Cambridge Assessment

GCSE

Science A

Session: 2010 June
Type: Question paper
Code: J630
Units: A211; A212; A213; A214

OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A211/01

Unit 1: Modules B1 C1 P1 (Foundation Tier)

OCE/15405

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 21 May 2010
Morning

Duration: 40 minutes

A211101

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly 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 that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

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 Read the article.

Can gene testing predict the future?

Extract removed due to third party copyright restrictions

(a) Which of the following is the best description of a **gene**?

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

A gene is …

… an instruction for making a nucleus. ☐

… an instruction for making DNA. ☐

… an instruction for making a protein. ☐

… an instruction for making a fat. ☐

[1]

The article continues.

Extract removed due to third party copyright restrictions

(b) Some questions about genetic tests can be answered by using a **scientific approach**, but others can not.

Put ticks (✓) in the boxes next to the **two** questions that can be answered using a scientific approach.

	can be answered using a scientific approach
Are the tests accurate and reliable?	☐
Have all the genes that might be involved in a disorder been identified?	☐
Should everybody be allowed to have the results of the tests?	☐
Should the Government pay for the tests?	☐

[1]

(c) Colin decides to have a genetic test for heart disease.

Suggest one advantage and one disadvantage of having this test.

.....

.....

.....

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

[Total: 4]

2 Cystic fibrosis (CF) is a genetic disorder.

Drugs are used to ease the symptoms.

(a) Put (rings) around the **two** correct symptoms of cystic fibrosis.

breathlessness **digestion problems** **forgetfulness** **twitching muscles**

[1]

(b) 1 in 25 people in the UK are carriers of a defective CF allele.

Put ticks (✓) in **three** boxes to show which of the statements about **carriers** are true.

Carriers of CF…	**true**
… have a dominant allele for CF.	☐
… have a recessive allele for CF.	☐
… have no symptoms of cystic fibrosis.	☐
… can develop symptoms of the disease in middle age.	☐
… have a 50% chance of passing on the allele to their children.	☐
… can not pass on the defective allele to their children.	☐

[3]

(c) Scientists are trying to treat CF using cloning techniques.

Embryonic stem cells are taken from human embryos and are cloned.

Some people are against the idea of using human embryonic stem cells.

Give reasons **for** and **against** using embryonic stem cells.

.....

.....

.....

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

[Total: 7]

3 Josh and Ryan are twin brothers.

They have the same mother and father.

They are **non-identical** twins.

(a) How are non-identical twins produced?

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

One egg is fertilised by one sperm.	☐
Two eggs are fertilised by one sperm.	☐
One egg is fertilised by two different sperm.	☐
Two eggs are fertilised by two different sperm.	☐

[1]

(b) Josh and Ryan are similar but not identical.

Put a tick (✓) in the correct box to show whether each statement provides an explanation for Josh and Ryan being **similar** or provides an explanation for Josh and Ryan being **different**.

	similar	**different**
They inherited their alleles from the same parents.	☐	☐
Every sex cell has a unique combination of alleles.	☐	☐
The boys have the same genes but different alleles.	☐	☐

[1]

(c) Complete the sentence to explain why both Josh and Ryan are male.

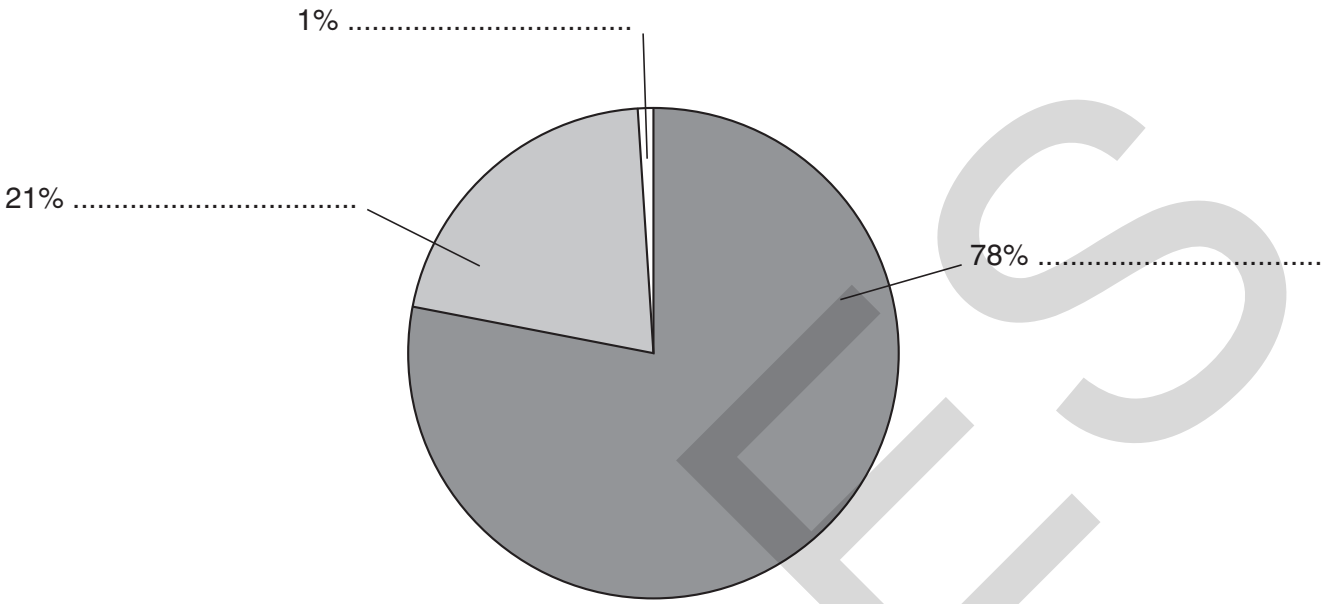
Josh and Ryan are both male because they inherited one X chromosome from their mother and one …… chromosome from their father. **[1]**

[Total: 3]

4 **(a)** The pie chart shows the three main gases in the air.

Label the pie chart using words from this list.

argon **carbon dioxide** **chlorine** **nitrogen** **oxygen**



[2]

(b) Burning fuels pollutes the air.

(i) Most fuels are compounds of hydrogen and carbon.

What is the name for compounds containing only hydrogen and carbon?

Put a ring around the correct answer.

diesel **hydrocarbons** **hydrogen oxides** **hydroxides** **petrol**

[1]

(ii) Particulate carbon, carbon dioxide, carbon monoxide and nitrogen oxides are pollutants made when fuels burn.

Draw a **single** straight line from **each pollutant** to **how it is made**.

pollutant	how it is made
particulate carbon	
	complete combustion of the fuel
carbon dioxide	
	incomplete combustion of the fuel
carbon monoxide	
	reaction of gases from the air at high temperature
nitrogen oxides	

[2]

(iii) Sulfur dioxide is a pollutant from coal-burning power stations.

How is sulfur dioxide made in a coal-burning power station?

You should write down where the sulfur atoms come from and explain how they are changed into sulfur dioxide.

.....

.....

.....

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

[Total: 7]

5 Read this newspaper article.

Clear skies for Beijing Olympics

China wanted to reduce air pollution in Beijing for the Olympic Games.

Two million cars (half the total number) were banned from the roads. 100 factories and some coal-burning power stations were shut down.

Beijing's massive experiment with controlling pollution gave scientists an opportunity to investigate pollution.

After the factory closures and traffic restrictions began, air pollution levels fell.

Weather conditions made a difference too. Every time it rained, pollution was reduced.

(a) (i) Use the article to decide how air pollution was reduced for the Beijing Olympics.

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

No cars were allowed on the roads. ☐

No electricity was generated in China. ☐

Some factories and power stations were shut down. ☐

People drove cars rather than travelled by bus. ☐

[1]

(ii) Scientists collected data on air quality in Beijing before and after the start of the Olympic Games.

Why did scientists collect these air quality data?

Put ticks (✓) in the boxes next to the **two** best scientific reasons.

So they could …

… prove that athletes and spectators were not harmed by poor air quality. ☐

… use data to make explanations. ☐

… detect changes in air pollution. ☐

… find out how many people ride bicycles. ☐

… show air pollution is caused only by traffic. ☐

[2]

(iii) After rainfall there is less air pollution.

Explain what happens to the pollutants when it rains.

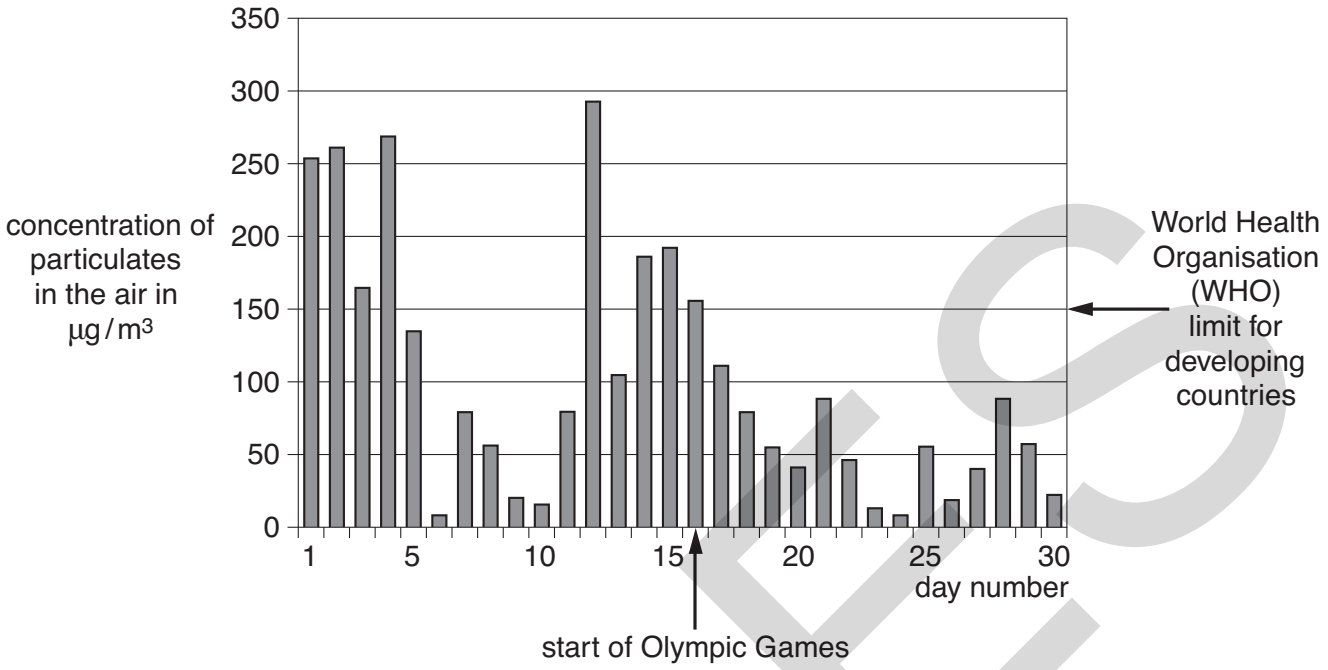
.....

.....

.....

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

(b) The chart shows measurements of particulates in the air for the 15 days before the Olympic Games started and the 15 days of the Games themselves.



Below are four statements about the data. Each statement is either true or false.

Put a tick (✓) in the correct box to show whether each statement is **true** or **false**.

	true	**false**
The WHO limit for developing countries is 150 µg/m^3.	☐	☐
Concentrations of particulates in the air were always lower than the WHO limit.	☐	☐
Concentrations of particulates were greater than 250 µg/m^3 on 4 days.	☐	☐
The lowest level of pollution was in the first five days of testing.	☐	☐

[2]

[Total: 7]

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Question 6 begins on page 12

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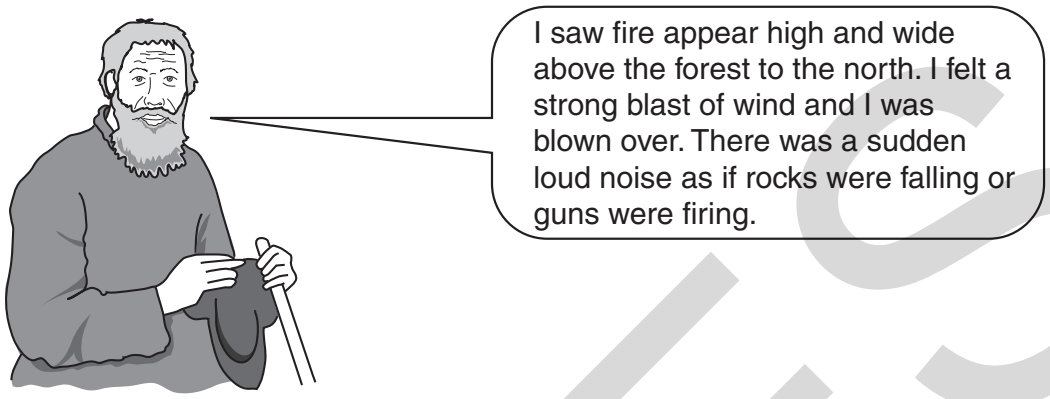
6 There was a massive explosion in northern Russia in 1908. A very large area of forest was destroyed.

It is now thought that this was caused by a comet or asteroid.

Not many people live in that remote area, but this is what one witness remembered.



(a) Which of the following statements is the best scientific explanation of his observations?

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

A comet or asteroid crashed into the ground. ☐

A comet or asteroid exploded high in the air. ☐

A comet or asteroid passed near the Earth. ☐

A comet or asteroid hit the Moon. ☐

[1]

(b) Which of the following statements about asteroids are true?

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

Asteroids orbit the Earth. ☐

Asteroids orbit the Sun. ☐

Asteroids are much smaller than a planet. ☐

Asteroids come from other planets. ☐

Asteroids come from the Moon. ☐

[2]

(c) Small asteroids often hit the Earth, but cause little damage.

(i) Explain how the impact of a **large** asteroid could affect the whole world.

.....

.....

.....

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

(ii) Although the **consequences** of a large asteroid colliding with the Earth would be very serious, the actual **risk** of people dying due to a large asteroid strike is not great.

Explain why.

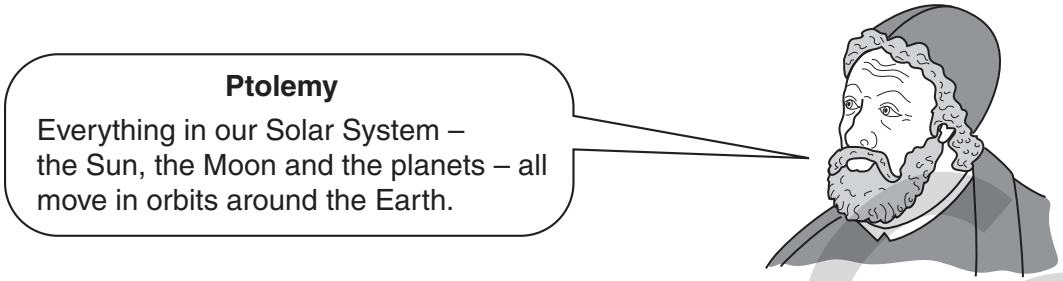
.....

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

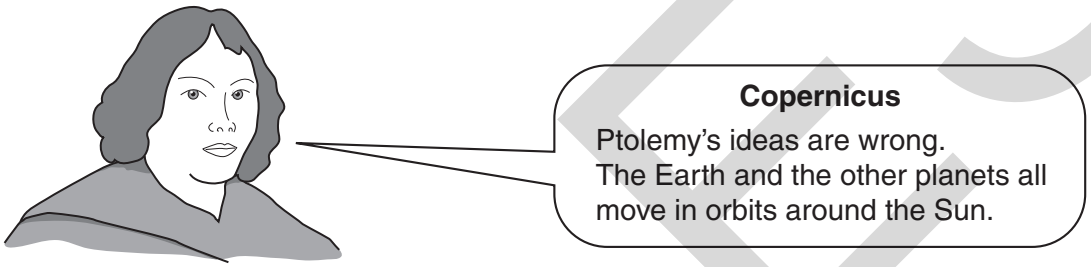
[Total: 6]

7 Ptolemy was an astronomer who lived nearly 2000 years ago.

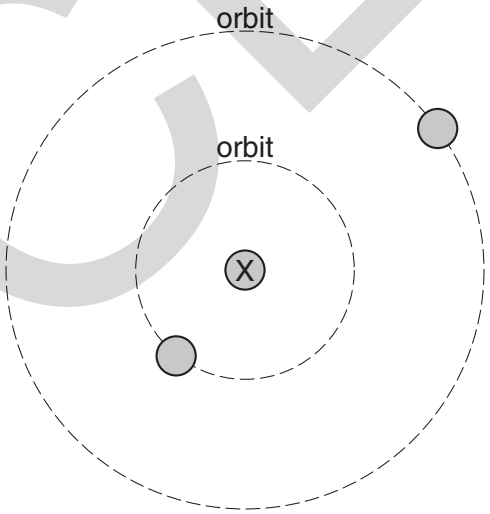
His ideas about the Sun, the Moon and the planets were believed for many hundreds of years.



In 1530, Nicolaus Copernicus had different ideas.



(a) The diagram below shows the Sun, the Earth and the planet Saturn. This diagram can fit both Ptolemy's ideas and Copernicus' ideas.



Use words from this list to complete the sentences.

Saturn **the Earth** **the Moon** **the Sun**

(i) Copernicus would say that X was …… . **[1]**

(ii) Ptolemy would say that X was …… . **[1]**

(b) It took over 100 years for Copernicus' ideas to be accepted.

Astronomers in 1530 preferred Ptolemy's ideas to Copernicus' ideas.

Put a tick (✓) in the box next to the statement that best explains why.

Ptolemy's ideas had always worked well. ☐

Ptolemy's ideas were too old-fashioned. ☐

All the astronomers were friends of Ptolemy. ☐

Copernicus was very good at persuading people that he was right. ☐

[1]

[Total: 3]

8 A strong earthquake hit the Central American country of Costa Rica in January 2009.

(a) Which of the following statements explains why earthquakes are common in Costa Rica?

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

Costa Rica is a poor country. ☐

Costa Rica is a small country. ☐

Costa Rica is at the edge of a tectonic plate. ☐

Hurricanes are very common near Costa Rica. ☐

[1]

(b) Which **two** of the following would you expect to find in a place like Costa Rica that often has earthquakes?

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

cities	☐
deserts	☐
forests	☐
mountains	☐
volcanoes	☐

[2]

(c) Which of the following could the government of a country like Costa Rica do to reduce deaths and injuries from future earthquakes?

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

Build taller buildings.	☐
Educate people so they know what to do during an earthquake.	☐
Move everyone to another country.	☐
Prepare emergency plans ready for earthquakes.	☐
Build wider roads.	☐

[2]

[Total: 5]

END OF QUESTION PAPER

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A211/02

SCIENCE A

Unit 1: Modules B1 C1 P1 (Higher Tier)

OCE/15406

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 21 May 2010
Morning

Duration: 40 minutes

A211102

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

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Answer **all** the questions.

1 Read the article.

Can testing genes predict the future?

Extract removed due to third party copyright restrictions

(a) Which of the following is the best description of a **gene**?

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

A gene is …

… an instruction for making a nucleus. ☐

… an instruction for making DNA. ☐

… an instruction for making a protein. ☐

… an instruction for making a fat. ☐

[1]

The article continues.

Extract removed due to third party copyright restrictions

(b) Some questions about genetic tests can be answered by using a **scientific approach**, but others can not.

Put ticks (✓) in the boxes next to the **two** questions that can be answered using a scientific approach.

	can be answered using a scientific approach
Are the tests accurate and reliable?	☐
Have all the genes that might be involved in a disorder been identified?	☐
Should everybody be allowed to have the results of the tests?	☐
Should the Government pay for the tests?	☐

[1]

(c) Colin decides to have a genetic test.

Explain why Colin might want to keep the results of the test to himself.

.....

.....

.....

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

[Total: 4]

2 Huntington's disorder and cystic fibrosis are both genetic disorders.

(a) Put ticks (✓) in the boxes to indicate which of the **symptoms** are those of Huntington's disorder and which are those of cystic fibrosis.

symptom	Huntington's disorder	cystic fibrosis
breathlessness		
digestion problems		
forgetfulness		
twitching muscles		

[1]

(b) 1 in 25 people in the UK are carriers of cystic fibrosis (CF).

These carriers do not have CF but their children can have CF.

Explain why.

.....

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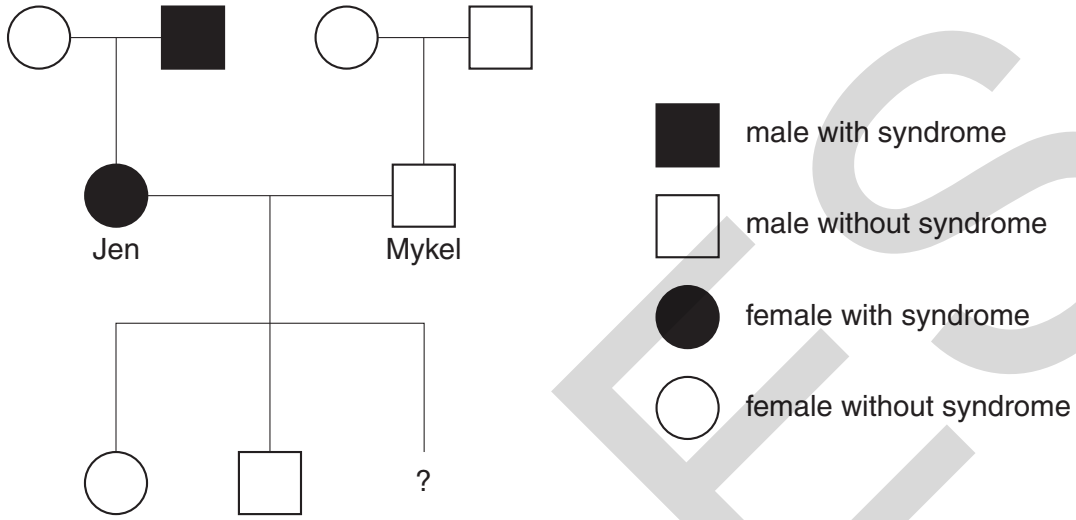
..... **[3]**

(c) Townes-Brocks syndrome is a genetic disorder.

People with this disorder have a variety of symptoms including heart and kidney problems.

The Townes-Brocks allele is dominant.

Look at the family tree.



(i) Jen and Mykel want to have another child.

What is the probability that this child will inherit Townes-Brocks syndrome?

probability = ... **[1]**

(ii) What alleles must Jen and Mykel have?

Use the letters **T** and **t** to represent the alleles.

Jen's alleles .....

Mykel's alleles ..... **[1]**

[Total: 6]

3 Josh and Ryan are twin brothers.

They have the same mother and father.

They are **non-identical** twins.

(a) Josh and Ryan are similar but not identical.

Put a tick (✓) in the correct box to show whether each statement provides an explanation for Josh and Ryan being **similar** or provides an explanation for Josh and Ryan being **different**.

	similar	**different**
They inherited their alleles from the same parents.	☐	☐
Every sex cell has a unique combination of alleles.	☐	☐
The boys have the same genes but different alleles.	☐	☐

[1]

(b) Some twins are identical.

Identical twins are an example of naturally-occurring clones.

Josh and Ryan are **non-identical** twins.

Put a tick (✓) in the correct box to indicate whether each statement is **true** or **false**.

	true	**false**
Clones can be produced by asexual reproduction.	☐	☐
Josh and Ryan have identical genes to their parents.	☐	☐
Josh and Ryan are genetically identical to each other.	☐	☐
Differences between clones can be caused by the environment.	☐	☐

[1]

(c) Human embryos can be made by artificial cloning.

These embryos can be used to supply human embryonic stem cells.

These cells can be used to treat some types of illness.

This is called therapeutic cloning.

(i) Complete the sentence about embryonic stem cells.

It may be possible to use these cloned cells to replace damaged adult cells, such as nerve cells, because embryonic stem cells are …… . **[1]**

(ii) How are cloned embryos made in therapeutic cloning?

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

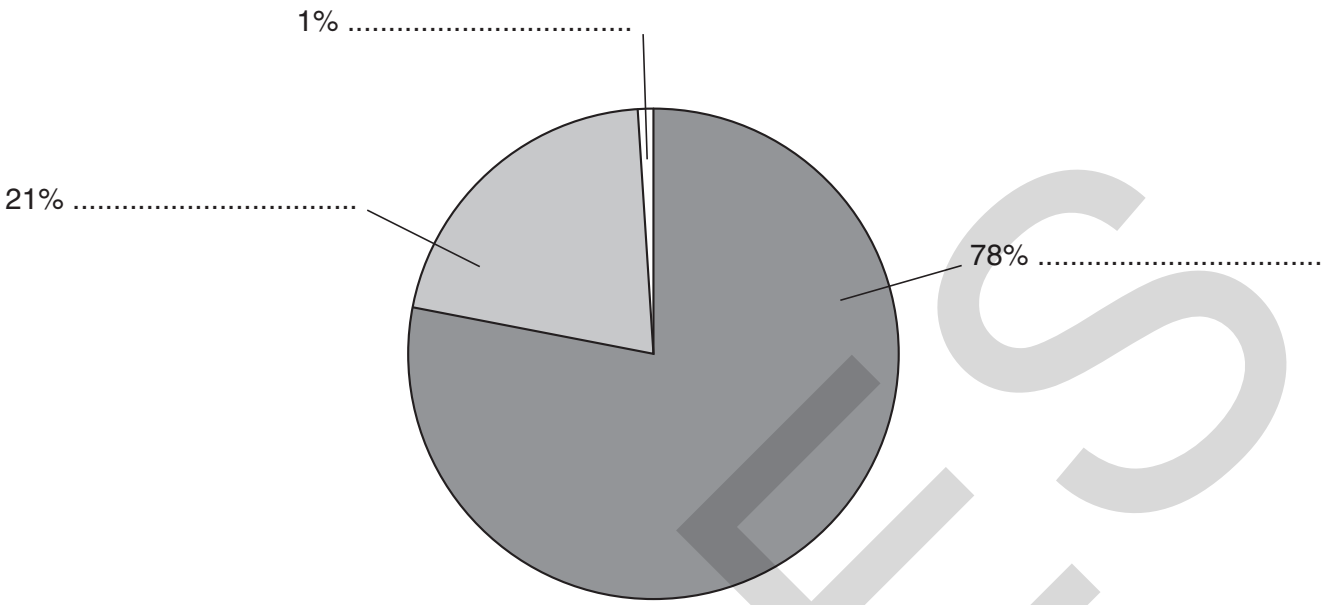
Replace the nucleus of a fertilised egg cell with the nucleus from an adult cell.	☐
Replace the nucleus of a fertilised egg cell with the nucleus from an embryonic cell.	☐
Replace the nucleus of an unfertilised egg cell with the nucleus from an adult cell.	☐
Replace the nucleus of an unfertilised egg cell with the nucleus from an embryonic cell.	☐

[1]

[Total: 4]

4 **(a)** The pie chart shows the three main gases in the air.

Label the pie chart with the names of the gases.



[2]

(b) **(i)** Burning fuels pollutes the air.

Most fuels are compounds of hydrogen and carbon.

What is the name for compounds containing only hydrogen and carbon?

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

(ii) Particulate carbon, carbon dioxide, carbon monoxide and nitrogen oxides are pollutants made when fuels burn.

Draw a **single** straight line from **each pollutant** to **how it is made**.

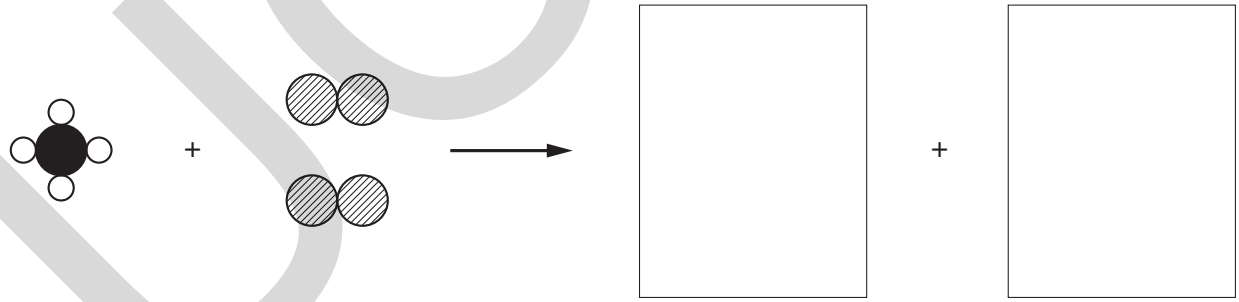
pollutant	how it is made
particulate carbon	complete combustion of the fuel
carbon dioxide	incomplete combustion of the fuel
carbon monoxide	reaction of gases from the air at high temperature
nitrogen oxides	

[2]

(c) Methane is a fuel.

Methane burns to make carbon dioxide and water.

Complete the diagram to show this chemical reaction.



[3]

[Total: 8]

5 Read this newspaper article.

Clear skies for Beijing Olympics

China wanted to reduce air pollution in Beijing for the Olympic Games.

Two million cars (half the total number) were banned from the roads. 100 factories and some coal-burning power stations were shut down.

Beijing's massive experiment with controlling pollution gave scientists an opportunity to investigate pollution.

After the factory closures and traffic restrictions began, air pollution levels fell.

Weather conditions made a difference too.

(a) Scientists collected data on air quality in Beijing before and after the start of the Olympic Games.

Why did scientists collect these air quality data?

Put ticks (✓) in the boxes next to the **two** best scientific reasons.

So they could …

… prove that athletes and spectators were not harmed by poor air quality. ☐

… use data to make explanations. ☐

… detect changes in air pollution. ☐

… find out how many people ride bicycles. ☐

… show air pollution is caused only by traffic. ☐

[2]

(b) Some weather conditions reduce the amount of air pollution.

Suggest and **explain** one weather condition that can reduce air pollution.

.....

.....

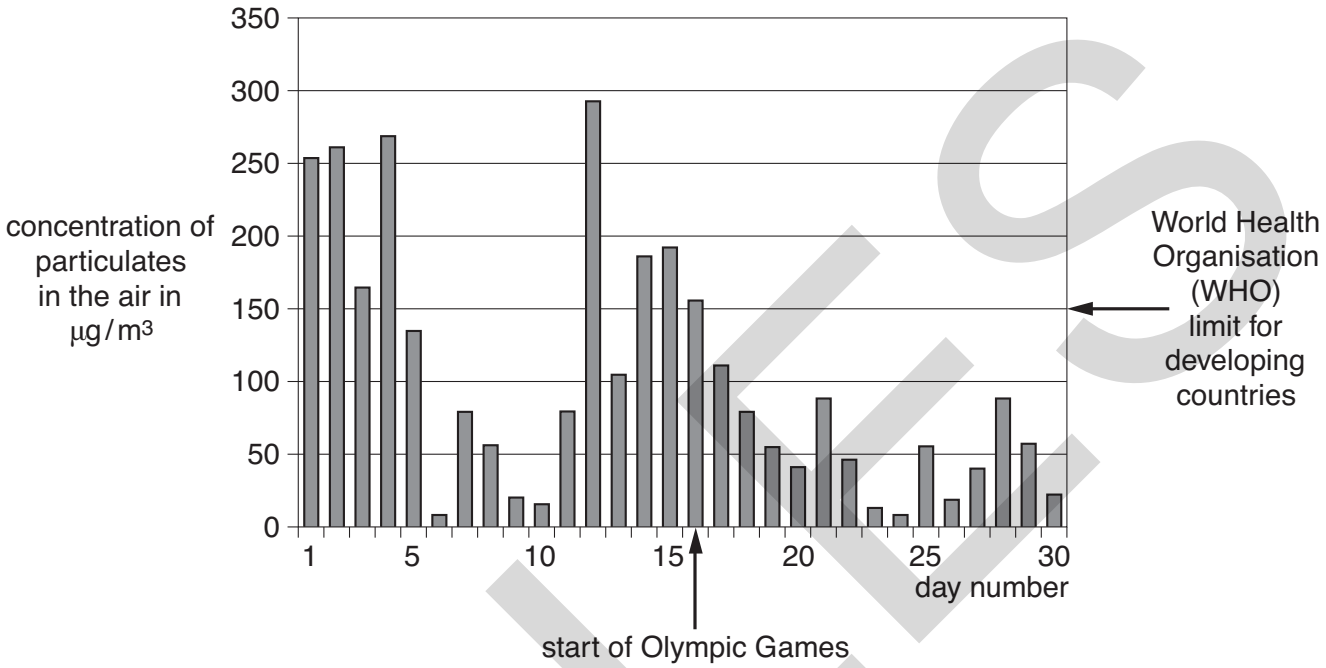
.....

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

(c) The chart shows measurements of particulates in the air for the 15 days before the Olympic Games started and the 15 days of the Games themselves.

mean concentration of particulates for 15 days before the Games started = 141 μg/m^3

mean concentration of particulates for 15 days after the Games started = 51 μg/m^3



(i) Here are three statements about the data. Each statement is either true or false.

Put a tick (✓) in the correct box to show whether each statement is **true** or **false**.

	true	**false**
Concentrations of particulates go down steadily over the 30 days.	☐	☐
Concentrations of particulates exceeded the WHO limit on 8 days.	☐	☐
The maximum measurement was over twice the WHO limit for developing countries.	☐	☐

[1]

(ii) Scientists want to know if there is a real difference between the particulate data before the Games and after the Games began.

Use the data and chart provided to show how scientists decide whether there is a real difference.

.....

.....

.....

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

[Total: 6]

6 There was a massive explosion in northern Russia in 1908. A very large area of forest was destroyed. It was thought that this was probably due to an asteroid or comet about 50 metres in diameter.

(a) Asteroids and comets are similar in their movement around the Sun, but the table shows three differences between them.

	made of	**structure**	**hardness**
asteroids	rock or metal	dense solid	hard
comets	ice and dust	loosely bound	soft

When scientists investigated the area that was damaged, they found no material evidence of any sort in the ground and no trace of any impact crater.

Use the information above to explain why scientists decided that the object was probably a comet.

.....

.....

.....

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

(b) Small asteroids often hit the Earth, but cause little damage.

(i) Explain how the impact of a **large** asteroid could affect the whole world.

.....

.....

.....

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

(ii) Although the **consequences** of a large asteroid colliding with the Earth would be very serious, the actual **risk** of people dying due to a large asteroid strike is not great.

Explain why.

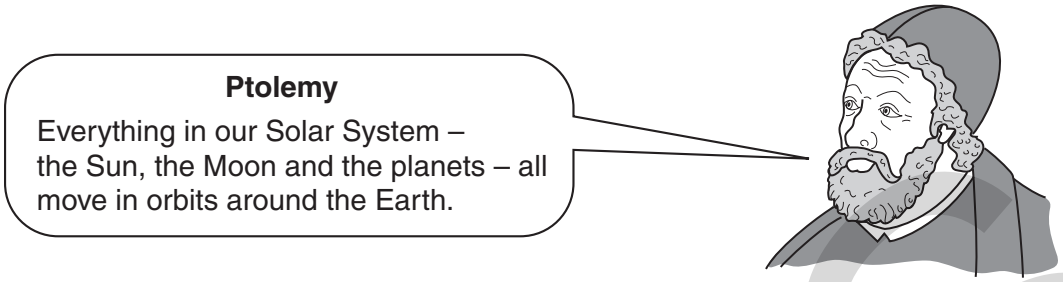
.....

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

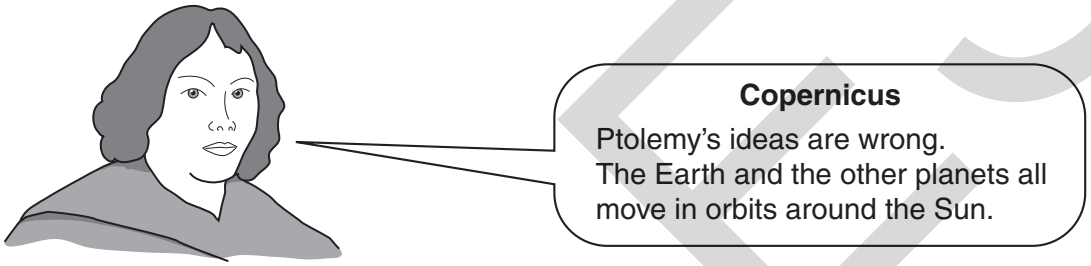
[Total: 5]

7 Ptolemy was an astronomer who lived nearly 2000 years ago.

His ideas about the Sun, the Moon and the planets were believed for many hundreds of years.



In 1530, Nicolaus Copernicus had different ideas.

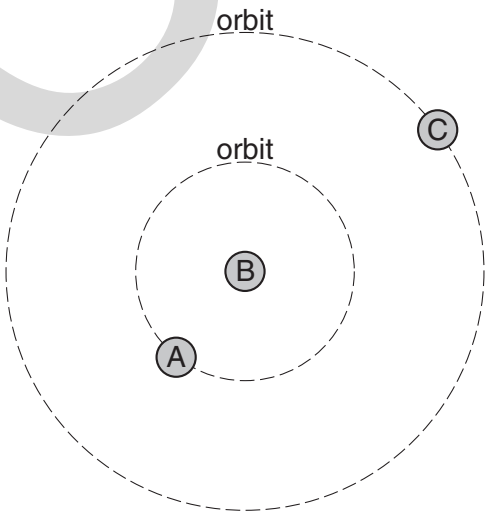


Both ideas were equally good at predicting the movement of the Sun and the planets.

(a) The diagram below shows the Sun, the Earth and the planet Mars.

Mars never moves between the Earth and the Sun.

This diagram can fit both Ptolemy's ideas and Copernicus' ideas.



Use words from this list to complete the sentences.

the Earth **Mars** **the Sun**

(i) Copernicus would say that

A was .....

B was .....

C was ..... .

[1]

(ii) Ptolemy would say that

A was .....

B was .....

C was ..... .

[1]

(b) It took over 100 years for Copernicus' ideas to be accepted.

(i) Put ticks (✓) in the boxes next to the **two** statements that explain why astronomers in 1530 preferred Ptolemy's ideas to Copernicus' ideas.

Ptolemy's ideas had worked well for hundreds of years. ☐

Ptolemy's ideas made better predictions of the movement of planets than Copernicus' ideas. ☐

Copernicus was very good at persuading people that he was right. ☐

Copernicus' ideas were new and different. ☐

[1]

(ii) Copernicus' ideas can account for **all** of the following observations. Ptolemy's ideas can account for **some** of them.

Put a tick (✓) in the box next to each observation that can be accounted for by **both** Ptolemy and Copernicus.

The Moon goes around the Earth.	☐
Most planets have moons which go around them.	☐
The planet Venus is sometimes between the Earth and the Sun.	☐
Spaceflight calculations are only successful because they assume the Sun is at the centre of the Solar System.	☐

[2]

[Total: 5]

8 A strong earthquake hit the central American country of Costa Rica in January 2009.

(a) Earthquakes are common in Costa Rica because it is on the boundary of two tectonic plates.

Read the following facts about Costa Rica.

Put ticks (✓) in the boxes next to the **two** facts that could be the result of Costa Rica being on the boundary of two tectonic plates.

Costa Rica has active volcanoes. ☐

A mountain chain runs along Costa Rica. ☐

Hurricanes are very common near Costa Rica. ☐

Costa Rica is near the equator. ☐

Costa Rica is where South America and North America join. ☐

[2]

(b) A country like Costa Rica can take action to reduce the damage from earthquakes.

Some actions will **reduce damage to property**, some will **reduce deaths and injuries** and some will **reduce both**.

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

action	**reduce damage to property**	**reduce deaths and injuries**	**reduce both**
Devise and enforce better building regulations.	☐	☐	☐
Educate people so they know what to do during an earthquake.	☐	☐	☐
Prepare emergency plans ready for earthquakes.	☐	☐	☐
Improve predictions about when earthquakes will occur.	☐	☐	☐

[2]

[Total: 4]

END OF QUESTION PAPER

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RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A212/01

Unit 2: Modules B2 C2 P2 (Foundation Tier)

OCE/15409

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)

Thursday 24 June 2010
Afternoon

Duration: 40 minutes

A212201

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

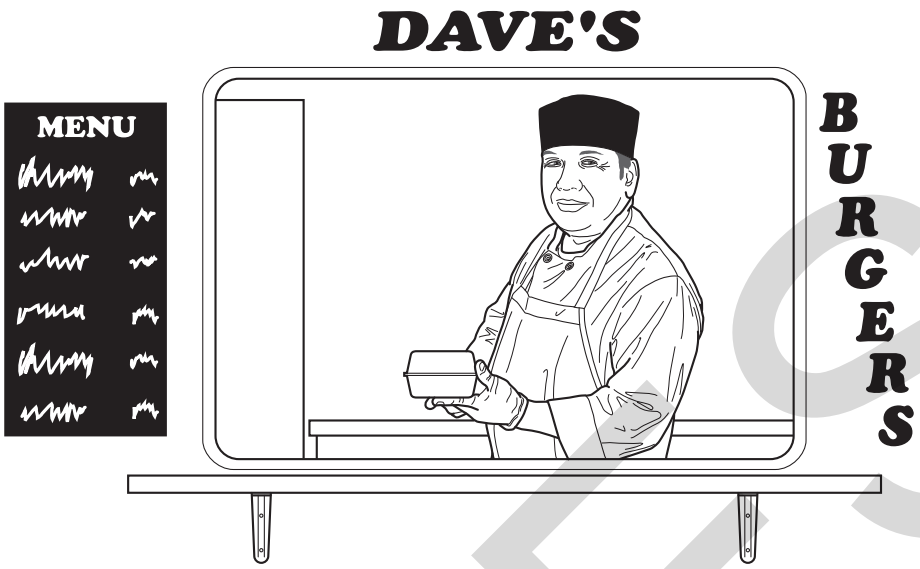
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the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

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



Dave sells hot burgers. He packs them in boxes.

He chooses the material for the boxes.

Look at the properties of different materials shown in the table below.

material	cost	heat insulation	melting point in °C	strength
low density poly(ethene) (LDPE)	low	poor	80	low
high density poly(ethene) (HDPE)	high	poor	180	high
polystyrene	medium	good	240	low

(a) Dave chooses polystyrene.

Which **two** properties make this the best choice?

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

cost ☐

heat insulation ☐

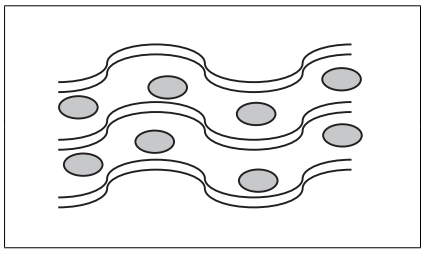
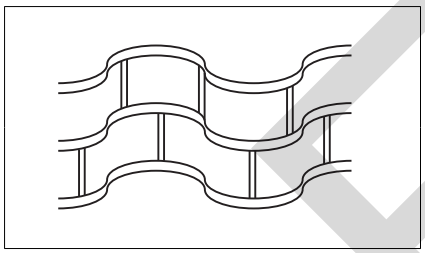
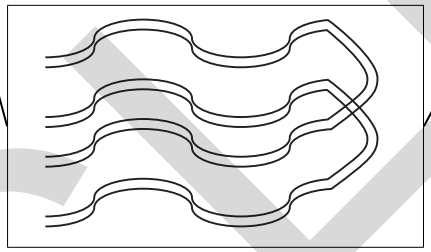
melting point ☐

strength ☐

[2]

(b) The properties of plastics depend on how the particles they are made from are arranged and held together.

Draw a straight line from each type of **arrangement** to the correct **diagram** and then to the **change in property**. One has been done for you.

arrangement	diagram	change in property
longer chain length		increased flexibility
added plasticiser		increased melting point
cross-linked		increased hardness

[2]

(c) Dave is advised to use cardboard boxes.

Using cardboard is **sustainable** and has **less environmental impact** than polystyrene.

Which of the statements explain why?

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

Cardboard is made from wood and polystyrene is made from crude oil. ☐

Cardboard is more flexible than polystyrene. ☐

Both cardboard and polystyrene can be recycled. ☐

Cardboard rots but polystyrene does not. ☐

Cardboard was used for many years before polystyrene was invented. ☐

[2]

(d) Polymers are made from crude oil.

Look at the sentences about making polymers from crude oil.

Some are true and some are false.

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

	true	**false**
Crude oil is mainly a mixture of hydrocarbon molecules.	☐	☐
Hydrocarbons are molecules made from water and oxygen only.	☐	☐
Crude oil contains polymers.	☐	☐
Small molecules from the crude oil are joined together to make polymers.	☐	☐

[2]

[Total: 8]

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Question 2 begins on page 6.

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2 This question is about fibres.

(a) Two students are testing the properties of different fibres.

Which fibre is made from a living thing?

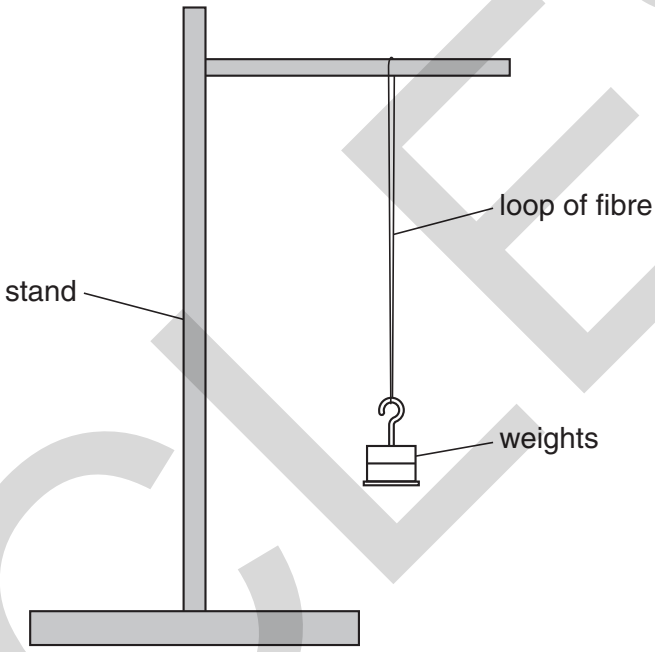
Put a (ring) around the correct answer.

cotton **polyester** **nylon** **polypropene**

[1]

(b) Mary and George are measuring the strength of different fibres.

A fibre is looped onto a support as shown in the diagram.



Weights are hung from the fibre until it breaks.

They repeat the test 5 times for each type of fibre.

(i) The length of each fibre is 30 cm.

Suggest **one** other factor that should be controlled to make this test fair.

Explain why it should be controlled.

.....

.....

.....

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

(ii) Here are Mary's results for cotton.

test number	1	2	3	4	5
weight to break fibre in N	0.60	1.45	0.90	1.35	0.70

What is the range of Mary's results?

..... N to ..... N **[1]**

(iii) George also investigates cotton.

Here are his results.

test number	1	2	3	4	5
weight to break fibre in N	0.95	0.80	0.90	1.00	0.85

They decide to use George's results to work out the true value of the strength of the fibre.

Explain why it is correct to use George's results rather than Mary's.

.....

.....

.....

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

[Total: 6]

3 **(a)** The chart below shows the electromagnetic spectrum.

radio waves	microwaves	infrared	light	ultraviolet	X-rays	gamma rays

(i) Which part of the spectrum provides the energy for photosynthesis?

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

(ii) Write down the part of the spectrum with the lowest energy photons.

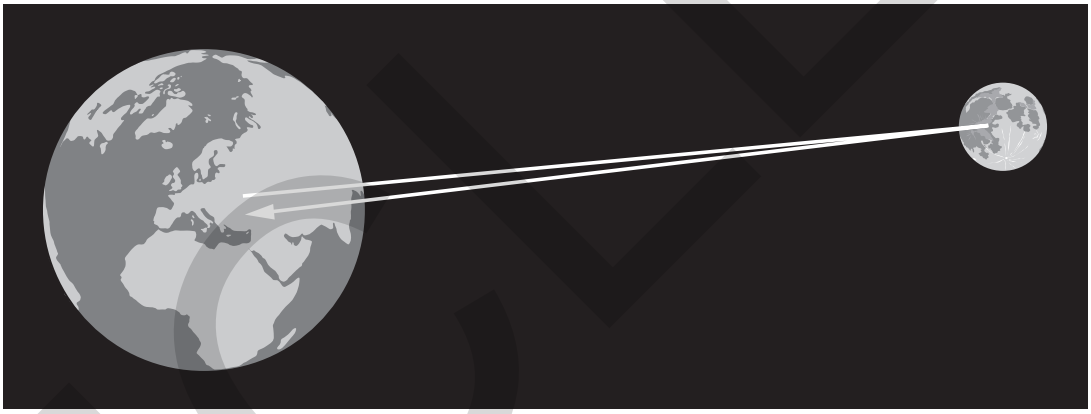
answer ..... **[1]**

(iii) Write down two parts of the spectrum used for transmitting information.

..... and ..... **[1]**

(b) Astronomers continuously measure the distance from the Earth to the Moon.

They use a laser, mirrors left on the Moon by astronauts and a detector on Earth.



Complete the sentences below using the **best** words from this list.

absorbs

emits

reflects

transmits

The laser on Earth …… light.

A mirror on the Moon …… the light.

The detector on Earth …… the light.

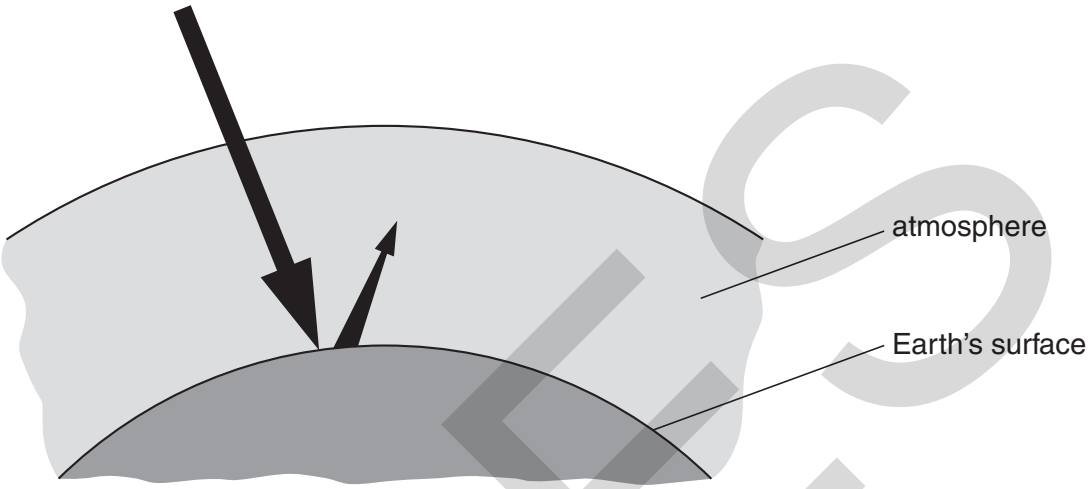
[2]

[Total: 5]

4 This question is about global warming.

Most scientists now agree that carbon dioxide produced by human activities is making the atmosphere warmer. This is due to the greenhouse effect.

(a) The diagram shows how the greenhouse effect works.



(i) The following statements explain the process in the diagram.

They are in the wrong order.

A The atmosphere becomes warmer.

B The energy is absorbed by the Earth.

C The Earth is heated by the radiation.

D The warm Earth gives off lower-energy radiation.

E High energy radiation from the Sun reaches the Earth.

F The infrared radiation is absorbed by greenhouse gases in the atmosphere.

Fill in the boxes to show the correct order.

The first one has been done for you.

E					

[2]

(ii) If global warming continues, the sea level could rise everywhere. This would cause problems in some parts of the world.

Explain the problems this would cause in a city like London, which is not far above sea level.

.....

.....

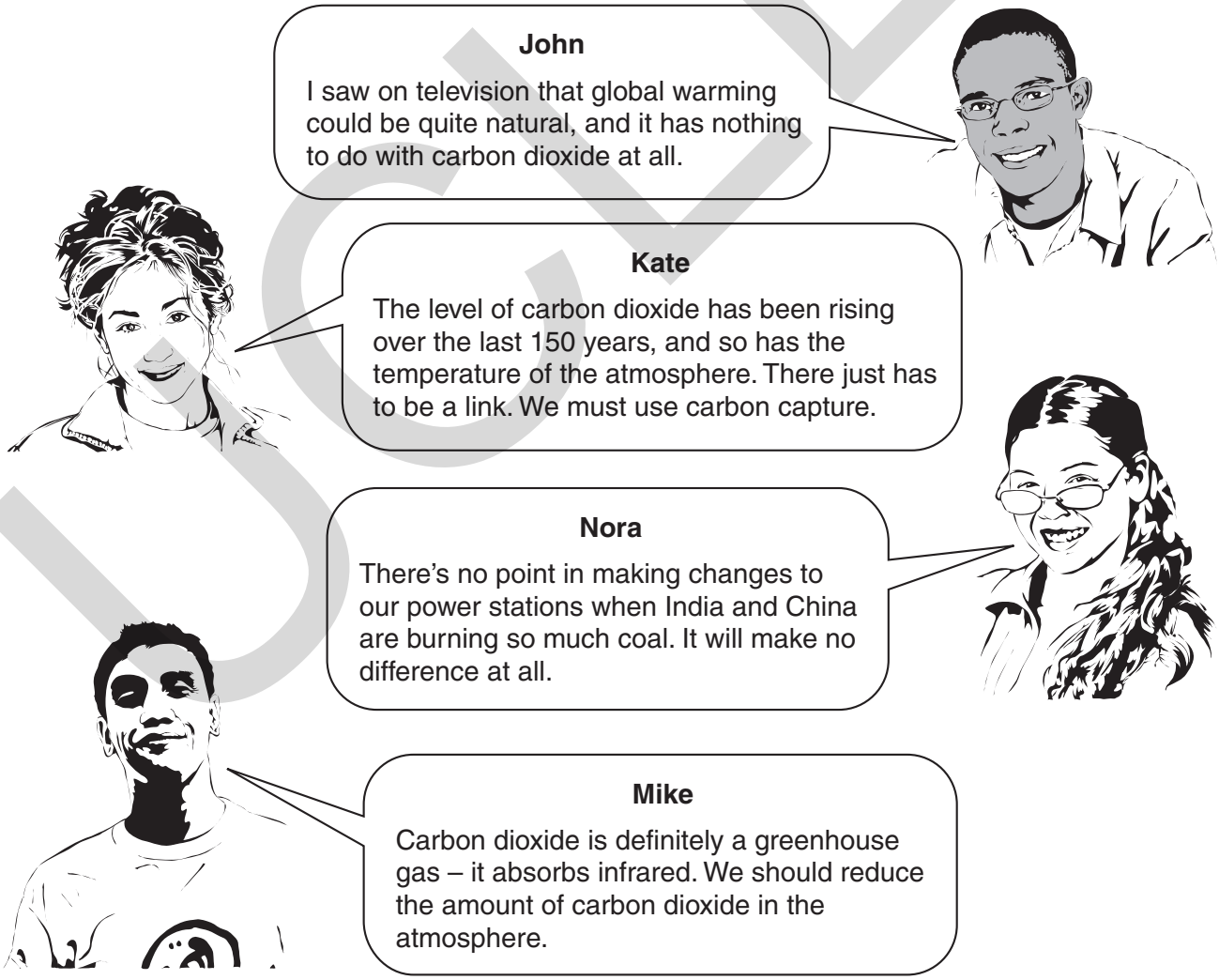
..... **[2]**

(b) Natural gas has become very expensive to use as a fuel in power stations. It is cheaper to burn coal.

Unfortunately, coal produces more carbon dioxide than any other way of generating power.

One way to solve this problem is called carbon capture and storage. All the carbon dioxide produced will be collected and stored deep underground. The carbon dioxide will dissolve in water in porous rocks.

These people are discussing global warming.



(i) Who says that we must reduce the amount of carbon dioxide put into the atmosphere?

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

John ☐

Kate ☐

Nora ☐

Mike ☐

[1]

(ii) Who mentions a **correlation**?

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

John ☐

Kate ☐

Nora ☐

Mike ☐

[1]

(iii) Who mentions a **cause**?

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

John ☐

Kate ☐

Nora ☐

Mike ☐

[1]

[Total: 7]

5 Many people have holidays in very sunny countries.

The level of ultraviolet radiation in these countries can be high.

People on holiday in sunny countries know that ultraviolet can harm their skin.

Give one reason why people will sunbathe, even though they know that it can damage their skin.

In your answer, make sure you write about the **benefit** you would get from sunbathing as well as the **risk** you run.

.....

.....

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

[Total: 2]

6 This question is about the disease measles.

(a) Measles is caused by a type of microorganism.

Measles cannot be treated using antibiotics.

Put a (ring) around the type of microorganism that causes measles.

bacterium **fungus** **virus**

[1]

(b) People with measles have a high temperature, a rash and generally feel unwell.

Use words from the list provided to complete the sentences describing how microorganisms can make a person ill.

antibiotics

hair

infection

poisons

rapidly

skin

slowly

spreading

symptoms

A microorganism gets past the body's natural barriers such as …… .

Once in the body the microorganism reproduces …… .

Microorganisms damage our cells by producing …… .

The damage to our cells causes …… of the disease.

[3]

(c) The graph shows the number of cases of measles in the UK from 1996 to 2008.

(i) Put ticks (✓) in the boxes to indicate which of the statements about the data in the graph are **true** and which are **false**.

statement	**true**	**false**
The number of measles cases rises and falls every three years.	☐	☐
There were about 10 times more cases of measles in 2008 than 1996.	☐	☐
The number of cases halved between 2003 and 2004.	☐	☐

[2]

(ii) Read this article about measles.

> About one in every fifteen children with measles becomes seriously ill.
>
> They may get chest infections, fits, swelling of the brain, and brain damage.
>
> In very serious cases, measles can be fatal.
>
> A measles vaccination can cause side effects. Many of these are mild, but there is a one in a million chance of inflammation of the brain.
>
> Between 1998 and 2008 the percentage of children being fully vaccinated against measles fell to 85%. This was less than the rate doctors think is necessary to prevent a measles epidemic.

Explain **one** advantage and **one** disadvantage of vaccination against measles.

.....

.....

.....

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

(d) There is a 99% probability that a child vaccinated against measles will be immune to the disease for life.

Why does the child become immune?

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

Red blood cells can engulf and digest measles microorganisms.	☐
White blood cells can now make antibodies against measles very quickly.	☐
White blood cells will change very quickly, confusing the measles microorganism.	☐
The body's natural barriers can now stop the measles microorganism from entering.	☐
White blood cells have been stimulated to produce antibodies against measles microorganisms.	☐

[2]

[Total: 10]

7 Read the article about aspirin and heart disease.

New advice on aspirin

Around 80% of people with diabetes die of heart disease.

A daily dose of aspirin was recommended to prevent heart disease.

However, aspirin can cause the stomach to bleed.

A major, long term study was recently peer reviewed and reported in the British Medical Journal.

Doctors found there was no difference in the frequency of heart attacks between those given aspirin and those given a dummy pill.

The new advice is not to take aspirin as a preventative treatment unless you have a history of heart disease.

(a) Which life style factor makes heart attacks **less** likely?

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

smoking ☐

stress ☐

regular exercise ☐

excessive alcohol drinking ☐

[1]

(b) Use the article to suggest **two** reasons why people with diabetes might decide not to take aspirin.

.....

.....

.....

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

(c) Heart disease is usually caused by blockages in the arteries that supply heart muscle.

Write down the name of the gas needed by heart muscle cells for them to respire.

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

[Total: 4]

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A212/02

Unit 2: Modules B2 C2 P2 (Higher Tier)

OCE/15407

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)

Thursday 24 June 2010
Afternoon

Duration: 40 minutes

A212/02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

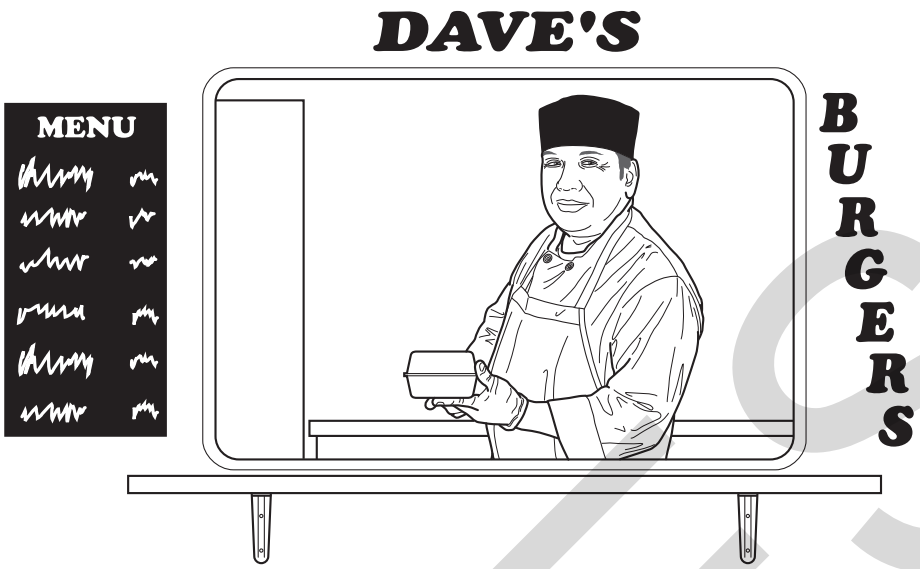
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the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

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



Dave sells hot burgers. He packs them in boxes.

He chooses the material for the boxes.

Look at the properties of different materials shown in the table below.

material	cost	density	melting point in °C	strength
low density poly(ethene) (LDPE)	low	low	80	low
high density poly(ethene) (HDPE)	high	medium	180	high
polystyrene	medium	very low	240	low

(a) Dave chooses polystyrene for his burger boxes.

Which statements explain why Dave chooses polystyrene?

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

Polystyrene is better than LDPE because it is cheaper and it will not be melted by the burgers. ☐

Polystyrene is better than LDPE because it is less dense and will not be melted by the burgers. ☐

Polystyrene is better than HDPE because it is cheaper and less dense. ☐

Polystyrene is better than HDPE because it is weaker and has a lower melting point. ☐

[1]

(b) Both LDPE and HDPE are made from poly(ethene) but their density and melting point are different.

Which of these statements explain why the density and melting point are different?

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

The molecules in HDPE are farther apart than in LDPE.	☐
Stronger forces are needed to break HDPE out of its solid structure than LDPE.	☐
Stronger forces are needed to break the molecules in HDPE than LDPE.	☐
The molecules are more tangled in LDPE than HDPE.	☐
HDPE has higher crystallinity than LDPE.	☐

[2]

(c) Dave is advised to use cardboard boxes.

Cardboard is more sustainable than polystyrene.

Explain why cardboard is more sustainable than polystyrene.

You should consider production **and** disposal of the materials in your answer.

.....

.....

.....

.....

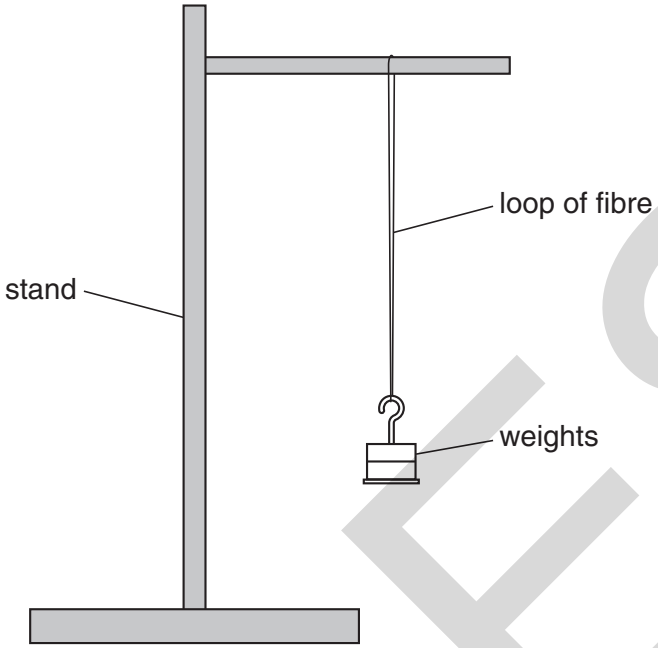
.....

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

[Total: 6]

2 Mary and George are measuring the strength of different fibres.

A fibre is looped onto a support as shown in the diagram.



Weights are hung from the fibre until it breaks.

They repeat the test 5 times for each type of fibre.

(a) The length of each fibre is 30 cm.

Suggest **one** other factor that should be controlled to make this test fair.

Explain why it should be controlled.

.....

.....

.....

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

(b) Here are Mary's results for cotton.

test number	1	2	3	4	5
weight to break fibre in N	0.60	1.45	0.90	1.35	0.70

George also investigates cotton.

Here are his results.

test number	1	2	3	4	5
weight to break fibre in N	0.95	0.80	0.90	1.00	0.85

They decide to use George's results to work out the true value of the strength of the fibre.

Explain why it is correct to use George's results rather than Mary's.

.....

.....

.....

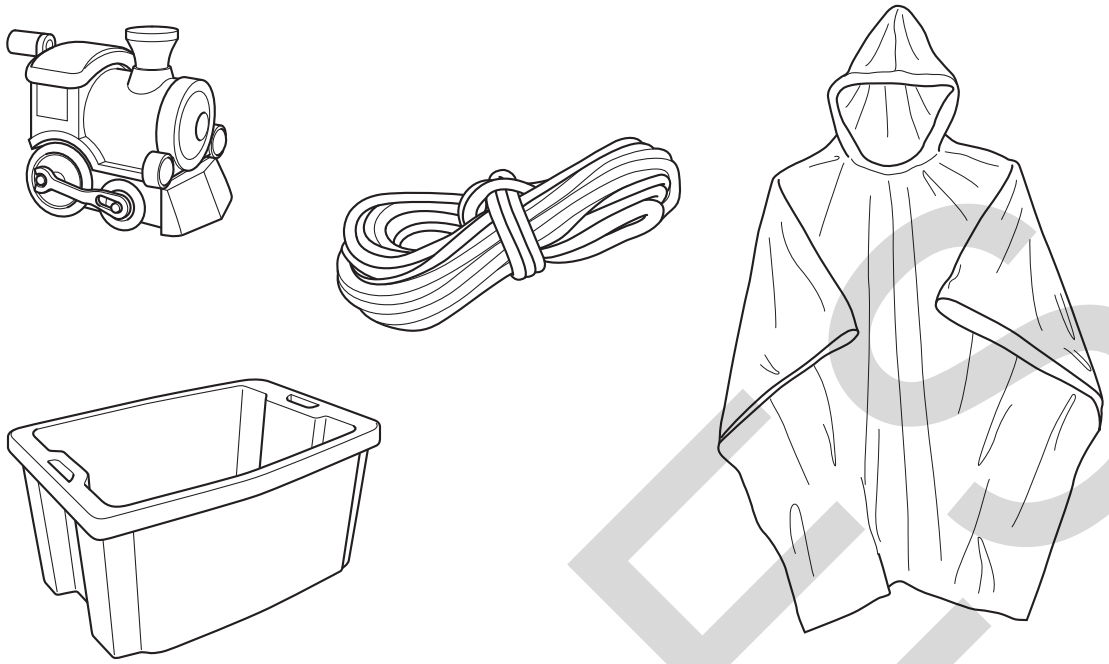
..... **[2]**

(c) Use **George's** results to calculate the mean value of the weight required to break the cotton thread.

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

[Total: 5]

3 Poly(propene) is a polymer used to make many different products such as toys, boxes, ropes and clothes.



(a) The results of Life Cycle Assessments (LCA) for these poly(propene) products are **different**.

Which features of the LCA will be **different**?

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

the energy needed to make poly(propene) from crude oil	☐
the energy needed to make the product from poly(propene)	☐
the sustainability of crude oil	☐
the useful lifetime of the product	☐
the environmental impact of disposing of poly(propene)	☐

[2]

(b) When poly(propene) is made into ropes and clothes a plasticizer is added.

The plasticizer increases the flexibility of the poly(propene).

Draw **one** straight line to make a sentence linking the correct **effect** of using a plasticizer to the correct **outcome** of this effect.

effect	**outcome**
Plasticizer breaks the polymer molecules …	… so less energy is needed for the molecules to slide past each other.
Plasticizer decreases the forces between polymer chains …	… so more energy is needed for the molecules to slide past each other.
Plasticizer increases the forces between polymer molecules …	… so the polymer molecules are smaller.
Plasticizer increases the forces inside polymer molecules …	… so the polymer molecules are branched.

[1]

[Total: 3]

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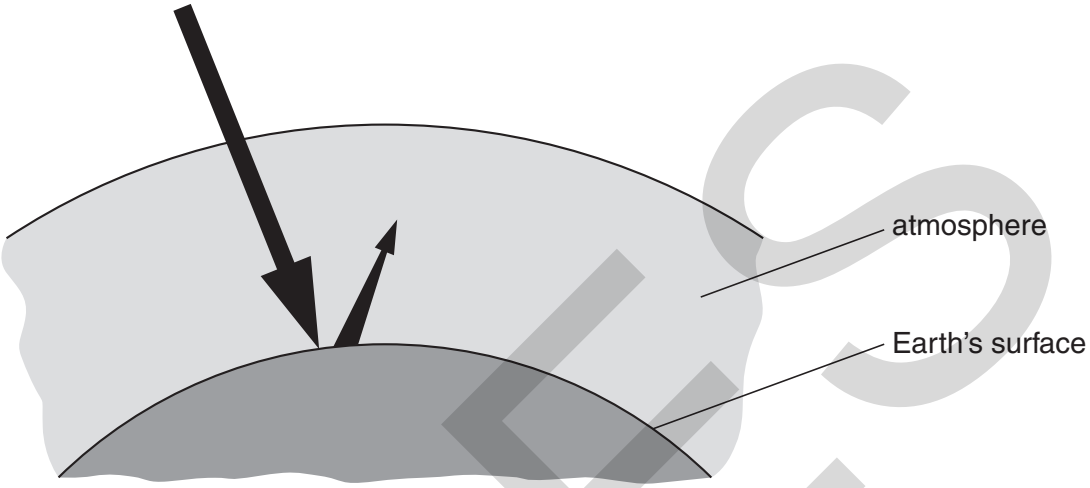
4 This question is about global warming.

Most scientists now agree that carbon dioxide produced by human activities is making the atmosphere warmer. This is due to the greenhouse effect.

(a) The diagram shows how the greenhouse effect works.



(i) The following statements explain the process in the diagram.

They are in the wrong order.

A The atmosphere becomes warmer.

B The energy is absorbed by the Earth.

C The Earth is heated by the radiation.

D The warm Earth gives off lower-energy radiation.

E High energy radiation from the Sun reaches the Earth.

F The infrared radiation is absorbed by greenhouse gases in the atmosphere.

Fill in the boxes to show the correct order.

The first one has been done for you.

E					

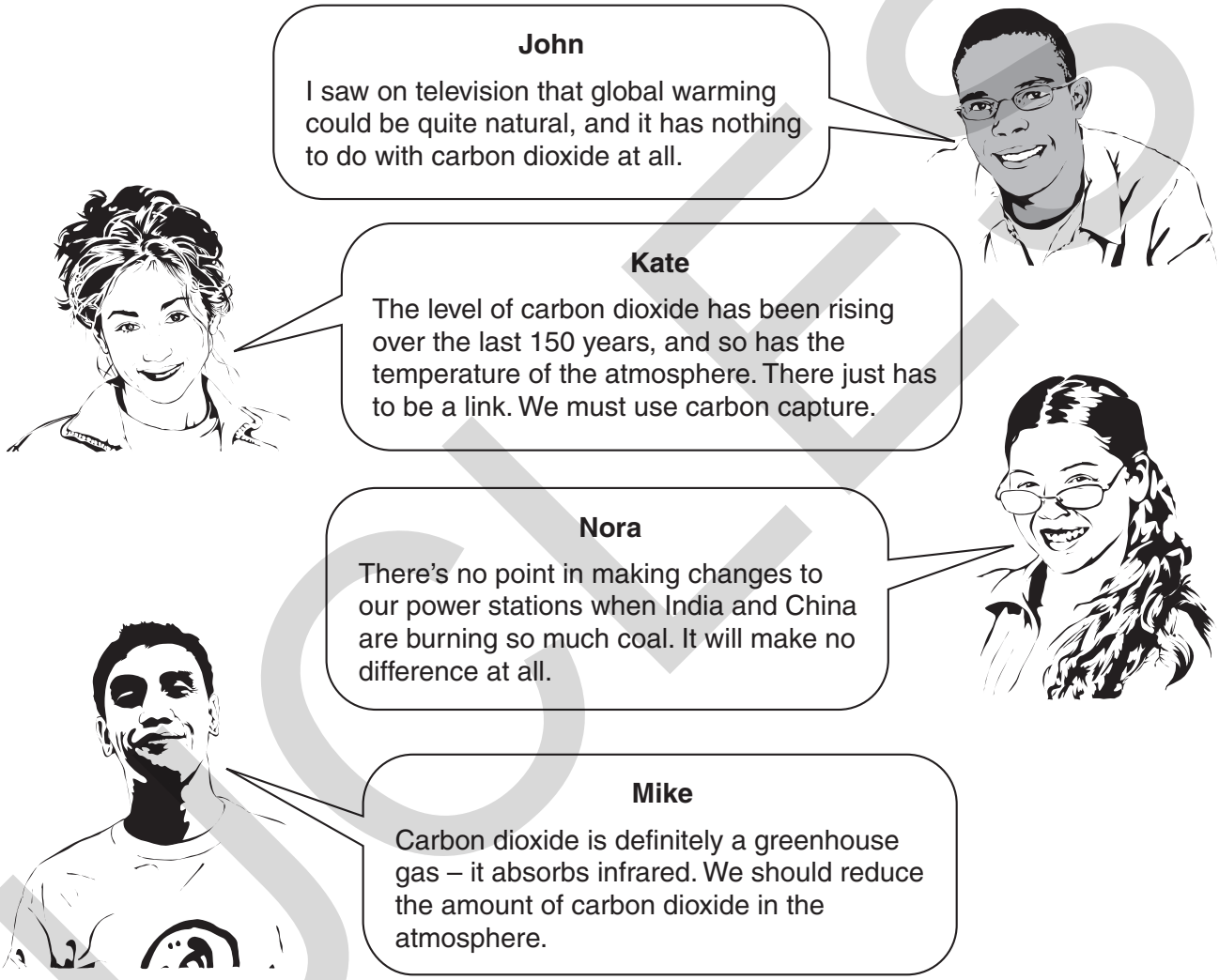
[2]

(b) Natural gas has become very expensive to use as a fuel in power stations. It is cheaper to burn coal.

Unfortunately, coal produces more carbon dioxide than any other way of generating power.

One way to solve this problem is called carbon capture and storage. All the carbon dioxide produced will be collected and stored deep underground. The carbon dioxide will dissolve in water in porous rocks.

These people are discussing global warming.



(i) Who mentions a **correlation**?

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

John ☐

Kate ☐

Nora ☐

Mike ☐

[1]

(ii) Who mentions a **cause**?

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

John ☐

Kate ☐

Nora ☐

Mike ☐

[1]

[Total: 4]

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5 Many people enjoy holidays in sunny countries, where the ultraviolet radiation can be intense.

(a) The amount of ultraviolet reaching parts of the Earth's surface is more now than it was fifty years ago. This is because the ozone layer has become thinner as a result of human activity.

Which two statements, taken together, can explain why the ozone layer has become thinner?

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

Natural chemicals in the atmosphere react with ozone. ☐

Ozone absorbs ultraviolet radiation. ☐

Pollutant chemicals in the atmosphere react with ozone. ☐

Ultraviolet radiation breaks up ozone molecules. ☐

Some chemical changes of ozone are not reversible. ☐

The ozone protects living things by absorbing ultraviolet. ☐

[2]

(b) People on holiday in sunny countries know that ultraviolet can harm their skin.

Explain why people will sunbathe, even though they know that it can damage their skin.

.....

.....

.....

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

[Total: 4]

6 **(a)** The chart below shows the electromagnetic spectrum. Some of the regions of the spectrum have been labelled **A**, **B**, **C**, **D**, **E** and **F**.

A	**microwaves**	**B**	**C**	**D**	**E**	**F**

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

Each letter may be used once, more than once, or not at all.

(i) Which part of the spectrum contains X-rays?

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

(ii) Which parts of the spectrum are ionising radiations?

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

(iii) Write down two parts of the spectrum, apart from microwaves, that are used for transmitting information.

..... and ..... **[1]**

(b) Barry has hurt his hand, and has it X-rayed.

The X-ray photograph shows that his bones are not damaged.

When X-rays reach a photographic film, they produce chemical changes which make the film black, so denser tissues appear lighter.

Which of the following statements about the X-ray are true?

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

Bone absorbs X-rays more effectively than muscle. ☐

Bone reflects X-rays more effectively than muscle. ☐

Bone transmits X-rays more effectively than muscle. ☐

High intensity X-rays are shown by a light colour in the photograph. ☐

Light parts of the film received fewer X-ray photons than dark parts of the film. ☐

[2]

[Total: 5]

7 This question is about the disease measles.

(a) Measles is caused by a type of microorganism.

Measles cannot be treated using antibiotics.

Write down the type of microorganism that causes measles.

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

(b) People with measles have a high temperature, a rash and generally feel unwell.

Complete the sentences describing how microorganisms can make a person ill.

You should use **one** word in each sentence.

A microorganism gets past the body's natural barriers such as …… .

Once in the body the microorganism reproduces …… .

Microorganisms damage cells by producing …… .

The damage to cells causes …… of the disease.

[3]

(c) The graph shows the number of cases of measles in the UK from 1996 to 2008.

(i) Put ticks (✓) in the boxes to indicate which of the statements about the data in the graph are **true** and which are **false**.

statement	true	false
The number of measles cases rises and falls every three years.	☐	☐
There were about 10 times more cases of measles in 2008 than 1996.	☐	☐
The number of cases halved between 2003 and 2004.	☐	☐

[2]

(ii) Read this article about measles.

> Measles is an infectious disease.
>
> About one in every fifteen children with measles becomes seriously ill. They may get chest infections, fits, swelling of the brain and brain damage.
>
> A measles vaccination contains live, weakened microorganisms and can cause side effects. Up to 20% of children vaccinated suffer a mild fever or rash, but there is a one in a million chance of inflammation of the brain.
>
> The measles vaccine only works against measles. It does not work against other viruses such as the flu.
>
> Some parents choose not to have their children vaccinated. Between 1998 and 2008 the percentage of children being fully vaccinated against measles fell to 85%.
> Doctors think a vaccination rate of 95% is necessary to prevent a measles epidemic.

Explain why it is necessary to vaccinate such a high percentage of children in order to prevent a measles epidemic.

.....

.....

.....

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

(iii) The article includes some facts about vaccination and some information about the benefits and risks of measles vaccination.

Children benefit from vaccination although there are some risks.

Society as a whole benefits from measles vaccination.

Put ticks (✓) in the boxes to show which of the **facts about measles vaccination** show

- **benefits of vaccination for society**
- **risks of vaccination for children**
- **neither.**

facts about measles vaccination	benefits of vaccination for society	risks of vaccination for children	neither
Some vaccinated children will suffer from a mild fever.			
The measles vaccine does not work against the flu virus.			
Some parents choose not to have their children vaccinated.			
Measles epidemics can be prevented if over 95% of children are vaccinated.			

[2]

(d) There is a 99% probability that a child vaccinated against measles will be immune to the disease for life.

Why does the child become immune?

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

Red blood cells can engulf and digest measles microorganisms. ☐

White blood cells can now make antibodies against measles very quickly. ☐

White blood cells will change very quickly, confusing the measles microorganism. ☐

The body's natural barriers can now stop the measles microorganism from entering. ☐

White blood cells have been stimulated to produce antibodies against measles microorganisms. ☐

[2]

[Total: 12]

8 A recent study investigated the preventative effects of aspirin on human heart disease.

This was a major long-term study.

It used a blind trial.

Explain what a blind trial is and why placebos are rarely used in human trials.

.....

.....

.....

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

[Total: 3]

END OF QUESTION PAPER

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OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A213/01

Unit 3: Modules B3 C3 P3 (Foundation Tier)

OCE/16231

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 18 June 2010
Afternoon

Duration: 40 minutes

A213301

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly 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 that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

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 Using radioactive materials to treat cancer is called radiotherapy.

One material used for radiotherapy emits beta radiation.

A small amount of radioactive material is put inside a patient's body, near the cancerous cells.

It is taken out 10 days later.

(a) Which of the following statements is the reason for using this type of radiotherapy?

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

It kills cancer cells. ☐

It kills healthy cells. ☐

It makes healthy cells cancerous. ☐

It makes cancerous cells healthy. ☐

[1]

(b) Beta radiation is better than gamma radiation for this type of radiotherapy.

Which statement explains why?

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

Gamma radiation is more ionising than beta radiation. ☐

Gamma radiation is not given out by radioactive materials. ☐

Cancer cells absorb beta radiation more effectively than gamma radiation. ☐

Cancer cells absorb beta radiation less effectively than gamma radiation. ☐

[1]

(c) The patient had a large dose of radiation from the treatment.

Which of the following changes to the treatment would give a **bigger** dose?

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

leaving the radioactive material in the patient for 5 days instead of 10 days	☐
leaving the radioactive material in the patient for 15 days instead of 10 days	☐
putting the radioactive material in the body for 10 days but farther away from the cancerous cells	☐
putting less radioactive material into the patient	☐
putting more radioactive material into the patient	☐

[2]

(d) Some hospital staff are at risk from the radioactive materials used in radiotherapy.

Write down the job of one person in the hospital who may be at risk from handling radioactive materials.

job .....

Suggest **two** ways in which the hospital could reduce the risk to this person.

.....

.....

.....

.....

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

[Total: 7]

2 This question is about generating electricity.

(a) (i) Electricity is a useful source of energy.

Which of the following statements explain why it is useful?

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

Electricity can be used in many ways. ☐

Only electricity can be used for lighting. ☐

Electricity is easy to transmit over large distances. ☐

High voltage electricity can be dangerous. ☐

Most power stations produce carbon dioxide. ☐

[2]

(ii) Which one of the following statements about electricity is true?

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

Electricity is a fossil fuel. ☐

Electricity is a primary energy source. ☐

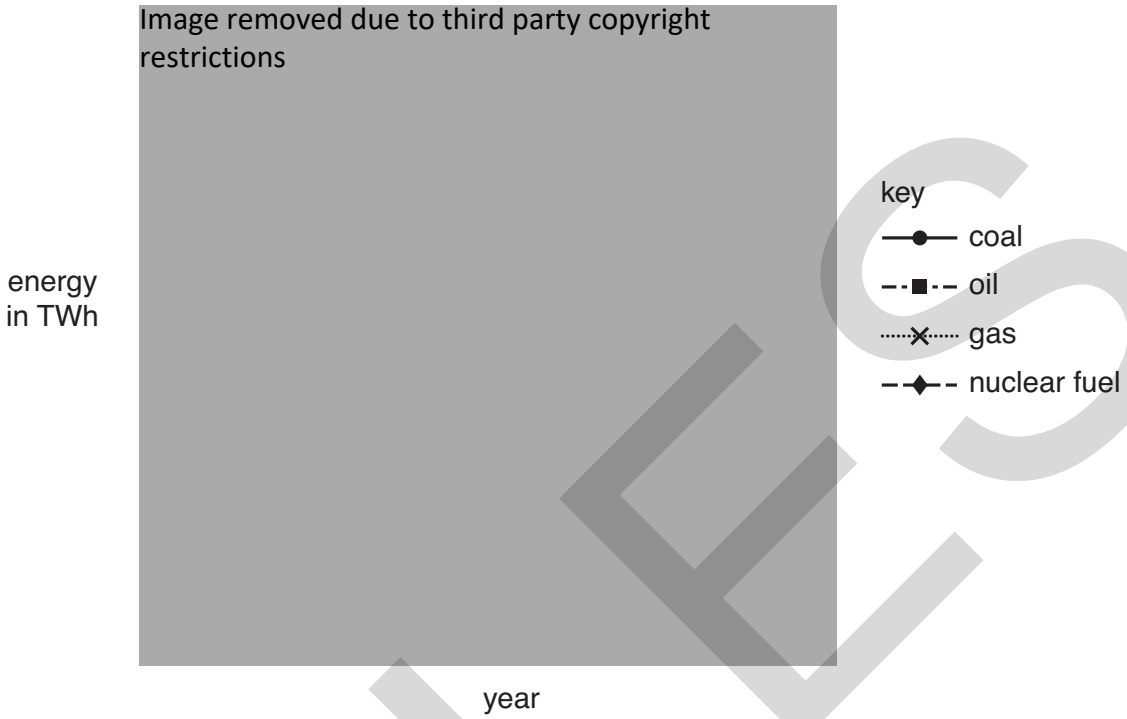
Electricity is a renewable energy source. ☐

Electricity is a secondary energy source. ☐

[1]

(b) The graph shows the amount of electrical energy generated in Great Britain from 1996 to 2007. The amount of energy is measured in terawatt-hours (TWh).

The electricity was generated from four different sources: coal, oil, gas and nuclear fuel.



(i) Electrical energy generated from which source, **coal**, **oil**, **gas** or **nuclear fuel**, decreased by the greatest amount from 1996 to 2007?

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

(ii) In which one year did gas generate more electrical energy than any other fuel?

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

(iii) Which fuels generated more than 250 TWh in any year since 2000?

Write the name of **each** correct fuel in this space.

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

(iv) Which fuels generated less than 200 TWh in any year on the graph?

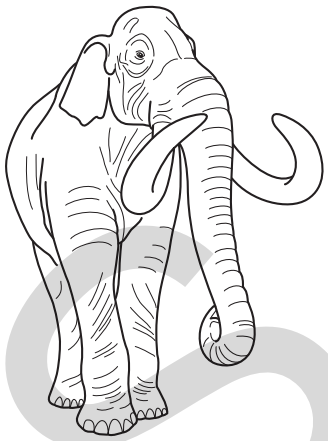
Write the name of **each** correct fuel in this space.

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

[Total: 7]

3 Read the newspaper article.

Mammoth skull found



A fossil of a mammoth skull has been found in France.

The skull is the most complete steppe mammoth skull ever found.

Steppe mammoths are thought to be a stage in evolution between the southern mammoth and the woolly mammoth.

All species of mammoth are now extinct.

(a) Fossils are one source of evidence for evolution.

Which other source of evidence for evolution is used by scientists?

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

the internet	☐
photographs	☐
DNA analysis	☐
TV programmes	☐

[1]

(b) Scientists do not agree on how different mammoth species evolved.

Some scientists do not agree that steppe mammoths are a stage of evolution between southern mammoths and woolly mammoths.

What is the best **scientific** reason for this?

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

They may not believe in evolution.	☐
Some scientists do not like new ideas.	☐
Very few complete skulls have been found.	☐
Scientists need to do breeding experiments with mammoths.	☐

[1]

[Total: 2]

4 **(a)** Two communication systems have evolved in multicellular animals.

Put a (ring) around **each** of these **two** communication systems.

blood **digestive** **hormonal** **nervous** **respiratory**

[2]

(b) The sentences below describe how the communication systems work.

Complete the sentences by using the **best** words from the list.

blood

effector

impulse

receptor

response

spinal

A stimulus or change is detected by ……..…… cells.

A change caused by a stimulus is called a ……..…… .

The change is produced by ……..…… cells.

[2]

[Total: 4]

5 Read the newspaper article on Neanderthal man.

Latest research on Neanderthal man

early Modern man

Neanderthal man

Neanderthal man probably became extinct about 24 000 years ago, during the last Ice Age.

Early Modern man and Neanderthal man lived at the same time and in the same places.

Scientists have recently excavated a cave near Gibraltar. The cave had been used by Neanderthal man. They found evidence of fires and flint stone tools.

Chemical analysis of bones shows that early Modern man ate a much greater variety of foods than Neanderthal man.

(a) One explanation for the extinction of Neanderthal man is:

- early Modern man was in competition with Neanderthal man, and
- early Modern man was more successful than Neanderthal man.

Which of the observations below are evidence for this explanation?

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

Neanderthal man lived in caves.	☐
Neanderthal man used fire and flint stone tools.	☐
Early Modern man ate a greater variety of foods.	☐
Neanderthal man became extinct about 24 000 years ago.	☐
Early Modern man and Neanderthal man lived at the same time and in the same places.	☐

[2]

(b) Apart from competition, suggest **two other** possible reasons why Neanderthal man became extinct.

.....

.....

.....

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

[Total: 4]

6 Most scientists agree that evolution can be explained by natural selection.

Natural selection was first described by Darwin and Wallace in the 1850s.

(a) Which observations support their explanation?

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

Some species are found in many countries.	☐
Characteristics can be inherited.	☐
Variation exists between individuals.	☐
Sexual reproduction occurs in plants and animals.	☐
Asexual reproduction occurs in plants and animals.	☐

[2]

(b) In 1858, when Darwin and Wallace published their ideas, many people disagreed with the idea of natural selection.

Suggest **two** reasons why many people at this time rejected natural selection.

.....

.....

.....

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

[Total: 4]

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Question 7 starts on page 12.

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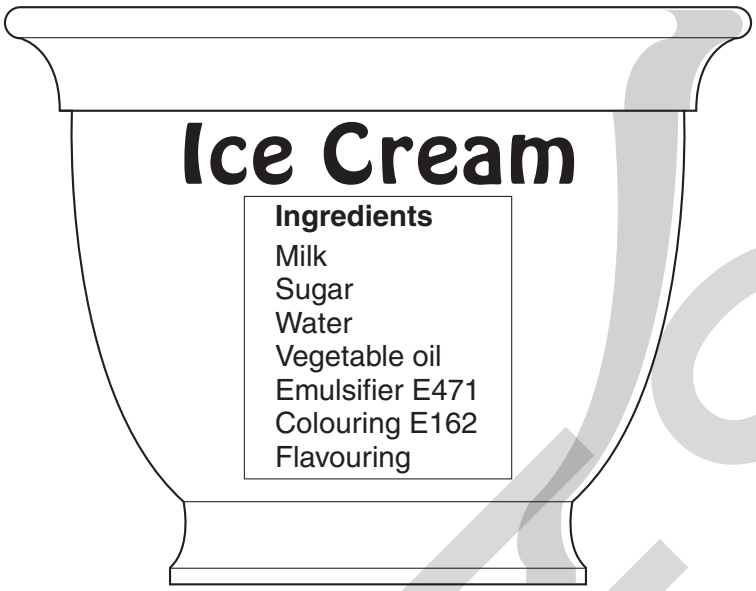
7 The label on a tub of ice cream shows the ingredients in the ice cream.



(a) Emulsifiers are added to food.

They help some ingredients to mix together.

Which two ingredients in ice cream need an emulsifier so they can mix together?

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

sugar ☐

water ☐

vegetable oil ☐

colouring ☐

flavouring ☐

[2]

(b) (i) Emulsifiers are called additives because they are added to foods.

Name **one** other food additive and explain why it is added to food.

.....

.....

.....

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

(ii) Most additives are given E numbers.

Here are four statements about additives with E numbers.

They are not all true.

Put a tick (✓) in the correct box after each statement to show whether it is **true** or **false**.

	true	**false**
They all supply energy to the body.	☐	☐
They have passed a safety test.	☐	☐
They are approved for use in the UK.	☐	☐
They are never harmful.	☐	☐

[2]

(c) Ice cream contains carbohydrates and proteins.

Draw a straight line from each **food type** to the elements it **consists of**.

You should draw only **two** straight lines.

food type	**consists of**
	only carbon and hydrogen
carbohydrate	only carbon and oxygen
protein	only carbon, oxygen and hydrogen
	carbon, oxygen, nitrogen and hydrogen

[2]

[Total: 8]

8 The most common cause of food poisoning in the UK is bacteria in food.

Some bacteria produce toxins when they grow in food.

Bacteria grow quickly at room temperatures but are killed at high temperatures.

Suggest **two** ways to reduce the risk of food poisoning from bacteria in food.

.....

.....

.....

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

[Total: 2]

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Question 9 starts on page 16.

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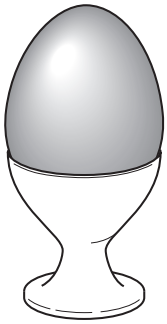
9 Read this report.



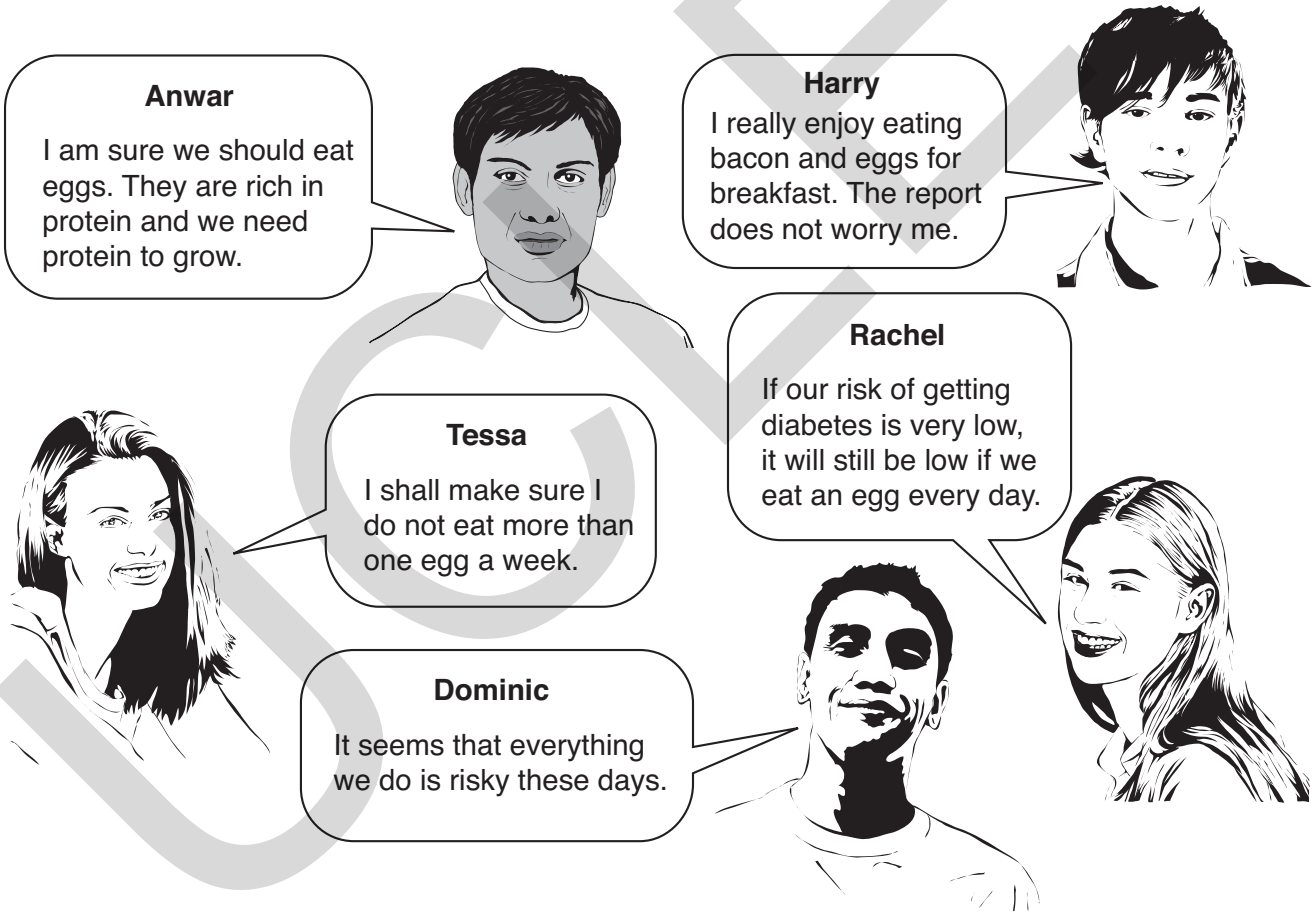
An egg a day – the risk

Recent research suggests that an egg a day increases the risk of type 2 diabetes. Scientists reached this conclusion after tracking 57000 men and women over a period of 20 years.

They found that eating an egg every day increased the overall risk of type 2 diabetes by about 60 per cent. Eating just one egg a week carried no increased risk.

Other scientists disagree with this research. They say that other lifestyle factors were not considered in the study, and that there is no possible mechanism to explain the link.

Some students are talking about the report.



(a) Which **one** person is suggesting a way of reducing any risk from eating eggs?

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

(b) Which **two** people think the benefits of eating eggs outweigh the risks?

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

(c) Some scientists think that other lifestyle factors are more important in increasing the risk of type 2 diabetes.

Suggest one lifestyle factor, **apart from diet**, that increases the risk of type 2 diabetes.

.....

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

[Total: 4]

END OF QUESTION PAPER

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A213/02

SCIENCE A

Unit 3: Modules B3 C3 P3 (Higher Tier)

OCE/16233

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 18 June 2010
Afternoon

Duration: 40 minutes

A213 02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly 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.
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- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

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 Using radioactive materials to kill cancer is called radiotherapy.

In one form of radiotherapy a small amount of radioactive material is put inside a patient's body, near the cancerous cells.

One material used for this type of radiotherapy emits beta radiation.

(a) (i) Beta radiation is more suitable for this type of radiotherapy than alpha radiation or gamma radiation.

Which of the following statements **explain** why?

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

Beta radiation carries a negative electrical charge.	☐
Alpha radiation carries a positive electrical charge.	☐
Beta radiation is less ionising than alpha radiation.	☐
Beta radiation is more penetrating than alpha radiation.	☐
Gamma radiation is part of the electromagnetic spectrum.	☐
Gamma radiation is not absorbed as easily as beta radiation.	☐

[2]

(ii) The treatment for one patient used 2 mg of radioactive material. The material has a long half-life.

The radioactive material was taken out of the patient's body after 10 days.

The patient had a 0.2 sievert dose of radiation from the treatment.

Which of the following changes to the treatment would give a dose of 0.4 sievert?

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

amount of radioactive material	**time it is in the patient**	
2 mg	5 days	
2 mg	20 days	
4 mg	5 days	
4 mg	20 days	

[1]

(b) The surgeons at the hospital who put the radioactive material into the patient are also at risk.

Explain what is meant by the ALARA principle, and how the hospital needs to apply it to reduce the risk to the surgeons.

.....

.....

.....

.....

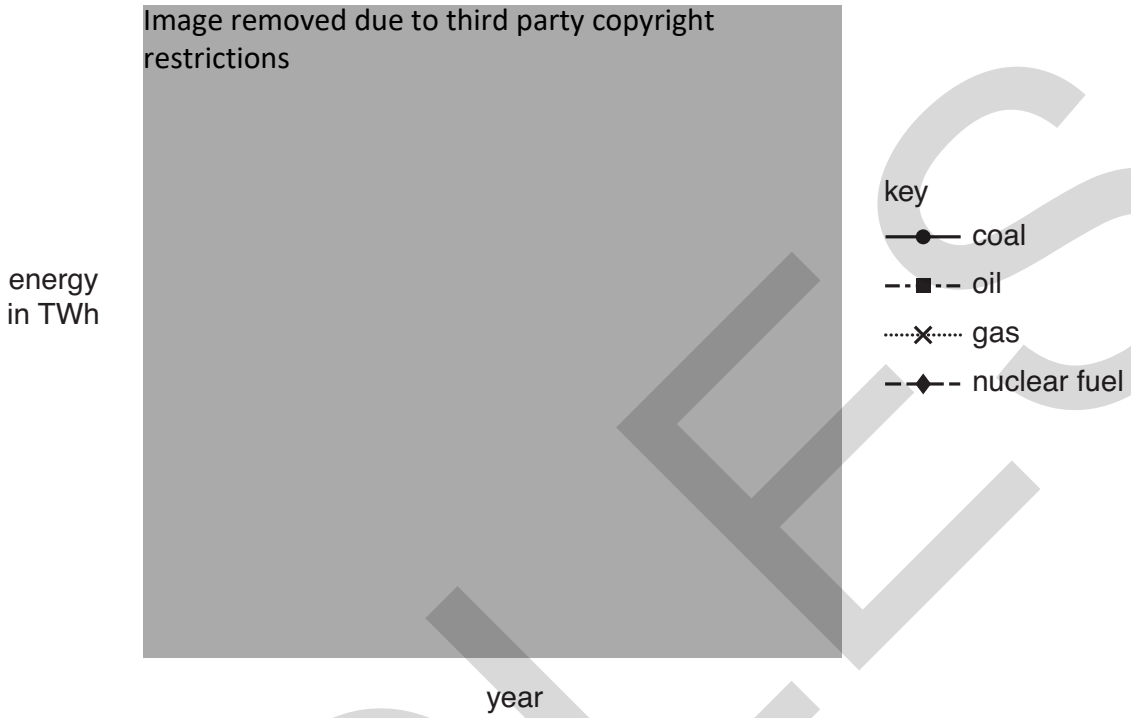
..... **[3]**

[Total: 6]

2 This question is about generating electricity.

(a) The graph shows the amount of electrical energy generated in Great Britain from 1996 to 2007. The amount of energy is measured in terawatt-hours (TWh).

The electricity was generated from four different sources: coal, oil, gas and nuclear fuel.



(i) Electrical energy generated from which source, **coal**, **oil**, **gas** or **nuclear fuel**, decreased by the greatest amount from 1996 to 2007?

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

(ii) In which one year did gas generate more electrical energy than any other fuel?

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

(iii) Which fuels generated more than 250 TWh in any year since 2000?

Write the name of **each** correct fuel in this space.

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

(iv) Which fuels generated less than 200 TWh in any year on the graph?

Write the name of **each** correct fuel in this space.

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

(b) Read the article about Combined Heat and Power (CHP) stations.

Thermal electrical power stations are powered by fossil fuels or nuclear power. They have a low efficiency of around 35%. This can be improved if the 'waste' heat is used. One way to do this is to pump hot water from the power station around local housing for space-heating.

Used this way, the power station becomes a Combined Heat and Power (CHP) station and the energy wasted drops to about 25%.

Which of these statements about CHP stations are true?

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

They use renewable energy sources. ☐

They are more efficient than other thermal power stations. ☐

They produce less heat than other power stations. ☐

They are more useful in a town than in the countryside. ☐

They produce more electricity than other power stations. ☐

[1]

[Total: 5]

3 This question is about radioactive isotopes.

(a) For an atom of an element,

N = number of neutrons

Z = number of protons

A = **N** + **Z** = the total number of particles in the nucleus.

Which of these numbers stay the **same** for atoms of different isotopes of an element?

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

A only	☐
N only	☐
Z only	☐
A, **N** and **Z**	☐

[1]

(b) A radioactive isotope of radium decays with a half-life of 15 days.

If you start with 16 grams of this isotope, how long would it take until there is only 1 gram of the isotope left?

Show your working clearly.

answer = ... days **[2]**

[Total: 3]

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Question 4 starts on page 8.

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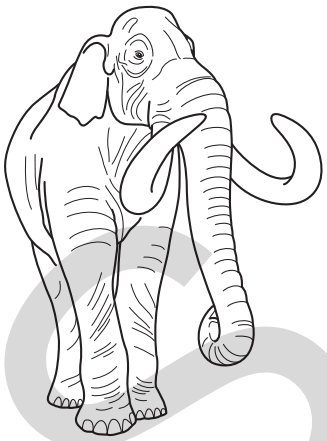
4 Read the newspaper article.

Mammoth skull found



A fossil of a mammoth skull has been found in France.

The skull is the most complete steppe mammoth skull ever found.

Steppe mammoths are thought to be a stage in evolution between the southern mammoth and the woolly mammoth.

(a) Fossils are one source of evidence for evolution.

Another source of information about evolutionary relationships is the chemical that chromosomes are made from.

Name this chemical.

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

(b) Jade is explaining to her mother how a new species can evolve.

Not all Jade's statements agree with accepted current scientific explanations.

This is what she says.

Jade

Mammoths changed over time – this is an example of evolution. Individual southern mammoths were different from each other. Differences between individuals could be due to the genes inherited from their parents or due to the environment. Both of these types of variation can be passed on to the next generation.

As well as this, mutations occur by chance. Mutations are changes to proteins. If the mutation is in a sex cell it can be inherited.

Over a long time the typical characteristics of the southern mammoths changed so much that a new species had been produced.

Put a tick (✓) in the correct box after each statement to show if it **agrees** or **disagrees** with current scientific explanations.

Jade's statements	agrees	disagrees
Mammoths changed over time – this is an example of evolution.	☐	☐
Differences between individuals could be due to the genes inherited from their parents or due to the environment.	☐	☐
Both of these types of variation can be passed on to the next generation.	☐	☐
Mutations occur by chance.	☐	☐
Mutations are changes to proteins.	☐	☐
If the mutation is in a sex cell it can be inherited.	☐	☐

[3]

[Total: 4]

5 Two communication systems have evolved in multicellular animals.

(a) Name the two communication systems present in multicellular animals.

..... system and ..... system **[1]**

(b) Complete the sentences to describe how the communication systems work.

Use **one** word in each case.

Stimuli or changes are detected by …… cells.

The change caused by the stimulus is called a …… .

The changes are produced by …… cells.

[3]

(c) One function of the body's communication systems is to maintain a constant internal environment.

Write down the scientific term for maintaining a constant internal environment.

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

[Total: 5]

6 Natural selection was first described by Darwin and Wallace.

In 1858, when Darwin and Wallace published their ideas, many people disagreed with the idea of natural selection.

Suggest **two** reasons why many people at this time rejected natural selection.

.....

.....

.....

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

[Total: 2]

7 Read the newspaper article on Neanderthal man.

Latest research on Neanderthal man

early Modern man

Neanderthal man

Neanderthal man probably became extinct about 24 000 years ago, during the last Ice Age.

Scientists have recently excavated a cave near Gibraltar. They found evidence of fires and flint stone tools which had been used by Neanderthal man, long after it had been thought that Neanderthals were extinct. By this time, early Modern man had arrived in Gibraltar. These observations show that early Modern man and Neanderthal man lived at the same time and in the same places.

(a) Some scientists originally thought that Neanderthal man was extinct before early Modern man appeared.

The new evidence suggests that this theory is not correct.

Suggest **two** reasons why scientists may be reluctant to give up an explanation when new data appears to conflict with it.

1.....

.....

2.....

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

(b) Apart from competition, suggest **two other** possible reasons why Neanderthal man became extinct.

.....

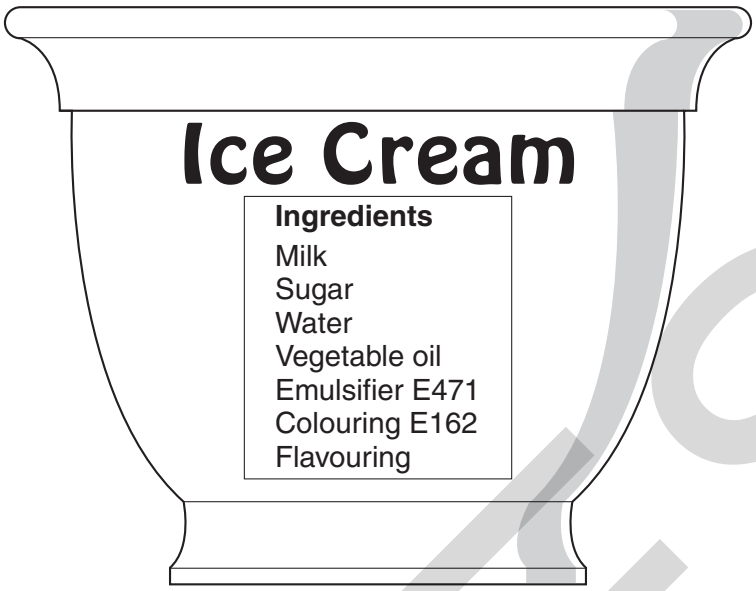
.....

.....

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

[Total: 3]

8 The label on a tub of ice cream shows the ingredients in the ice cream.



(a) (i) Emulsifiers are added to food.

They help some ingredients to mix together.

Which two ingredients in ice cream need an emulsifier so they can mix together?

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

sugar ☐

water ☐

vegetable oil ☐

colouring ☐

flavouring ☐

[2]

(ii) Most additives are given E numbers.

Here are four statements about additives with E numbers.

They are not all true.

Put a tick (✓) in the correct box after each statement to show whether it is **true** or **false**.

	true	**false**
They all supply energy to the body.	☐	☐
They have passed a safety test.	☐	☐
They are approved for use in the UK.	☐	☐
They are never harmful.	☐	☐

[2]

(b) (i) Ice cream contains carbohydrates and proteins.

Complete each sentence by choosing the best word from this list.

A word may be used once, more than once or not at all.

fats

hydrocarbons

minerals

nitrogen

oxygen

polymers

sugars

sulfur

Starches and proteins are natural ……..…… .

Examples of carbohydrates are ……..…… .

Carbohydrates consist of carbon, hydrogen and ……..…… .

[3]

(ii) Complete the sentence about digestion.

Put a (ring) around the correct option in each box.

Some carbohydrates break down into | **amino acid** / **fatty acid** / **glucose** | molecules,

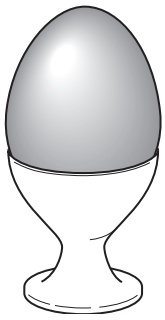
which are | **large insoluble molecules** / **small insoluble molecules** / **small soluble molecules** | that are | **absorbed into the blood.** / **mixed into the blood.** / **precipitated into the blood.**

[1]

[Total: 8]

9 Read this report.

An egg a day – the risk

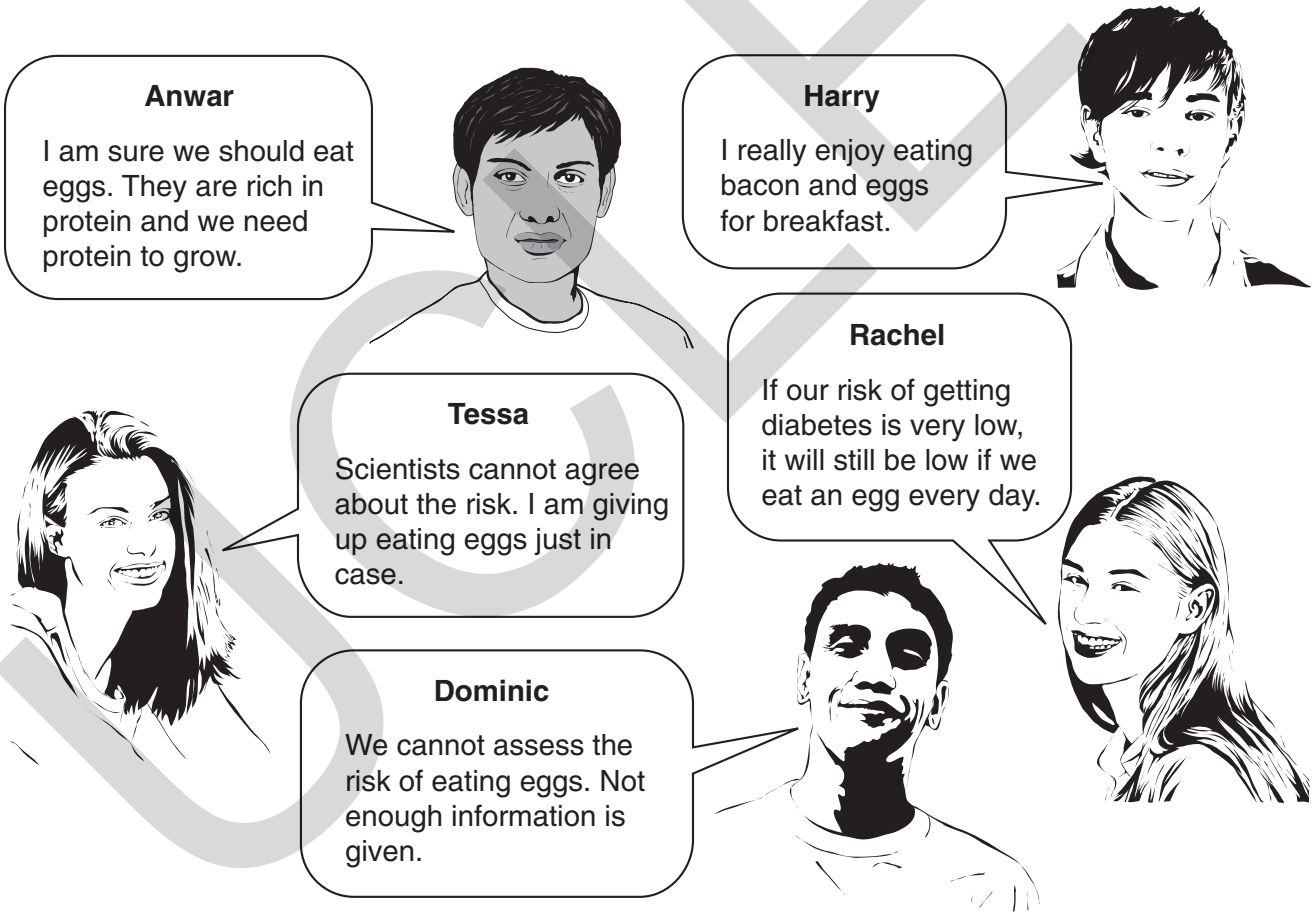


Recent research suggests that an egg a day raises the risk of type 2 diabetes. Scientists reached this conclusion after tracking 57 000 men and women over a period of 20 years.

They found that eating an egg every day increased the overall risk of type 2 diabetes by about 60 per cent. Eating just one egg a week carried no increased risk.

Other scientists disagree with this research. They say that other lifestyle factors were not considered in the study, and that there is no possible mechanism to explain the link.

Some students are talking about the report.



(a) Which **one** person is applying the **precautionary** principle?

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

Harry	☐
Anwar	☐
Rachel	☐
Tessa	☐
Dominic	☐

[1]

(b) Using the information given above, explain why some people may still choose to eat lots of eggs.

Use ideas about **risk** and **benefit** in your answer.

.....

.....

.....

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

(c) Dominic says that we cannot assess the risk of eating eggs.

What information does he need in order to assess the risk?

.....

.....

.....

.....

.....

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

[Total: 6]

END OF QUESTION PAPER

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RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/01

Unit 4: Ideas in Context (Foundation Tier)

Candidates answer on the Question Paper
A calculator may be used for this paper

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Friday 28 May 2010
Morning

Duration: 45 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly 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 that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

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 **40**.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- This document consists of **8** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question is based on the article 'To cull or not to cull?'

(a) TB is now increasing in the UK human population.

Suggest two reasons why.

1 .....

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

(b) A vaccine is being developed to protect cattle against TB.

This vaccine may not completely get rid of TB in cattle.

Suggest two reasons why.

1 .....

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

(c) Scientists wanted to find out if TB in the badger population was being spread to cattle. They decided to collect some data.

Which two people in the article, chosen from Jane, Ranjit, Peter and Stella, are using **data** in their argument?

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

(d) (i) Which person, Jane, Ranjit, Peter or Stella, is stating a correlation but **not** giving a cause?

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

(ii) Which person, Jane, Ranjit, Peter or Stella, is stating a correlation and giving a cause?

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

(e) Peter talks about a 20% increase in TB in cattle on neighbouring land when more badgers were culled.

This is an **average** value.

Suggest and explain why an average value was calculated.

.....

.....

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

(f) A correlation described in the article supports the view that badgers spread TB to cattle.

What is this correlation?

.....

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

(g) Some scientists concluded that there was no evidence that culling badgers would reduce the number of cattle with TB.

Describe two ways, other than culling badgers, that scientists recommend to reduce the number of cattle with TB in the future.

1 .....

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

[Total: 13]

2 This question is based on the article 'Cleaning up the Marshall Islands'.

(a) The radioactive waste that fell on Rongelap Island had four main elements in it.

(i) Put ticks (✓) in the **two** correct boxes in each row of the table to show what types of radiation each element gave off.

element	alpha radiation	beta radiation	gamma radiation
americium			
caesium			
plutonium			
strontium			

[3]

(ii) The radioactive waste emits **ionising** radiation.

Write down two things that may happen to living cells after exposure to ionising radiation.

1 .....

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

(b) Suggest **two** risks from nuclear weapons testing on Bikini Atoll to people living on an island 150 km away.

.....

.....

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

(c) Even though Rongelap Island was still radioactive until quite recently, many tourists go diving in the sea there.

Suggest why these people dive there even though there may be a risk from radiation.

One mark is for a clear explanation that considers both risks and benefits.

.....

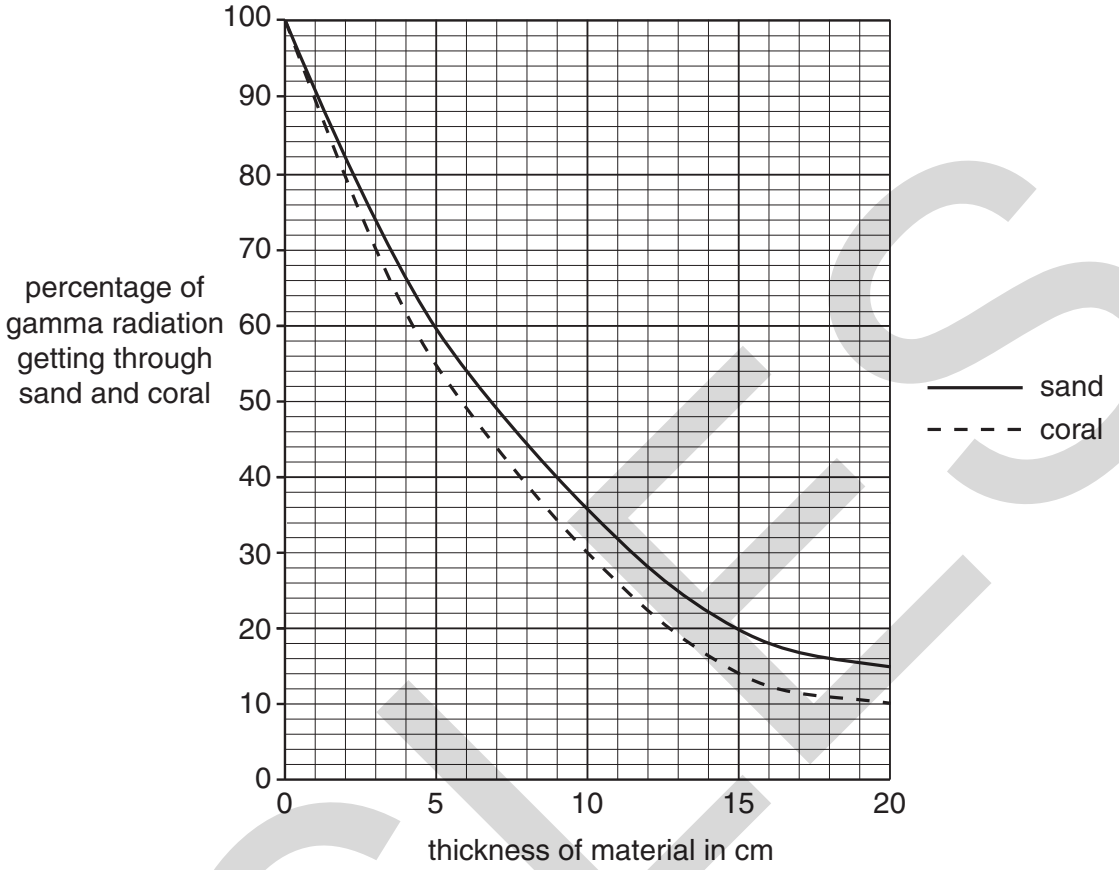
.....

.....

..... **[2+1]**

(d) The graph compares the percentage of gamma radiation getting through sand and coral of different thicknesses.

absorption of gamma radiation by sand and by coral



(i) Scientists used crushed coral, rather than sand, to cover the ground containing radioactive chemicals.

Use the graph to find the percentage of gamma radiation getting through a 15 cm depth of sand and a 15 cm depth of coral.

	sand	**coral**
percentage of gamma radiation getting through 15 cm of material	.....%	.....%

[2]

(ii) A 20 cm depth of **coral** is enough to make the amount of gamma radiation getting through ten times smaller.

Explain how the graph shows this.

.....

.....

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

[Total: 14]

3 This question is based on the article 'Call to ban food colourings'.

(a) Some school children suffer from attention deficit hyperactivity disorder (ADHD).

Write down **two** symptoms of ADHD mentioned in the article.

1 .....

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

(b) Suggest why artificial colourings are added to soft drinks.

.....

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

(c) Scientists at Southampton University carried out research on the effects of some food colourings on hyperactivity in children.

(i) The scientists studied the effect of food colourings combined with a preservative commonly found in soft drinks.

What is the name of this preservative?

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

(ii) The scientists used two drinks containing different mixtures of the preservative with food colourings.

Which **food colourings** were present in both mixtures?

.....

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

(iii) The drink given to some children was water.

Explain why.

.....

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

(d) Scientists have advised caution in applying results from this study to the whole UK population.

Use the article to state two reasons why.

1 .....

.....

2 .....

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

(e) There is evidence that some food colourings may cause hyperactivity in children. Despite this evidence, some parents buy their children drinks containing these additives instead of natural fruit juices.

(i) Suggest why parents may be willing to buy these drinks for their children.

.....

.....

.....

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

(ii) It is impossible for any soft drink to be completely safe to drink.

Give **two** reasons why.

.....

.....

.....

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

[Total: 13]

END OF QUESTION PAPER

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OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/01/INS

Unit 4: Ideas in Context (Foundation Tier)

INSERT

Friday 28 May 2010
Morning

Duration: 45 minutes

OCE/16198

INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

- Do not send this Insert for marking; it should be retained in the centre or destroyed.

INSTRUCTIONS TO CANDIDATES

- This insert contains the three articles required to answer the questions.

INFORMATION FOR CANDIDATES

- This document consists of **8** pages. Any blank pages are indicated.

To cull or not to cull?

Tuberculosis (TB) is a disease caused by a bacterium. It was once a very serious human disease but the discovery of antibiotics brought the disease under control. In recent years a new strain of TB has become resistant to many antibiotics. TB is making a comeback in the UK because fewer people are being vaccinated and many people travel to the UK from countries that do not vaccinate against TB. The human TB vaccine is not 100% successful and it does not provide lifetime immunity.

Cattle and badgers can also catch TB. Vaccines for badgers and cattle do not yet exist but are being developed. It is likely that these vaccines will also not be 100% effective.

Some farmers think that badgers may provide a reservoir of infection for TB. They are worried that if their cattle get infected with TB from the badgers, their herd will have to be destroyed. They want to reduce the number of badgers to prevent them from spreading the disease. This killing of badgers is called a cull.

Some conservationists do not believe that the badgers are spreading the disease. They believe that the disease is spread when farmers move their cattle around the country to other farms and markets.

In 1998, scientists started a five-year study to answer the question "Do badgers spread TB to cattle?" They decided to cull badgers in 30 high-infection areas of the country to see if the number of cattle catching TB dropped.

The scientists divided each high-infection area into three zones:

zone 1 all badgers culled

zone 2 no badgers culled

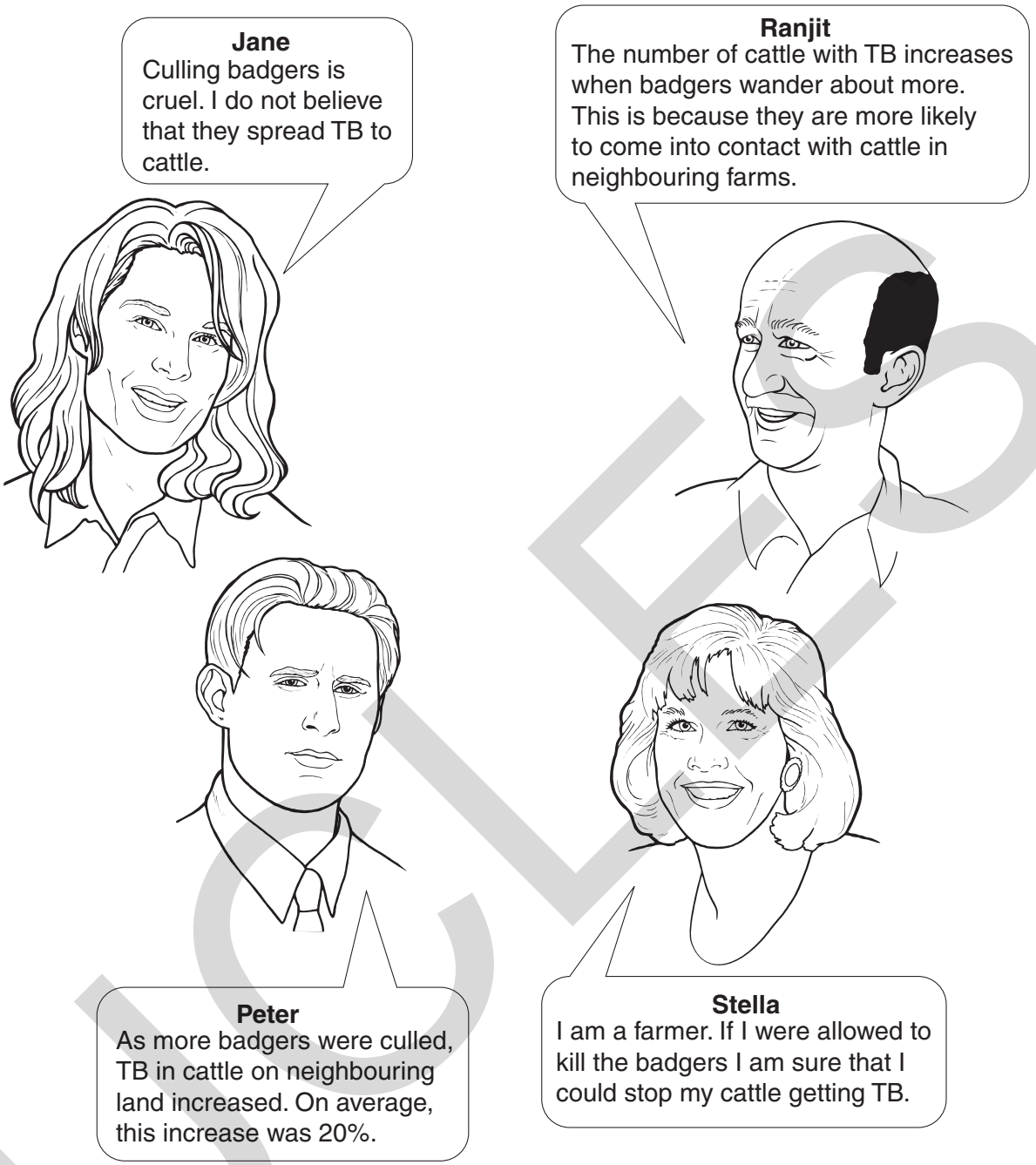
zone 3 badgers only culled around farms that have cattle with TB.

They then monitored the number of cases of TB in cattle in each zone. Different zones gave different results, but these results also varied from one high-infection area to another. For example, in one high-infection area the number of cattle with TB in zone 1 remained the same, but in another high-infection area the number of cattle with TB in zone 1 actually increased.

These results did not definitely prove that badgers spread TB. In fact, the incidence of TB in cattle increased in areas where badgers were culled. One possible explanation for this is that the surviving badgers wander much further in areas where badgers are being culled. This results in the TB being spread even more.

Some scientists think that a more effective way of reducing TB in cattle would be to have better cattle control measures such as moving cattle less often, testing cattle for TB before they are moved, quarantining purchased cattle and having more frequent TB tests.

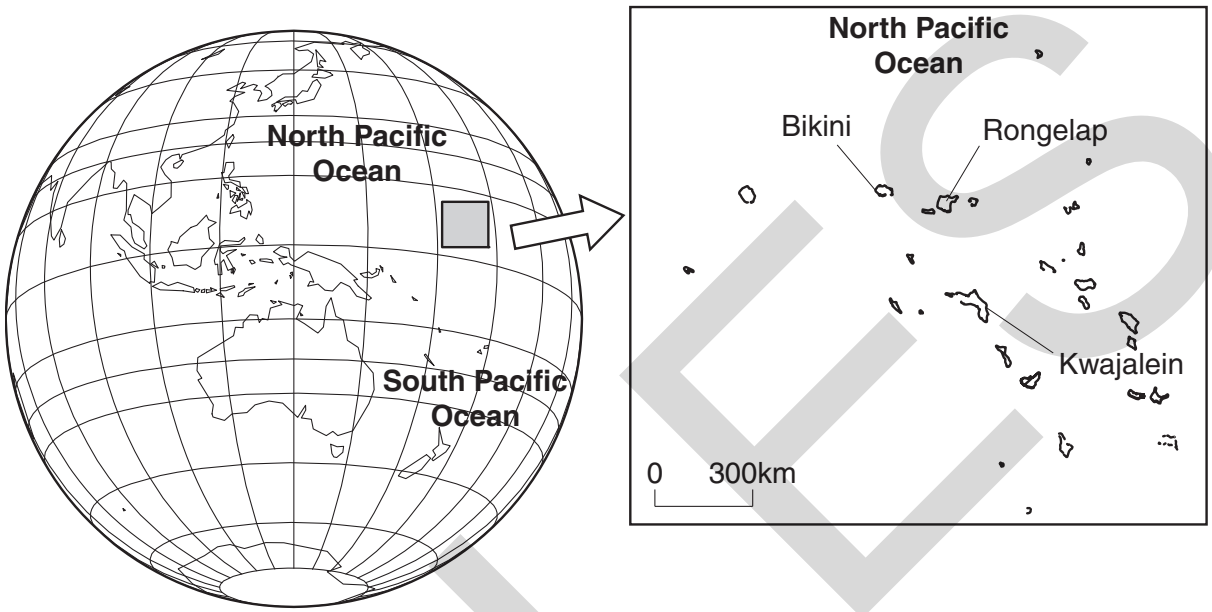
There are different opinions about culling badgers.



Cleaning up the Marshall Islands

Nuclear weapons in the 1950s and 1960s

In the years after the Second World War, the USA and the Soviet Union (now mostly Russia) developed powerful nuclear weapons. The USA tested many of its weapons on a tiny part of the Marshall Islands, called the Bikini Atoll, in the middle of the Pacific Ocean. At the time, these islands were governed by the United States. The few people who lived on Bikini were moved to islands many kilometres away.



After one particularly powerful test, named Bravo, in 1954, radioactive chemicals were spread much further than had been expected. People living on Rongelap Island, 150 km away from the blast, had to move away to the islands of Kwajalein Atoll because Rongelap was too radioactive.

Radioactive waste

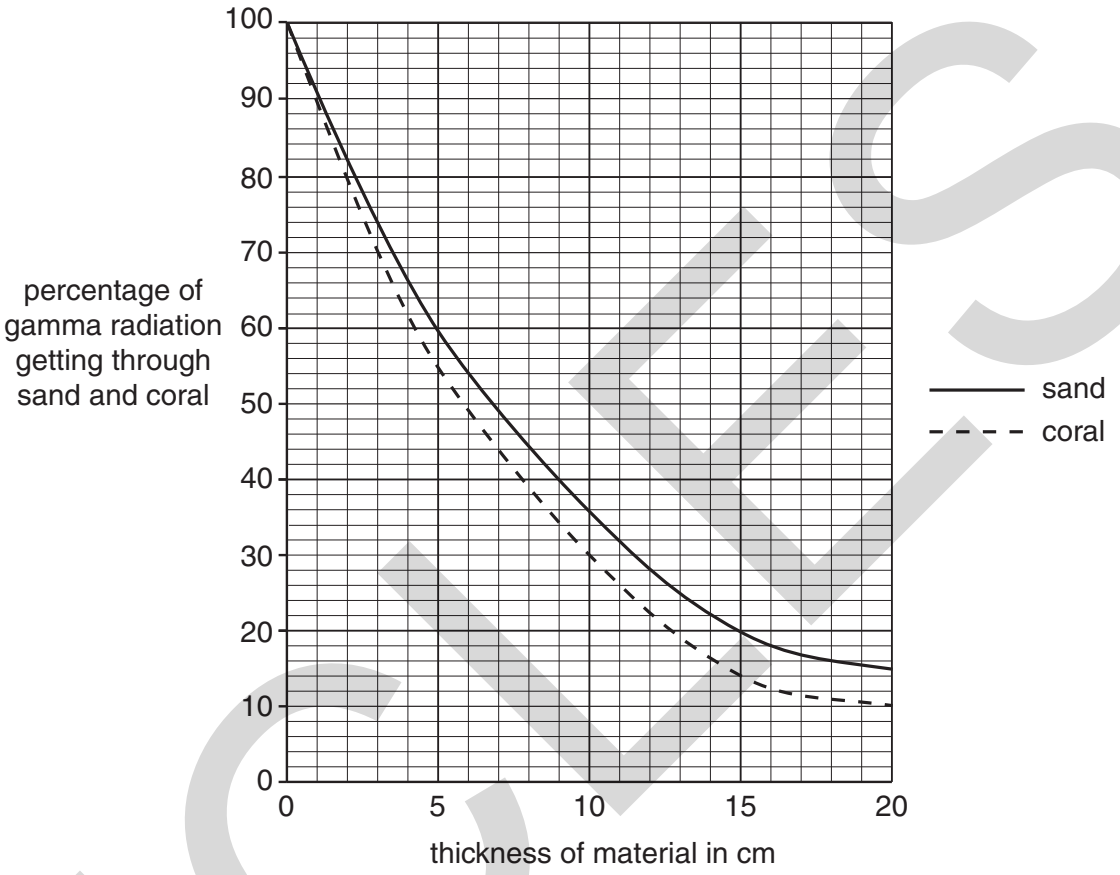
Nuclear weapons produce radioactive waste just like nuclear power stations do. However, the waste from nuclear weapons is spread over a large area. The waste from the Bravo test contained radioactive forms of the elements plutonium and americium, which emit alpha radiation, and strontium and caesium, which emit beta radiation. All four of these also emit gamma radiation. A large enough dose of any of these forms of radiation can cause serious damage to living cells.

Decontaminating Rongelap Island

The most contaminated soil was removed from the areas where people lived. Then clean, crushed coral was used to cover the remaining soil.

Coral was used because it is better at absorbing ionising radiation than sand, as shown in the graph.

absorption of gamma radiation by sand and by coral



The future for Rongelap

By the summer of 2002, the levels of radiation in Rongelap were no higher than the background radiation in most places in the world. Building is now taking place so that the people can return.

A new source of income for this tiny island is tourism. The waters around the tropical island of Rongelap have been undisturbed for half a century. They provide an untouched marine environment for tourists attracted by the ideal conditions for diving.

Image removed due to third party copyright restrictions

Call to ban food colourings

Between 5% and 10% of school-age children suffer some degree of ADHD – attention deficit hyperactivity disorder. Symptoms of ADHD include inability to concentrate, excessive activity and impulsive behaviour.

In 2008, the Food Standards Agency (FSA) advised that six artificial colourings should be banned from food and drink made in Britain by the end of 2010. They have asked for this ban because research has suggested that the additives may cause hyperactive behaviour in children. FSA representative, Dame Deirdre Hutton said, 'We have evidence that suggests it would be sensible for these colourings to be taken out of food.' Some supermarkets have already stopped using these additives in their own-brand products.

One study of food additives was carried out at Southampton University. Scientists gave drinks containing mixtures of some food colourings to 153 three-year-olds and 144 eight-year-olds. The drinks also contained the preservative sodium benzoate. The children were randomly given one of three soft drinks. Drink A and Drink B contained different mixtures of colourings with the preservative. These two drinks were designed to be like those that a typical child might have during a normal day. Drink C was water.

Drink A	Drink B
Carmoisine (E122)	Allura red (E129)
Ponceau 4R (E124)	Carmoisine (E122)
Sodium benzoate (E211)	Quinoline yellow (E104)
Sunset yellow (E110)	Sodium benzoate (E211)
Tartrazine (E102)	Sunset yellow (E110)

The children's hyperactivity levels were measured before and after they had the drinks.

The scientists found that some mixtures of colourings resulted in an increase in hyperactivity.

Results showed that, compared with water:

- in the sample of 3-year-old children, Drink A increased the average level of hyperactivity within the group, but Drink B did not
- in the sample of 8-year-old children, Drink B increased the average level of hyperactivity, but Drink A did not.

There were differences between children in their response to Drink A and Drink B. The mixtures had a large effect on some children but had no effect on others in the same group.

The British Soft Drink Association said in a statement, 'All additives, including colours used in food and drink, have been approved by the FSA as being safe for use and are carefully selected and monitored. They are included to meet the expectations of the public about the appearance and shelf-life of products and to enhance the choices that are available to them.'

Advisers to the European Food Standards Agency do not consider that the Southampton University research provided enough information to support changes to recommended intakes of food colourings. Scientists advise caution in using results from such a small study to judge effects on the whole UK population.

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/02

Unit 4: Ideas in Context (Higher Tier)

Candidates answer on the Question Paper
A calculator may be used for this paper

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Friday 28 May 2010
Morning

Duration: 45 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
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INFORMATION FOR CANDIDATES

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- The total number of marks for this paper is **40**.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- This document consists of **8** pages. Any blank pages are indicated.

Answer **all** the questions.

This question is based on the article 'To cull or not to cull?'

1 **(a)** In the UK, it is common for herds of cattle without TB to become infected with the disease.

Use information from the article to explain how they may become infected.

.....

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

(b) A vaccine is being developed to protect cattle against TB.

This vaccine may not completely get rid of TB in cattle.

Suggest two reasons why.

1 .....

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

(c) Explain why, when a vaccine does become available, it will be necessary to vaccinate most of the cattle population.

.....

.....

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

(d) It is likely that a vaccine for badgers will be developed before a vaccine for cattle. Scientists do not think that vaccination will be very effective in controlling TB in the badger population.

Suggest **two** reasons why.

.....

.....

.....

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

(e) Scientists wanted to find out if TB present in the badger population was being spread to cattle. They decided to collect some data.

In each high-infection area, the data was collected the same way.

However, the percentage of cattle infected with TB varied from area to area.

Suggest **one** reason why.

.....

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

(f) In the article, different opinions are expressed about culling badgers.

Write down the correlation suggested by Stella's argument.

.....

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

(g) Peter talks about a 20% increase in TB in cattle on neighbouring land when more badgers were culled.

This is an **average** value.

Suggest and explain why an average value was calculated.

.....

.....

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

(h) The article suggests that, following a cull, the surviving badgers roam over larger areas, and there is an increase of TB in cattle in those areas.

If this were the case, would it prove that badgers spread TB to cattle?

Explain your answer.

.....

.....

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

[Total: 13]

2 This question is based on the article 'Cleaning up the Marshall Islands'.

(a) Radioactive waste emits **ionising** radiation.

Write down two things that may happen to living cells when ionising radiation strikes them.

1 .....

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

(b) The United States government decided to clean up the Marshall Islands.

They removed soil from some of the most contaminated places, and replaced it with crushed coral.

(i) Suggest and explain one reason, apart from cost, why they did not remove **all** the soil from Rongelap and replace it with crushed coral.

.....

.....

.....

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

(ii) When a nuclear accident occurred in England in 1957, the clean-up that took place afterwards removed a much greater fraction of the spilt radioactive chemicals than happened in Rongelap.

Suggest **two** reasons why a more thorough clean-up was done in England compared with the Marshall Islands.

.....

.....

.....

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

(c) Scientists used crushed coral to cover the ground that still contained some radioactive chemicals. They found that for every 6 cm of coral they added, the amount of gamma radiation went down by half.

Calculate the percentage of gamma radiation that would get through 18 cm of crushed coral. Show your working clearly.

answer ..... % **[2]**

(d) The main radioactive chemical risk to the Rongelap Islanders was caesium-137, which has a half-life of 30 years.

(i) Explain why the amount of caesium-137 left in the ground in Rongelap goes down to half its value in about 9 years.

.....

.....

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

(ii) Caesium-137 is chemically very similar to potassium.

Explain why this makes caesium-137 a high risk to Rongelap islanders.

.....

.....

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

(e) Even though Rongelap Island was still radioactive until quite recently, many tourists go diving in the sea there.

Suggest why these people dive there even though there may be a risk from radiation.

One mark is for a clear explanation that considers both risks and benefits.

.....

.....

.....

..... **[2+1]**

[Total: 14]

3 This question is based on the article 'Call to ban food colourings'.

Scientists at Southampton University carried out research on the effects of some food colourings on hyperactivity in children.

(a) The scientists used two drinks containing different mixtures of food colourings and a preservative.

They also used a third drink, with no additives at all.

Explain why these different drinks were used.

.....

.....

.....

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

(b) Scientists have advised caution in applying results from this study to the whole UK population.

Use the article to state two reasons why.

1 .....

.....

2 .....

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

(c) The statement from the British Soft Drink Association suggests that some drinks manufacturers prefer to continue using the six food colourings.

Suggest why drinks manufacturers may want to continue using these food colourings.

.....

.....

.....

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

(d) Some people say that food colourings should not be added to drinks.

Discuss whether this is a sensible idea.

In your answer, distinguish between what **could** be done and what **should** be done.

.....

.....

.....

.....

.....

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

(e) There is evidence that some food colourings may cause hyperactivity in children. Some parents give their children drinks containing these additives.

Other parents do not allow their children to have drinks containing these food colourings.

(i) Explain how parents who do not allow their children to have drinks containing these food colourings are applying the **precautionary principle**.

.....

.....

.....

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

(ii) It is impossible for any soft drink to be completely safe to drink.

Give **two** reasons why.

.....

.....

.....

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

[Total: 13]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

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RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/02/INS

Unit 4: Ideas in Context (Higher Tier)

INSERT

Friday 28 May 2010
Morning

Duration: 45 minutes

OCE/16195

INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

- Do not send this Insert for marking; it should be retained in the centre or destroyed.

INSTRUCTIONS TO CANDIDATES

- This insert contains the three articles required to answer the questions.

INFORMATION FOR CANDIDATES

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To cull or not to cull?

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Cattle and badgers can also catch TB. Vaccines for badgers and cattle do not yet exist but are being developed. It is likely that these vaccines will also not be 100% effective.

Some farmers think that badgers may provide a reservoir of infection for TB. They are worried that if their cattle get infected with TB from the badgers, their herd will have to be destroyed. They want to reduce the number of badgers to prevent them from spreading the disease. This killing of badgers is called a cull.

Some conservationists do not believe that the badgers are spreading the disease. They believe that the disease is spread when farmers move their cattle around the country to other farms and markets.

In 1998, scientists started a five-year study to answer the question "Do badgers spread TB to cattle?" They decided to cull badgers in 30 high-infection areas of the country to see if the number of cattle catching TB dropped.

The scientists divided each high-infection area into three zones:

zone 1 all badgers culled

zone 2 no badgers culled

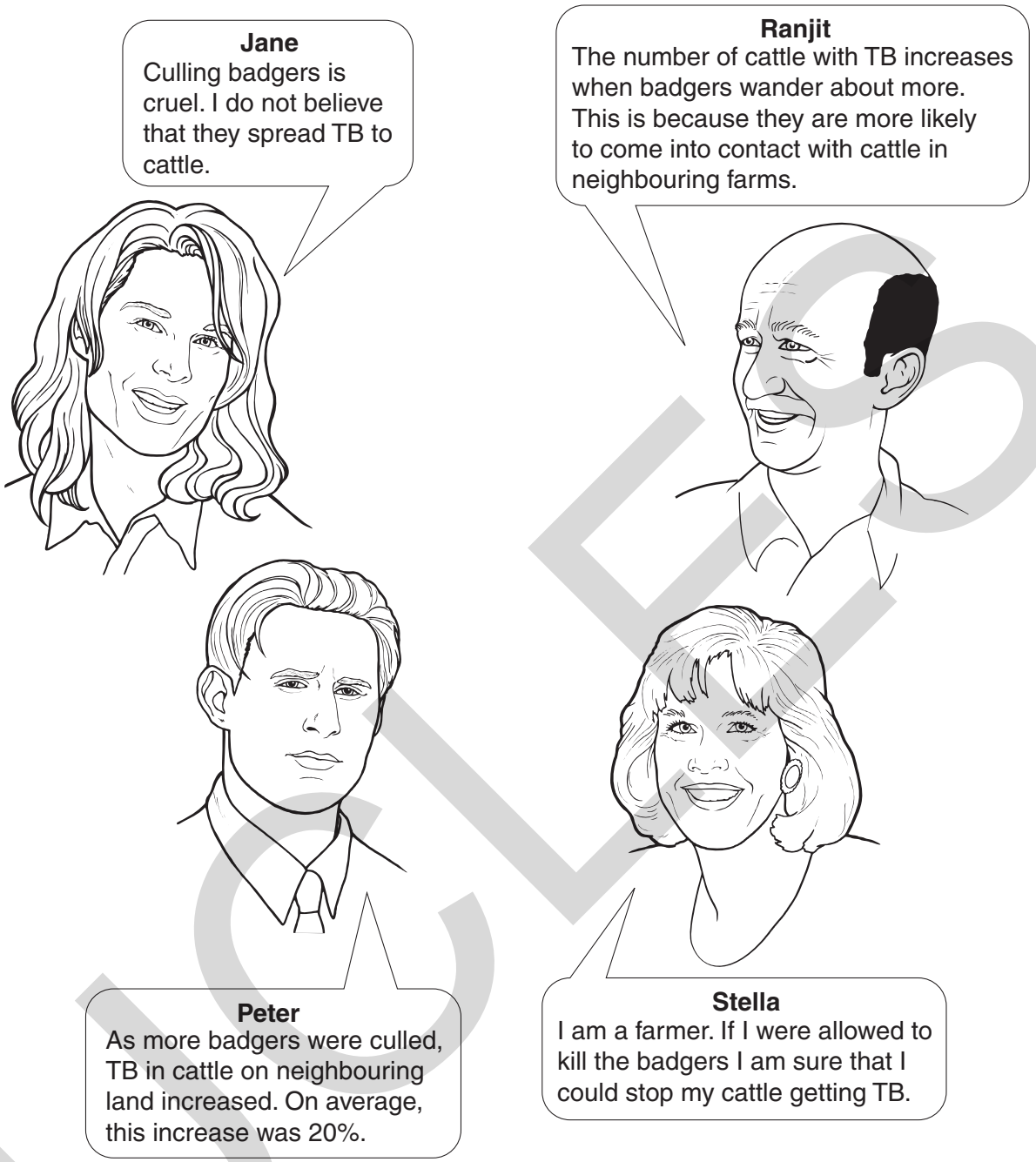
zone 3 badgers only culled around farms that have cattle with TB.

They then monitored the number of cases of TB in cattle in each zone. Different zones gave different results, but these results also varied from one high-infection area to another. For example, in one high-infection area the number of cattle with TB in zone 1 remained the same, but in another high-infection area the number of cattle with TB in zone 1 actually increased.

These results did not definitely prove that badgers spread TB. In fact, the incidence of TB in cattle increased in areas where badgers were culled. One possible explanation for this is that the surviving badgers wander much further in areas where badgers are being culled. This results in the TB being spread even more.

Some scientists think that a more effective way of reducing TB in cattle would be to have better cattle control measures such as moving cattle less often, testing cattle for TB before they are moved, quarantining purchased cattle and having more frequent TB tests.

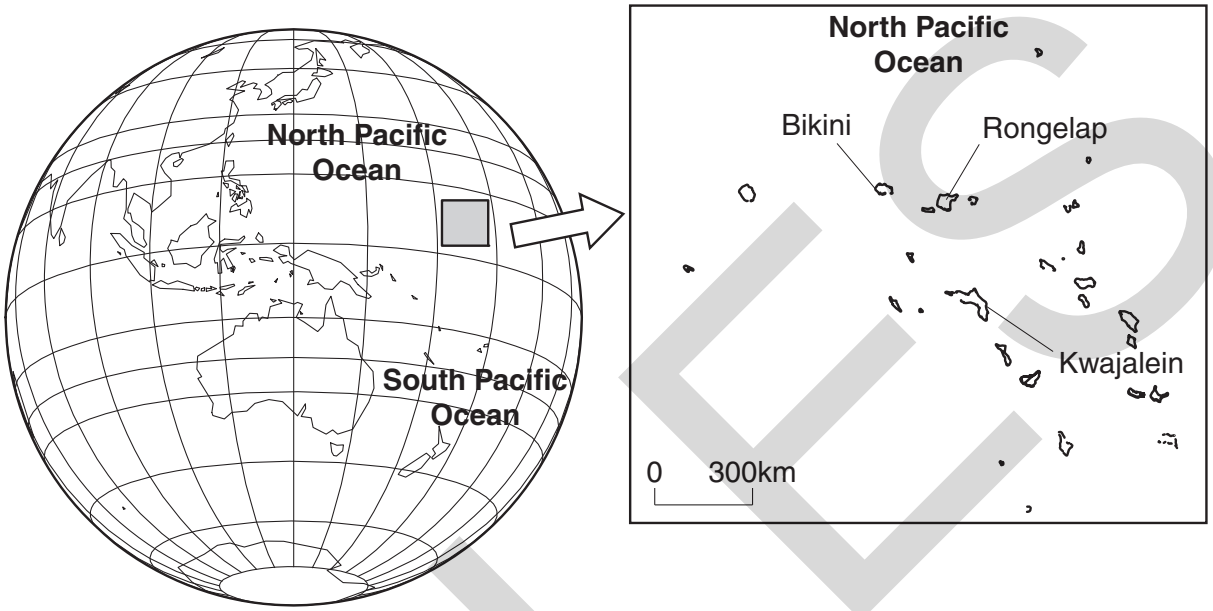
There are different opinions about culling badgers.



Cleaning up the Marshall Islands

Nuclear weapons in the 1950s and 1960s

In the years after the Second World War, the USA and the Soviet Union (now mostly Russia) developed powerful nuclear weapons. The USA tested many of its weapons on a tiny part of the Marshall Islands, called the Bikini Atoll, in the middle of the Pacific Ocean. At the time, these islands were governed by the United States. The few people who lived on Bikini were moved to islands many kilometres away.



After one particularly powerful test, named Bravo, in 1954, radioactive chemicals were spread much further than had been expected. People living on Rongelap Island, 150 km away from the blast, had to move away to the islands of Kwajalein Atoll because Rongelap was too radioactive.

Radioactive waste

Nuclear weapons produce radioactive waste just like nuclear power stations do. However, the waste from nuclear weapons is spread over a large area. The waste from the Bravo test contained radioactive forms of the elements plutonium and americium, which emit alpha radiation, and strontium and caesium, which emit beta radiation. All four of these also emit gamma radiation. A large enough dose of any of these forms of radiation can cause serious damage to living cells.

This is particularly serious if the radioactive chemicals are absorbed and used by the body.

Decontaminating Rongelap Island

The most contaminated soil was removed from the areas where people lived. Then two ways were used to clean up Rongelap Island.

1. Clean, crushed coral was used to cover the remaining soil.

Coral was used because it is better at absorbing ionising radiation than sand. It also stops dust containing radioactive elements from blowing about and getting into the food chain.

2. Fertilizer containing potassium was added to the ground.

It was found that 95 % of the radiation dose that Rongelap Islanders were getting was from caesium-137. This is because caesium is chemically very like potassium, which all plants and animals need. The soil in the Marshall Islands is very low in potassium, so the plants were absorbing radioactive caesium-137 from the soil. By putting plenty of potassium fertilizer on the soil, the plants absorb potassium instead of caesium. This greatly reduces the dose for anyone eating those plants. Caesium-137 has a half-life of about 30 years, although in practice the radioactivity of the soil dies away much faster than this, as caesium compounds are all soluble. This suggests that the caesium level in the soil now, 50 years after the Bravo test, is about 2 % of the high level in the 1950s.

The future for Rongelap

By the summer of 2002, the levels of radiation in Rongelap were no higher than the background radiation in most places in the world. Building is now taking place so that the people can return, although everyone will be tested for caesium-137 at regular intervals.

A new source of income for this tiny island is tourism. The waters around the tropical island of Rongelap have been undisturbed for half a century. They provide an untouched marine environment for tourists attracted by the ideal conditions for diving.

Call to ban food colourings

Between 5% and 10% of school-age children suffer some degree of ADHD – attention deficit hyperactivity disorder. Symptoms of ADHD include inability to concentrate, excessive activity and impulsive behaviour.

In 2008, the Food Standards Agency (FSA) advised that six artificial colourings should be banned from food and drink made in Britain by the end of 2010. They have asked for this ban because research has suggested that the additives may cause hyperactive behaviour in children. FSA representative, Dame Deirdre Hutton said, 'We have evidence that suggests it would be sensible for these colourings to be taken out of food.' Some supermarkets have already stopped using these additives in their own-brand products.

One study of food additives was carried out at Southampton University. Scientists gave drinks containing mixtures of some food colourings to 153 three-year-olds and 144 eight-year-olds. The drinks also contained the preservative sodium benzoate. The children were randomly given one of three soft drinks. Drink A and Drink B contained different mixtures of colourings with the preservative. These two drinks were designed to be like those that a typical child might have during a normal day. Drink C was water.

Drink A	Drink B
Carmoisine (E122)	Allura red (E129)
Ponceau 4R (E124)	Carmoisine (E122)
Sodium benzoate (E211)	Quinoline yellow (E104)
Sunset yellow (E110)	Sodium benzoate (E211)
Tartrazine (E102)	Sunset yellow (E110)

The children's hyperactivity levels were measured before and after they had the drinks.

The scientists found that some mixtures of colourings resulted in an increase in hyperactivity.

Results showed that, compared with water:

- in the sample of 3-year-old children, Drink A increased the average level of hyperactivity within the group, but Drink B did not
- in the sample of 8-year-old children, Drink B increased the average level of hyperactivity, but Drink A did not.

There were differences between children in their response to Drink A and Drink B. The mixtures had a large effect on some children but had no effect on others in the same group.

The British Soft Drink Association said in a statement, 'All additives, including colours used in food and drink, have been approved by the FSA as being safe for use and are carefully selected and monitored. They are included to meet the expectations of the public about the appearance and shelf-life of products and to enhance the choices that are available to them.'

Advisers to the European Food Standards Agency do not consider that the Southampton University research provided enough information to support changes to recommended intakes of food colourings. Scientists advise caution in using results from such a small study to judge effects on the whole UK population.

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