OCR
Oxford Cambridge and RSA

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# Wednesday 1 November 2017 – 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.

**OCR supplied materials:**
None

**Other materials required:**
- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour

* A 1 6 1 0 2 *

* 2 7 7 1 6 3 2 4 1 5 *

| 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

**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.

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**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

**1** Sandra investigates human characteristics.

Many characteristics are controlled by genes.

**(a)** Complete the sentences.

Chromosomes are found in the ..... of body cells.

Chromosomes are made from a chemical called ..... .

Genes are found on chromosomes.

Each gene codes for a specific ..... .

**[2]**

**(b)** Sandra knows that dimples are a characteristic caused by a dominant allele.

**(i)** A person with dimples can have one of two possible genotypes.

Write down these **two** genotypes.

Use **D** to represent the dominant allele and **d** to represent the recessive allele.

..... and .....

**[1]**

**(ii)** Sandra does not have dimples but both her parents do.

Complete the genetic diagram to show how this is possible.

Label Sandra on your genetic diagram.

Use **D** to represent the dominant allele and **d** to represent the recessive allele.

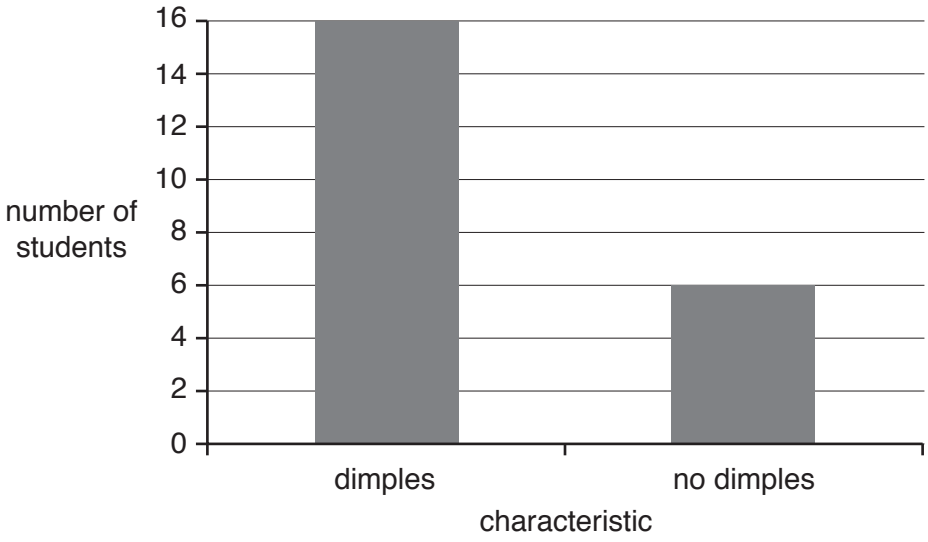
| | | Sandra's mother | |
|---|---|---|---|
| | | ..... | ..... |
| Sandra's father | ..... | ..... | ..... |
| | ..... | ..... | ..... |

**[3]**

**(c)** Sandra looks at each student in her science class.

She records whether or not they have got dimples.

She plots her results on a graph.




Dimples are a dominant condition and they are controlled by a single gene.

Explain how Sandra's graph and the Punnet square in part **(b)(ii)** support these facts.

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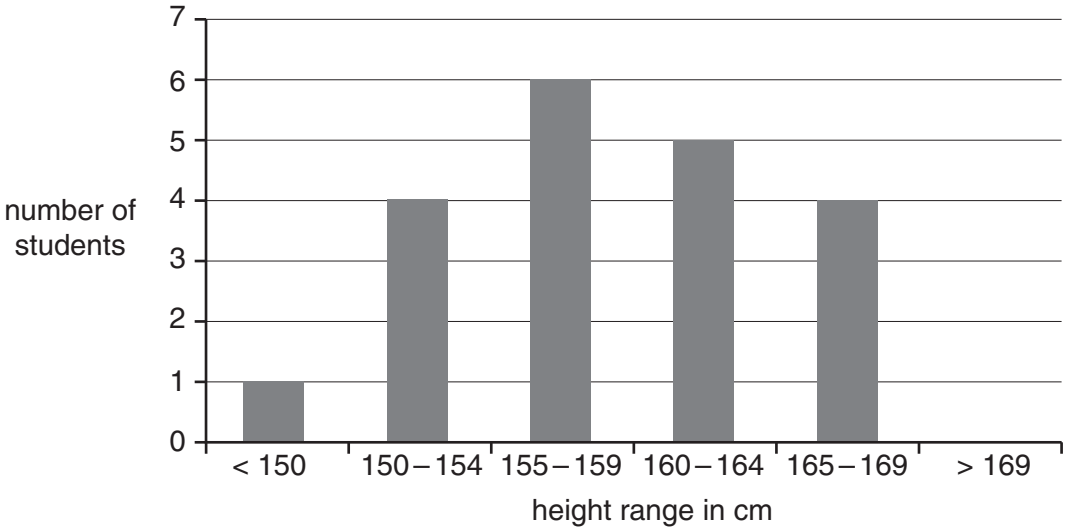
..... **[2]**

**(d)** Sandra records the height of each student in her class.

She plots her results on a graph.




Which two statements, **when taken together**, explain the difference between this graph and the graph in part **(c)**?

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

Height is not affected by genes. ☐

Height is controlled by a number of genes. ☐

Height is influenced by the environment. ☐

Height changes with age. ☐

Height of boys is always greater than girls. ☐

**[2]**

**[Total: 10]**

**2** Read the newspaper article.

**Stem cell therapy causes tumours**

Four years ago, some embryonic stem cells were injected into a boy's brain and spinal cord to treat him for a rare genetic disorder.

The boy now has tumours (growths) in his brain and spinal cord.

Doctors think that the tumours may have grown from the stem cells.

They have tested the tumours and they are **not** cancerous.

Another patient did not develop tumours following an injection of stem cells.

Some people think that stem cell therapy is unethical.

**(a)** Explain why stem cells are used to treat diseases.

.....

.....

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

**(b)** Suggest two reasons why some people think that this example of stem cell therapy is unethical.

1 .....

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2 .....

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**[2]**

**(c)** It is likely that stem cell therapy will continue despite the issues raised in the article.

Suggest reasons why.

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..... **[6]**

**[Total: 10]**

**3** Whooping cough is an infectious disease caused by bacteria.

The infection can lead to pneumonia, brain damage and sometimes death.

Since 1957, babies have been vaccinated against whooping cough in the UK.

The vaccination is given when the babies are 8 weeks old.

**(a)** Explain how the vaccine protects babies against whooping cough.

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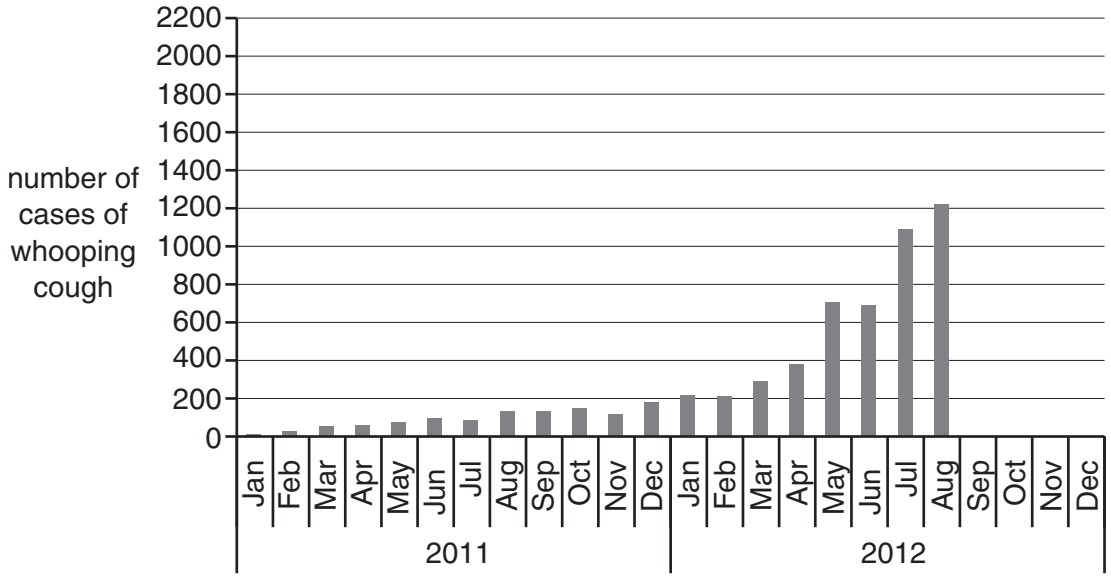
..... **[3]**

**(b)** There has recently been an increase in the number of cases of whooping cough.

The graph shows the number of confirmed cases of whooping cough in England and Wales between January 2011 and August 2012.

Most of these cases of whooping cough were in babies younger than 8 weeks old.




**(i)** Which **two** statements could explain the pattern shown on the graph?

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

The vaccination is becoming more effective over time. ☐

A high percentage of the population has been vaccinated. ☐

Vaccines can never be completely risk-free. ☐

Babies are not vaccinated until they are 8 weeks old. ☐

The bacteria that cause whooping cough are mutating. ☐

Due to genetic differences, people react differently to vaccines. ☐

**[2]**

**(ii)** Rory looks at the graph. He predicts that by the end of 2012, there will be over 2000 cases of whooping cough in England and Wales.

**On the graph** show how Rory made this prediction. **[1]**

**(c)** In October 2012, the whooping cough vaccine was offered to all pregnant women in the UK.

Discuss the factors that should be considered before the introduction of this vaccine for pregnant women.

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

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..... **[6]**

**(d)** Whooping cough can be treated by antibiotics.

Rory has a cough.

The doctor says that Rory's cough is caused by a virus and is not whooping cough.

Rory asks for antibiotics but the doctor does not give him any.

Explain why the doctor does not give Rory any antibiotics.

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

**(e)** Excessive use of antibiotics is causing problems for disease control.

Explain why.

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

**[Total: 16]**

**4** The table shows the water loss from Lucy's body on Monday.

| Method of water loss | Water loss per day in $cm^3$ |
|---|---|
| breathing | 400 |
| sweating | 600 |
| urine | 1500 |
| faeces | 100 |

**(a)** On Tuesday, Lucy has exactly the same to eat and drink, but she plays tennis after work.

Predict whether the water loss data would **increase**, **decrease** or **stay the same** when comparing Tuesday with Monday.

Put one tick (✓) on each row to show your predictions.

| | Increase | Decrease | Stay the same |
|---|---|---|---|
| breathing | | | |
| sweating | | | |
| urine | | | |

**[2]**

**(b)** The concentration of Lucy's urine is controlled by a hormone called ADH.

Explain how ADH controls the concentration of Lucy's urine when she exercises.

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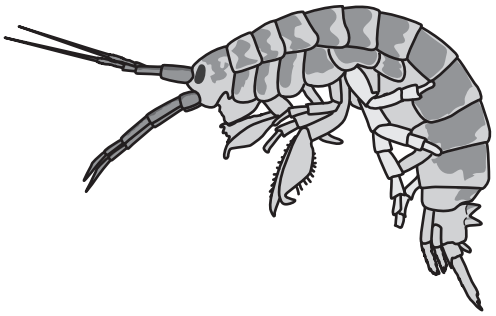
..... **[3]**

**[Total: 5]**

**5** In 2010, 'killer shrimps' were discovered in Grafham Water in Cambridgeshire.



Here are some features of the 'killer shrimp'.

**A** It has powerful mouth parts.

**B** It has a very fast reproductive rate.

**C** It has two cone-shaped structures on its tail.

**D** It has stripes on its back.

**E** It can survive in sea water.

**(a)** Which of the features, **A**, **B**, **C**, **D** or **E**, provides the best evidence for:

**(i)** why the 'killer shrimp' is a vicious predator?

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

**(ii)** how the 'killer shrimp' is believed to have moved to the UK from Europe?

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

**(iii)** why the 'killer shrimp' is outcompeting the native shrimp?

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

**(b)** 'Killer shrimps' have been found in lakes used for fishing and water sports.

Signs encourage people to check, clean and dry their fishing or sailing equipment before leaving the site.

Suggest how these measures will help to maintain biodiversity.

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

**[Total: 5]**

**6** Lamarck and Darwin were both scientists who proposed different scientific explanations for the process of evolution.

Describe the observations Darwin made and explain why Darwin's theory of evolution offers a better scientific explanation than that of Lamarck.

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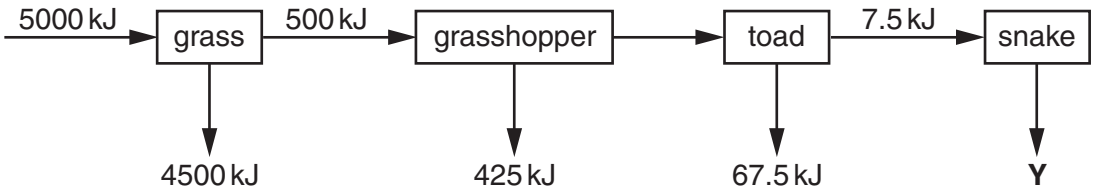
..... **[6]**

**[Total: 6]**

**7** Look at the following food chain.

It shows the energy transferred from each organism to the next and to the environment.




**(a) (i)** Calculate how much energy is transferred from the grasshopper to the toad.

Show your working.

energy transferred……..kJ **[1]**

**(ii)** Explain why it is not possible to calculate the energy lost to the environment at point **Y**.

.....

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

**(b)** Scientists calculate the percentage efficiency of energy transfer between the different stages of a food chain.

Which statement describes why?

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

Percentages …

… are always small numbers. ☐

… allow more valid comparisons to be made. ☐

… make the measurements more accurate. ☐

… make it easier to identify outliers. ☐

… allow a mean to be calculated. ☐

**[1]**

**(c)** Malcolm calculates the percentage efficiency of energy transfer between the grass and the grasshopper as 10%.

He then calculates the percentage efficiency of energy transfer between the grass and the snake as 0.5%.

**(i)** Has Malcolm calculated the percentages correctly?

Show your working.

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

**(ii)** Explain why there is a difference between the two percentages that you have calculated.

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

**(d)** The diagram shows the energy transferred from the food chain to the environment.

Describe how this energy can be made available to other food chains.

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

**[Total: 8]**

**END OF QUESTION PAPER**