OCR
Oxford Cambridge and RSA

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Tuesday 17 May 2016 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE
BIOLOGY A/SCIENCE A

A161/02   Modules B1 B2 B3 (Higher Tier)

Candidates answer on the Question Paper. A calculator may be used for this paper.	**Duration:** 1 hour
OCR supplied materials: None	
Other materials required: • Pencil • Ruler (cm/mm)	

Candidate forename		Candidate surname	

Centre number						Candidate number					

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. HB pencil may be used for graphs and diagrams only.
* Answer **all** the questions.
* 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
* Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

* The quality of written communication is assessed in questions marked with a pencil (✐).
* 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 **60**.
* This document consists of **16** pages. Any blank pages are indicated.

OCR is an exempt Charity   **Turn over**

2

Answer **all** the questions.

1 Our genes and chromosomes contain genetic information.

(a) Write a word in the gap to complete each sentence.

Genes are instructions for a cell that describe how to make …………………………… .

Genes are sections of long molecules of ……………………………… that make up chromosomes.

The combination of alleles an organism has is called its ……………………………… .

The observable characteristics of an organism are called its ……………………………… . **[2]**

(b) Human body cells usually contain 23 pairs of chromosomes.

In males and females, 22 of these pairs of chromosomes look the same.

Write down the name of the pair of chromosomes that look different in males and females.

……………………………… . **[1]**

[Total: 3]

2 Jane goes to her doctor to have a genetic test.

The doctor finds that Jane has a faulty allele.

Women with this faulty allele are at greater risk of cancer.

The doctor tells Jane there is an 87% chance she will develop breast cancer.

(a) (i) What is the **probability** that Jane will develop breast cancer?

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

(ii) What would it mean for Jane if her probability of developing breast cancer was **1**?

.... **[1]**

(b) Jane could have major surgery to reduce her risk of developing breast cancer.

The surgery would remove tissue from Jane's body.

What must she consider when deciding whether or not to have the surgery?

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.... **[3]**

4

(c) Jane's doctor looks at information about the allele and at part of Jane's family tree.

> **Information about the allele:**
>
> The normal allele can become faulty during a person's life. This happens in one person out of every 1000.

Key:

⬤ Female with the faulty allele

◯ Female without the faulty allele

(?) Female who may or may not have the faulty allele

☐ Male
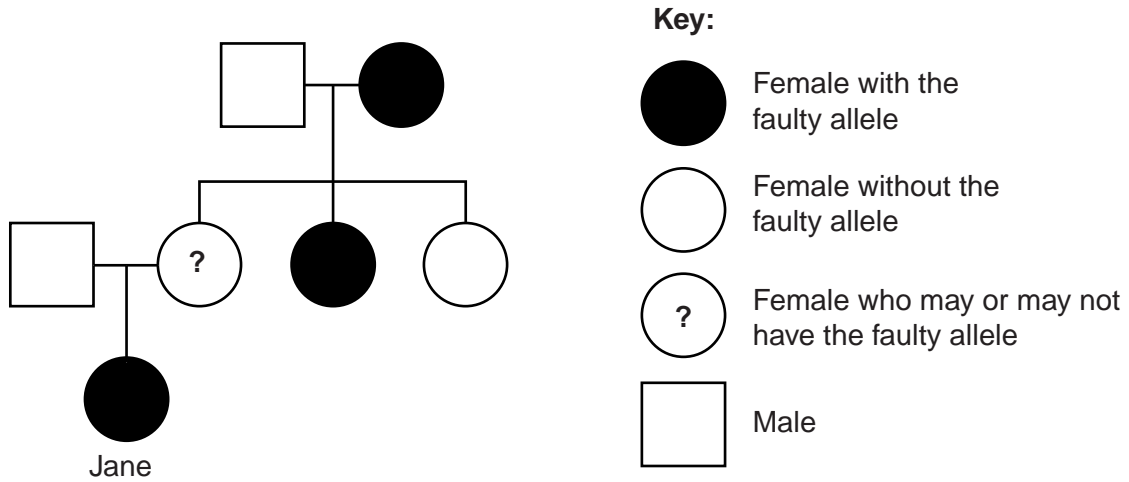
The doctor concludes that Jane's mother probably has the faulty allele.

What evidence supports this conclusion?

Your answer should include evidence from the family tree and from the information about the allele.

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.... **[2]**

[Total: 7]

3 Jack and Ted are identical twins.

Identical twins are an example of naturally occurring clones.
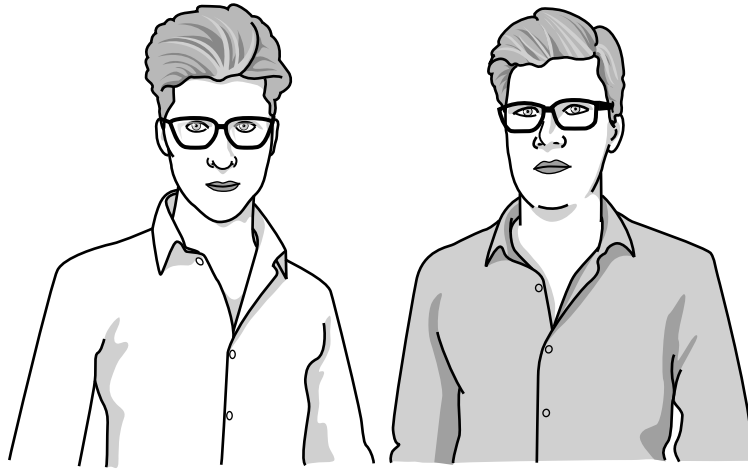
(a) How many egg cells and sperm cells were needed during fertilisation to produce these identical twins?

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

Two egg cells and two sperm cells.

Two egg cells and one sperm cell.

One egg cell and two sperm cells.

One egg cell and one sperm cell.

[1]

(b) Describe how an adult animal could be cloned **artificially**.

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.... **[2]**

Turn over

6

(c) Many scientists investigate how our genes and other factors affect our characteristics.

The study of identical twins such as Jack and Ted can be useful to these scientists.

Suggest why identical twins are useful to these scientists and discuss whether it is right to use identical twins in experiments.

The quality of written communication will be assessed in your answer.

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.... **[6]**

[Total: 9]

4 An outbreak of Ebola virus disease started in West Africa in 2013.

When the outbreak started, no drugs were known to cure the disease.

(a) The table shows data from several countries.

The case fatality rate is calculated using the formula:

$$\text{case fatality rate} = \frac{\text{number of deaths}}{\text{number of cases}}$$

Country	Number of cases of Ebola	Number of deaths caused by Ebola	Case fatality rate
Guinea	2871	1876	0.65
Liberia	8478	3605	0.43
Mali	8		0.75
Sierra Leone	10 340	3145	0.30

(i) Calculate the number of deaths caused by Ebola in Mali.

Show your working.

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

(ii) Look at this news headline:

> ## Ebola kills three out of every four infected people

Explain why the headline is **not** a good summary of the data.

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....

.... **[2]**

Turn over

8

(b) Scientists soon developed a drug that could be used to treat Ebola.

The drug was then tested in a human trial.

(i) In a human trial, different treatments are given to different groups of people.

- Some groups are treated with the new drug.
- Some groups are treated with a different drug or a placebo.

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

	True	False
A placebo contains a very small amount of the new drug.		
The safety and effectiveness of the drug are tested using a group of people who have the disease.		
One of the groups treated with the drug is a group of healthy people.		
In an 'open-label' trial, the doctor knows which treatment the patient receives, but the patient does not know.		
In a 'blind' trial, neither the doctor nor the patient knows which treatment the patient receives.		

[3]

(ii) Explain why it is important to test drugs in **long-term** human trials.

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.... **[2]**

9

(iii) One woman infected with Ebola virus was not treated with drugs.

She was treated with blood taken from a man who had recovered from Ebola.

Suggest how this could help the woman to recover and suggest reasons why this treatment might not work.

🖊 *The quality of written communication will be assessed in your answer.*

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.... **[6]**

[Total: 15]

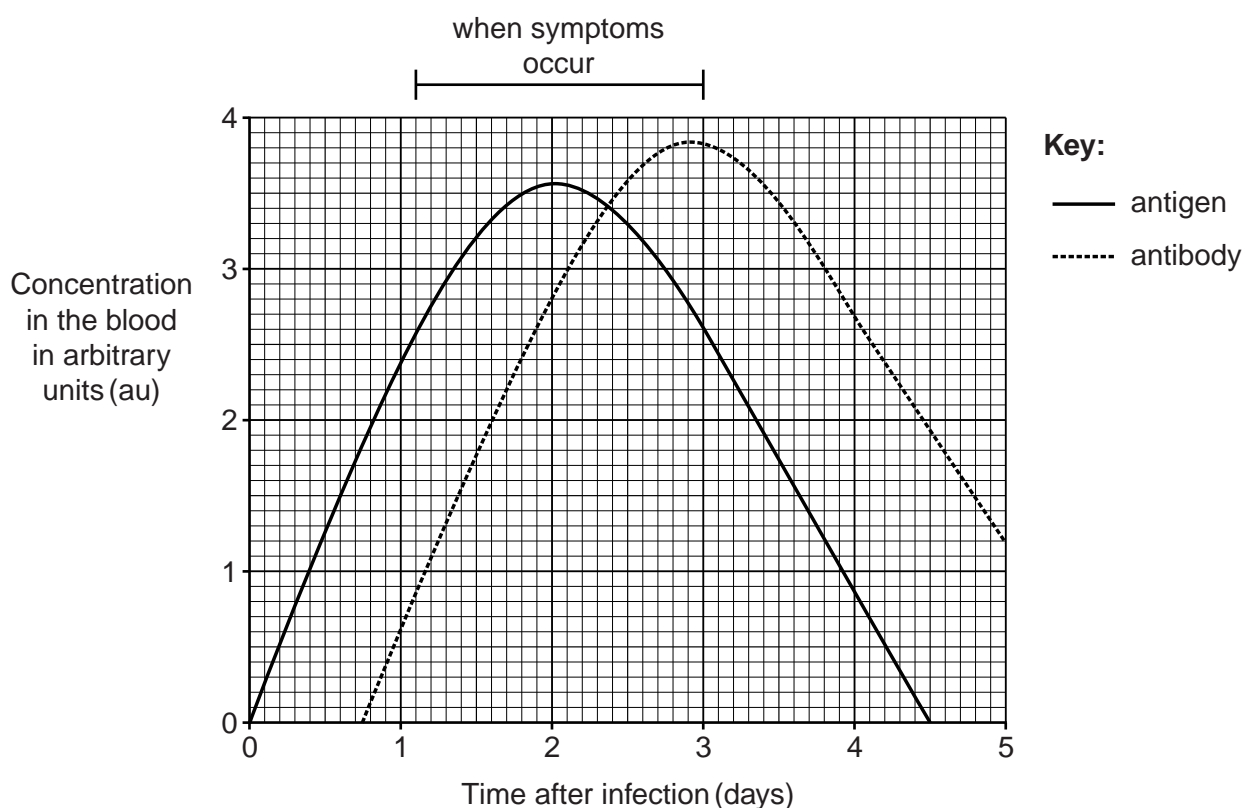**5** The graph shows data collected from a person infected with a microorganism.

(a) Why does the concentration of **antigen** increase during the first two days after infection?

....

.... **[1]**

Use the graph to help you answer the following questions.

(b) For how many days does the infection last?

answer = ... days **[1]**

(c) Describe the relationship between the concentration of **antigen** and the presence of symptoms.

....

....

.... **[1]**

(d) What is the minimum concentration of **antibody** required to destroy microorganisms at a faster rate than they are produced?

concentration = ... au **[1]**

[Total: 4]

6 Marty drinks a large glass of water.

The water is absorbed into his blood.

The hormone ADH helps to control the water balance in Marty's body.

(a) Which part of the body secretes ADH?

Draw a (ring) around the correct answer.

blood

heart

kidney

pituitary gland

[1]

(b) Explain how the regulation of water in Marty's blood plasma is achieved using ADH.

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.... **[4]**

[Total: 5]

7   Neanderthals are an extinct species of humans.

Fossils of Neanderthals help us investigate the evolution of humans.

(a) Two scientists talk about fossils of Neanderthal teeth.
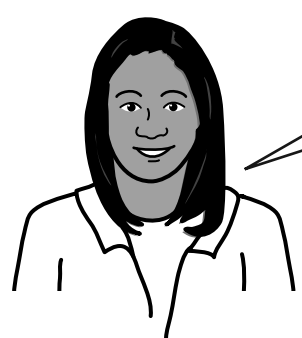
> **Doctor Rowe**
> There are pieces of vegetables and herbs stuck to the teeth. I conclude that Neanderthals ate those plants as part of a balanced diet.

> **Doctor Wilson**
> I disagree. Neanderthals probably ate the stomach contents of deer that had eaten the vegetables and herbs.

Both scientists looked at the same data.

Suggest **two** reasons why they developed different explanations.

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.... **[2]**

(b) The diagram shows part of the Neanderthals' food web.
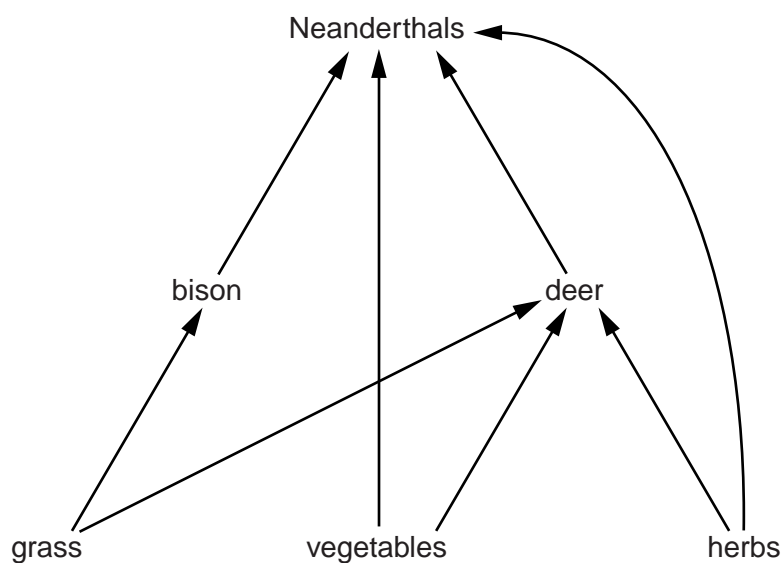
Use the food web to explain why the sizes of the bison population and the deer population are interdependent.

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.... **[3]**

Turn over

(c) The Neanderthal species is now extinct.

Explain what could have caused the Neanderthals to become extinct.

🖋 *The quality of written communication will be assessed in your answer.*

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.... **[6]**

(d) Neanderthals and modern humans are different species.

Scientists think both species evolved from a common ancestor called Heidelberg Man.

Choose words from the list to complete the explanation of how two different species evolved from Heidelberg Man.

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

    competition   **isolation**   **mutation**   **selection**   **variation**

The Heidelberg Man population split into two groups. The two groups lived in

....

There was genetic .... in both groups, caused by

.... of individuals' genes.

This gave the individuals in each group different characteristics.

Each group became adapted to its own environment because of the natural

.... of individuals with beneficial characteristics.   **[3]**

(e) Syed investigates the similarity between the DNA of six species, **A** to **F**.

His results are shown in the table.

DNA of ancestor species	Similarity with DNA of species			
	C	**D**	**E**	**F**
A	Very low	Very high	Very low	Very high
B	Medium	Very low	Medium	Very low

(i) Syed's data can be used to work out the evolutionary relationships between the species.

He knows that species **A** and **B** lived before species **C**, **D**, **E** and **F** existed.

Write the letters in the correct boxes to show the **species that evolved** from each ancestor.
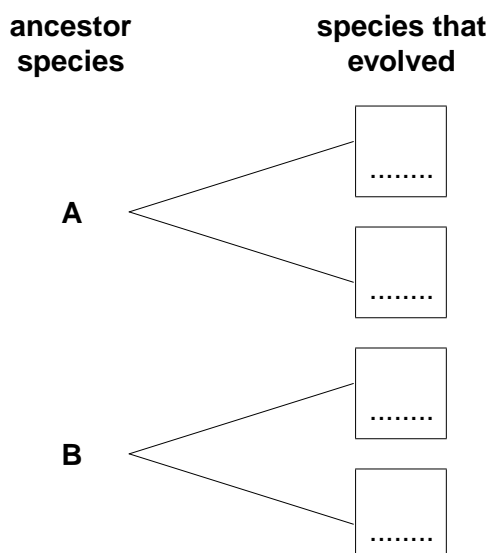
[1]

(ii) Syed thinks species **D** and **F** were formed most recently.

Explain why he is correct.

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.... **[2]**

[Total: 17]

END OF QUESTION PAPER

16

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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