OCR

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Tuesday 13 May 2014 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE
BIOLOGY A/SCIENCE A

A161/02   Modules B1 B2 B3 (Higher Tier)

Duration: 1 hour

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 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 **20** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

Answer **all** the questions.

1 Cystic fibrosis is an inherited disorder.

Sharon and Eric are both carriers for cystic fibrosis.

Sharon is pregnant. Eric is the father.

There is a chance that the fetus will have cystic fibrosis.

(a) Calculate the probability that the fetus will have cystic fibrosis.

Use a genetic diagram or Punnett square to help you.

Use T = normal allele and t = cystic fibrosis allele.

probability of fetus having cystic fibrosis = ... **[3]**

(b) The fetus can be tested for cystic fibrosis.

This test usually involves pushing a long needle into the mother's uterus.

umbilical
cord
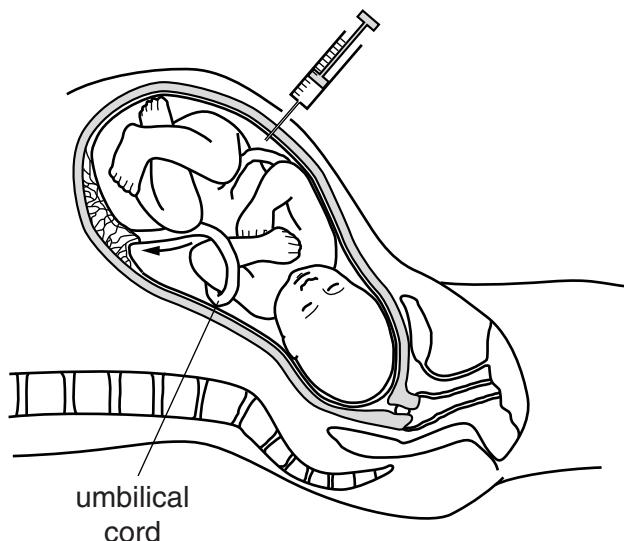
Cells from the fetus can then be removed and tested.

Scientists are developing a new method of collecting fetal cells.

They plan to remove a sample of the mother's blood from her arm.

This contains a very small number of fetal cells.

(i) Suggest **one** advantage of the current method that extracts fetal cells directly from the uterus.

....

.... **[1]**

(ii) Suggest **one** advantage of the new method that extracts fetal cells from a sample of the mother's blood.

....

.... **[1]**

Turn over

(c) Sharon and Eric decide that they will have their fetus tested for cystic fibrosis.

Another couple, who are also both carriers for cystic fibrosis, decide not to have their fetus tested.

Discuss reasons why these two couples make a different decision about having their fetus tested.

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

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.... **[6]**

[Total: 11]

2 (a) Explain how a sample of fetal cells can be used to find out the sex of a fetus.

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.... **[2]**

(b) Explain how a **gene** can determine the sex of a fetus.

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.... **[3]**

[Total: 5]

3 Tim's father and grandfather both died from heart disease when they were 54 years old.

Tim is 35 years old.

His doctor tells him about a genetic test.

The test can predict how likely it is that he will develop heart disease.

(a) Tim wants the test to tell him for certain whether or not he will develop heart disease.

Which of the statements are reasons why the test cannot do this?

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

A large number of people die from heart disease each year. ☐

Having a particular gene does not guarantee that you will develop heart disease. ☐

Tim's mother does not have heart disease. ☐

Tim's father and grandfather died from heart disease. ☐

The results of the test can sometimes be incorrect. ☐

There are lots of factors that can contribute to heart disease. ☐

[2]

(b) Suggest what implications the results of the test might have when Tim applies for life insurance.

....

....

.... **[2]**

(c) Tim is told he has a 40% chance of developing heart disease.

He gives up smoking and joins the local gym.

His colleague, Greg, also has the genetic test.

He is told he has a 70% chance of developing heart disease.

Despite this, he continues to smoke and eat food that is high in fat and salt.

Use ideas about risk to suggest why Tim and Greg behave differently following the results of their genetic tests.

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.... **[2]**

[Total: 6]

Turn over

4   Ian decides to join a running club.

At the first session, the instructor takes Ian's resting pulse rate.

(a) Explain how the instructor would measure Ian's pulse rate.

....

.... **[1]**

(b) The instructor wants to work out how much blood the heart pumps out in a minute.

This is called cardiac output.

He uses this formula.

cardiac output = pulse rate × volume of blood pumped out per heart beat

The results for Ian and three other members of the running club are shown in the table.

Name	Resting pulse rate in beats per minute	Volume of blood pumped out per heart beat in cm³	Cardiac output in cm³ per minute
Alistair	80	75	6000
Byron		80	5440
Colin		70	4970
Ian	75	92	

(i) Calculate Ian's cardiac output.

.... cm³ per minute **[1]**

(ii) The instructor says that resting pulse rate is a good indication of fitness.

The lower your resting pulse rate the fitter you are.

Use the data in the table to work out who is the fittest person.

Show your working.

[2]

(iii) Although the pulse rate measurements are accurate, the instructor is not convinced that his measurements identify the fittest person.

Suggest reasons why he may think this, and explain what he could do to have more confidence in his measurements.

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.... **[2]**

[Total: 6]

Turn over

5   Helen is investigating the effect of antibiotics on the growth of bacteria.

Bacteria are grown on nutrient jelly. This makes the jelly look cloudy.

Helen puts a small paper disc into each of three different antibiotic solutions, **A**, **B** and **C**.

She puts another paper disc into water.

She then places all of the paper discs onto the nutrient jelly.

The diagram shows the apparatus she uses for her investigation.
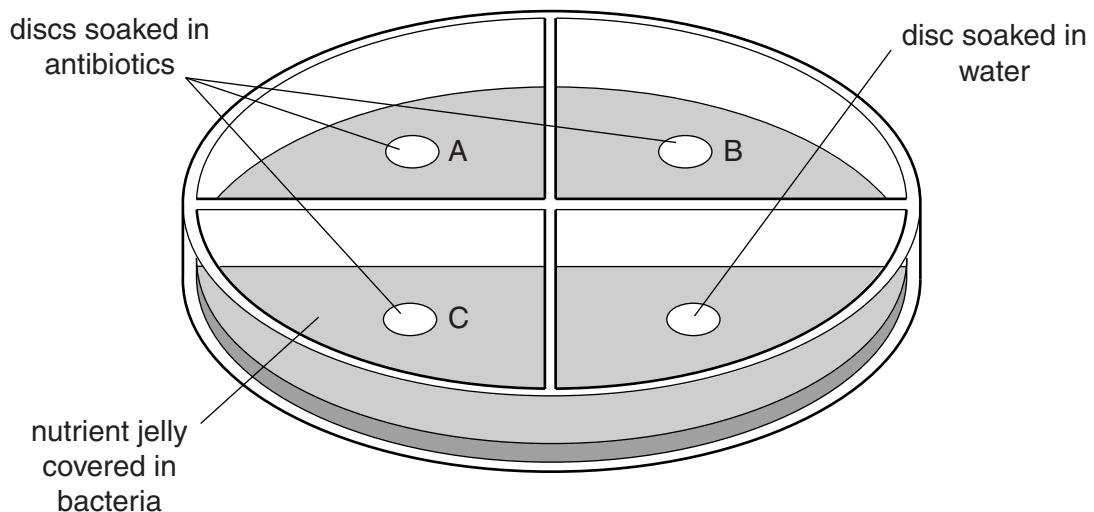
After two days Helen sees clear circular areas around some of the paper discs.

Helen measures the radius (r) as shown in the diagram.
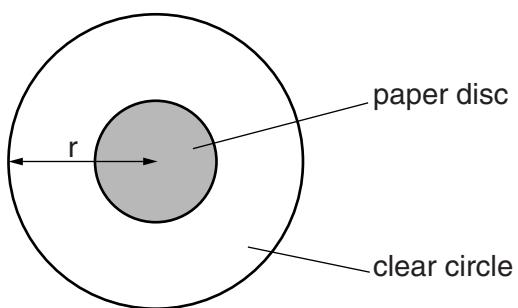
She then calculates the total area of the clear circle (including the paper disc) using the formula:

area = πr^2 (where π = 3.14).

Here are her results.

	Radius in mm	**Total area of the clear circle (including the paper disc) in mm^2**
A	8	
B	14	615.44
C	3	28.26
water	3	28.26

(a) Complete the table by calculating the total area of the clear circle (including the paper disc) for **A**.

Show your working below.

[2]

(b) Describe Helen's results and explain the conclusions she can make from them.

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

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.... **[6]**

(c) Helen designed her experiment so that it was a fair test.

Explain what it meant by this and why it is important.

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.... **[2]**

(d) New drugs must be tested to make sure that they are safe and effective.

Explain how this is done.

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.... **[2]**

[Total: 12]

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**Question 6 begins on page 14**

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6   Species that no longer exist are said to be extinct.

The graph shows the estimated total number of extinctions worldwide since 1800.

total number of extinctions (y-axis, from 0 to 80 000)

year (x-axis, from 1800 to 2020)
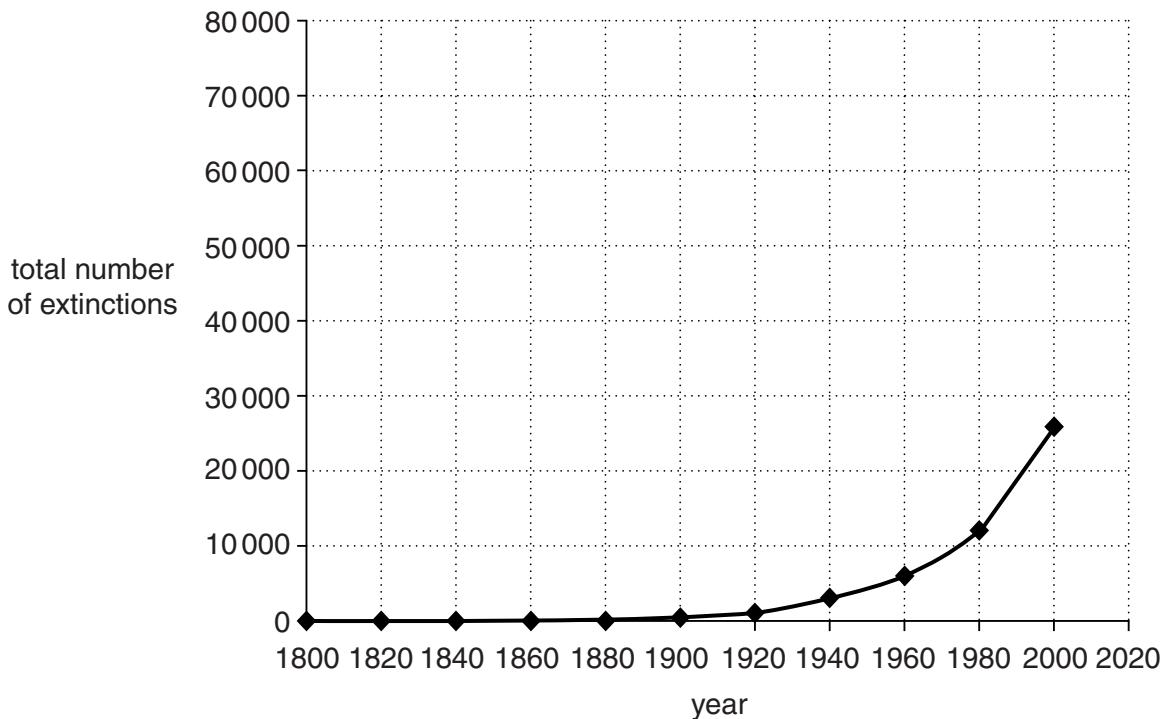
(a) (i) The graph suggests that very few, if any, species became extinct between 1800 and 1900.

Which of the statements are the most likely reasons for this?

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

Between 1800 and 1900 …

… there were fewer species so there were fewer to become extinct.   ☐

… human activity was less damaging to plants and animals.   ☐

… humans were eating all the plants and animals.   ☐

… life on Earth began.   ☐

… there is not much evidence written down about the plants and animals.   ☐

[2]

(ii) Continue the line on the graph to predict how many species are likely to have become extinct by 2020.

number of extinct species by 2020 = ... **[1]**

(iii) Describe the trend shown on the graph after 1900 and give a possible explanation for this.

....

.... **[1]**

(b) Scientists work hard to prevent species becoming extinct.

(i) Suggest **one** way in which scientists can help to prevent species becoming extinct.

....

.... **[1]**

(ii) Suggest why preventing extinctions is an important part of using the environment in a sustainable way.

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.... **[2]**

[Total: 7]

7 There is a huge variation of life on Earth.

The processes of natural selection and selective breeding have been involved in producing this variation.

Compare natural selection and selective breeding.

Include the similarities and differences between the two processes.

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

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.... **[6]**

[Total: 6]

8 The diagram shows some of the processes involved in the carbon cycle.

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┌─────────────────┐      ┌───┐      ┌─────────────────┐
│ carbon dioxide  │─────▶│   │─────▶│ carbon compounds│
│ gas in the air  │      └───┘      │    in plants    │
└─────────────────┘                 └─────────────────┘
        ▲  ▲     ┌───┐
        │  │     │   │   ┌─────────────────┐
        │  │     └───┘   │ carbon compounds│
        │  └──────────── │   in animals    │
      ┌───┐              └─────────────────┘
      │   │                      │
      └───┘                      ▼
        │           ┌─────────────────┐
        └───────────│ carbon compounds│
                    │ in fossils fuels│
                    └─────────────────┘
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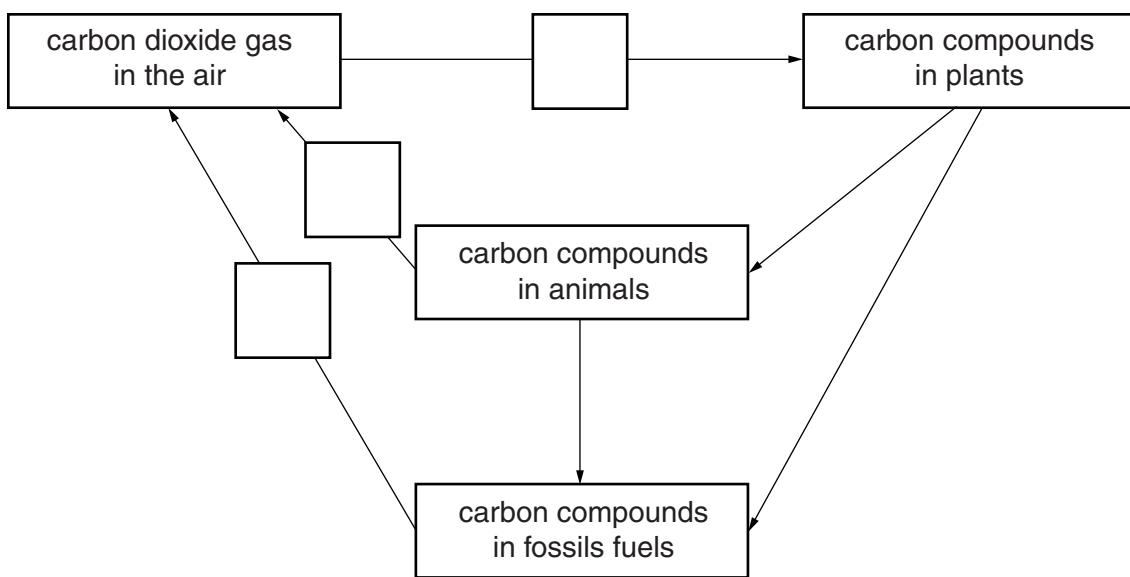
  (a) Look at the following processes:

   A   Combustion
   B   Excretion
   C   Feeding
   D   Photosynthesis
   E   Respiration.

   Write the correct three letters, **A**, **B**, **C**, **D** or **E**, in the correct boxes to complete the diagram.
   [3]

  (b) Explain the role of detritivores in the carbon cycle.

   ....

   ....

   ....

   .... **[2]**

Turn over

 (c) Carbon is transferred along a food chain as one organism eats another.

 Foxes eat rabbits.

 Only a small amount of carbon is transferred from the rabbit to the fox.

 Suggest why.

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 .... **[2]**

[Total: 7]

END OF QUESTION PAPER

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