

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
SCIENCE A**

**A211/02**

Unit 1: Modules B1 C1 P1 (Higher Tier)

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 19 May 2011  
Afternoon**

**Duration: 40 minutes**



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**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 **16** pages. Any blank pages are indicated.

Answer **all** the questions.

**1** Friedreich's ataxia (FRDA) is a genetic disorder.

People with this disorder have problems with balance and coordination and may slur their words. This is because their bodies are unable to produce a particular protein which is involved in nervous system control.

**(a)** To understand how FRDA is inherited you need to know some technical terms.

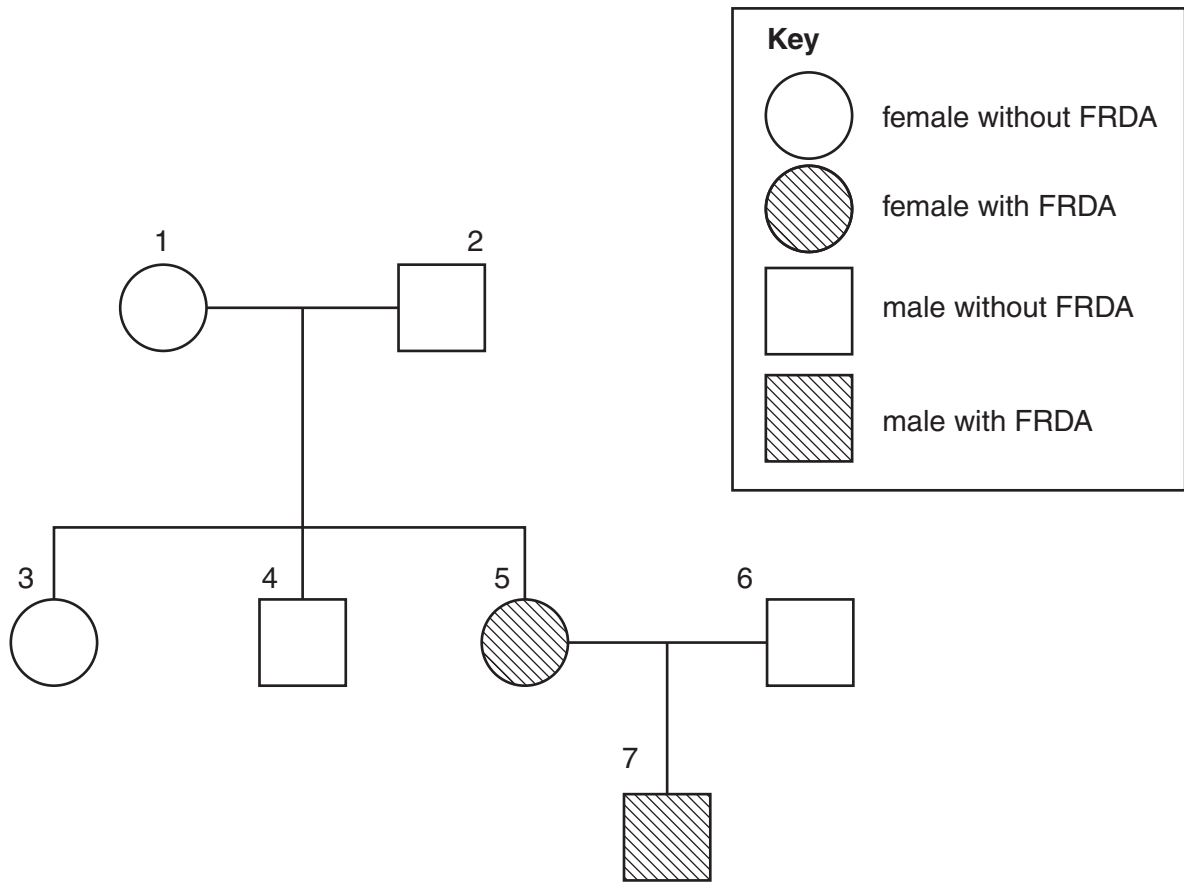
Draw four straight lines to join each **technical term** with its best **description**.

technical term	description
chromosome	only one needed to have the feature it produces
gene	two copies needed to have the feature it produces
dominant allele	long strand of DNA
recessive allele	instructions for a cell that describes how to make a protein

**[3]**

(b) FRDA is inherited like cystic fibrosis. The FRDA gene has two alleles  
The diagram shows a family tree.

**A** = normal allele  
**a** = ataxia allele



(i) Write down the numbers of the individuals in the family tree who **must be** carriers of the FRDA allele.

..... [1]

(ii) Individuals 5 and 6 have a second child.

What is the probability that this child will also have FRDA?

answer ..... [1]

(c) Scientists are doing research to develop **gene therapy** to treat FRDA.

They genetically alter mice to give them FRDA.  
They then use a virus to move a **normal (A) allele** into these mice.  
The mice show signs of recovery from FRDA within 4 weeks of treatment.

How does gene therapy treat FRDA in mice?

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

The cells with a normal (A) allele ...

- ... are stronger than cells without the allele.
- ... make the missing protein.
- ... are made from the missing protein.
- ... are human cells not mouse cells.

[1]

(d) Embryonic stem cells might possibly be used to treat some genetic disorders.

Explain why.

In your answer include

- what an embryonic stem cell is
- why they may be used to treat some illnesses.

.....

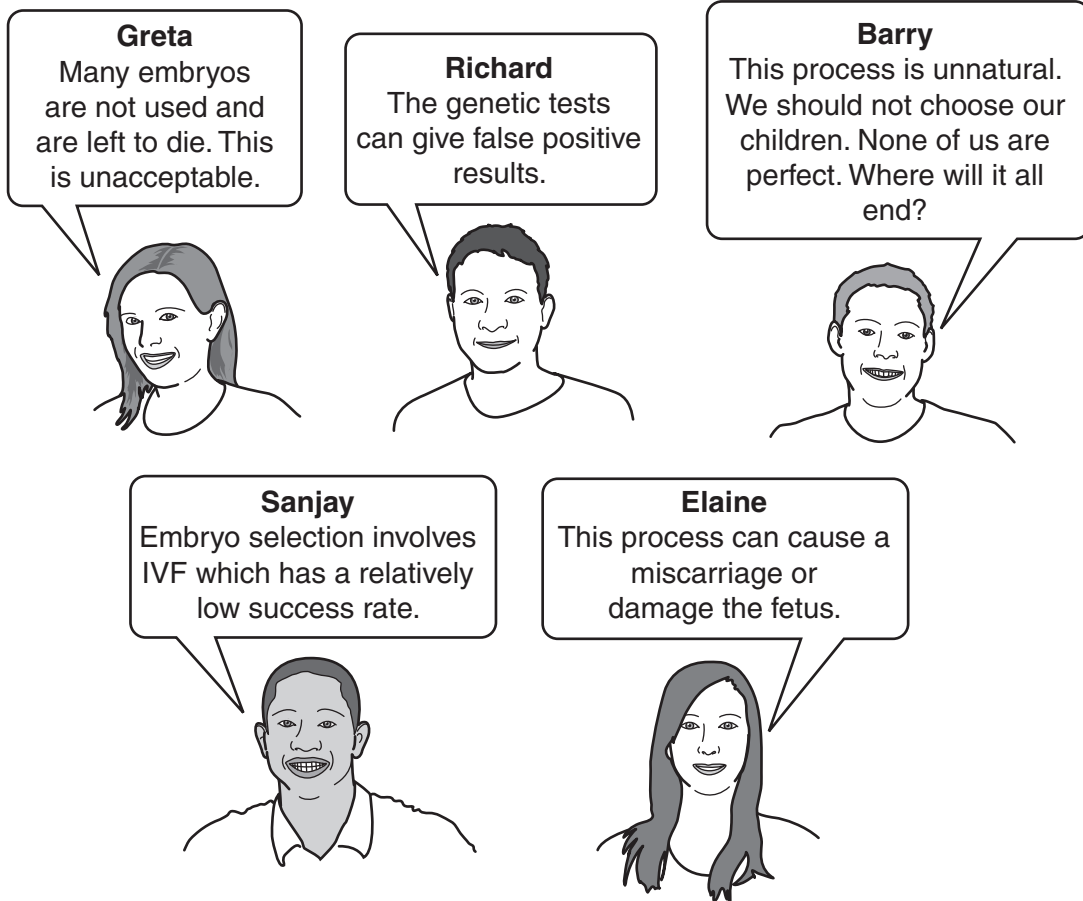
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.....

..... [3]

- (e) Jane and John are both carriers of FRDA.  
 They want to have a baby.  
 They know the baby might have FRDA.  
 It is now possible to test, select and implant embryos free of FRDA.

Some of their friends are discussing this process.  
 They are worried about the reliability, risks and ethics of this technology.



Write the names of the friends concerned about **risk**, **reliability** and **ethics** in the correct columns.

risk	reliability	ethics

[3]

[Total: 12]

2 Animal clones can be formed naturally or artificially.

An example of natural cloning is the formation of identical twins.

An example of artificial cloning was the production of Dolly, the first successful clone of an adult sheep.

Describe how **artificial cloning** of animals can be done.

.....

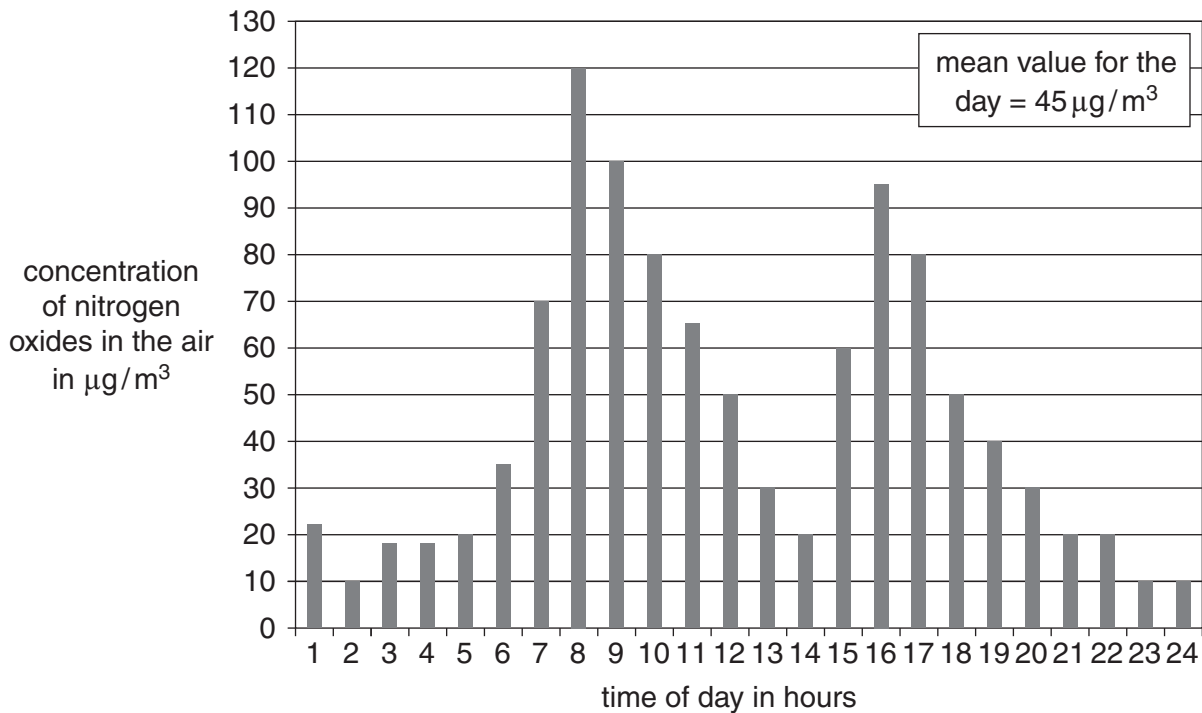
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..... [2]

[Total: 2]

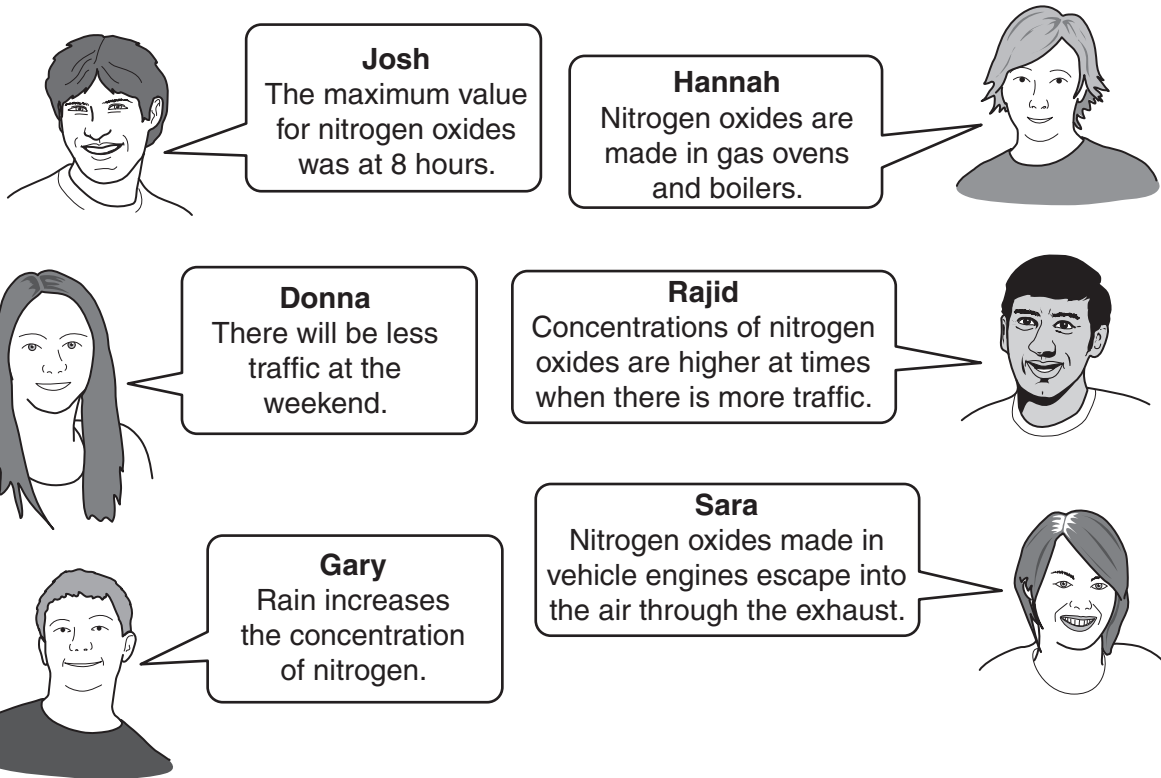
3 Some of the gases that affect air quality are nitrogen oxides.

This graph shows how the amount of nitrogen oxides in air changes over a typical weekday in a city.



(a) Six students are talking about this graph.

This is what they say.



**Josh**  
The maximum value for nitrogen oxides was at 8 hours.

**Hannah**  
Nitrogen oxides are made in gas ovens and boilers.

**Donna**  
There will be less traffic at the weekend.

**Rajid**  
Concentrations of nitrogen oxides are higher at times when there is more traffic.

**Gary**  
Rain increases the concentration of nitrogen.

**Sara**  
Nitrogen oxides made in vehicle engines escape into the air through the exhaust.

(i) Which **two** students are using data from the graph?

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

(ii) Which student is describing a correct correlation?

answer ..... [1]

(iii) Which student is describing a cause for this correlation?

answer ..... [1]

(b) The graph shows measurements of nitrogen oxides.

Nitrogen oxides include nitrogen monoxide and nitrogen dioxide.

How is nitrogen **dioxide** formed in a car engine?

Put ticks (✓) in the boxes next to the **two** sentences which, when taken together, explain how nitrogen dioxide is formed.

Nitrogen and oxygen from the air react at high temperatures to make nitrogen monoxide.

Nitrogen and oxygen from the fuel react in the high temperature of the engine to make nitrogen monoxide.

Nitrogen dioxide is split to make nitrogen monoxide and oxygen.

Nitrogen monoxide and nitrogen react to make nitrogen dioxide.

Nitrogen monoxide is oxidised to form nitrogen dioxide.

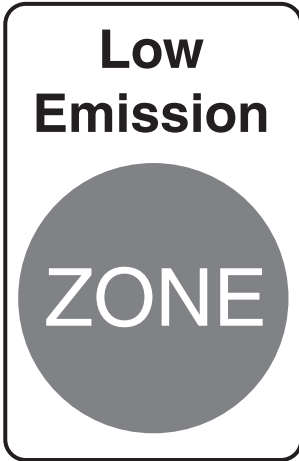
Nitrogen from the fuel and oxygen from the air react at high temperatures to make nitrogen dioxide.

[1]

[Total: 5]



4



In London there is a Low Emission Zone.

Pollutants in the exhaust gases of lorries and buses are measured as part of the normal testing.

These are

- carbon monoxide
- nitrogen oxides
- particulates.

Lorries and buses that make exhaust gases above a limit are made to pay a charge.

(a) The aim of the Low Emission Zone is to lower air pollutants in London.

Explain **one** advantage and **one** disadvantage of having legal limits to emissions of polluting gases.

.....

.....

.....

.....

..... [2]

(b) Suggest **two** other ways of lowering pollution from road traffic. For each one explain how it lowers pollution.

.....

.....

.....

.....

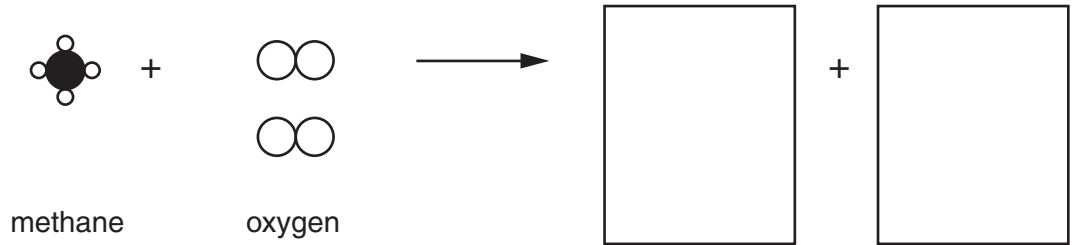
..... [3]

[Total: 5]

5 (a) Methane is a pollutant found in the air.

When methane burns completely, carbon dioxide and water are made.

Complete the boxes in the diagram to show this reaction.



[2]

(b) Write down **two** ways that carbon dioxide is removed from the air.

1 .....

2 .....

[2]

[Total: 4]

- 6 Adrian knows that the Moon goes around the Earth, and that the planets go around the Sun. He wants to know more about astronomy.

**Adrian**  
I am unsure about stars, galaxies and asteroids.  
Where are they?  
How big are they?  
Do they move around the Sun?



Answer Adrian's questions about stars, galaxies and asteroids.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

7 Light from distant stars has taken a long time to reach us.

(a) Write down the speed of light.

speed = ..... km / s [1]

(b) What is meant by a 'light year'?

No calculation is required.

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

(c) Measurement of the distance to a far-away star is more uncertain than the measurement of the distance to a nearby star.

Which **two** of the following statements explain this?

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

Far-away stars appear very dim.

Far-away stars are moving more quickly.

The light from far-away stars left them long ago.

The parallax seen for far-away stars is very small.

Some far-away stars have planets larger than the Earth.

[1]

[Total: 3]

- 8 Two scientists are discussing possible explanations for mass extinctions. A mass extinction is when many species suddenly die out.



**Dr Adams**  
 The dinosaurs died out about 65 million years ago.  
 Geological evidence shows that a giant asteroid hit the Earth at about this time and made a huge crater in Mexico.

**Dr Baker**  
 The dinosaurs started to die out before the asteroid crashed into Mexico.  
 Huge volcanic eruptions happened in India much nearer the time that the dinosaurs became extinct.



**Dr Adams**  
 Huge volcanic eruptions happened in Scotland 58 million years ago. There were no mass extinctions then.

**Dr Baker**  
 There were huge volcanic eruptions in Russia 250 million years ago. There was a mass extinction then.



Who has said something to support the following statements?

Put one tick (✓) in each row of the table to show whether the statement is supported by **Dr Adams only**, **Dr Baker only**, **both scientists** or **neither scientist**.

statement	Dr Adams only	Dr Baker only	both scientists	neither scientist
An asteroid definitely caused the extinction of the dinosaurs.				
I have data which can be linked to the extinction of the dinosaurs.				
I have an explanation for the extinction of the dinosaurs.				
Volcanic eruptions may have caused the extinction of the dinosaurs.				

[3]

[Total: 3]  
 Turn over

- 9 (a) Alfred Wegener suggested that the Earth's continents have moved. Other scientists at the time believed that the continents have always been fixed in the same places.

Each of the following facts was known at the time.

Put a tick (✓) in the box next to the sentence to show whether it **supports Wegener's explanation**, **supports the 'fixed continents' explanation** or **supports neither explanation**.

	<b>supports Wegener's explanation</b>	<b>supports the 'fixed continents' explanation</b>	<b>supports neither explanation</b>
Rock layers in different continents match up.			
Rocks around the whole world have fossils.			
The continents did not appear to be moving.			
The continents of Africa and South America seem to fit together.			

[3]

(b) Here are five sentences describing how mountain chains build up.

They are in the wrong order.

- A In some places the plates move towards each other.
- B One plate becomes buckled and folded.
- C The mantle of the Earth moves slowly.
- D The plates push against each other.
- E This makes tectonic plates move.

Put the letters, **A**, **B**, **C**, **D** and **E**, in the boxes to show the correct order.

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[1]

[Total: 4]

**END OF QUESTION PAPER**

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