OCR
Oxford Cambridge and RSA

Friday 10 June 2016 – Morning

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02 How scientific ideas have developed

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
- Insert (R072/02/I – inserted)

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

Duration: 1 hour

R072/02

6355511047

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found inside this document.
- 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 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**.
- Your quality of written communication is assessed in questions marked with a pencil (✎).
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question refers to the case study 'Natural Selection'.

(a) Why are there species of animals on the Galápagos Islands which do not exist anywhere else?

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

(b) (i) Suggest why Darwin could **not** prove that the Galápagos finches had a common ancestor.

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

(ii) Explain why the common cactus finches and the medium ground finches can both survive on the small island of Daphne Major.

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

(c) The scientific name for the medium ground finch is *Geospiza fortis*.

The scientific name for the common cactus finch is *Geospiza scandens*.

What do the scientific names tell us about the genus and species of these finches?

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

(d) Look at **Fig. 3**.

Describe what the graph shows.

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

(e) Look at **Fig. 2**, **Fig. 4** and **Fig. 5**.

Describe and explain how the 1977 drought affected the medium ground finches.

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..... **[4]**

(f) The Grants continued to study the medium ground finches on Daphne Major after 1978.

They developed a hypothesis that rainfall was causing a change in the distribution of size of beaks and in the overall population size of medium ground finches.

Which measurements would increase confidence in the hypothesis?

Put a tick (✓) in one box for **each** statement to show if it is **true** or **false**.

	True	**False**
mean size of beaks for *Geospiza fortis*		
mean size of beaks for *Geospiza scandens*		
the total rainfall		
the number of *Geospiza fortis*		
the number of *Geospiza scandens*		
the number of cactus plants		

[2]

[Total: 15]

2 The greenhouse effect can change the surface temperature of the Earth.
The table gives the current concentration of some greenhouse gases in the atmosphere.

	Water vapour	**Carbon dioxide**	**Methane**
Concentration in the atmosphere (parts per million)	18 000	400	1.8

(a) Scientists are concerned about an increase in the concentration of carbon dioxide in the atmosphere. They are less concerned about the concentration of water vapour and methane.

Explain how gases in the atmosphere can cause the greenhouse effect and suggest why scientists are most concerned about the concentration of carbon dioxide.

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

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

(b) Each of the following have happened in the last 50 years.

Which could be caused by an increase in the concentration of greenhouse gases?

Put a tick (✓) in the boxes next to each of the **two** correct answers.

earthquakes ☐

melting ice-caps ☐

sea-floor spreading ☐

sea-level rise ☐

volcanoes ☐

[2]

(c) Most scientists agree that human activity is causing a change in the surface temperature of the Earth.

Suggest why some people may not agree.

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

[Total: 10]

3 Optical fibres are used to send data over very long distances.
Mobile phones only work fairly close to a mast.

(a) (i) Name the type of electromagnetic wave that is used to send data along an optical fibre.

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

(ii) Name the type of electromagnetic wave that is used to send data between a mobile phone and a mast.

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

(iii) Complete the following sentence.

All electromagnetic waves travel at the same speed in air but they have a different

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

(iv) Explain why optical fibres can operate over much longer distances than mobile phones.

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

(b) Digital data is sent as a stream of binary digits, commonly called bits.

(i) The number 9 can be represented in binary as 1001.

How many bits are being used to represent the number 9? ..... **[1]**

(ii) A gigabit is a large number of bits.

How many bits are in one gigabit?

Put a (ring) around the correct answer.

1 **1000** **1 000 000** **1 000 000 000** **1 000 000 000 000**

[1]

(iii) A byte is a group of bits.

How many bits are there in one byte?

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

(c) (i) Dave has taken a picture of himself with the camera in his mobile phone.
It consists of 5 megabits of data.
The process of uploading the photo to the internet takes 2 seconds.

What is the data rate for this process?
Use this equation:

$$\text{data rate (bits per second)} = \frac{\text{number of megabits} \times 1\,000\,000}{\text{time in seconds}}$$

Show your working.

data rate = ... bits per second **[2]**

(ii) Zoe is keen to show that her new phone is faster than Dave's.
She takes a photo of Dave and uploads it to the internet.

What does she need to do to make sure that it is a fair comparison?

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

(iii) Zoe finds that her phone uploads the data in half the time.
On her blog, Zoe writes that her phone is twice as fast as Dave's.
Some of her friends disagree.

Explain why this is **not** what scientists mean by **peer review**.

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

[Total: 13]

4 Helen and Ian measure the level of glucose in their blood at 08:00.
They then eat breakfast and take more measurements.
Their results are shown in the table.

Time	**08:00**	**08:30**	**09:00**	**09:30**	**10:00**
Helen's blood glucose level (mmol/L)	10.0	17.0	19.0	15.0	12.5
Ian's blood glucose level (mmol/L)	4.5	7.0	6.0	5.0	5.0

(a) Helen has diabetes. Her cells do not make enough insulin.
Ian does not have diabetes.

Explain Helen's and Ian's results.

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

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

(b) Helen's change in blood glucose levels are a symptom of diabetes.

Give **two** other symptoms of diabetes.

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2 .....

[2]

(c) Suggest what further data could be collected to show how diabetes affects blood glucose level.

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

(d) **(i)** Banting and Best first used insulin to treat diabetes in 1921.

Suggest why they could not use blood glucose levels to monitor their subjects.

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

(ii) Name the organ of the body from which Banting and Best extracted insulin.

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

[Total: 11]

5 In the 1950s, many scientists in the USA and Britain were trying to work out the structure of DNA, which had been discovered about 80 years earlier.

Watson and Crick published one of the first models of the structure of DNA but the model was incorrect.

(a) Why did Watson and Crick publish an incorrect model?

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

The model explained the evidence they had at the time. ☐

They wanted to publish before anyone else. ☐

Their idea had been peer-reviewed. ☐

They had just discovered DNA. ☐

They wanted to see what was wrong with the model. ☐

[2]

(b) Give **two advantages** of a scientist publishing their work.

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

(c) Suggest why a scientist may wait a long time before publishing their work.

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

(d) The correct structure for DNA involves bonding between four bases.
In a sample of human DNA, 30% of the bases are called Adenine (A).

Adenine is always joined to Thymine.
Cytosine is always joined to Guanine

Complete the table to show the percentage of each of the bases.

Adenine (A)	Thymine (T)	Cytosine (C)	Guanine (G)
30%			

[3]

(e) Explain how the sequence of the bases in DNA code for the synthesis of proteins in cells.

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

[Total: 11]

END OF QUESTION PAPER

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).