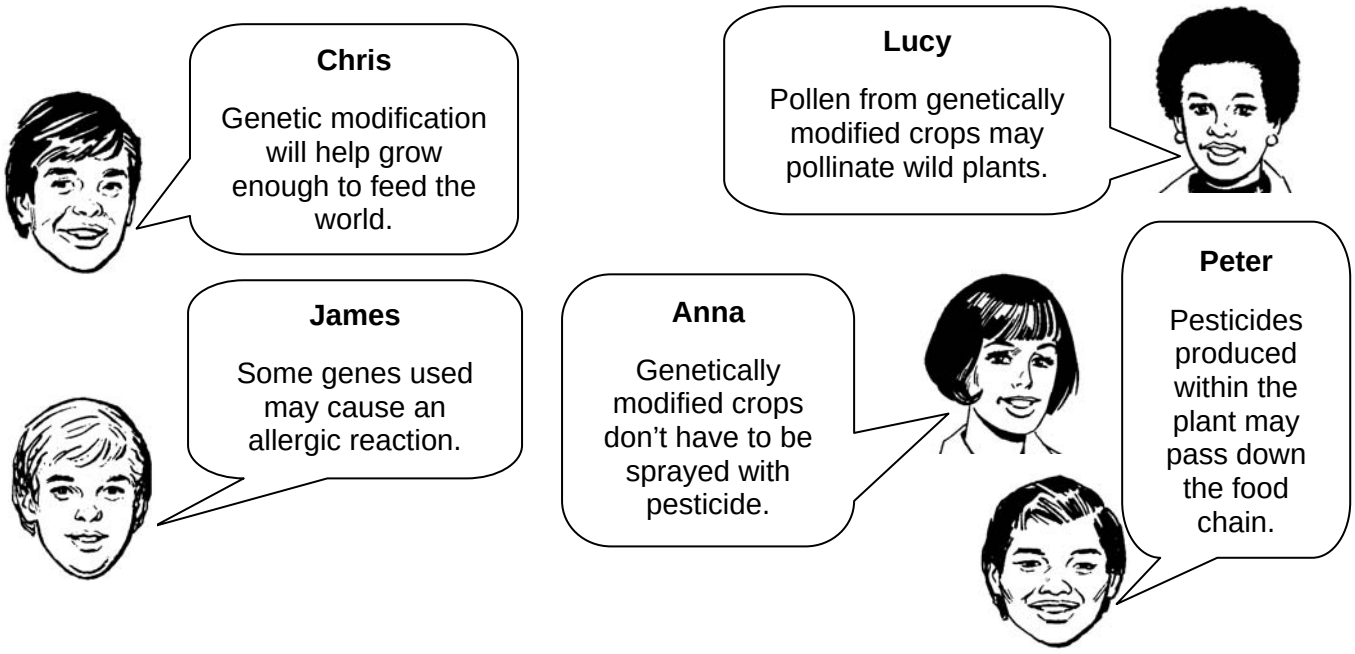
7 Crops can be grown by genetic modification. Some people think that genetic modification is a good idea. Some people do not.

Chris and his friends are discussing the advantages and disadvantages of genetic modification in their science class.

Here is what they say.



Complete the table below to show the names of those talking about an **advantage** of genetic modification and the names of those talking about a **disadvantage** of genetic modification.

names of those talking about an **advantage**	names of those talking about a **disadvantage**

[3]

[Total: 3]

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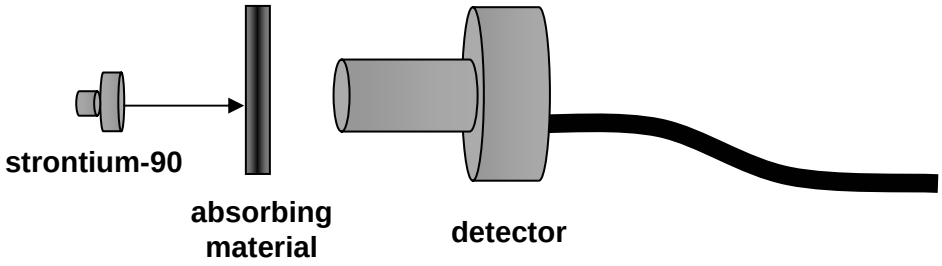
8 This question is about radioactivity.

Strontium-90 is radioactive. It emits beta radiation.

(a) One way of classifying different types of radioactive emission is by their penetration properties.

An experiment was done to confirm that strontium-90 is emitting beta radiation.



Different absorbing materials were placed between the strontium-90 and a radiation detector. The amount of radiation detected was noted for each absorbing material.

Which **two** of the following materials would you expect the beta radiation to pass through?

Put ticks (✓) in the boxes next to the **two** correct answers.

thick concrete	☐
a sheet of paper	☐
a few centimetres of aluminium	☐
a few centimetres of lead	☐
a few centimetres of air	☐

[2]

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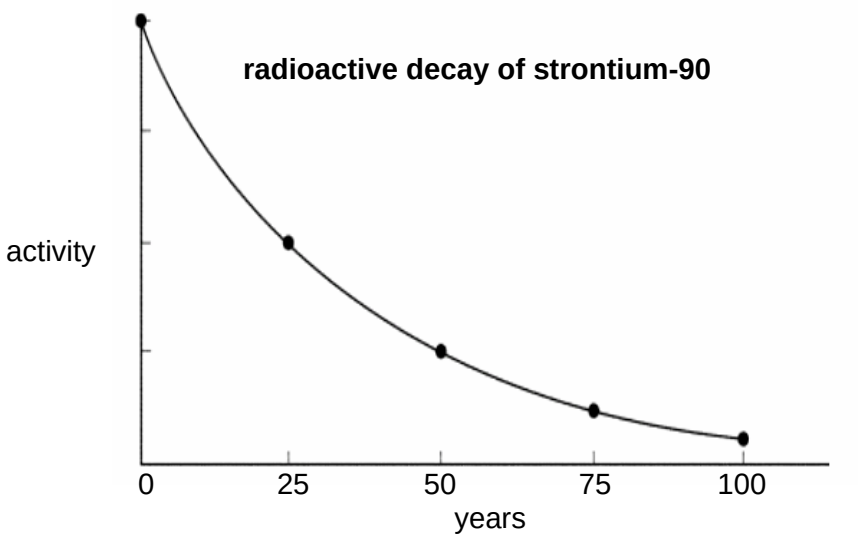
(b) The following graph can be used to work out the half-life for strontium-90.



(i) What will happen to the activity of the sample of strontium-90 over the next hundred years?

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

It remains the same if you don't use it.	☐
It does not change much in one hundred years.	☐
It decreases to about a half of the original activity.	☐
It decreases to less than a quarter of the original activity.	☐

[1]

(ii) What is the **best** description of the term **half-life**?

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

half of the total time for the activity to reach zero	☐
the time taken for half of the radioactive material to decay	☐
half of the total time for the activity to reach background levels	☐

[1]

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(iii) The half-life of strontium-90 is roughly 29 years.

If the mass of strontium-90 present in a sample is initially 60 g, roughly what mass of strontium-90 would you expect to be left 58 years later?

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

0 g	☐
7.5 g	☐
15 g	☐
30 g	☐
60 g	☐

[1]

[Total: 5]

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9 Nina is a radiotherapist.
She treats people who have been diagnosed with cancer.

An image has been removed due to copyright restrictions.

Details:
a medical technician treating a patient by radiotherapy; the patient lies shirtless and face down on a table while the technician guides the radiotherapy machine over him

(a) The following steps, **A**, **B**, **C**, **D** and **E**, explain how the cancer treatment works.

A	A source of gamma radiation is used to treat some kinds of cancer.
B	The patient lies on a table with the cancer cells positioned centrally.
C	The source of gamma radiation is rotated around the patient.
D	The cancer cells are continuously exposed to gamma radiation.
E	Healthy cells around the cancer cells receive a smaller dose.

Which **two** statements, taken together, explain how the risk to healthy cells is reduced?

..... and ..... [1]

(b) What may happen when gamma radiation strikes a living cell?

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

The cell repels it. ☐

It kills the cell. ☐

The cell becomes cancerous. ☐

The cell turns green. ☐

White blood cells engulf the radiation. ☐

[2]

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(c) There are potential health risks for anyone who is exposed to ionising radiation.

For this reason, the radiation dose of both patient and staff needs to be carefully monitored.

In what units is the radiation dose measured? ..... [1]

[Total: 4]

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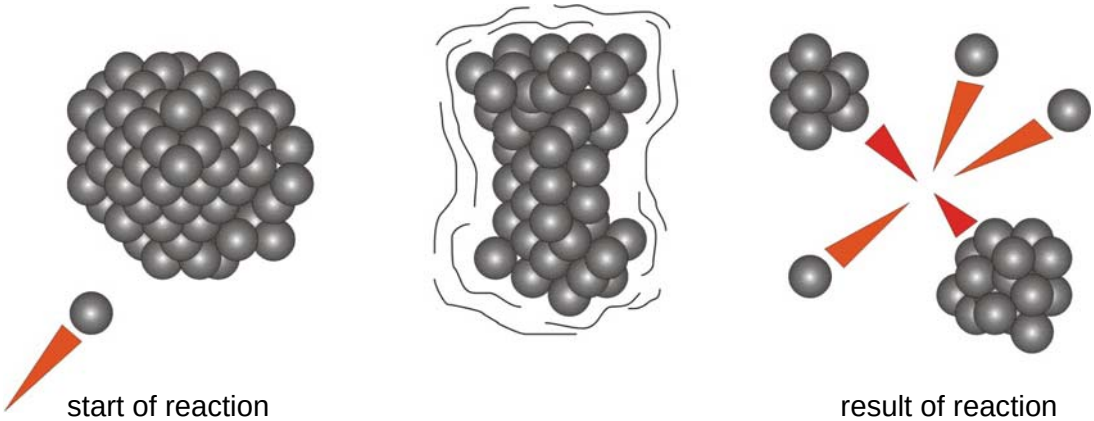
10 This question is about nuclear power.



start of reaction result of reaction

A nuclear reactor is used to generate electricity using nuclear power.

The reactor core contains uranium.

Finish the following sentences that describe the reaction shown in the diagram. Choose the best words from the list.

You may use each word **once**, **more** than once or **not at all**.

electron

fission

five

fusion

neutron

proton

stable

three

two

unstable

Uranium has a large and ..... nucleus. [1]

The nucleus of the uranium absorbs a slow moving ..... . [1]

The nucleus of the uranium will split into ..... smaller fragments roughly equal in size. [1]

In addition to this, the reaction releases more ..... s. [1]

This process is known as nuclear ..... . [1]

[Total: 5]

END OF QUESTION PAPER

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Acknowledgements:

Q.3 graphic From The Daily Express, 9 November 2005
Q.4 article text Adapted from Diabetes UK, www.diabetes.org.uk

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