OCR
Oxford Cambridge and RSA

Monday 9 January 2017 – 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

5203136451

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 barcodes.

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 **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question refers to the case study 'The story of DNA'.

(a) How is 'nuclein' different from proteins?

.....

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

(b) Miescher collected a large amount of used bandages from a local hospital.

Explain why he needed a large amount of used bandages.

.....

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

(c) Look at **Fig. 1**.

Complete this table to show the number of each type of atom in cytosine.

	Number of each type of atom	
	Thymine (T)	**Cytosine (C)**
Carbon	5	4
Hydrogen	6	
Oxygen	2	
Nitrogen	2	

[1]

(d) Look at Chargaff's data in **Table 2**.

Which two conclusions can be deduced from this data?

Put a tick (✓) next to **two** correct conclusions.

DNA is the same in every species. ☐

Each species has different DNA to other species. ☐

The percentage of guanine is always less than the percentage of thymine. ☐

The percentage of adenine is always the same as the percentage of thymine. ☐

Guanine has the lowest percentage in all DNA. ☐

Adenine has the highest percentage in all DNA. ☐

[2]

(e) (i) Describe how a DNA crystal caused the X-rays to make the pattern in the photo shown in **Fig. 2**.

.....

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

(ii) Franklin did not publish her results from the first X-ray photographs.

She took many other photos both before and after 'photograph 51'.

Explain why she took so many photos.

.....

.....

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

(f) (i) Three bases in DNA make a code for each amino acid.

Explain why two bases are not enough to make a code for every amino acid.

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.....

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

(ii) A protein in yeast is made up from 400 amino acid molecules in a specific order.

What is the total number of bases in a DNA molecule needed to make this protein?

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

(g) (i) Look at **Fig. 4** which shows the triplet codes which match amino acids in a protein.

Complete this table.

Triplet code	Amino acid
CAT	His
	Ser
CAC	His
GTA	
	Met

[2]

(ii) The DNA shown below has one different base to the DNA shown in **Fig. 4**.

Would the protein formed from this DNA be the same or different to the protein formed in **Fig. 4**?

Explain your answer.

Use the table from part **(g)(i)** to help you.

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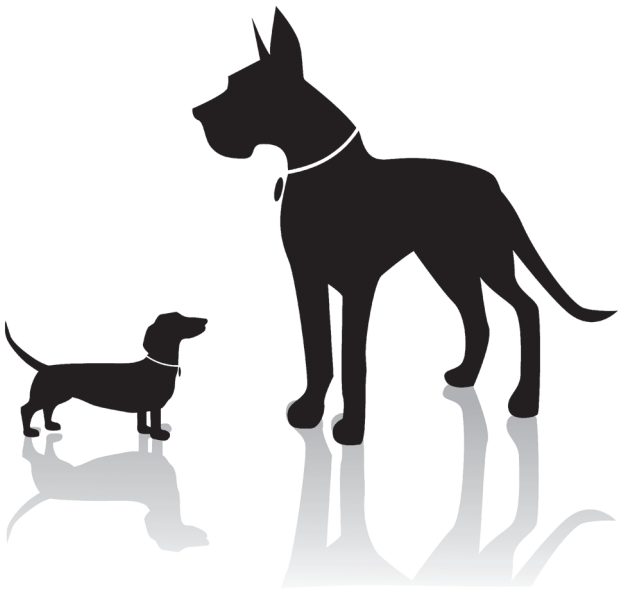
.....

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

[Total: 15]

2 Over hundreds of years, human beings have bred many different types of dogs.

Both of these dogs have a common ancestor.



Describe what human beings did to produce these different dogs and compare this to natural selection.

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

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

[Total: 6]

3 Andy is watching a game of football on a cold day.

(a) He starts to shiver.

The following statements explain why Andy shivers but they are **not** in the correct order.

A	Andy's brain sends an electrical signal to effectors.
B	A sensor detects that the blood temperature is below 37°C.
C	The body temperature increases.
D	Electricity makes muscles tighten and relax very quickly.
E	Cold air makes Andy's skin start to cool down.

(i) Put the statements in the correct order. Two have been done for you.

E				**C**

[2]

(ii) Explain why shivering is an example of a **negative feedback system**.

.....

.....

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

(b) Andy's friend Bob is playing in the football game.

Bob's trainer wants to monitor Bob's body temperature during the game.

The trainer gives Bob an electronic wristband temperature monitor.

(i) Suggest why using an electronic wristband is a better method than using a thermometer to monitor body temperature during the game.

.....

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

(ii) At the end of the game, Bob feels hot and his face looks red.

His trainer says that his face looks red due to changes in his blood vessels.

Explain how and why these changes happen.

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.....

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

(iii) Describe and explain **one other** response which Bob's body makes when he is hot.

.....

.....

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

[Total: 9]

4 **(a)** Infra-red, microwaves, radio waves and visible light are all waves in the electromagnetic spectrum.

Put these waves in order of increasing wavelength.

Infra-red has been done for you.

Use these words: **microwaves**, **radio waves** and **visible light**.

	Infra-red		

Shortest wavelength → **Longest wavelength**

[2]

(b) Different detectors detect different types of electromagnetic waves.

Draw one straight line from each **detector** to the correct **electromagnetic wave**.

detector	**electromagnetic wave**
	infra-red
human eye	
	microwaves
aerial in a mobile phone	
	radio waves
receiver for 'over the horizon' communication	
	visible light

[3]

[Total: 5]

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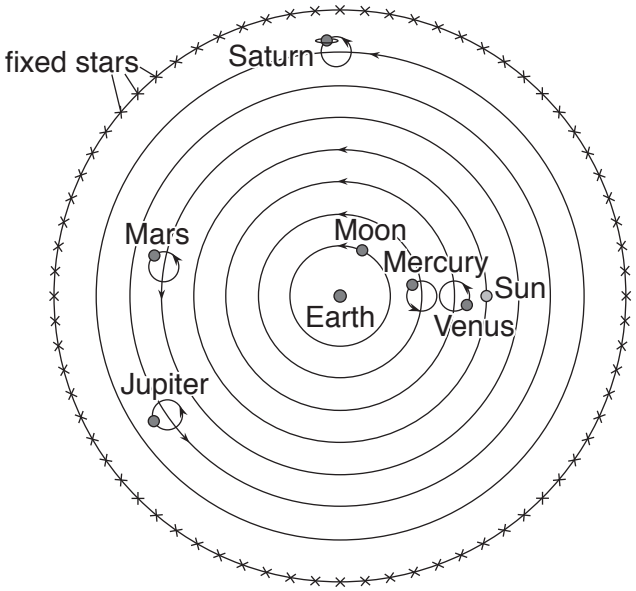
5 The early Greek model of the Universe is shown in the diagram.



Early Greek model

Later, Copernicus introduced a new model which arranged the Earth, the Sun and the planets differently.

11

Describe Copernicus's model and explain how the work of Newton supported this model.

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

You may draw a labelled diagram as part of your answer.

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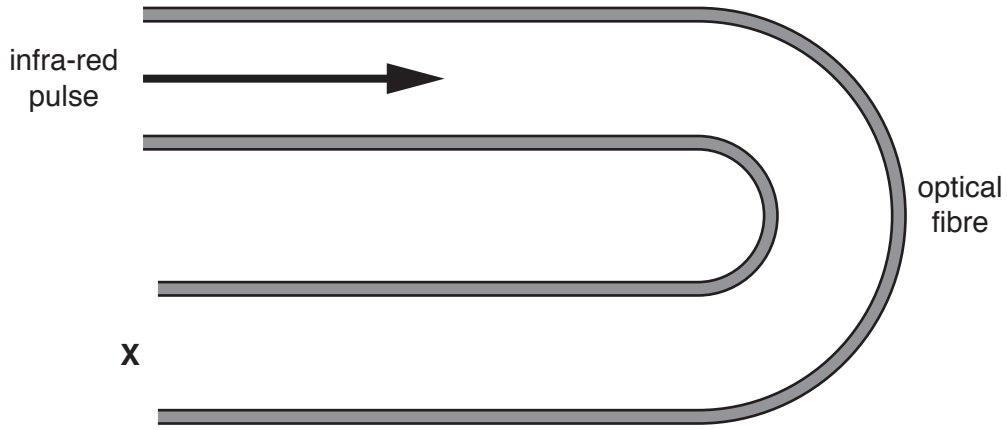
..... **[6]**

[Total: 6]

6 Some houses are connected to the internet by optical fibres.

Infra-red pulses are sent along the optical fibres.



The diagram shows an infra-red pulse in a piece of optical fibre.

(a) Complete the diagram above by drawing the path of the pulse until it reaches **X**. **[2]**

(b) Houses were connected by cable to the internet before optical fibres were developed.

Give **two** advantages of using optical fibres for internet connections.

1 .....

2 .....

[2]

(c) Sam downloads a film file from the internet.

The file size is 5 Gb and the download data rate for Sam's internet connection is 40 Mb / s.

Calculate how long Sam takes to download the film.

Show your working.

time = ... s **[3]**

[Total: 7]

7 In the early 20th century, Alfred Wegener developed the theory of continental drift to describe how the continents have moved over time.

His theory proposed that the continents had once been joined, and over time had drifted apart.

(a) What evidence did Wegener use to support his theory?

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.....

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

(b) When Wegener proposed his theory it was not accepted by scientists.

One reason they gave was that Wegener was not a geologist.

Give another reason why the scientists did not accept the theory.

.....

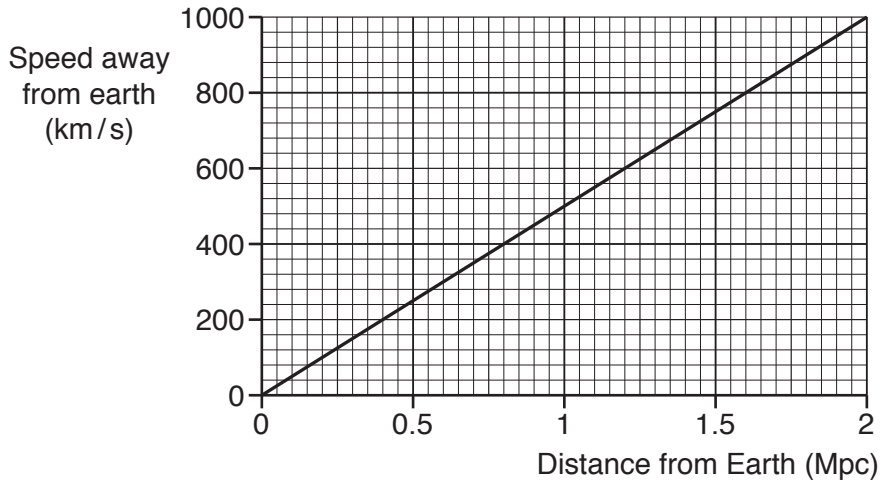
..... **[1]**

[Total: 3]

8 At the beginning of the 20th century, the astronomer Edwin Hubble collected data about galaxies.

He measured the speed each galaxy was travelling away from the Earth and the distance of each galaxy from the Earth.

(a) He used his results to plot **Graph 1**.



Graph 1

He concluded that the speed that each galaxy moves away from the Earth is directly proportional to its distance from the Earth.

This is called Hubble's law.

(i) Explain how the graph shows this relationship.

.....

.....

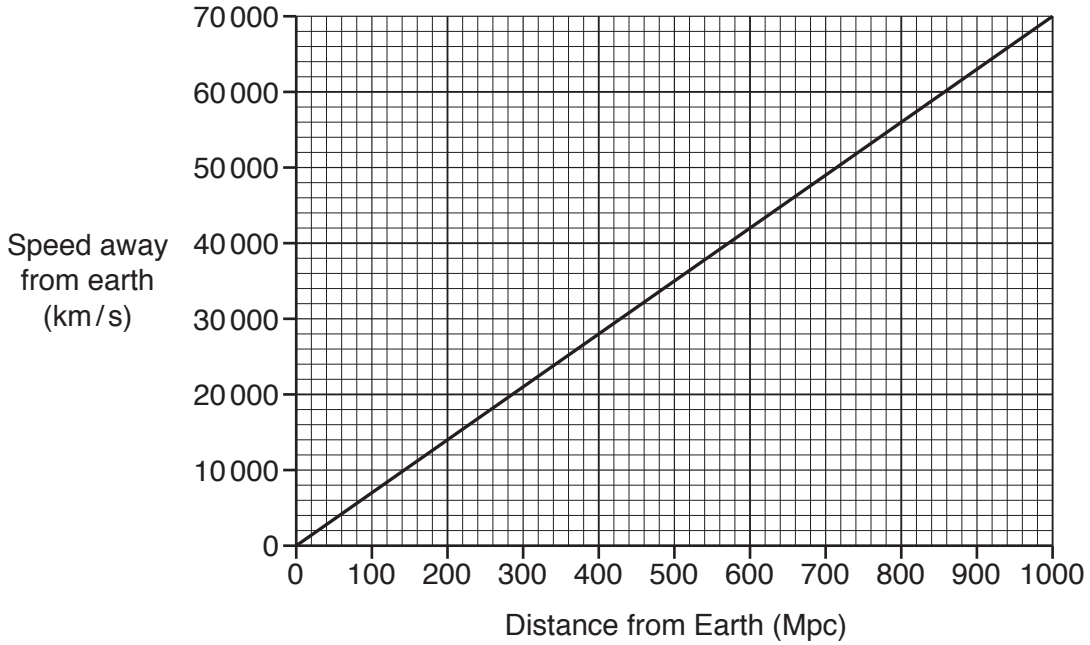
..... **[2]**

(ii) Explain how Hubble's law supports the idea of an expanding universe.

.....

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

(b) Nowadays, scientists have data about many more galaxies. **Graph 2** shows the graph drawn from this data.



Graph 2

(i) Hubble had distance data for galaxies up to 2 Mpc away.

Graph 2 shows distance data about galaxies up to 1000 Mpc away.

Explain why the range of distance data is very much larger in **Graph 2** than in **Graph 1**.

.....

.....

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

(ii) Hubble's law can be written as

$$V = H_o \times d$$

Where V is the speed away from the Earth, d is the distance from the Earth and H_o is Hubble's constant.

Use data from **Graph 2** to calculate the value of H_o.

Show your working.

H_o = ... km / s / Mpc **[3]**

[Total: 9]

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).