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**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

# TWENTY FIRST CENTURY SCIENCE SCIENCE A

**A213/02**

Unit 3: Modules B3 C3 P3 (Higher Tier)

*OCE/35569*

Candidates answer on the question paper.
A calculator may be used for this paper.

**OCR supplied materials:**
None

**Other materials required:**
- Pencil
- Ruler (cm/mm)

**Friday 17 June 2011**
**Afternoon**

**Duration:** 40 minutes

*A213302*

| Candidate forename | | Candidate surname | |
|---|---|---|---|

| Centre number | | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

## INSTRUCTIONS TO CANDIDATES

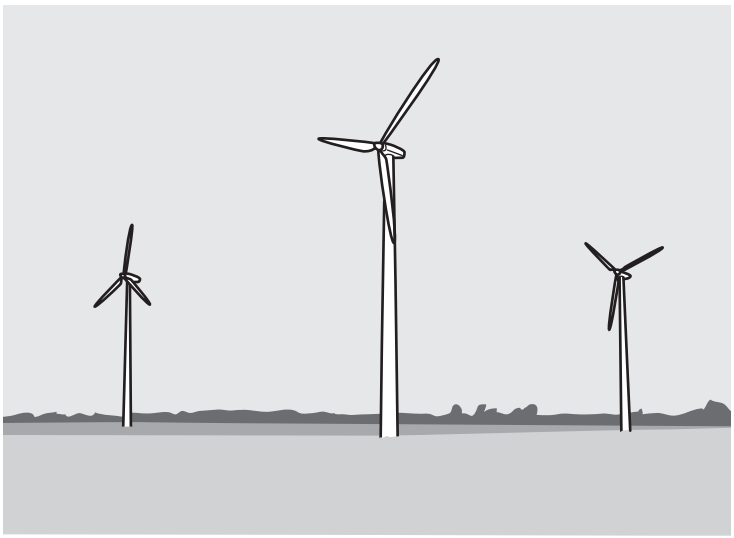
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

## INFORMATION FOR CANDIDATES

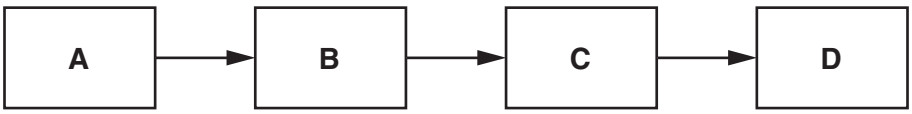
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

**1** Wind turbines can be used to generate electricity in wind farms.



**(a)** The block diagram below shows the stages by which a wind turbine generates electricity.




The letters **A**, **B**, **C** and **D** stand for the statements below.

Put the correct letter next to each statement.

Electricity is generated. ☐

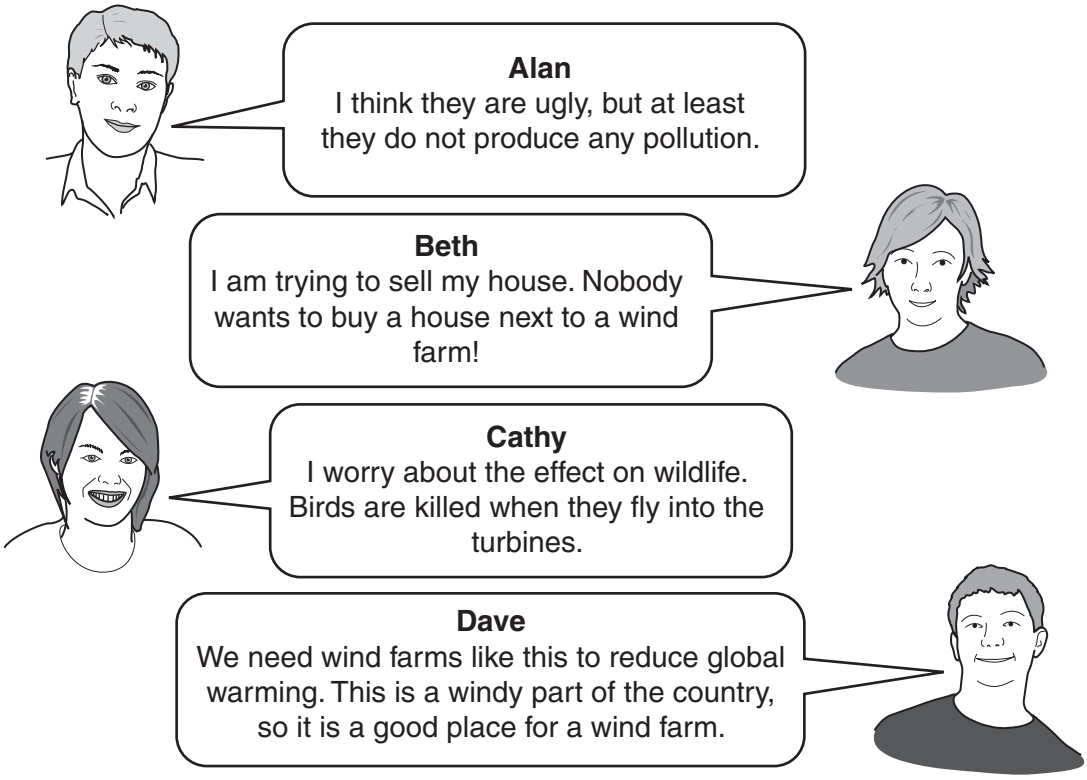
Electricity is passed on to the National Grid. ☐

The generator spins. ☐

The blades of the turbine rotate. ☐

**[1]**

**(b)** These people have different ideas about the wind farm next to their village.




**(i)** Who mentions an advantage of having the wind farm?

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

Alan ☐

Beth ☐

Cathy ☐

Dave ☐

**[1]**

**(ii)** Who mentions both an advantage and a disadvantage of having the wind farm?

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

Alan ☐

Beth ☐

Cathy ☐

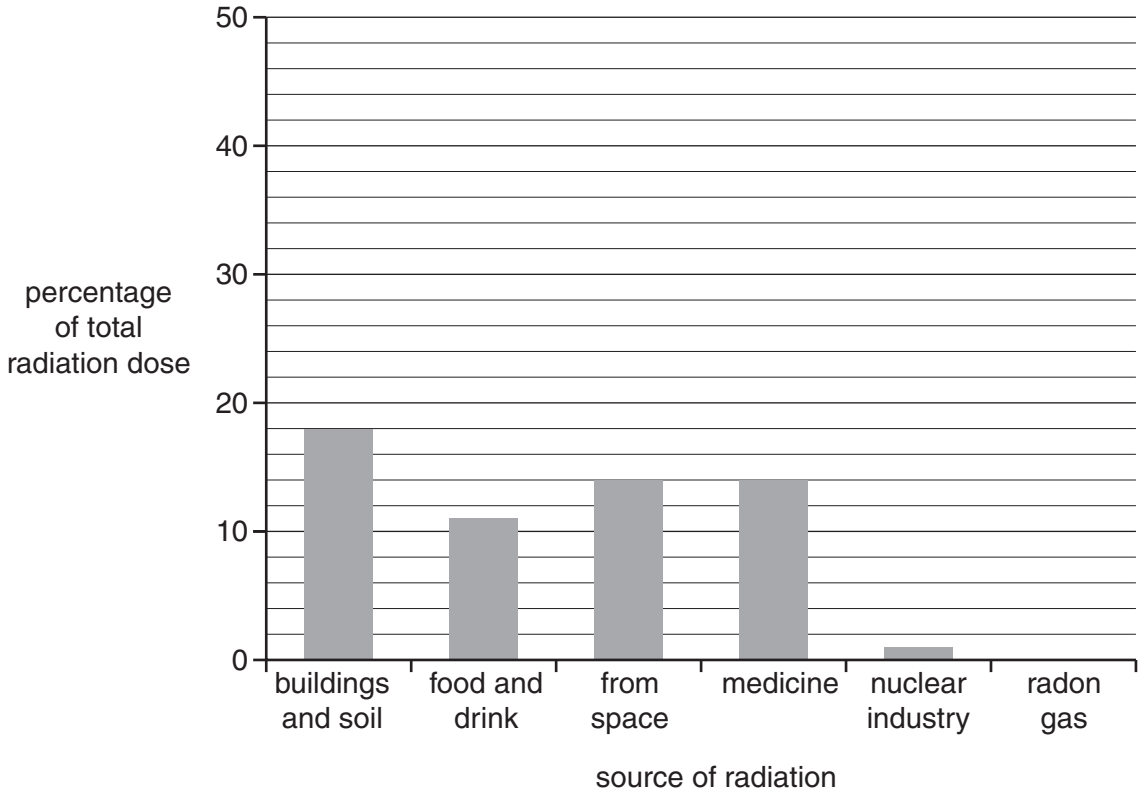
Dave ☐

**[1]**

**[Total: 3]**

**2** The average radiation dose of people living in Europe can be measured.
The radiation comes from different sources.
The bar chart shows the percentage of the total dose that is received from different sources.

The percentage for one source of radiation has **not** yet been plotted on the chart.




**(a)** Assume that no other sources give any radiation dose.

Draw a bar on the chart to show the percentage of the total radiation dose from radon gas. **[1]**

**(b)** The radioactive materials used in medicine and in the nuclear industry are artificial ones, not natural ones.

**(i)** What is the percentage of the total radiation dose given by these two artificial sources of radiation?

answer = ..... % **[1]**

**(ii)** Which of the natural sources of radiation gives the smallest percentage of the total radiation dose?

answer ..... **[1]**

**(c)** Explain how risk to workers in the nuclear industry is controlled by the Government and the nuclear industry employers.

In your answer you should consider

- the **risks** and **benefits**
- the **official regulations**.

.....

.....

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.....

.....

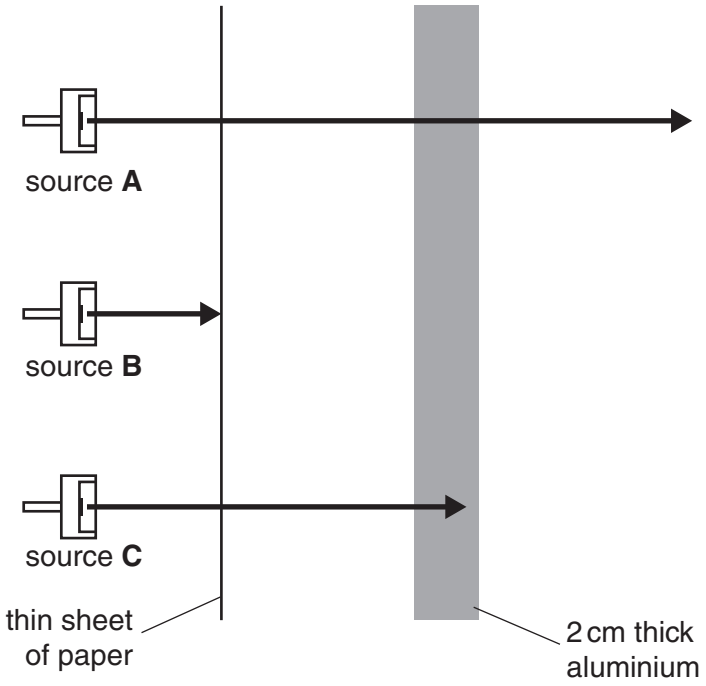
..... **[3]**

**[Total: 6]**

**3** **(a)** The diagram shows three different types of radiation being given out by radioactive sources **A**, **B** and **C**.

Sheets of thin paper and thick aluminium are put in front of the sources.

The arrows show how far each type of radiation can travel through these materials.




Write down the name of the type of radiation given out by each source.

Source **A** gives out …… radiation.

Source **B** gives out …… radiation.

Source **C** gives out …… radiation. **[1]**

**(b)** The different sorts of radiation come from the centre of the atom.

**(i)** What is this part of the atom called?

answer ..... **[1]**

**(ii)** What particles are found in this part of the atom?

answer …… and …… **[1]**

**(c)** A sample of a radioactive material has a half-life of 3 minutes.

At the beginning of an experiment the sample has an activity of 400 counts/second.

Calculate the activity of the sample 12 minutes after the start of the experiment.

You should show your working clearly.

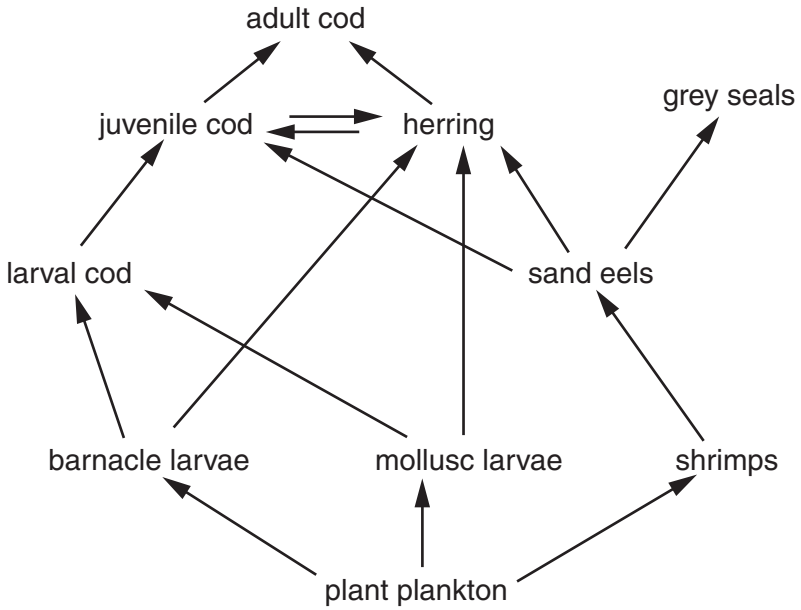
activity = ..... counts/second

**[2]**

**[Total: 5]**

**4** This question is about food webs.

**(a)** The diagram shows part of a food web for the North Sea.




**(i)** Use information from the food web to complete the sentence.

The species with the most varied diet is …… . **[1]**

**(ii)** Barnacle larvae, mollusc larvae and shrimps all feed on plant plankton.

All three are using the same food resource.

Scientists call this interaction …… . **[1]**

**(b)** Grey seals eat sand eels.

Overfishing has reduced the numbers of cod and herring.

What effect will overfishing have on the seal population for this food web?

Draw **one** straight line to link the correct **effect on grey seal population** to its **explanation**.

Draw **one** straight line only.

| **effect on grey seal population** | **explanation** |
|---|---|
| | cod do not eat sand eels |
| it increases | |
| | fewer sand eels are eaten by other predators |
| it decreases | |
| | more sand eels are eaten by other predators |
| it stays the same | |
| | grey seals do not eat herring or cod |

**[1]**

**[Total: 3]**

**5** This question is about evolution.

Darwin suggested that evolution happened due to natural selection.

Read the information about peacocks.


Males have very large colourful tails with eyespots.
Females do not have large colourful tails.
Research shows that females prefer to mate with males with the most eyespots on their tails.

Explain why male peacocks have evolved such large tails.

In your answer write about

- variation of peacocks
- competition between peacocks
- reproduction.

.....

.....

.....

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

**[Total: 3]**

**6** This is a question about extinctions.

Read the information about passenger pigeons.

**1** When European settlers arrived in North America in the 1600s, there were millions of passenger pigeons.

**2** The female passenger pigeons only laid one egg a year.

**3** The passenger pigeons had few natural predators.

**4** The birds fed mainly on acorns, chestnuts and beech nuts in the extensive woodlands of North America.

**5** Settlers cut down woods for fuel and to build houses.

**6** The settlers hunted the birds for food and feathers.

**7** In 1914 the last passenger pigeon died in captivity.

**(a)** Four of the sentences explain the rapid extinction of the passenger pigeon.

Which four?

sentence number ……, ……, …… and …… **[1]**

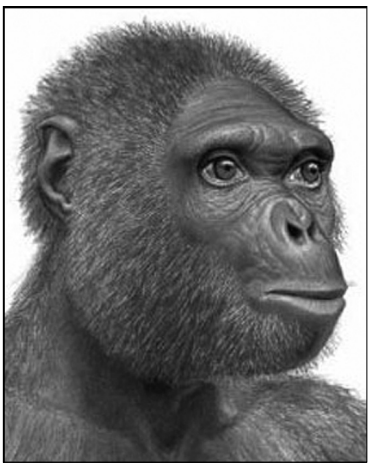
**(b)** Extinctions reduce the number of species in a habitat.

What is the word that scientists use for the number of species in a habitat?

answer ..... **[1]**

**[Total: 2]**

**7** Read the article.



Artists reconstruction of *A. ramidus*

## Missing link – the scientific breakthrough of 2009

Parts of an ancient skeleton of an ape-type animal, *Ardipithecus ramidus*, were discovered in 1994. The skeleton had grasping feet like modern chimpanzees.

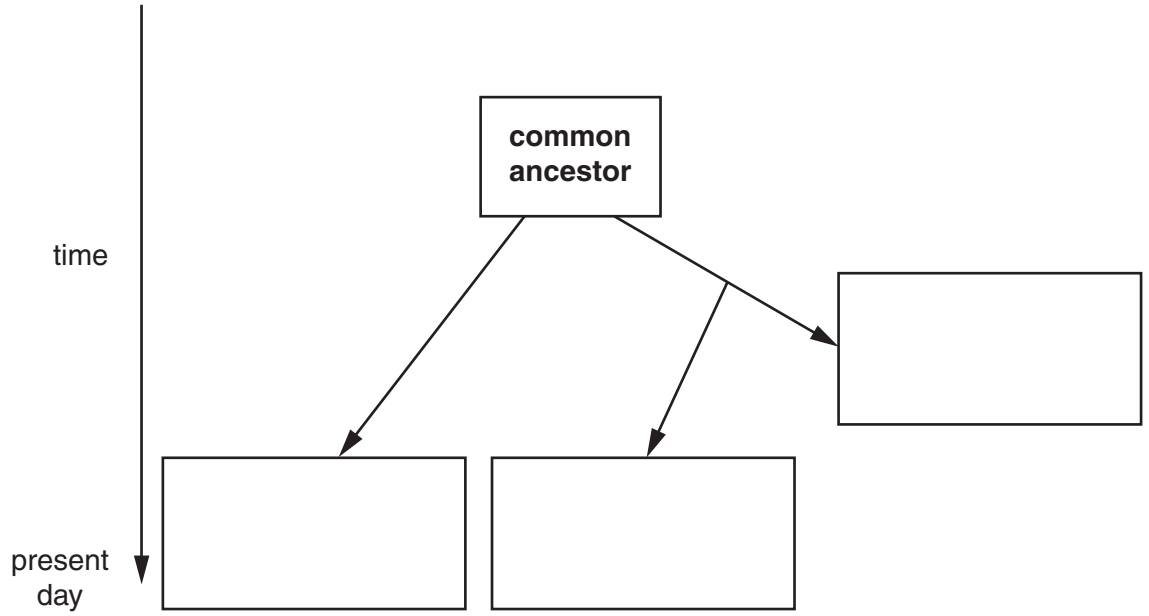
Scientists spent years piecing together fragments of the badly crushed pelvis bones. In 2009 they decided that *A. ramidus* could walk upright. They said this means *A. ramidus* was, like humans, a hominid and not an ancestor of modern chimpanzees or a common ancestor of chimpanzees and humans.

These scientists also think that the grasping feet mean that *A. ramidus* had lived in woodland. This would show that hominids may have evolved in woodland.

Other scientists think that hominids evolved in open grassland.

**(a)** Use information from the article to complete the labels in the simplified diagram of human evolution.

***A. ramidus*** **chimpanzees** **hominids** **humans**




**[2]**

**(b)** Some scientists think the *A. ramidus* skeleton is evidence that hominids evolved in woodland.

Other scientists think hominids evolved on the grassland of Africa rather than in woodland.

Put ticks (✓) in the boxes next to the **two** sentences that explain why the evidence is not conclusive.

| | |
|---|---|
| *A. ramidus* was not the common ancestor of chimpanzees and humans. | ☐ |
| Only one example of *A. ramidus* has been found. | ☐ |
| The skeleton had grasping feet. | ☐ |
| *A. ramidus* probably walked upright. | ☐ |
| Analysis of other hominid teeth supports the idea that hominids lived in grassland. | ☐ |

**[1]**

**[Total: 3]**

**8** Multicellular organisms like humans have developed systems for communication between cells.

**(a)** Name the two communication systems in humans.

…… and …… **[1]**

**(b)** The two communication systems work in different ways.

One communication system uses electrical impulses. The other uses chemicals transported in the blood.

Each way of working has different features.

Draw **two** straight lines from **each** way of working to its **two** correct features.

You should draw **four** lines.

| **way of working** | **features** |
|---|---|
| | short-lived responses |
| uses electrical impulses | |
| | slow responses |
| | rapid responses |
| uses chemicals transported in blood | |
| | long-lasting responses |

**[2]**

**[Total: 3]**

**9** Read these sentences from a newspaper article.

> Supermarkets have been told to remove packets of dried fruit from their shelves.
>
> They contain the preservative sulfur dioxide, but this is not mentioned on the food label.

**(a)** Suggest an argument the authorities might use to justify taking packets of dried fruit off supermarket shelves.

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.....

.....

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

**(b)** Why does the dried fruit contain sulfur dioxide?

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

| | |
|---|---|
| Sulfur dioxide reacts with oils, so the oils do not react with oxygen. | ☐ |
| Sulfur dioxide stops harmful chemicals forming during cooking. | ☐ |
| Sulfur dioxide neutralises pesticides sprayed on food crops. | ☐ |
| Sulfur dioxide stops the growth of fungi and bacteria. | ☐ |

**[1]**

**[Total: 3]**

**10** Martha reads a healthy eating leaflet written by the Food Standards Agency.

**(a)** What are the jobs of the Food Standards Agency?

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

| | |
|---|---|
| to find out the safe levels of chemicals in food | ☐ |
| to tell you if food is organic | ☐ |
| to stop people having diabetes because they are overweight | ☐ |
| to advise people on what they should eat | ☐ |
| to pass laws about healthy eating | ☐ |

**[2]**

**(b)** The leaflet has a table that tells Martha the levels of fat, sugar and salt in a food.

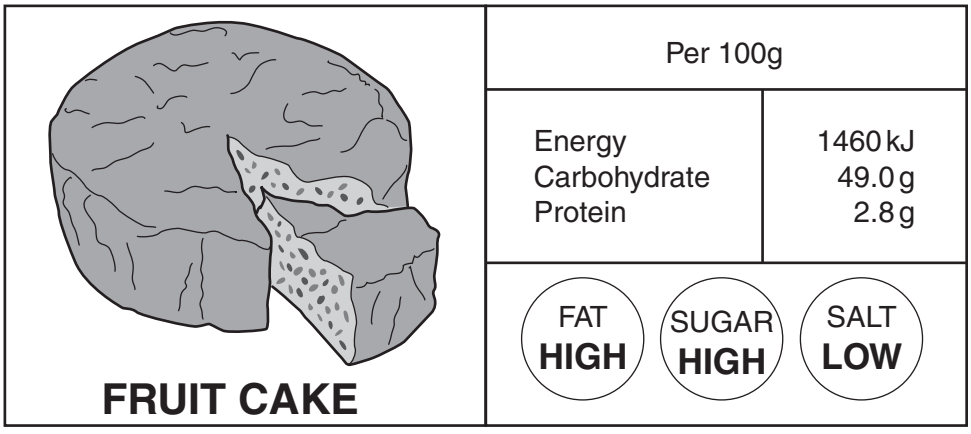
The levels are classified as **high** and **low**.

Each amount is given as grams in every 100 g of food.

| | **levels of fat, sugar and salt in food in g / 100 g food** | | |
|---|---|---|---|
| | **fat** | **sugar** | **salt** |
| food that is **high** has **more than** | 20 | 15 | 1.5 |
| food that is **low** has **less than** | 3 | 5 | 0.3 |

Martha buys a cake at the supermarket.

She looks at the label.



**(i)** Here are some statements about a 100 g slice of cake.

Only **one** of them is true.

Put a tick(✓) in the box next to the **true** statement.

A 100 g slice contains …

… 20 g fat and 0.5 g salt. ☐

… 10 g fat and 1 g salt. ☐

… 45 g fat, and 1 g salt ☐

… 25 g fat and no salt. ☐

**[1]**

**(ii)** Martha knows there is a health risk in eating too much fat and sugar.

What information will Martha need in order to assess this risk?

.....

.....

.....

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

**(c)** The cake label also shows the amounts of carbohydrate and protein in the cake.

What are the **four** main elements in proteins?

1 .....

2 .....

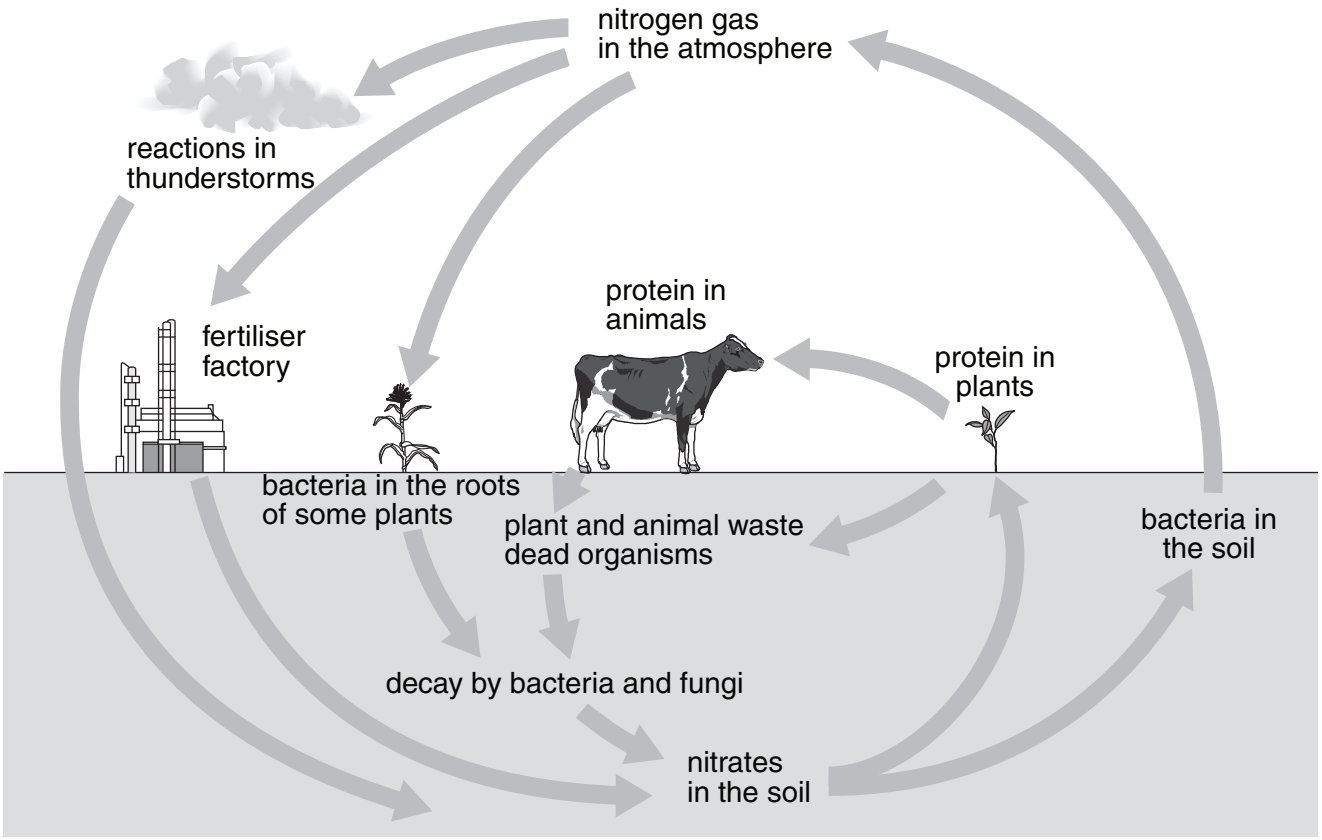
3 .....

4 .....

**[2]**

**[Total: 7]**

**11** This is a diagram of the main stages in the nitrogen cycle.



Here are five chemical reactions involving nitrogen.

| | |
|---|---|
| **A** | Amino acids break down to make nitrates. |
| **B** | Amino acids build up to make proteins. |
| **C** | Nitrates are used to make proteins. |
| **D** | Nitrates break down to make nitrogen gas. |
| **E** | Nitrogen gas from the air is changed to nitrates. |

Which chemical reactions are involved in each of the following stages of the nitrogen cycle?

Complete the table by writing the correct letter, **A**, **B**, **C**, **D** or **E**, next to each statement.

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

| stage of the nitrogen cycle | chemical reaction |
|---|---|
| in the fertiliser factory | |
| when dead animals and plants decay | |
| in thunderstorms | |
| in the bodies of living animals | |

**[4]**

**[Total: 4]**

**END OF QUESTION PAPER**

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