OCR
RECOGNISING ACHIEVEMENT

# H

## A213/02

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**
**TWENTY FIRST CENTURY SCIENCE**
**SCIENCE A**
Unit 3 Modules B3 C3 P3 (Higher Tier)

**MONDAY 21 JANUARY 2008**

Afternoon
Time: 40 minutes

Candidates answer on the question paper.
**Additional materials (enclosed):**
None

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

*CUP/T40785*

| Candidate Forename | | Candidate Surname | |
|---|---|---|---|
| Centre Number | | Candidate Number | |

**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

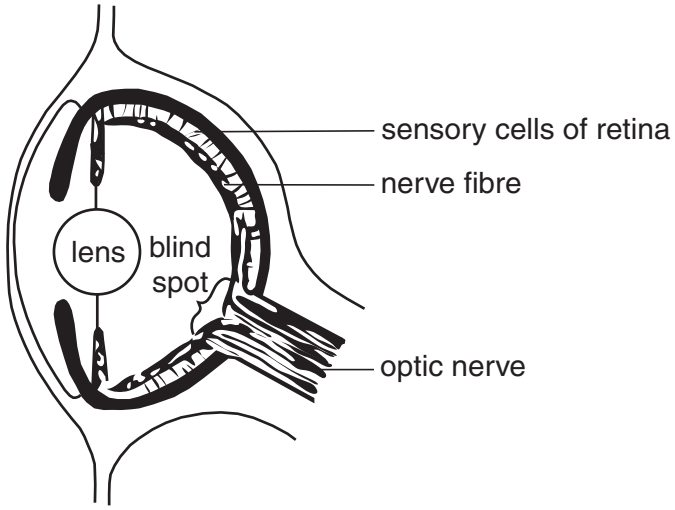
- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 42.

| FOR EXAMINER'S USE | | |
|---|---|---|
| **Qu.** | **Max.** | **Mark** |
| 1 | 6 | |
| 2 | 4 | |
| 3 | 4 | |
| 4 | 11 | |
| 5 | 3 | |
| 6 | 10 | |
| 7 | 4 | |
| **TOTAL** | 42 | |

This document consists of **18** printed pages and **2** blank pages.

Answer **all** the questions.

**1** The diagram shows an octopus eye.




octopus eye

**(a)** Eyes help animals survive by detecting changes.

Cells which detect changes are called ..... cells. [1]

**(b)** Octopus eyes are very complex.
Some people say they have been designed.
Most scientists believe that eyes evolved by natural selection.

The sentences **A**, **B**, **C**, **D** and **E** describe possible steps in the natural selection of eyes. They are in the wrong order.

**A** Individuals which survived longer bred and passed on their genes.

**B** Individuals with better eyesight were more likely to survive.

**C** Over many generations, lenses improved.

**D** Individuals who could focus light on the retina could find food or escape predators better.

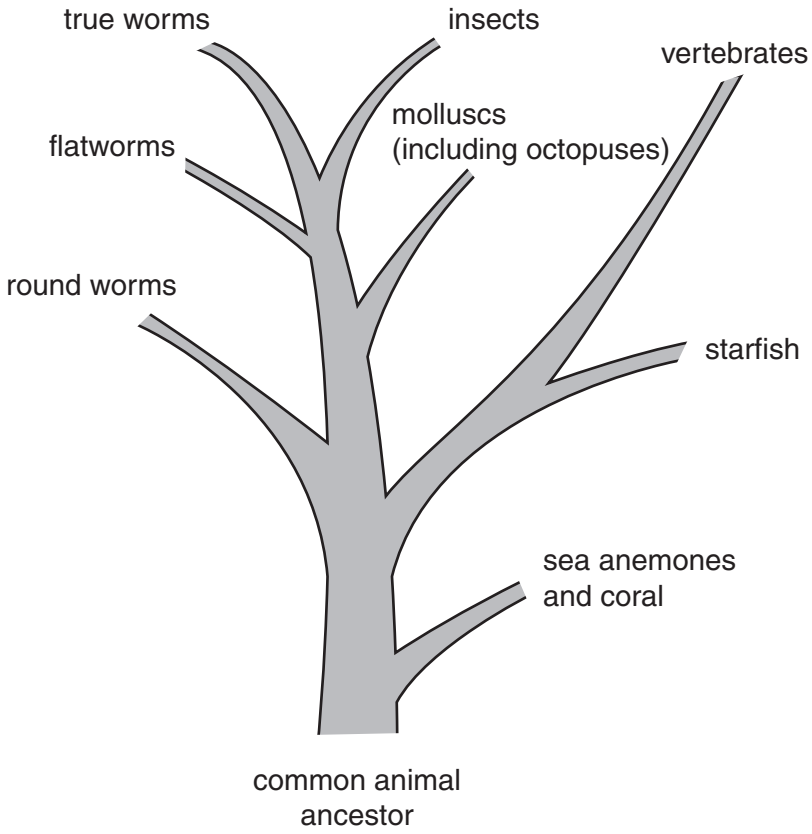
**E** Due to natural variation, some individuals in a population had lenses which focused light on the retina.

Fill in the boxes to show the right order. The first one has been done for you.

| | | | | |
|---|---|---|---|---|
| E | | | | |

[3]

**(c)** The diagram shows how scientists believe the major animal groups have evolved.




Vertebrate eyes are very similar to octopus eyes.

Which **two** of the statements **best** explain why the eyes of a vertebrate and an octopus are similar?

**1** Octopuses evolved from vertebrates.

**2** The eyes of all animals are the same.

**3** Vertebrates evolved from octopuses.

**4** Eyes have evolved in many different animals.

**5** Natural selection often produces similar solutions to similar problems.

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

[Total: 6]

**2** Read the following article.

# Single DNA change causes mosquito resistance

## Some mosquitoes can transmit malaria when they bite humans.

Insecticides are used to kill mosquitoes to stop the spread of malaria. However, resistance to common insecticides has existed for 25 years and is widespread. Scientists may have discovered the cause of this resistance. They have found a single gene change in the mosquito DNA. This alters an important protein in the nervous system which prevents the insecticide killing the mosquito.

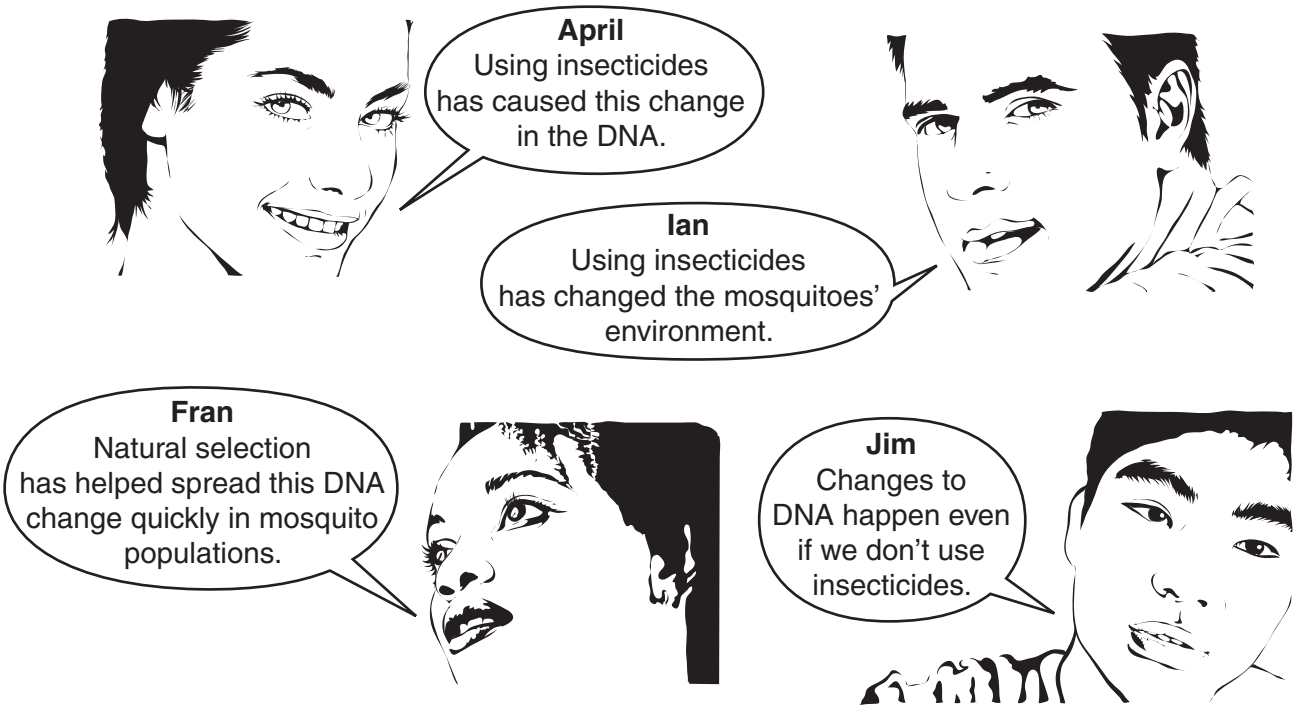
**(a) (i)** What name do scientists give to a length of DNA that codes for one protein?

answer .....[1]

**(ii)** What is the scientific term for a change to the DNA code like the one described in the article?

answer .....[1]

**(b)** Four friends are discussing the article. Here are some of the things they say.



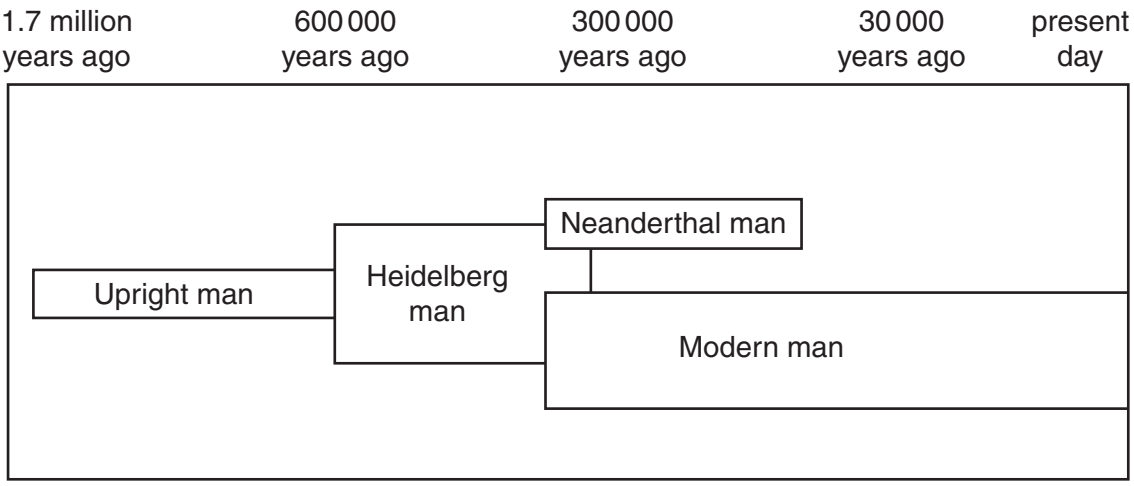

Write the **names** of the friends in the correct box.

| correct statements | incorrect statements |
|---|---|
| | |

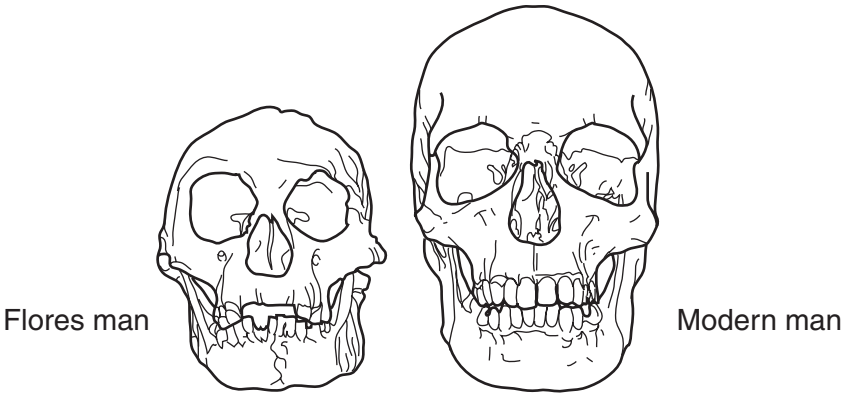
[2]

[Total: 4]

**3** The diagram below shows one possible pattern for human evolution. This is a simplified diagram which only shows four of the many hominid species which scientists think have existed over the last 1.7 million years.




**(a)** In 2004 on the Indonesian island of Flores, scientists found the skull and some bones from an adult human female. Read the statements about this find.




**A** The female was only one metre tall.

**B** Next to the bones, scientists also found stone tools and signs of cooking.

**C** The bones were 13 000 years old.

**D** Scientists said the bones belonged to a species new to science. They called this species Flores man.

The scientists said that although the species had a smaller brain than modern man, it may have been quite intelligent.

Which statement, **A**, **B**, **C** or **D**, provides evidence supporting this hypothesis?

answer .....[1]

**(b)** The graph below shows the relationship between average height and average brain size for some human species.


Flores man evolved after Upright man.

The evolution of Flores man does **not** fit the usually accepted theory of how humans have changed as they evolved over time.

Put ticks (✓) in the boxes next to any trends in which Flores man does **not** fit.

They have developed sophisticated language. ☐

They have become taller. ☐

They have developed larger brains. ☐

They have developed more sophisticated tools. ☐

[1]

**(c)** In 2006, a second team of scientists challenged the idea that Flores man was a new species. They suggested the remains could be those of a modern human who had a small brain due to a disease. The scientists put forward the following points to back up their argument.

- Modern humans inhabited Flores at the same time as Flores man.
- The tools found are the same as those used by modern humans.
- Some diseases are known to stunt brain and body growth.

Here are some suggestions about why the second team came to different conclusions using the same data about the bones found at Flores.

**A** The second team don't agree with the dating of the bones.

**B** The second team think that the first group of scientists may have lacked imagination.

**C** The second team don't believe the evidence justifies changing established ideas about human evolution.

**D** The second team think the observations on the tools found are wrong.

**E** The second team think they have discovered new evidence.

**F** The second team think that they have made better conclusions based on the same evidence.

Which **two** suggestions, **A**, **B**, **C**, **D**, **E** or **F**, do you think best explain how the two teams of scientists have such different ideas?

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

[Total: 4]

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**Question 4 starts on page 10**

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**4** Eve is trying to eat healthily. She knows that it is important to cut down on some food chemicals such as sugar, fat and salt.

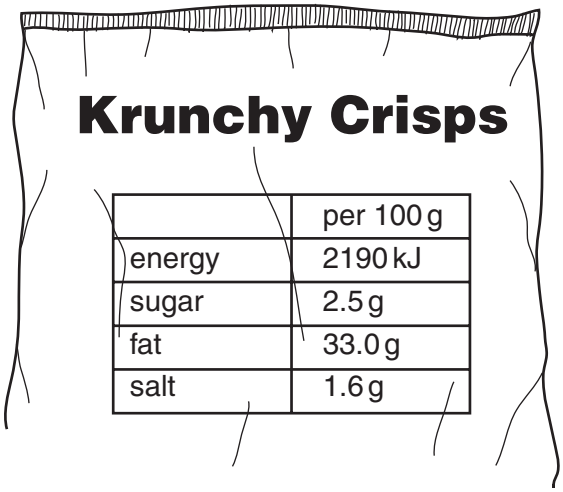
Eve has a fridge magnet that shows guidelines for healthy amounts of sugar, fat and salt in foods.

CHECK THE

**LABELS!**


| | What's a little? (per 100 g) | What's a lot? (per 100 g) |
|---|---|---|
| Sugar | 2 g | 10 g |
| Fat | 3 g | 20 g |
| Salt | 0.3 g | 1.5 g |

**(a)** Eve looks at the label on a packet of Krunchy Crisps.



**(i)** Use information from the fridge magnet and the Krunchy Crisp packet to decide whether the crisps are **high** or **low** in sugar, fat and salt.

Put a tick (✓) in each correct box.

| | **high** | **low** |
|---|---|---|
| sugar | | |
| fat | | |
| salt | | |

[2]

**(ii)** Eve knows that she cannot assess the risk of eating Krunchy Crisps using only this information.

Which statements show why she cannot assess the risk?

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

She might be eating other foods that are more harmful than crisps. ☐

She does not know the outcomes of eating too much sugar, salt and fat. ☐

She needs to take into account the amount of crisps that she eats. ☐

Other brands of crisps may have different amounts of sugar, salt and fat. ☐

[2]

**(b) (i)** The label on the Krunchy Crisps also gives information about the amounts of carbohydrates and protein in the crisps.

What elements are present in carbohydrates and protein?

Put a tick (✓) in each correct box for each element.

| | **carbohydrates** | **protein** |
|---|---|---|
| carbon | | |
| hydrogen | | |
| oxygen | | |
| nitrogen | | |

[2]

**(ii)** The fridge magnet does not have a recommended maximum amount for protein. Our bodies need lots of protein.

Finish the sentences by putting a (ring) around the correct word or words.

Proteins are broken down during digestion to form …… **glucose / amino acids / urea.**

Proteins are synthesised in the body from …… **amino acids / DNA / haemoglobin.**

The part of the body that is mainly protein is …… **bones / teeth / tendons.**

Waste excess protein is broken down in the …… **intestine / kidneys / liver.**

After being broken down, waste protein is excreted from the body in the form of …… **urea / urine / amino acids**.

[3]

**(c)** Eve reads an article that says that eating too much fat can increase the risk of getting heart disease.

Eve knows that her grandmother eats lots of fatty foods and has a very healthy heart.

Which of the following statements are true and which are false?

Write **T** in the box next to each **true** statement and **F** in the box next to each **false** one.

| | **T** (true) or **F** (false) |
|---|---|
| Eve's grandmother proves that the article is wrong. | |
| Eating too much fat is only one factor in causing heart disease. | |
| Eve's grandmother will definitely get heart disease in the future. | |
| Individual cases do not always fit a correlation. | |

[2]

[Total: 11]

**5** The table shows the E numbers for approved food additives in the European Union.

| E number | purpose of additive |
|---|---|
| E100–E199 | colours |
| E200–E299 | preservatives |
| E300–E399 | antioxidants |
| E400+ | emulsifiers and stabilisers |

**(a)** Draw a straight line from each **E number** to its **purpose** and a straight line from each **purpose** to **how it works**.

| E number | purpose | how it works |
|---|---|---|
| E220 | emulsifier | stops fats and oils deteriorating in air |
| E350 | antioxidant | prevents growth of harmful organisms |
| E410 | preservative | mixes ingredients that normally separate |

[2]

**(b)** Additives with E numbers have all been approved for use in the UK and the European Union.

Put a cross (**X**) in the box next to each **false** statement about foods containing additives.

Additives are always the highest risk chemicals in foods. ☐

Fresh food without additives is always safer. ☐

All approved additives have always passed a safety test. ☐

Approved additives never cause health problems. ☐

[1]

[Total: 3]

**6** Radon gas is given off by the rocks in some parts of Britain.
Radon is a radioactive gas. It gives off alpha radiation.

**(a) (i)** Complete the sentences below. Choose words from this list.

**electrons** **neutrons** **protons**

Two different types of radon atoms are given off by some rocks.

These two types of atoms have different numbers of particles in the nucleus.

In the nucleus, there is the same number of ..... but

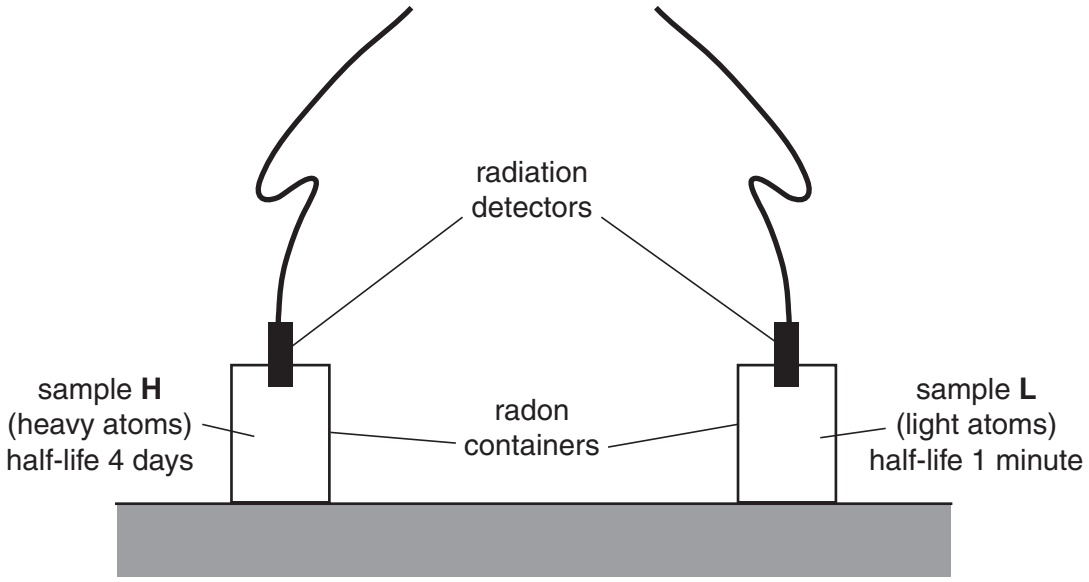
different numbers of ..... .

[1]

**(ii)** The heavier type of radon atoms has a half-life of nearly 4 days, while the lighter type has a half-life of about a minute.

In an experiment, the activity of samples of these two types of radon was measured.

Sample **H** contained the heavier type only. Sample **L** contained the lighter type only.
Each sample had the same number of atoms at the start.




Put a tick (✓) in the box next to **each** correct statement about these two samples.

After an hour, sample **L** will have no radon atoms left. ☐

Sample **H** will always have a smaller activity than sample **L**. ☐

When the samples are first set up, they will have the same activity. ☐

After 8 days, sample **H** will have about a quarter of its activity at the start. ☐

It is impossible to predict the exact activity of sample **H** after two days. ☐

[2]

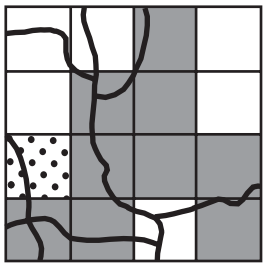
**(b)** This question is about houses in regions where there is too much radon gas.

If the level of radon is too high, there is a health risk, so action must be taken.

The maps show the percentage of houses with a health risk due to radon gas in three different regions of England.

Cambridgeshire

Norfolk



Yorkshire

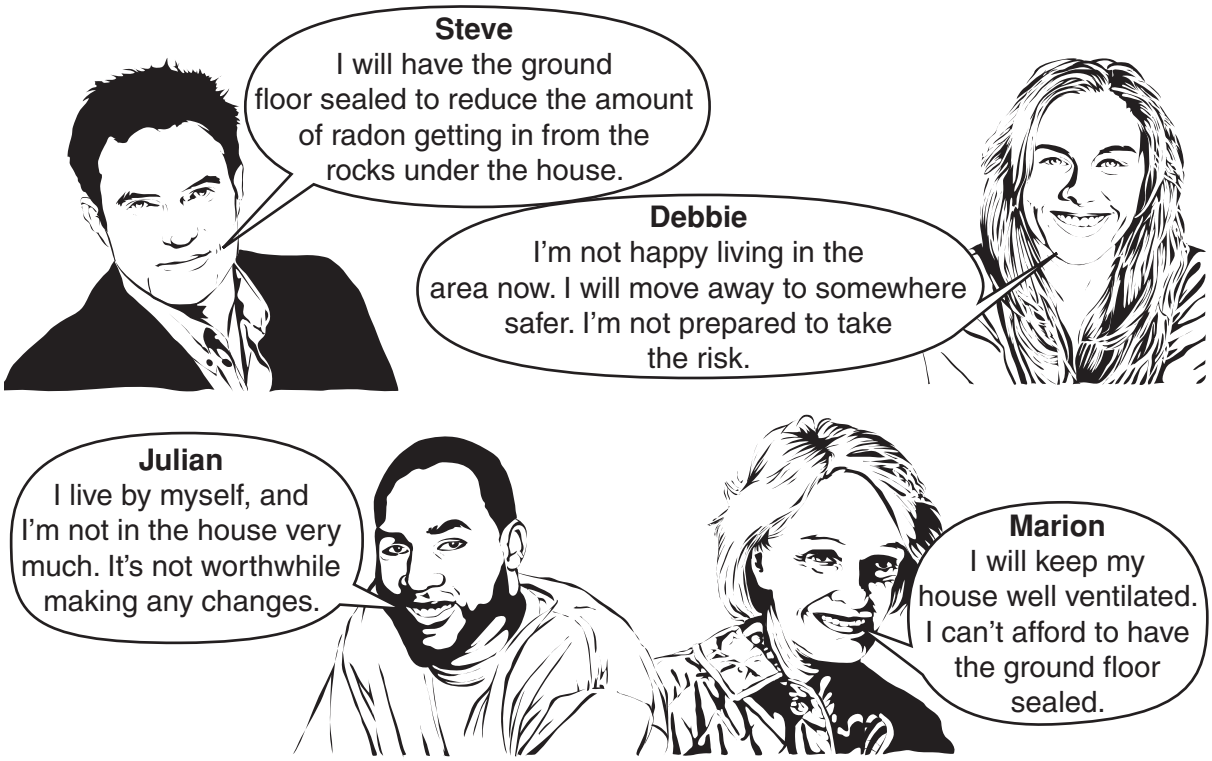
| percentage of houses where action must be taken | |
|---|---|
| | less than 1% |
| | between 1% and 3% |
| | between 3% and 5% |
| | between 5% and 10% |
| | more than 10% |

Put a tick (✓) in the box for **each** correct region for each statement.

| | Cambridgeshire | Norfolk | Yorkshire |
|---|---|---|---|
| One part of this region has very high radon levels. | | | |
| Over half of these regions have very low radon levels. | | | |
| No area in this region has more than 3% of houses where action must be taken. | | | |

[4]

**(c)** Four people who live on one street have been told that their houses are above the level where action must be taken.




**(i)** Who is taking action to reduce radon levels in their house?

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

Steve ☐

Debbie ☐

Julian ☐

Marion ☐

[2]

**(ii)** Which person's statement is the **best** example of the 'precautionary principle'?

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

Steve ☐

Debbie ☐

Julian ☐

Marion ☐

[1]

[Total: 10]

**7** Read the following letter from a local newspaper.
The writer has strong views, but he has some of his facts wrong.

*Dear Sir,*

*I am very angry about the plan to build a nuclear power station in our area. Not many people realise how very dangerous they are. Let me explain how they work. The nuclear fuel is burnt to release heat energy. This makes steam, and steam is used to turn turbines and generators. However, it also leaves dangerous radioactive waste. Some of this waste will be radioactive for thousands of years.*

*Nuclear power stations also produce radiation, which can cause cancer. This radiation can leak out and poison our water supplies; this happened in Chernobyl!*

*We owe it to our great-grandchildren - and their great-grandchildren, and so on, many times - to stop this evil menace now.*

*I plead with all readers to write letters to our Member of Parliament straight away!*

*Yours faithfully,*

*I R Ateman*

Write **T** in the box next to each **true** statement from the letter and **F** in the box next to each **false** one.

| | **T** (true) or **F** (false) |
|---|---|
| The nuclear fuel is burnt to release heat energy. | |
| Steam is used to turn turbines and generators. | |
| It also leaves dangerous radioactive waste. | |
| Some of this waste will be radioactive for thousands of years. | |
| Nuclear power stations also produce radiation which can cause cancer. | |

[4]

[Total: 4]

**END OF QUESTION PAPER**

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