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)
SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Time: 40 minutes

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

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

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 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.
- 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

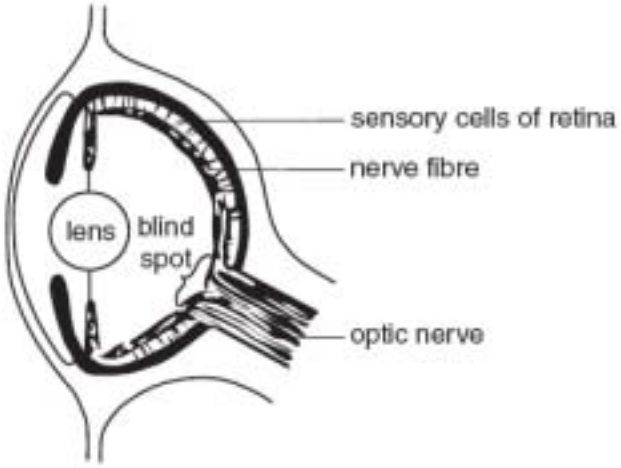
- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**6**	
2	**4**	
3	**4**	
4	**12**	
5	**3**	
6	**10**	
7	**3**	
TOTAL	**42**	

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

Answer **all** the questions.

1 The diagram shows an octopus eye.



octopus eye

(a) Octopus eyes are very complex.

Some people say they have been designed.

Most scientists believe that eyes evolved by natural selection.

Explain how natural selection may have led to eyes that could focus light better.

Use these ideas to help you.

- variation in eyes
- survival
- reproduction

.....

.....

.....

.....

.....

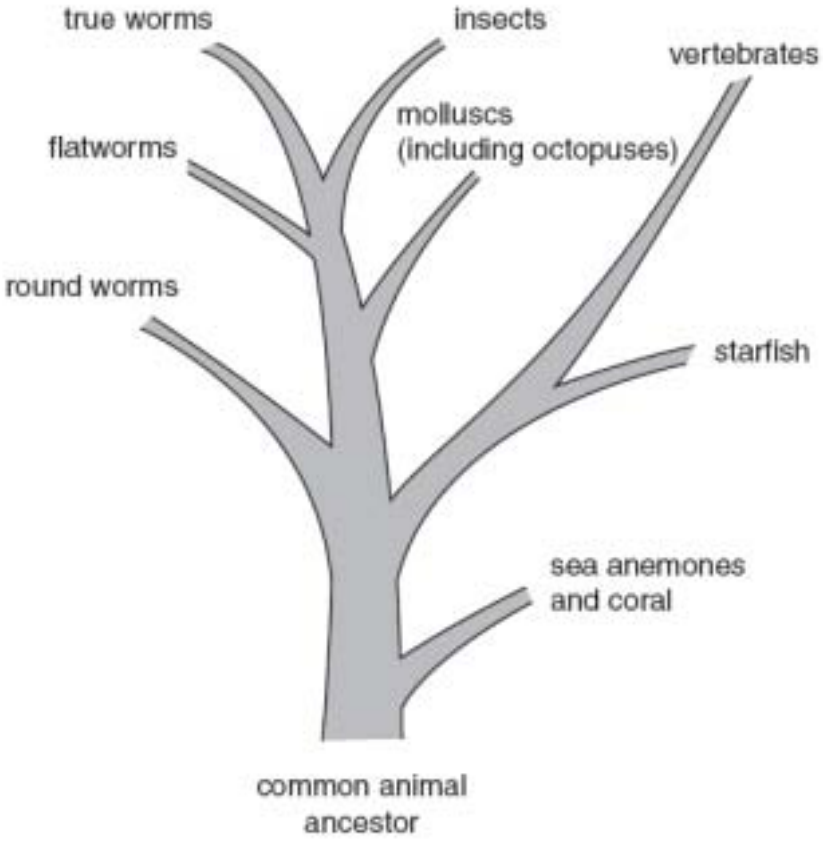
.....

.....

.....

[4]

(b) 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.

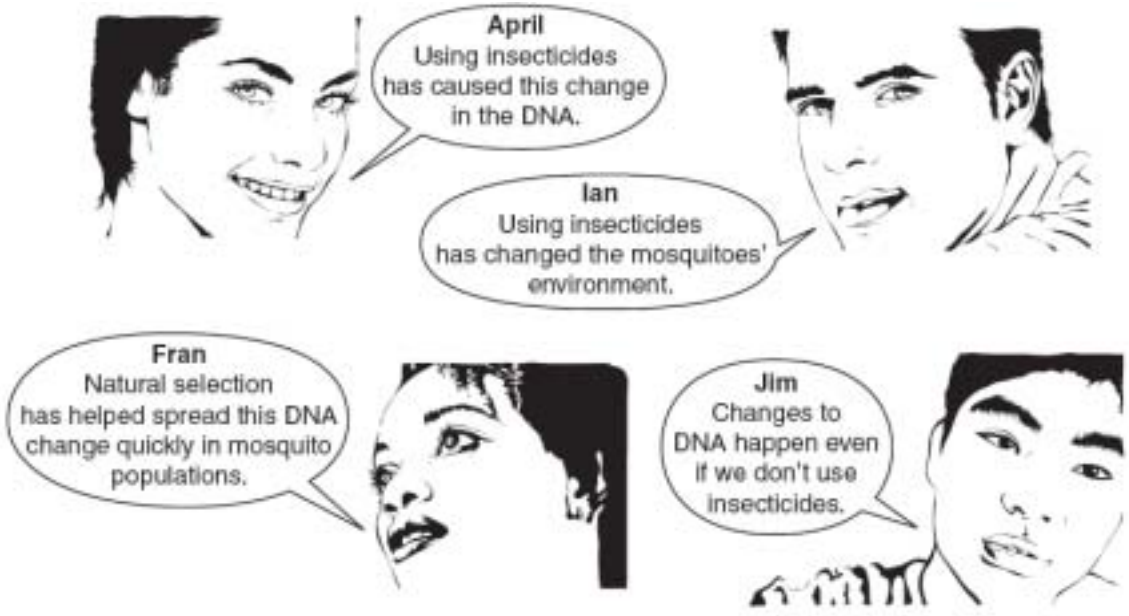
(a) **(i)** What name do scientists give to a length of DNA that codes for one protein?

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.



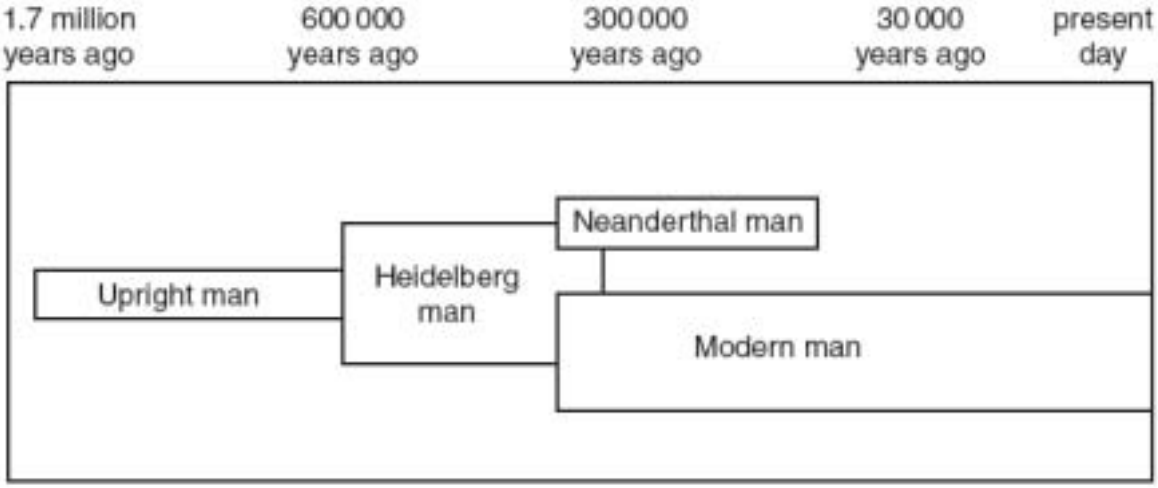
Write the **names** of the friends in the correct box.

correct statements	incorrect statements

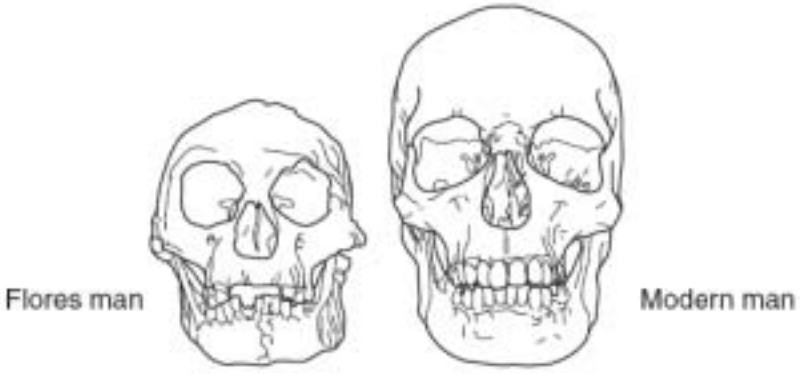
[2]

[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.

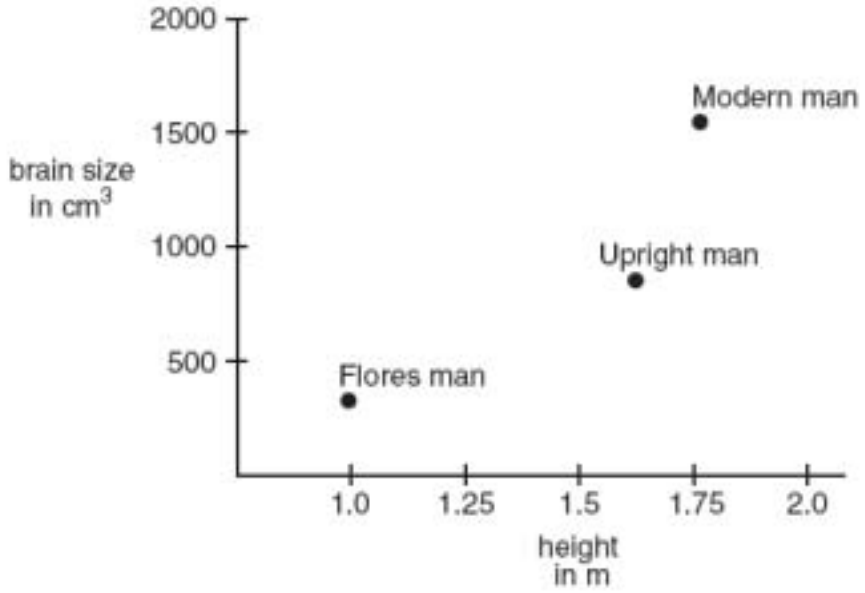
D Scientists said the bones belonged to a species new to science. They called this species Flores man.

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]

BLANK PAGE

Question 4 starts on page 10

PLEASE DO NOT WRITE ON THIS PAGE

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.

Krunchy Crisps

	per 100 g
energy	2190 kJ
sugar	2.5 g
fat	33.0 g
salt	1.6 g

(i) Use information from the fridge magnet and the Krunchy Crisps 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 people with a high fat diet have an increased risk of getting heart disease.

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

Does Eve's Grandmother prove that the article is wrong?

Explain your answer

.....

.....

.....

.....

[3]

[Total: 12]

5 **(a)** In the European Union food additives are given E numbers. There are four categories of E numbers

E100–E199

E200–E299

E300–E399

E400+

Each range of numbers applies to a different category of food additive. Explain the purpose of two categories of food additives.

.....

.....

.....

.....

[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 (a) Radon gas is given off by the rocks in some parts of Britain.

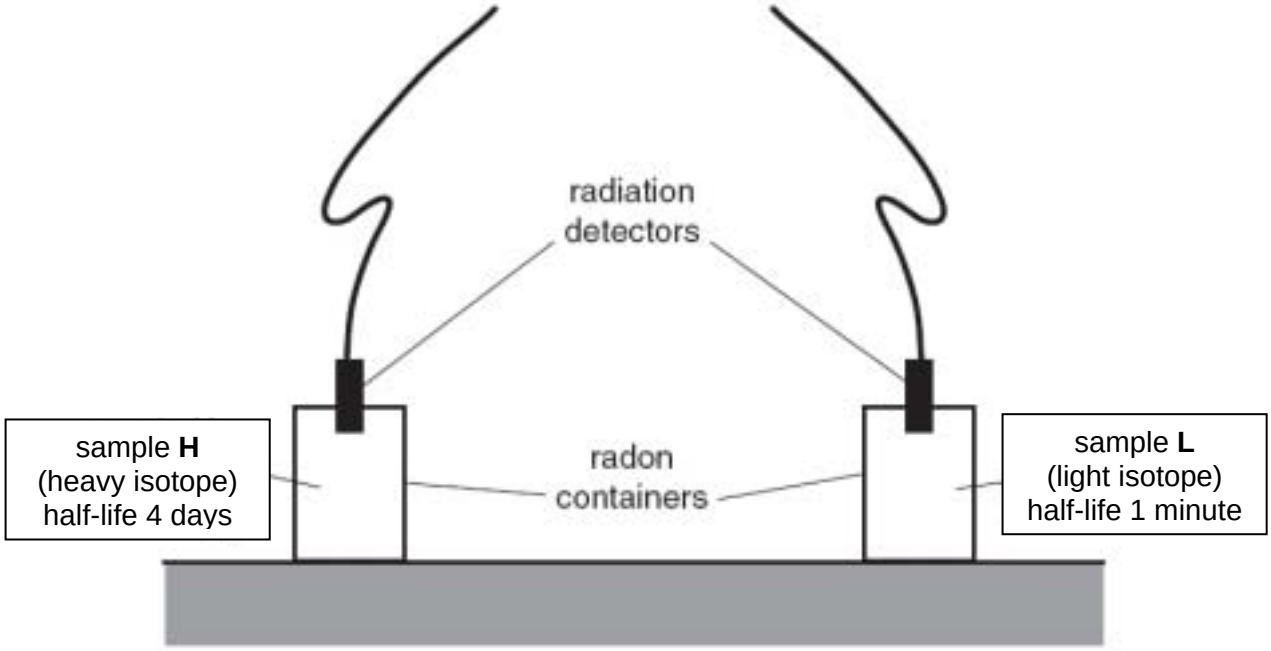
Radon is a radioactive gas. It gives off alpha radiation.

Two different radon isotopes are given off by some rocks.

The heavier radon isotope has a half-life of nearly 4 days, while the lighter isotope 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. ☐

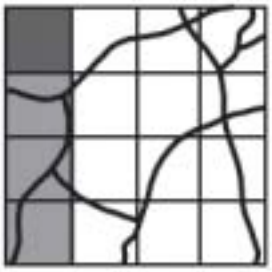
It is impossible to predict the exact activity of sample **H** after two days. ☐

[2]

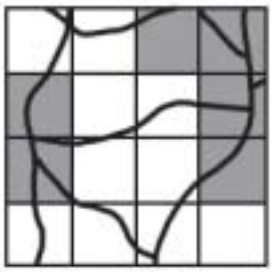
(b) This question is about houses in regions where there is too much radon gas.

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

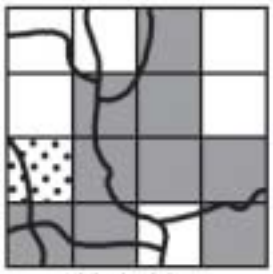
The maps show the percentage of houses with a health risk due to radon gas in three different regions of England.



Cambridgeshire



Norfolk



Yorkshire

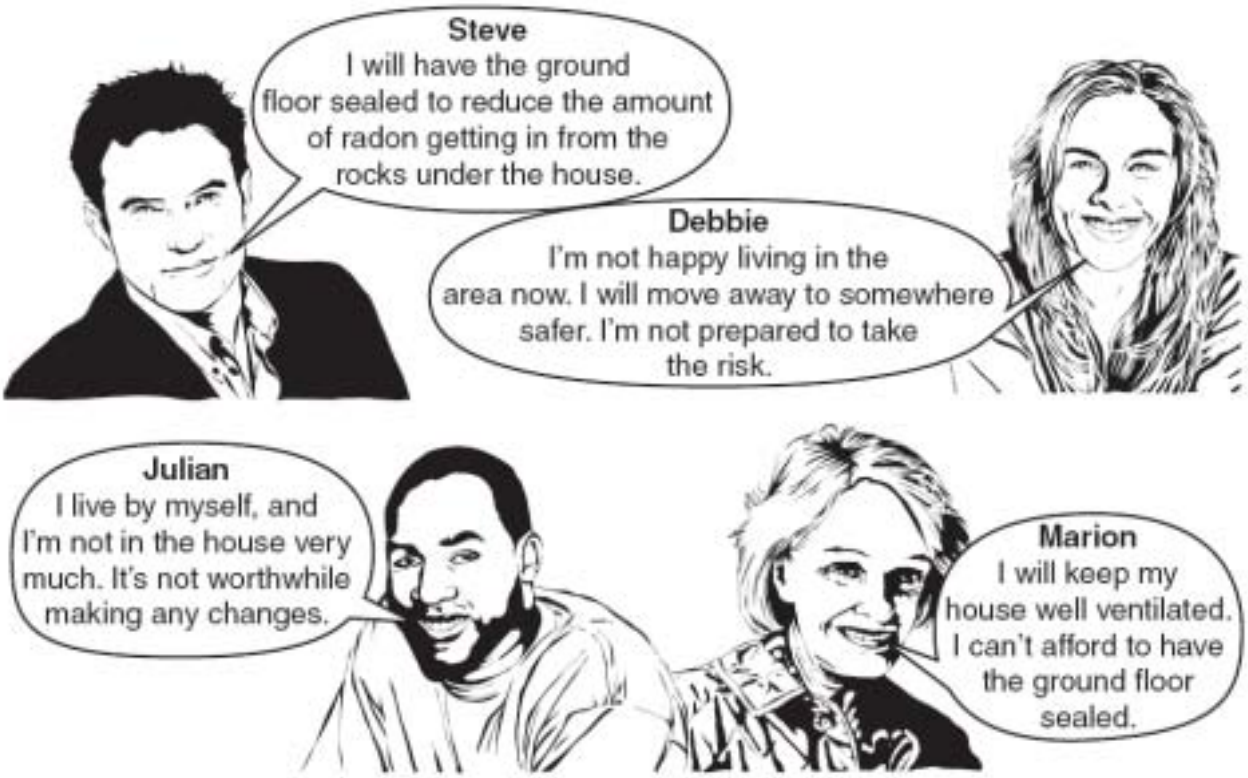
percentage of houses where action must be taken	
	less than 1%
	between 1% and 3%
	between 3% and 5%
	between 5% and 10%
	more than 10%

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 thinks there is **no** real risk from radon gas in their house?

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

Steve ☐

Debbie ☐

Julian ☐

Marion ☐

[1]

(ii) Use the comments of these four people to explain what is meant by the precautionary principle.

.....

.....

.....

.....

[3]

[Total: 10]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

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.	
Some of this waste will be radioactive for thousands of years.	
Nuclear power stations also produce radiation which can cause cancer.	

[3]

[Total: 3]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

RECOGNISING ACHIEVEMENT

CONFIDENTIAL

GCSE Unit

MARK SCHEME

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Science A (J630)
Modules B3, C3 and P3
Higher Tier

A213/02

Maximum Mark: 42

Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant - applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   <u>words</u> = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ORA = or reverse argument

   E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.
7. The list principle:
   If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

8. Marking method for tick boxes:

   Always check the additional guidance.

   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

   E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected Answers	Marks	Rationale
1	a		some individuals have eyes that focus/work better; individuals with better eyes are more likely to find food/escape predation/find mates/survive; so individuals with better eyes are more likely to breed and pass on genes; over many generations the eyes slowly improve;	4	
	b		4 **and** 5	2	One mark for **each** correct response **Accept** either order for correct responses **Accept** – a clear indication of the correct response eg. underline or circle numbers 4 and 5 in the question, if responses are not provided in the correct spaces if more than two responses - **deduct** one mark
			Total	**6**	

2	a	i	gene / allele	1	**Reject** – chromosome
		ii	mutation	1	**Accept** – mutate **Reject** – mutant
	b		<table><tr><th>correct</th><th>incorrect</th></tr><tr><td>Ian Fran Jim</td><td>April</td></tr></table>	2	all 4 correct = 2 marks **deduct** one mark for each incorrect or missing response
			Total	**4**	

Question			Expected Answers	Marks	Rationale
3	a		B	1	**Accept** – a clear indication of the correct answer eg. Underline or circle letter B in the question More than 1 response = 0 marks
	b		become taller ✓ developed larger brains ✓	1	Two correct responses = 1 mark More than 2 response = 0 marks **accept** a clear response eg. ✓ or X or shading etc. **ignore** X if combination of ✓ and X used
	c		C **and** F	2	One mark for **each** correct response **Accept** either order for correct responses **Accept** – a clear indication of the correct response eg. underline or circle numbers 4 and 5 in the question, if responses are not provided in the correct spaces if more than two responses - **deduct** one mark
			Total	**4**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Rationale</th></tr>
<tr><td>4</td><td>a</td><td>i</td><td>
<table>
<tr><th></th><th>high</th><th>low</th></tr>
<tr><td>sugar</td><td></td><td>✓</td></tr>
<tr><td>fat</td><td>✓</td><td></td></tr>
<tr><td>salt</td><td>✓</td><td></td></tr>
</table>
</td><td>2</td><td>3 correct = 2 marks
1 or 2 correct = 1 mark

accept a clear response eg. ✓ or X or shading etc.

ignore X if combination of ✓ and X used</td></tr>
<tr><td></td><td></td><td>ii</td><td>
<table>
<tr><td>does not know the outcome</td><td></td></tr>
<tr><td>amount of crisps that she eats</td><td>✓</td></tr>
<tr><td></td><td>✓</td></tr>
<tr><td></td><td></td></tr>
</table>
</td><td>2</td><td>one mark for each correct tick

accept a clear response eg. ✓ or X or shading etc.

ignore X if combination of ✓ and X used

if more than two responses - deduct one mark</td></tr>
<tr><td></td><td>b</td><td>i</td><td>
<table>
<tr><th></th><th>carbohydrates</th><th>proteins</th></tr>
<tr><td>carbon</td><td>✓</td><td>✓</td></tr>
<tr><td>hydrogen</td><td>✓</td><td>✓</td></tr>
<tr><td>oxygen</td><td>✓</td><td>✓</td></tr>
<tr><td>nitrogen</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>one mark for each correct column

accept a clear response eg. ✓ or X or shading etc.

ignore X if combination of ✓ and X used</td></tr>
<tr><td></td><td></td><td>ii</td><td>amino acids
amino acids
tendons
liver
urea</td><td>3</td><td>5 correct responses = 3 marks
3 or 4 correct responses = 2 marks
2 correct responses = 1 mark

accept a clear response eg. underline, shading, ticks etc.</td></tr>
</table>

Question			Expected Answers	Marks	Rationale
4	c		[3 marks] Candidate demonstrates a high level of understanding of the difference between correlation and cause, and in the context of heart disease illustrates other contributing factors than a high fat diet. The significance of individual cases is accounted for in the answer. The answer is expressed clearly and logically. [2 marks] Candidate demonstrates a good understanding that individual cases do not always fit an accepted pattern. The presence of a correlation is identified **or** the lack of a causal link in the article. The answer is expressed clearly and logically. [1 mark] Candidate states whether the article is proven wrong, and gives a valid, relevant reason for their answer, but does not compare correlation and causal links. These points may not be expressed in a logical sequence.	3	there is a correlation between a high fat diet and heart disease; does not prove **cause**; individual cases do not always fit the pattern; there are other factors which may cause heart disease
			Total	**12**	

Question			Expected Answers	Marks	Rationale
5	a		colour; to make food more attractive; preservatives; to slow the growth of microorganisms/make food last longer; antioxidants; prevent fats and oils deteriorating on contact with oxygen emulsifiers/stabilisers; help ingredients stay mixed that would otherwise separate sweeteners; reduce the amount of sugar added to food	2	any two must have correct purpose for each example cited
	b		highest risk chemicals x fresh food always safer x never cause heath problems x	1	all 3 correct responses = 1 mark **accept** a clear response eg. ✓ or shading etc.
			Total	**3**	

Question			Expected Answers	Marks	Rationale
6	a		quarter of its activity at start ✓ impossible to predict exact activity ✓	2	one mark for **each** correct tick **deduct** one mark for each incorrect tick if more than two ticks used **accept** a clear response eg. X or shading etc. **ignore** X if combination of ✓ and X used
	b		Cambs: ✓ / ✓ / — Norfolk: — / ✓ / ✓ Yorks: — / — / —	4	Mark each row separately first row – 1 mark for correct ✓ (2 or 3 ✓ = 0 marks) second row - 1 mark for each correct ✓ (3 ✓ = 1 mark) third row – 1 mark for correct ✓ (2 or 3 ✓ = 0 marks) **accept** a clear response eg. ✓ or X or shading etc. **ignore** X if combination of ✓ and X used
	c	i	Steve ✓ Marion ✓	1	**deduct** one mark for each incorrect tick if more than two ticks used **accept** a clear response eg. X or shading etc. **ignore** X if combination of ✓ and X used

Question			Expected Answers	Marks	Rationale
6	c	ii	[3 marks] Candidate demonstrates a high level of understanding of the precautionary principle; in a particular situation: • the risk is not clearly known or understood, and • the consequences may be serious It is then advisable not to proceed (until you know more). Debbie is identified as an example of this from the question. The answer is expressed clearly and logically. [2 marks] Candidate goes beyond a colloquial definition, linking the precautionary principle to the unquantified nature of the risk, but not relating it to the severity of the outcome that could result. The answer is expressed clearly and logically. [1 mark] Candidate offers a colloquial definition of the precautionary principle (better safe than sorry owtte), and identifies Debbie as an example.	3	
			Total	**10**	

Question			Expected Answers		Marks	Rationale
7			burnt to release heat energy steam used to turn turbines radioactive for thousands of years can cause cancer	F T T T	3	4 correct responses = 3 marks 3 correct responses = 2 marks 2 correct responses = 1 mark **accept** ✓ and X if used together **reject** ✓ or X if used alone
			Total		**3**	

			Section total	**42**	