

**Tuesday 16 May 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



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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 barcodes.

**INFORMATION FOR CANDIDATES**

- The quality of written communication is assessed in questions marked with a pencil (P).
- 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 **20** pages. Any blank pages are indicated.

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3

Answer **all** the questions.

- 1 A human female and a human male have different genotypes. They also have a different phenotype.

(a) Draw straight lines to join each **description** with the correct **example**.

| description      | example |
|------------------|---------|
| female genotype  | testes  |
| male phenotype   | XX      |
| female phenotype | XY      |
| male genotype    | ovaries |

[2]

- (b) The combination of sex chromosomes in a fertilised egg is determined during fertilisation.

There are many genes on the sex chromosomes.

Explain how the sex-determining gene determines whether the fertilised egg develops into a male or a female.

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..... [2]

[Total: 4]

4

2 Cystic fibrosis is a genetic disorder in humans.

(a) Byron and Tania are friends.

- Byron is 22 years old. He has one faulty allele that causes cystic fibrosis.
- Tania is also 22 years old. She has one faulty allele that causes a disorder called Huntington's disease.
- Neither person has noticed any symptoms.

Explain why Byron and Tania have **not** noticed any symptoms of the disorders.

Use ideas about the inheritance of the different alleles for these disorders in your answer.



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

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..... [6]

5

- (b) Tania is worried about telling others that she has the allele for Huntington's disease.

Explain how sharing this information with others could have **financial** implications for Tania.

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..... [2]

[Total: 8]

### 3 Haemophilia is a genetic disorder.

Haemophilia is caused by a recessive allele (**h**). The allele is found on the X chromosome.

A person with the dominant allele (**H**) is healthy.

The allele is **not** found on the Y chromosome.

- A male with the recessive allele is  $X^hY$ .
- A male with the dominant allele is  $X^HY$ .

(a) Complete the table by writing in the correct combination of chromosomes and alleles for each person.

| Person                     | Combination of chromosomes and alleles |
|----------------------------|--|
| male with haemophilia      |  |
| male without haemophilia   | $X^HY$                                 |
| female with haemophilia    |  |
| female without haemophilia | $X^HX^H$                               |
| female carrier             |  |

[3]

(b) A couple decide to have a baby.

The Punnett square shows all the possible combinations of chromosomes and alleles in their offspring.

|                  |          |        |                  |
|------------------|----------|--------|------------------|
|                  | $X^H$    | $Y$    | father's gametes |
| $X^H$            | $X^HX^H$ | $X^HY$ |                  |
| $X^h$            | $X^HX^h$ | $X^hY$ |                  |
| mother's gametes |          |        |                  |

7

Use the Punnett square to help you answer the following questions.

- (i) If the couple have 8 children, how many of the children are likely to have the combination  $X^hY$ ?

number of children = ..... [1]

- (ii) What percentage of the couple's offspring are likely to be males **without** haemophilia?

percentage = ..... % [1]

- (iii) What percentage of the couple's offspring are likely to be females **without** haemophilia?

percentage = ..... % [1]

- (c) Explain why haemophilia is more common in males than in females.

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..... [2]

[Total: 8]

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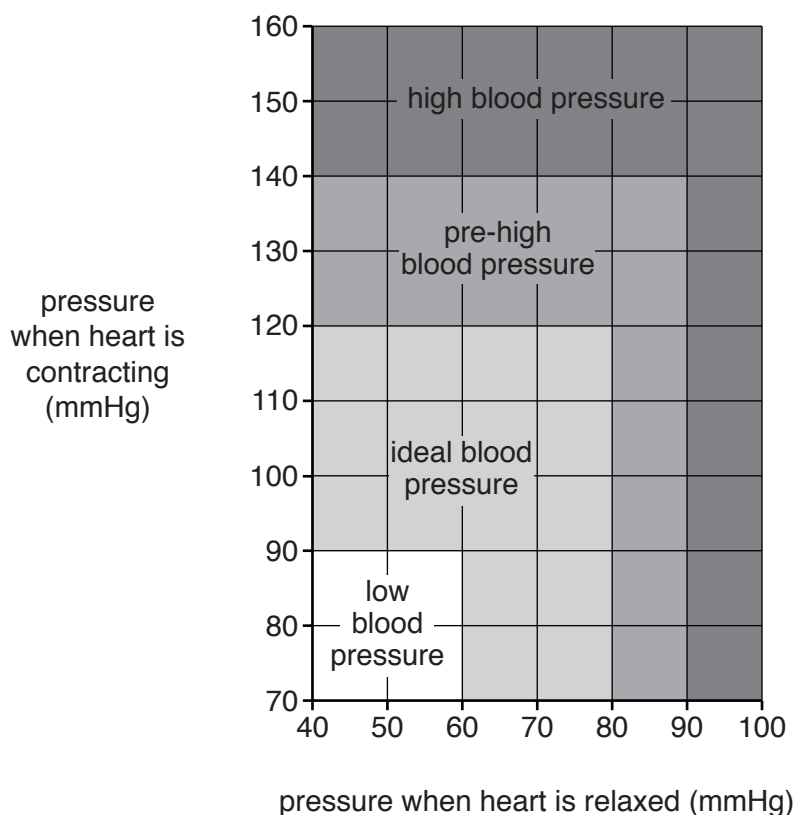
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- 4 High blood pressure increases the risk of heart disease.

A person's blood pressure can be measured.

- (a) The graph below shows how blood pressure measurements are classified into categories.



- (i) Ali's blood pressure measurement is 150/95. Ali thinks he will definitely develop heart disease.

Is he correct?

Explain your answer.

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..... [2]

- (ii) Ravi's blood pressure measurement is classified as 'pre-high'.

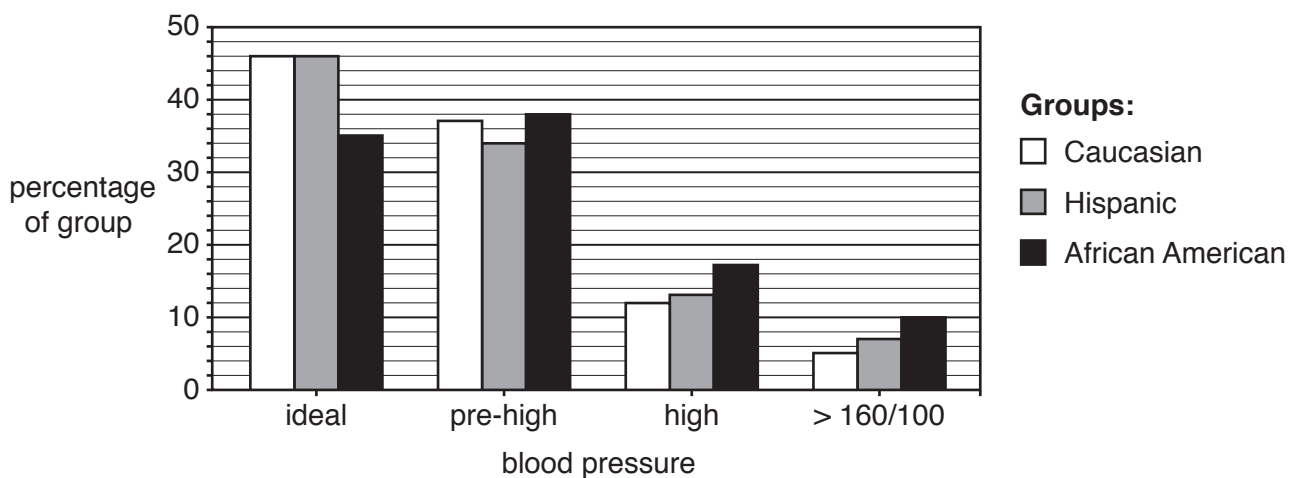
Estimate what his blood pressure measurement is likely to be.

blood pressure = ..... / ..... [1]

10

- (b) A large study in the USA investigated whether there are differences in blood pressure between groups of people with different ethnic origin.

The results are shown in the graph below.



- (i) Calculate the percentage of the Caucasian group that had a blood pressure measurement greater than 140/90.

Use both graphs to help you answer the question.

percentage = ..... % [1]

- (ii) Each group contained 2000 people.

People with a blood pressure measurement greater than 140/90 have a significantly increased risk of developing heart disease.

Calculate the number of Hispanic people in the study who have a significantly increased risk of heart disease. Show your working.

number of Hispanic people = ..... [2]

- (iii) Which group of people has the **lowest** risk of developing heart disease?

Explain your answer.

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..... [2]

11

- (iv) The study investigated differences in blood pressure between groups of people with different ethnic origin.

Suggest one thing that the researchers will have considered when they designed this study, and explain why it was important.

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..... [2]

[Total: 10]

5 Maintaining the body's water balance is important.

(a) What is the name given to the maintenance of a constant internal environment?

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

circulation

☐

homeostasis

☐

homozygous

☐

steady state

☐

[1]

(b) The body gains water from liquids we drink.

Write down **two** other ways the body gains water.

1 .....

2 ..... [1]

(c) Maintaining the body's water balance depends on negative feedback.

Explain what is meant by 'negative feedback'.

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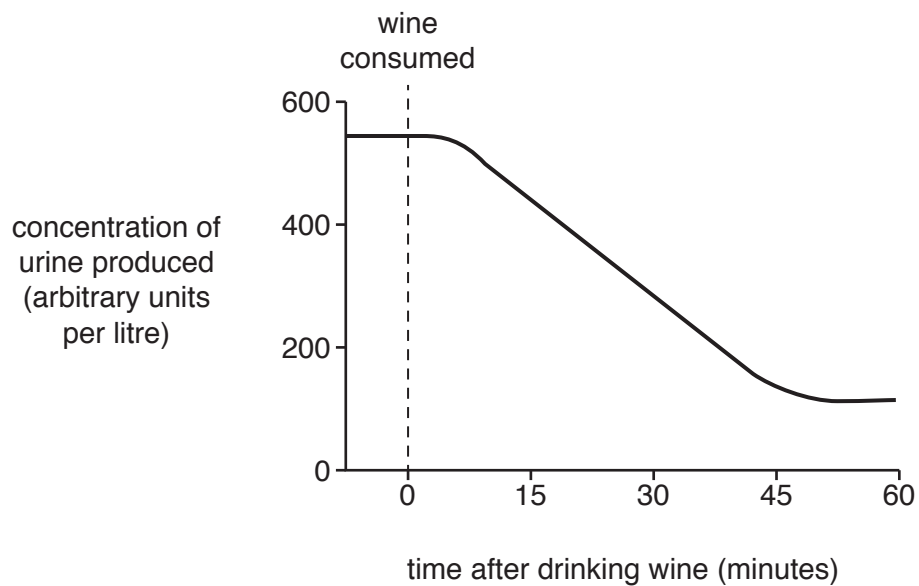
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**(d)** Roger drinks a large glass of wine.

The graph shows how the concentration of the urine produced by Roger changes during the 60 minutes after he drinks the wine.



Explain what happens in Roger's body to cause these changes in urine concentration and why his urine concentration would eventually return to normal.



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

[6]

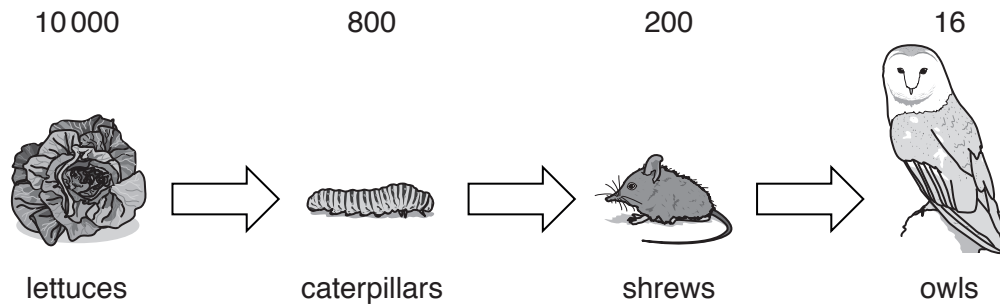
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**[Total: 10]**

- 6 The diagram shows the transfer of energy through a food chain.

Each arrow represents an energy transfer.

Each number is the amount of energy stored in the population of organisms. The energy is measured in kJ per m<sup>2</sup> per year.



- (a) Describe **and** explain the trend in the energy data for this food chain.

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- (b) The percentage efficiency of the energy transfer from the lettuces to the caterpillars is 8%.

Calculate the overall percentage efficiency of the energy transfer from the **lettuces** to the **owls**.

Show your working, and give your answer to **one** significant figure.

overall percentage efficiency = ..... % [2]

- (c) Use ideas about energy to suggest why the owls are unlikely to have any predators.

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[Total: 6]

15

7 When carbon dioxide dissolves in the ocean it causes a decrease in the pH of the ocean water.

- (a) Phytoplankton are small plants that live in the ocean. They are one of the sources of carbon dioxide that dissolves in oceans.

How do phytoplankton add carbon dioxide to the ocean?

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

phytoplankton photosynthesise

☐

dead phytoplankton are decomposed

☐

phytoplankton respire

☐

phytoplankton are eaten by animals

☐

dead phytoplankton create sediments

☐

phytoplankton fix carbon from the environment

☐

[2]

- (b) Write down **one** other source of carbon dioxide that dissolves in oceans.

..... [1]

- (c) Explain how the pH of ocean water could be used as a non-living indicator of global warming.

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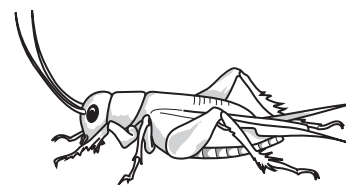
..... [3]

[Total: 6]

- 8 Insects called crickets live on an island in Hawaii.

The crickets 'sing' by rubbing their wings together. The 'singing' attracts mates, but it also attracts predators.

In 2003, scientists found a few crickets on the island that did not 'sing'. This change was caused by a mutation in a gene controlling wing shape.



Now, 96% of the crickets on the island do not sing. The population size is increasing.

- (a) Explain the spread of the mutated gene through the population of crickets on the island and why the population size is increasing.



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

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17

- (b) An article about the scientists' findings appeared on a news website.

Read the sentence from the article.

Crickets on the Hawaiian island cleverly fell silent so that they could avoid predators.

Do you agree with the sentence from the article?

Explain your answer.

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..... [2]

[Total: 8]

**END OF QUESTION PAPER**





This image shows a blank sheet of white paper designed for writing. It features a series of evenly spaced horizontal blue lines across its entire width. A single vertical red line runs down the left side, creating a narrow margin. The paper is otherwise completely empty, with no text or markings.

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