Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A211/02

TWENTY FIRST CENTURY SCIENCE

SCIENCE A

Unit 1: Modules B1 C1 P1 (Higher Tier)

THURSDAY 13 JANUARY 2011: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (LEO/SW) 11MEP01215 40993/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. 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.**

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.**

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QUESTION 1 STARTS ON PAGE 4

Answer ALL the questions.

1 This question is about chromosomes, genes and inheritance.

(a) Complete the sentences.

(i) Chromosomes are found in the

_____ of a cell. [1]

(ii) Genes are sections of the molecule

_____ . [1]

(b) Tom, John and Paul are all boys.

The sex chromosomes determine which sex someone becomes.

Complete the sentences about Tom, John and Paul's sex chromosomes.

Tom, John and Paul all have two sex

chromosomes _____ and _____ .

The _____ chromosome carries a gene

which determines the sex of an embryo.

This gene stimulates the development of the

_____ in the embryo. [2]

(c) Tom's parents want a daughter.

They ask the Human Fertilisation and Embryology Authority (HFEA) if they can use PRE-IMPLANTATION GENETIC DIAGNOSIS.

(i) Explain what is meant by pre-implantation genetic diagnosis.

_____

_____

_____ **[2]**

(ii) Suggest why the HFEA may refuse this request.

_____

_____ **[1]**

[Total: 7]

2 Huntington's disorder and Cystic fibrosis are both inherited conditions.

They are both caused by faulty alleles.

(a) Complete the table to show the combination of alleles each type of individual could have.

Use these symbols

H = allele that causes Huntington's disorder
h = allele that does not cause Huntington's disorder

B = allele that does not cause Cystic fibrosis
b = allele that causes Cystic fibrosis

	COMBINATION OF ALLELES PRESENT IN…		
DISORDER	**… AN INDIVIDUAL WITHOUT THE DISORDER**	**… AN INDIVIDUAL WITH THE DISORDER**	**… A CARRIER OF THE DISORDER**
HUNTINGTON'S DISORDER	_____	Hh or _____	no carriers
CYSTIC FIBROSIS	Bb or _____	_____	_____

[2]

(b) Genetic screening programmes are now being used by some companies to test workers or those wanting to use their services.

Many people are concerned about this type of genetic testing.

What are the implications of the use of such genetic testing?

_____

_____

_____

_____

_____ **[3]**

[Total: 5]

3 Refer to the diagram on the opposite page.

A cow embryo can be genetically modified so that it contains the gene to make human insulin.

Copies of this embryo can then be made by cloning.

The adult cows will produce human insulin.

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

The CLONED OFFSPRING will be identical to …

… their biological mothers. ☐

… their biological fathers. ☐

… their surrogate mothers. ☐

… each other. ☐

[1]

(b) Embryo cloning uses EMBRYONIC STEM CELLS.

Put a tick (✓) in the box next to the BEST description of an embryonic stem cell.

the egg cell from which an embryo develops ☐

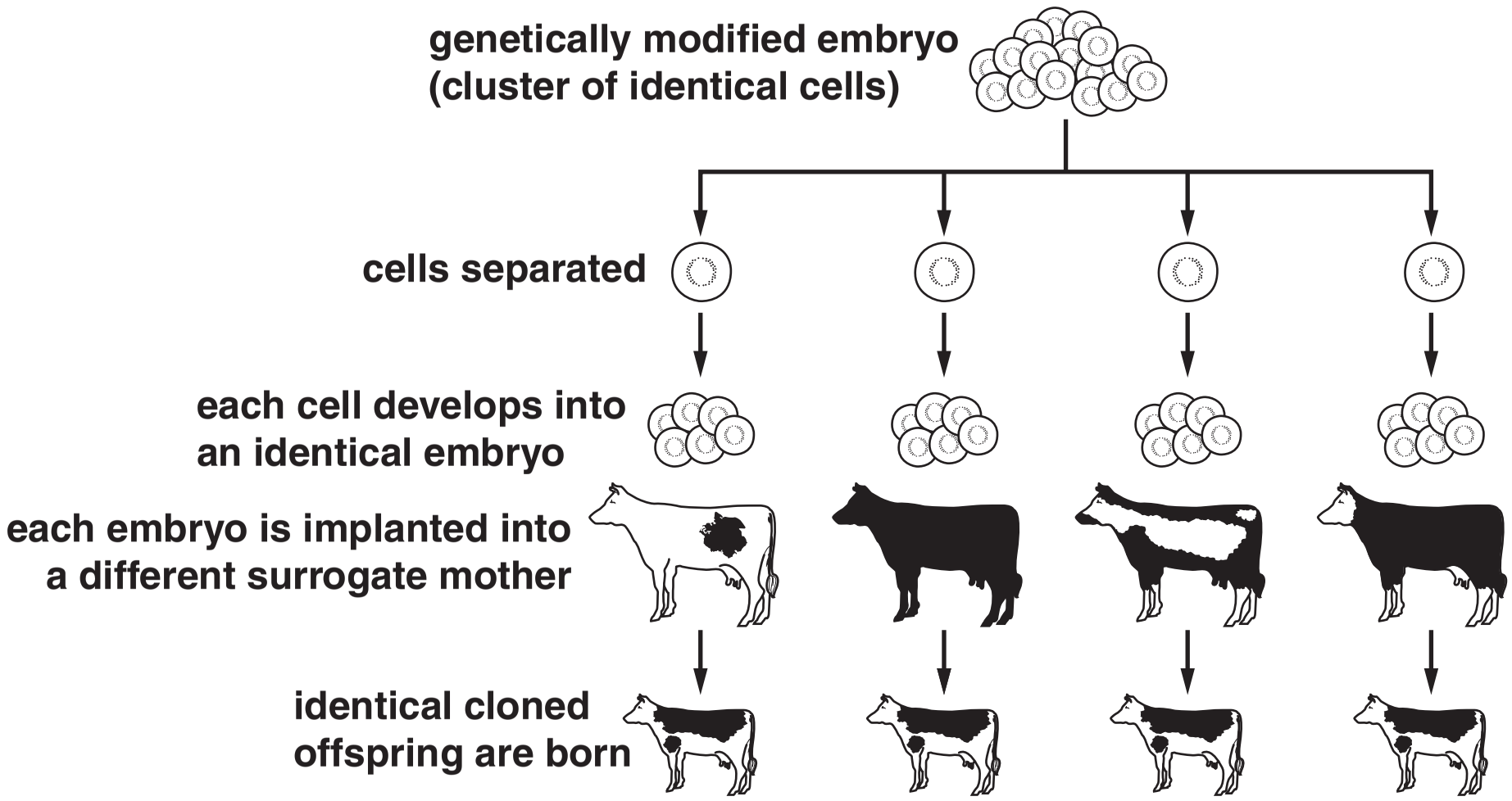
a specialised cell in an early embryo ☐

a cell with no sex chromosomes ☐

an unspecialised cell in an early embryo ☐

[1]

[Total: 2]


genetically modified embryo
(cluster of identical cells)
cells separated
each cell develops into
an identical embryo
each embryo is implanted into
a different surrogate mother
identical cloned
offspring are born

4 This question is about pollutants from car engines.

(a) Nitrogen DIOXIDE is a secondary pollutant from car engines.

Explain how nitrogen dioxide is made.

Include in your answer

- **where the nitrogen and oxygen come from and why they react**
- **the reactions needed to make nitrogen dioxide.**

_____

_____

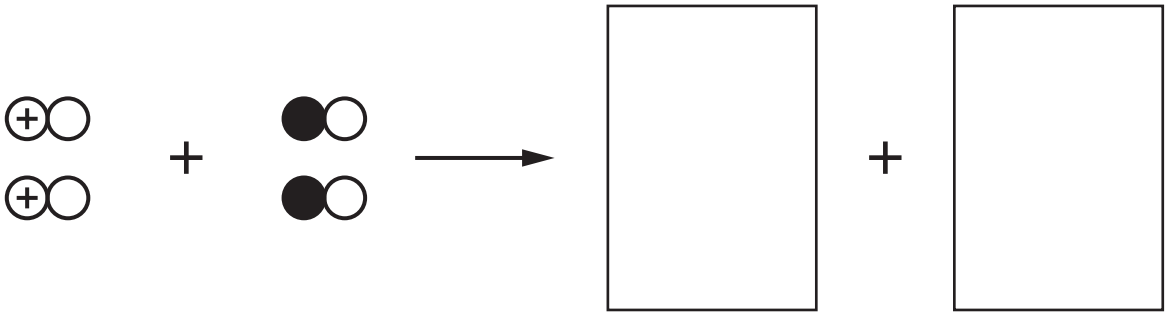
_____

_____ **[3]**

Catalytic converters are used to remove nitrogen MONOXIDE and other pollutants from car engine exhausts.

(b) Nitrogen monoxide reacts with carbon monoxide to make nitrogen and carbon dioxide.

Complete the diagram to show the rearrangement of atoms.



nitrogen monoxide **carbon monoxide** **nitrogen** **carbon dioxide**

[3]

(c) Catalytic converters have been fitted to new cars since 1994.

Look at the graphs, opposite.

Use the graphs to answer the following questions.

(i) What was the concentration of nitrogen oxides in the air when 50% of cars had a catalytic converter?

answer _____ [1]

(ii) There is a CORRELATION between the two graphs.
What is the BEST description of this correlation?

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

Nitrogen oxides in the air decrease from 52% to 35%. ☐

The percentage of cars with a catalytic converter has no effect on nitrogen oxides in the air. ☐

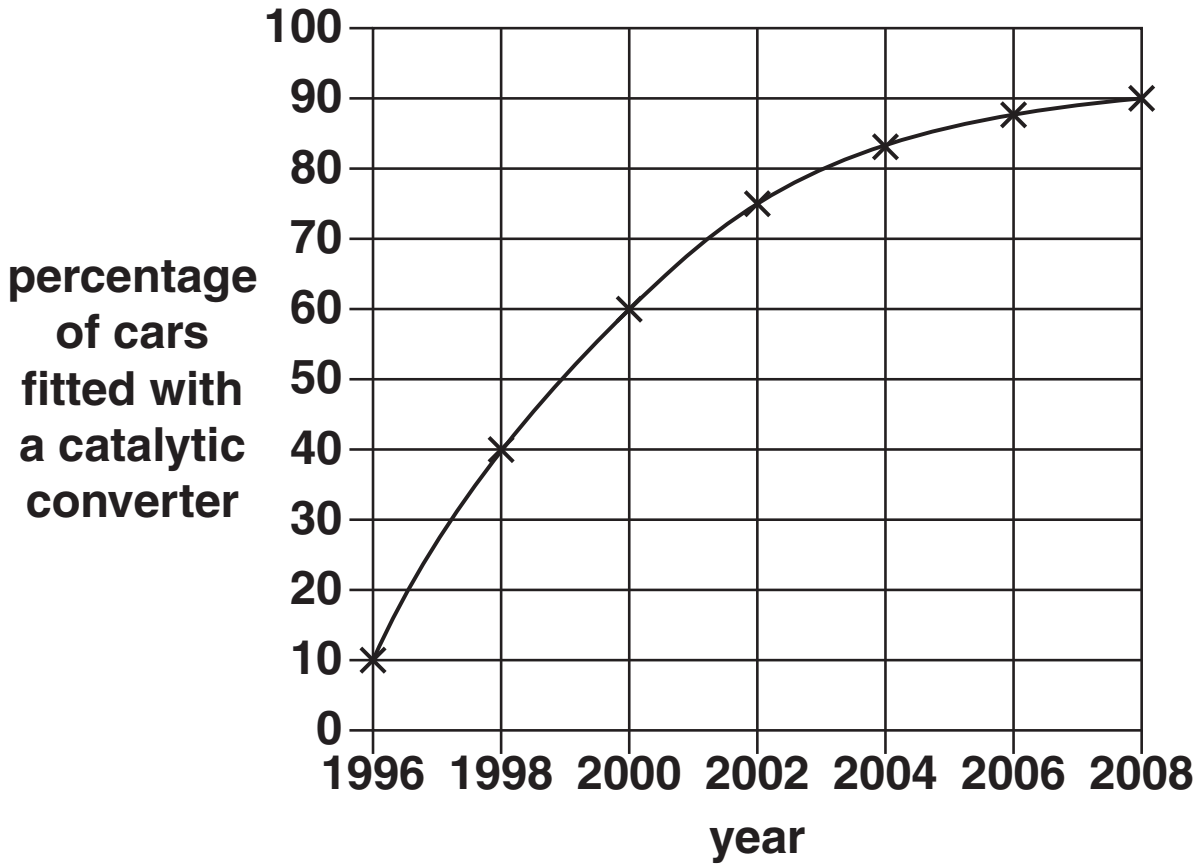
As the percentage of cars with a catalytic converter increases, nitrogen oxides in the air decrease. ☐

As the number of cars on the roads increases, nitrogen oxides in the air decrease. ☐

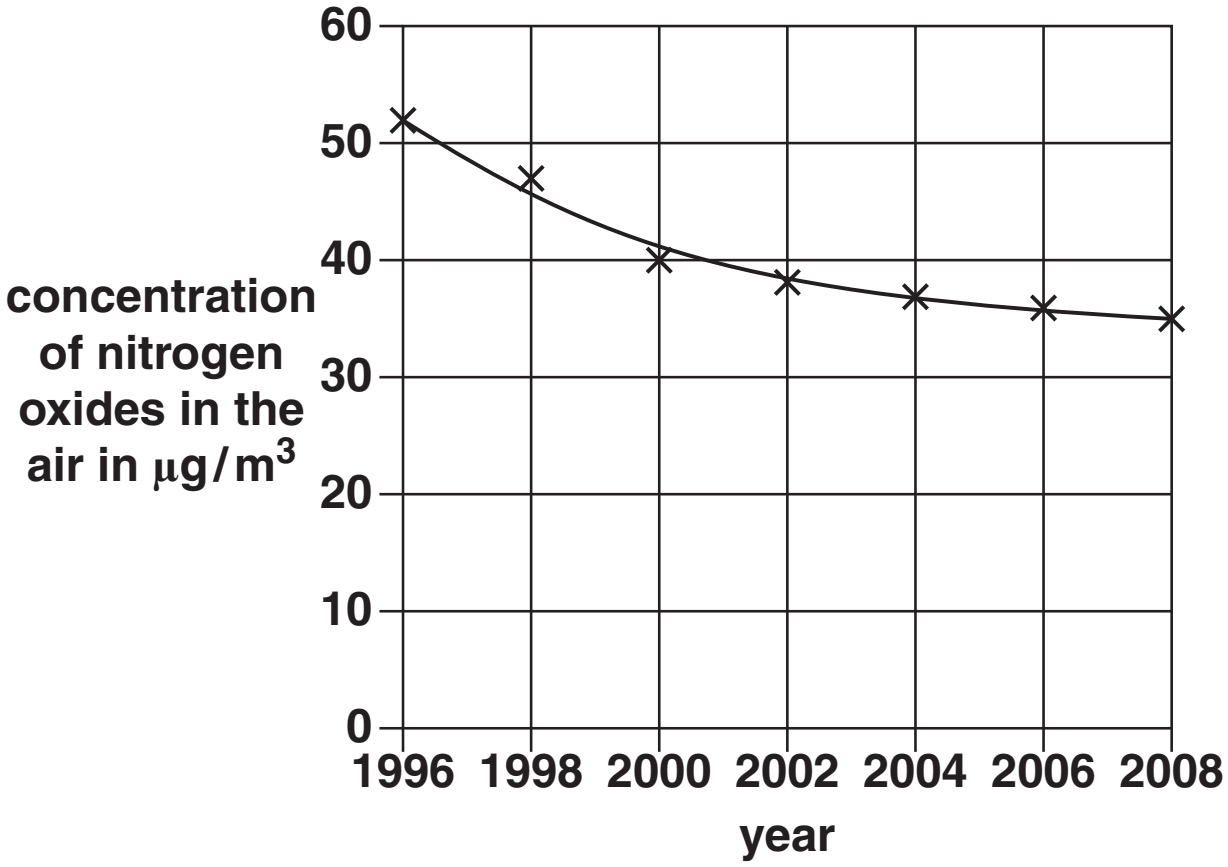
As the percentage of cars with a catalytic converter increases, nitrogen oxides in the air increase. ☐

[1]

THE PERCENTAGE OF CARS FITTED WITH A CATALYTIC CONVERTER



AVERAGE CONCENTRATION OF NITROGEN OXIDES IN THE AIR



(iii) Today more than 90% of cars have a catalytic converter but nitrogen oxides have only fallen by about 30%.

What is the reason for this?

Put a tick (✓) in the box next to the BEST reason.

Polluting gases are never removed from the air. ☐

Catalytic converters do not remove sulfur dioxide in car exhausts. ☐

Factories, power stations and homes still pollute the air with nitrogen oxides. ☐

Car engines are less efficient now than they were in 1996. ☐

[1]

[Total: 9]

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QUESTION 5 BEGINS ON PAGE 16

5 A power station burns fuel oil.

Fuel oil is a mixture of hydrocarbons.

(a) Particulate carbon (soot) is a pollutant from power stations.

It is made by the INCOMPLETE BURNING of fuel oil.

Another pollutant, a GAS, is made by the incomplete burning of fuel oil.

What is the name of this gas?

_____ **[1]**

(b) A scientist measures the amount of particulate carbon in the flue gases of the power station.

She takes five samples on Monday.

She takes another five samples at the same time on Tuesday.

Here are her results.

	PARTICULATE CARBON IN $\mu g/m^3$					
SAMPLE	**1**	**2**	**3**	**4**	**5**	**MEAN**
MONDAY	**55**	**59**	**63**	**61**	**67**	**61**
TUESDAY	**132**	**132**	**134**	**131**	**136**	

(i) The scientist says that the results are reliable.

How does she know from the table that the results are reliable?

_____

_____ **[1]**

(ii) What is the best estimate of the true value for the level of particulate carbon in the flue gases on TUESDAY?

Put a (ring) around the correct answer.

131 132 133 134 135

[1]

(iii) Here are some statements about the particulate carbon in the flue gases on these two days.

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

There are outliers in the values for Monday and Tuesday. ☐

The ranges of the values for Monday and Tuesday do not overlap. ☐

There is very little difference in the mean value on Monday and Tuesday. ☐

The mean value on Monday is inside the range of values on Tuesday. ☐

There is a real difference in the mean values on Monday and Tuesday. ☐

[2]

[Total: 5]

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QUESTION 6 BEGINS ON PAGE 20

6 Alfred Wegener suggested the idea of continental drift in 1912.

(a) Read the facts, opposite, that were available at the time Wegener published his theory.

Each fact either SUPPORTS WEGENER'S THEORY, or OPPOSES WEGENER'S THEORY, or NEITHER SUPPORTS NOR OPPOSES WEGENER'S THEORY.

Put a tick (✓) in the ONE correct box after each fact. [2]

(b) Wegener's theory was not accepted by geologists of his time.

Write down the reasons why these geologists did not accept Wegener's theory.

_____

_____

_____

_____

_____ **[3]**

	SUPPORTS WEGENER'S THEORY	OPPOSES WEGENER'S THEORY	NEITHER SUPPORTS NOR OPPOSES WEGENER'S THEORY
Fossils are found in certain layers of rock over the whole world.	☐	☐	☐
Many African fossils and South American fossils are identical.	☐	☐	☐
Older rock layers lie underneath younger rock layers.	☐	☐	☐
Rocks on some continents match those on other continents.	☐	☐	☐
Some continents have shapes that seem to fit against each other.	☐	☐	☐

(c) Evidence supporting Wegener's theory was found in the 1950s and 1960s.
A pattern of magnetic stripes was discovered around the mid-Atlantic oceanic ridge. This provided evidence of seafloor spreading.

Read the following statements.

A **The pattern of magnetic stripes is the same on each side of the ridge.**

B **The Earth's magnetism reverses every few hundred thousand years.**

C **Magma oozes onto the seabed from the mid-ocean ridge.**

D **Seafloor rocks near the mid-ocean ridge are younger than those further away.**

E **Solidifying rock pushes outwards on surrounding rocks.**

F **The Earth's magnetism is fixed in the new solid rocks.**

G **Volcanic islands are often found on the mid-ocean ridge.**

Use the letters A, B, C, D, E, F and G to answer these questions.

(i) Which TWO of the statements, when taken together, describe the PROCESS of seafloor spreading?

statements _____ and _____ [1]

(ii) Which TWO of the statements, when taken together, EXPLAIN the pattern of magnetic stripes due to seafloor spreading?

statements _____ and _____ [1]

(iii) Which ONE of the statements provides SUPPORTING EVIDENCE for seafloor spreading?

statement _____ [1]

[Total: 8]

7 A space probe was launched in 2009 to find out about the beginning of the Universe.

The probe may also help scientists to predict how the Universe will end.

Discuss what scientists understand about the changing Universe.

In your answer you should mention

- **what scientists think was the beginning of the Universe**
- **why the end of the Universe is difficult to predict.**

_____

_____

_____

_____ **[2]**

[Total: 2]

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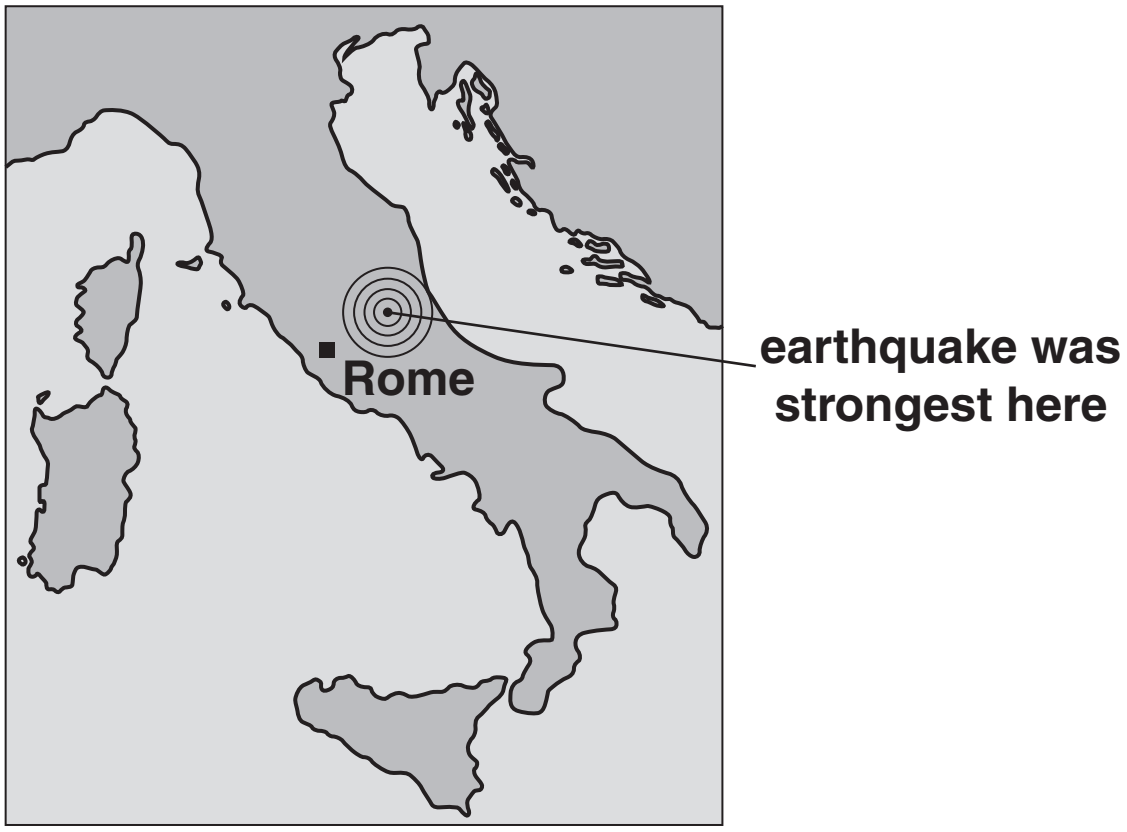
QUESTION 8 BEGINS ON PAGE 26

8 A serious earthquake struck central Italy in April 2009.



(a) Italy has earthquakes because it is close to where two tectonic plates meet.

Which of the following is the BEST indicator that Italy is close to where two tectonic plates meet?

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

Italy has mountains. ☐

Italy has active volcanoes. ☐

Italy is surrounded by sea. ☐

Many of the rocks in Italy are very old. ☐

[1]

(b) Five of the six statements, A, B, C, D, E and F, explain how movement of the tectonic plates contributes to the rock cycle.

A Rocks from the crust melt.

B One plate moves under the other.

C Plates moving sideways can cause earthquakes.

D Convection in the mantle makes tectonic plates move.

E In some places, tectonic plates move towards each other.

F As rocks move deeper into the Earth, heat and pressure change them.

Choose the correct FIVE statements and write them in the correct order in the boxes below.

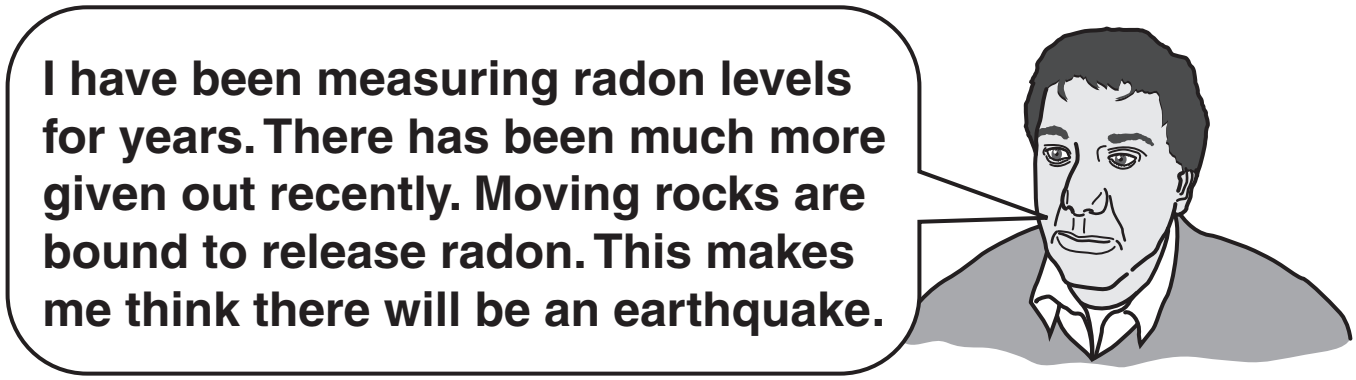
One has been done for you.

				A

[1]

(c) A laboratory technician had predicted that there would be an earthquake.

His job was measuring the radon gas given out by the rocks.



Some of his statements contain data, and some are explanations of the data.

These are the statements the laboratory technician makes.

1 I have been measuring radon levels for years.

2 There has been much more given out recently.

3 Moving rocks are bound to release radon.

4 This makes me think there will be an earthquake.

Which statement, 1, 2, 3, or 4, contains data?

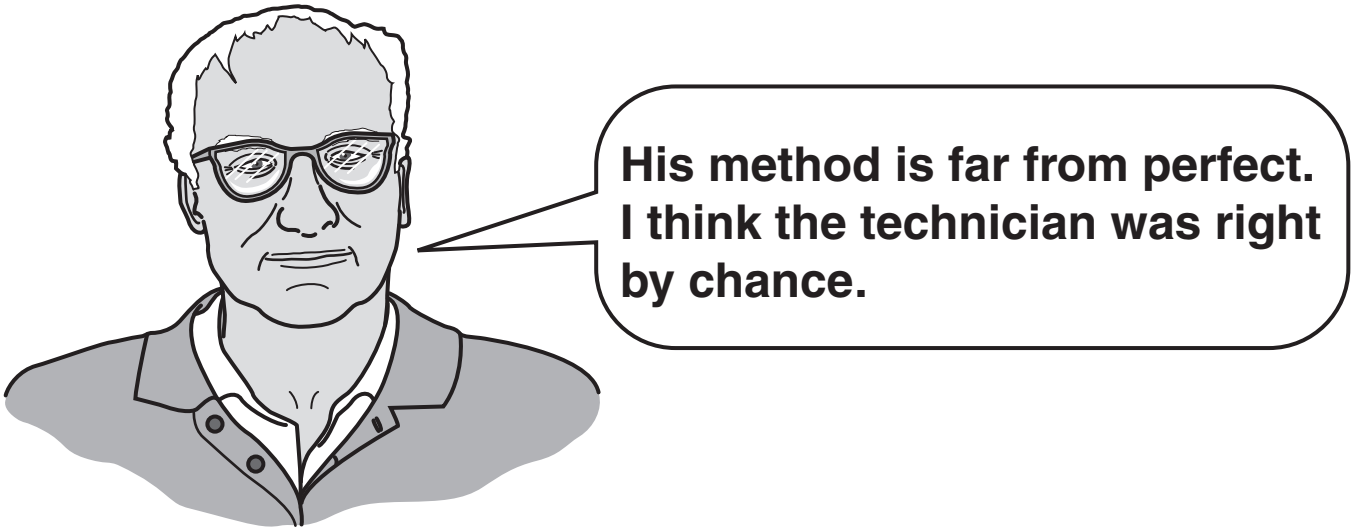
statement _____

Which statement, 1, 2, 3, or 4, is an explanation of this data?

statement _____

[1]

(d) An Italian professor in earth science has a different opinion.



The following statements are all reasons for rejecting a new scientific claim.

Which one is the correct scientific reason for this professor's opinion?

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

The claim had not been evaluated by other scientists. ☐

The results had not been replicated by other scientists. ☐

The claim had not been published in a peer-reviewed journal. ☐

A single observation that agrees with a prediction does not prove it is correct. ☐

[1]

[Total: 4]

END OF QUESTION PAPER

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