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 14 MAY 2009: Afternoon
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 (SM/CGW) OV90790 10804/2

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use 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.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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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Answer ALL the questions.

1 Read the newspaper article.

SHOULD HUMAN-ANIMAL EMBRYOS BE BANNED?

The government is considering plans to ban the creation of embryos which are made from a human cell nucleus and an animal egg.

Many MPs and scientists do not want this research to be banned.

There are many more animal eggs available for research than human eggs.

Some scientists believe that stem cells from these human-animal embryo clones could help develop treatments for disorders such as cystic fibrosis and Alzheimer's.

(a) In the table, some statements are true and some are false.

Put a tick (✔) in the correct box for each statement.

	TRUE	FALSE
Clones are made from a sperm nucleus and an egg nucleus.	☐	☐
Cloned cells will all be genetically identical.	☐	☐
Cloned human-animal embryos are made by fusing a human sperm nucleus with an animal egg nucleus.	☐	☐
Cloned human-animal embryos are made by fusing a human body cell nucleus with an animal egg nucleus.	☐	☐
Cloned human-animal embryos are made by putting a human body cell nucleus into an empty animal egg cell.	☐	☐
The embryonic cells produced will be unspecialised cells.	☐	☐

[3]

(b) Here are some statements about genetic research.

1 Too many people have genetic disorders.

2 Human and animal cells never join together in nature.

3 It is ethically less controversial to use animal eggs than human eggs.

4 Human-animal embryo cells may improve scientists' understanding of disorders.

5 It is a technological breakthrough to be able to make human-animal embryos.

6 The research is expensive and there is no guarantee that it will be useful.

These statements could be used to SUPPORT or OPPOSE creating human-animal embryos.

Complete the table by writing in the sentence numbers 1 to 6 in the correct columns.

SUPPORTS the creation of human-animal embryos	OPPOSES the creation of human-animal embryos	NEITHER supports NOR opposes the creation of human-animal embryos

[3]

[Total: 6]

2 Huntington's disorder is caused by a DOMINANT allele.

Read the newspaper article.

The article contains a mistake in the science.

NEW HOPE IN SEARCH FOR HUNTINGTON'S CURE.

1 Scientists have made a breakthrough in the search for a cure for Huntington's disorder.

2 About 8000 people in the UK have Huntington's disorder.

3 Symptoms develop between the ages of 30 and 50 years.

4 The symptoms are caused by a build up of a wrongly-formed protein in the brain.

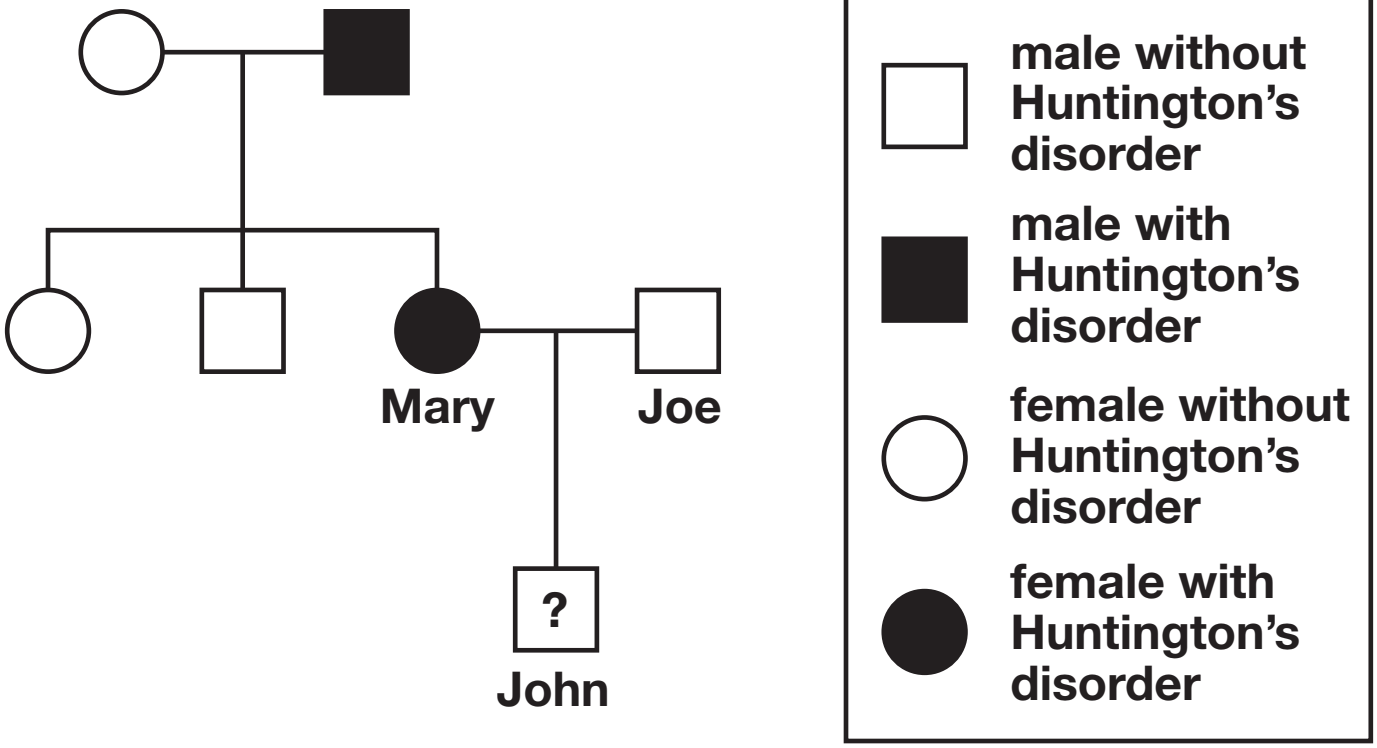
5 This only happens if both copies of the gene which code for the protein are defective.

6 A new drug has shown signs of treating the symptoms of Huntington's disorder in mice.

(a) The day after this article was first printed a correction was published.

Write down the number of the sentence containing the mistake. _____ [1]

(b) The diagram shows a family tree.



John is not old enough to have shown symptoms of Huntington's disorder.

What is the chance that John will have inherited Huntington's disorder from his mother?

Put a (ring) around the correct percentage.

0 % 25 % 50 % 75 % 100 %

Complete the genetic diagram to explain your answer.

H = Huntington's allele and h = normal allele

		Mary Hh	
		H	h
Joe hh	h		
	h		

[2]

(c) John cannot be a carrier for Huntington's disorder.

Why is this?

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

He cannot have both H and h alleles. ☐

If one allele is defective the protein is wrongly formed. ☐

Gene therapy can cure Huntington's disorder. ☐

His mother is not a carrier. ☐

He cannot have two H alleles. ☐

[1]

[Total: 4]

3 Read the article.

RARE QUADS BORN

A Canadian woman has given birth to four genetically identical daughters, Autumn, Brooke, Calissa and Dahlia.

The odds of producing quads like this are estimated to be 1 in 13 million.

The girls were conceived naturally.

They have an older brother, Simon.

(a) In the table, some statements are true and some are false.

Put a tick (✔) in the correct box for each statement.

	TRUE	FALSE
One egg was released and fertilised by a single sperm cell.	☐	☐
The quads are an example of cloning.	☐	☐
The quads will differ from each other because of their genes.	☐	☐
The quads were produced from embryonic stem cells.	☐	☐
The quads are not clones because of environmental factors.	☐	☐

[2]

(b) (i) Simon is male because of a gene on one of his chromosomes.

Which chromosome is this?

_____ [1]

(ii) Which organs ONLY start to develop in an embryo without this gene?

_____ [1]

[Total: 4]

4 Read the article on biofuels.

Cars and lorries cause a quarter of the UK's atmospheric pollution.

The UK government wants all petrol and diesel sold by 2010 to contain 5% biofuel.

Biofuels are made from crops such as cereals, soya bean, rape seed, sugar cane and palm trees.

Biofuels are carbon neutral. The amount of carbon dioxide released when biofuels are burned in an engine, is the same as the amount of carbon dioxide absorbed by the plants when they were growing.

Environmentalists are worried about the land needed for growing these crops. This could damage ecosystems such as rainforests and reduce the area available for food crops in developing countries.

(a) The article says that biofuels are 'carbon neutral'.

Why are biofuels called carbon neutral?

Put a tick (✔) in the box next to the BEST answer.

Carbon dioxide dissolved in water makes a neutral solution.	☐
When biofuels are made and used there is no overall change in the amount of carbon dioxide in the atmosphere.	☐
Incomplete combustion of biofuels does not make carbon.	☐
The amount of carbon dioxide in the atmosphere decreases when biofuels are burned.	☐

[1]

(b) Some scientists do not think biofuels should be made.

Which TWO of the following statements, when put together, explain their thinking?

Put ticks (✔) in the boxes next to the TWO correct statements.

Large areas of land in the UK are available to grow biofuel crops. ☐

Not enough biofuel can be made to reduce the amount of crude oil required. ☐

Large areas of land in developing countries would be needed to grow biofuel crops. ☐

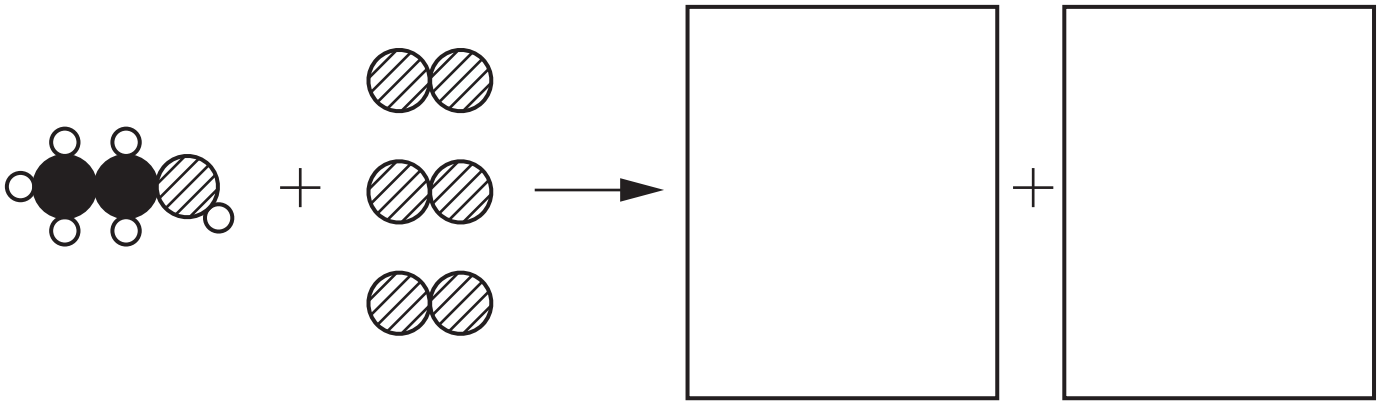
Habitats may be damaged and there would be less land to grow food crops. ☐

No-one will buy biofuels because they are too expensive. ☐

[2]

(c) Many biofuels contain ethanol. Ethanol burns to make carbon dioxide and water.

Complete this diagram to show this reaction.



ethanol oxygen carbon dioxide water

Key:

carbon

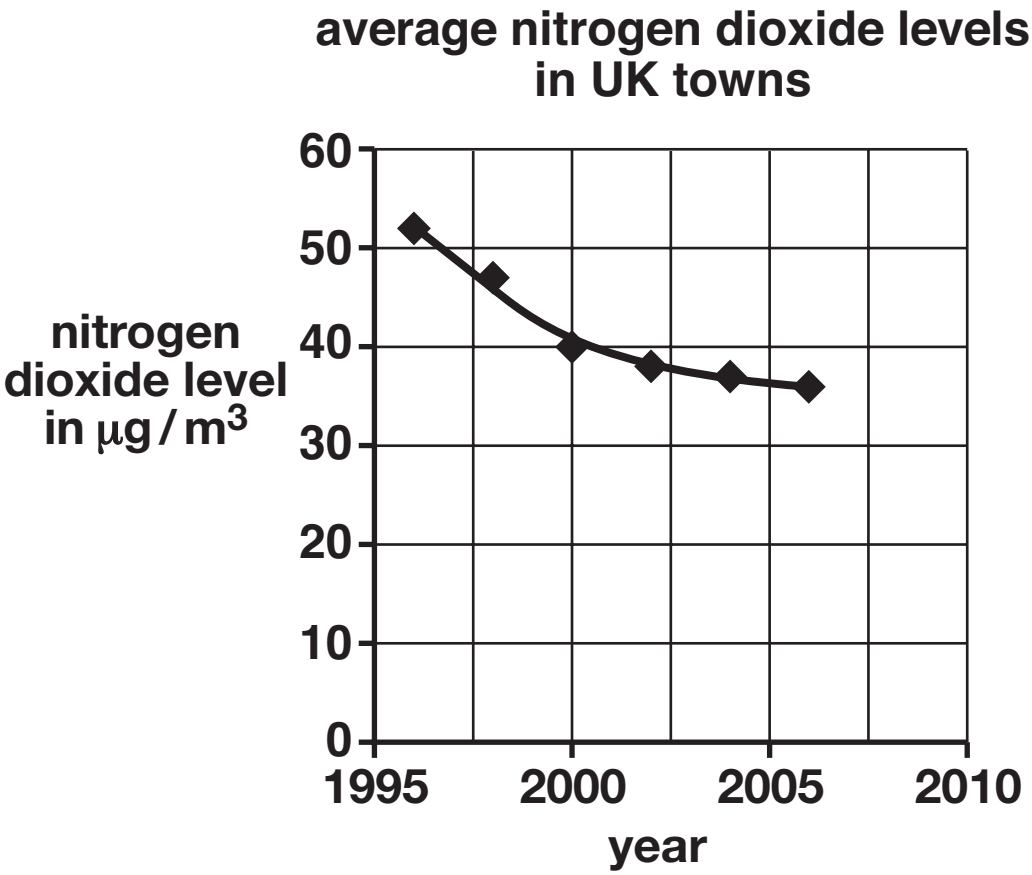
hydrogen

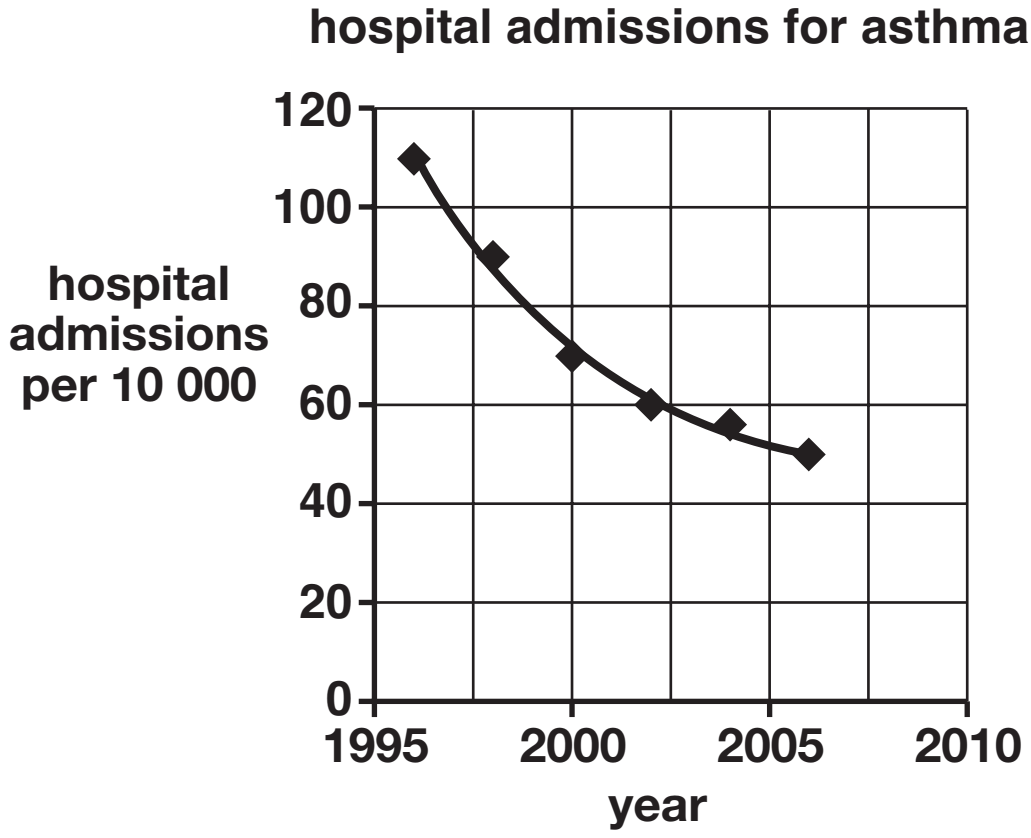
oxygen

[3]

[Total: 6]

5 The graphs show nitrogen dioxide pollution in the air and the number of hospital admissions for asthma between 1996 and 2006.





(a) Look at the statements about the graphs. Put a tick (✔) in the correct box for each statement.

	TRUE	FALSE
Data is given for the same period of time.	☐	☐
As the level of nitrogen dioxide decreased, the number of hospital admissions stayed the same.	☐	☐
There is a correlation between the nitrogen dioxide levels and the number of asthma patients.	☐	☐

[2]

(b) Students are discussing how to investigate the link between nitrogen dioxide pollution and asthma.

This is what they say.

ANNA
"We should find out how many asthma inhalers are prescribed by doctors."

BEN
"We need to collect data for 2007, 2008 and 2009 to check the graphs don't change shape."

OMAR
"We must find out how nitrogen dioxide is made in a car engine."

MATT
"We must find out how many of the asthma patients smoke."

KATE
"We must find out exactly how nitrogen dioxide affects breathing."

(i) Name <u>ONE</u> person who is talking about a factor other than nitrogen dioxide that might affect the number of people suffering from asthma.

_____ [1]

(ii) Which person suggests investigating whether nitrogen dioxide <u>CAUSES</u> asthma?

_____ [1]

(c) Here are SOME statements about the production of nitrogen dioxide in a car engine.

Some of them are INCORRECT.

A Nitrogen monoxide is formed in the engine.

B Only nitrogen dioxide is formed in the engine.

C Nitrogen in the fuel reacts with oxygen in the air.

D Nitrogen monoxide is oxidised to nitrogen dioxide.

E Nitrogen monoxide dissolves in water.

F Nitrogen and oxygen from the air react with each other.

G Nitrogen dioxide is reduced to nitrogen monoxide.

Choose the THREE correct statements.

Put them in the order in which they occur in the production of nitrogen dioxide and write them in the boxes.

[2]

(d) Between 1996 and 2006, the number of miles driven by motor vehicles in the UK increased by 50%.

During this time the amount of pollution by nitrogen dioxide decreased.

Here are five ways that pollution from vehicle exhausts could have been reduced.

1 manufacturing cars with more efficient engines

2 using low sulfur fuels

3 installing catalytic converters in cars

4 introducing congestion charges in cities

5 encouraging people to travel on public transport

Which of these would account for the DECREASE in nitrogen dioxide pollution even though the distance driven by vehicles INCREASED?

Write down the numbers of the TWO CORRECT answers.

_____ and _____ [2]

[Total: 8]

6 In the 1950s, there were two main theories about how the Universe began.

MARTIN RYLE
"The Universe started as a burst of energy at one point and rapidly got bigger. Galaxies are all moving outwards from this 'Big Bang'."

FRED HOYLE
"I agree that galaxies are moving apart, but I don't think the Universe had a beginning like you say. It has always been the same. New galaxies are being made all the time. They form in the gaps between old galaxies, which are dying out."

(a) Here are some astronomical statements.

Each statement agrees with what is being said by RYLE, or by HOYLE, or by BOTH of them, or by NEITHER of them.

Put a tick (✔) in the ONE correct box after each statement.

	RYLE	HOYLE	BOTH	NEITHER
Galaxies are moving apart from each other.				
In the past, all the galaxies would have been close together.				
Older galaxies have newer galaxies between them.				
The Universe will eventually stop expanding.				

[4]

(b) In the 1960s, the Big Bang theory became accepted as correct.

The boxes on the left on page 25 opposite show possible STAGES IN ACCEPTING A SCIENTIFIC THEORY.

Link each one to the correct box in the DEVELOPMENT OF THE BIG BANG THEORY.

One has been done for you. **[3]**

[Total: 7]

STAGES IN ACCEPTING A SCIENTIFIC THEORY

1. Observations are made.

2. Someone thinks up a scientific explanation to account for these observations.

3. This explanation is used to make predictions.

4. Observations are made which seem to confirm the theory.

5. New experiments are devised to test the new observations more carefully.

6. The improved experiments confirm the theory.

DEVELOPMENT OF THE BIG BANG THEORY

Astronomers discovered that galaxies were all moving away from each other.

Big Bang theory suggested that the Universe should now be filled with microwave radiation.

Satellite measurements of the microwave radiation from space showed it fitted the Big Bang theory exactly.

Detailed measurements of the microwave radiation from space were made by a satellite.

Scientists detected microwave radiation coming from all directions in space.

Big Bang theory showed how galaxies started at one point and why they are now moving apart.

7 (a) This question is about interpreting the data related to earthquakes.

The damage caused by earthquakes is related to their magnitude.

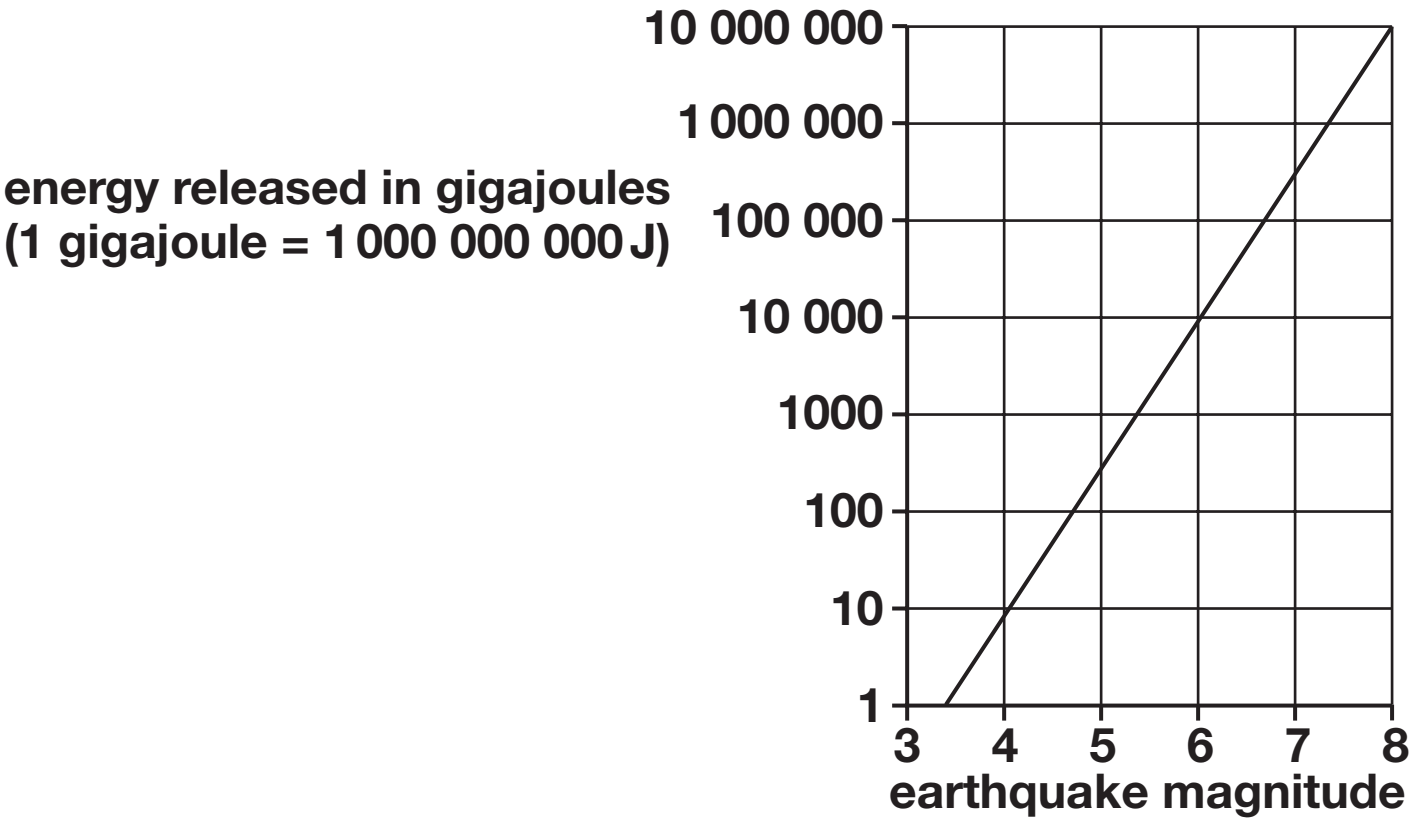
MAGNITUDE	HOW OFTEN THEY HAPPEN	EFFECT
under 3.5	800 000 each year	Detected only by seismometers.
3.5 – 4.2	30 000 each year	Just about noticeable indoors.
4.2 – 4.8	4800 each year	Most people notice them. Windows rattle.
4.8 – 5.4	1400 each year	Everyone notices them. Dishes fall off shelves.
5.4 – 6.1	500 each year	Slight damage to buildings.
6.1 – 6.8	100 each year	Much damage to buildings.
6.8 – 7.1	15 each year	Serious damage. Bridges twist, walls break.
7.1 – 8.0	4 each year	Great damage. Most buildings collapse.
more than 8.0	one every 5 to 10 years	Total damage. Surface waves seen, objects thrown in the air.

(i) How many earthquakes per year would you expect people to notice?

Put a (ring) around the closest estimate.

1400 4800 30 000 37 000 [1]

(ii) The following graph shows the energy released by earthquakes of different magnitudes.



Use the table on the opposite page and the graph above to decide which of the following statements are true and which are false.

Put a tick (✔) in the correct box after each statement.

	TRUE	FALSE
Earthquakes of magnitude 8 release 10 million joules.	☐	☐
Earthquakes of magnitude less than 3 cannot be detected.	☐	☐
A magnitude 8 earthquake releases 1000 times as much energy as a magnitude 6 earthquake.	☐	☐
Earthquakes releasing at least 1 000 000 gigajoules happen more than 10 times a year.	☐	☐

[2]

(b) Earthquakes are quite common in certain parts of the world.

(i) Here is a list of statements about earthquakes.

Some contain DATA about earthquakes, and some have EXPLANATIONS of data. Some contain BOTH.

Put ONE tick (✔) in the correct box next to each statement.

	DATA	EXPLANATION	BOTH
Earthquakes are common in Chile.	☐	☐	☐
Chile is on the edge of two tectonic plates.	☐	☐	☐
Tectonic plates move on top of the Earth's mantle due to slow movement of the mantle.	☐	☐	☐
Earthquakes happen when tectonic plates slip against each other.	☐	☐	☐

[2]

(ii) In countries where earthquakes are common, it is important that the governments make plans and take actions to reduce earthquake damage.

Join each PLANNED ACTION below to the EFFECT it should produce.

PLANNED ACTION	EFFECT
Make sure all builders follow the regulations.	
	Fewer buildings will fall down.
Emergency services practise what to do when an earthquake happens.	
	Trained staff go into action quickly.
Educate all the people about emergency procedures.	
	The whole population knows what to do when an earthquake strikes.
Write regulations for making buildings earthquake-proof.	

[2]

[Total: 7]

END OF QUESTION PAPER

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