OCR
Oxford Cambridge and RSA

# Wednesday 7 January 2015 – Morning

## LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

**R072/02** How scientific ideas have developed

*5073413366*

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*

| 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. 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 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.

**This question is based on the case study 'Continental Drift'.**

**1 (a)** Look at **Table 1**.

Use the data in **Table 1** to identify which continents may have been directly linked.

Which pairs of continents may have been linked?

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

| | |
|---|---|
| Africa and India | ☐ |
| Antarctica and South America | ☐ |
| India and South America | ☐ |
| South America and Africa | ☐ |
| South America and Australasia | ☐ |

**[2]**

**(b)** How did scientists before Wegener believe mountains and oceans were formed?

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

**(c)** The theory of land bridges was developed by a number of scientists. However, Wegener developed his theory by himself.

Scientists support each other when working as a team.

How do they do this?

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

**(d)** Wegener used evidence from fossils to support his theory that the different continents had once been joined. Give **two other** pieces of evidence that Wegener used to support his theory.

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

**(e)** Wegener said that Pangaea began to break up about 200 million years ago.

How did Wegener explain what caused this to happen?

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

**(f)** Look at the responses to Wegener's theory on page 4 of the case study.

Which **two** people are using evidence to argue against Wegener's theory?

Put a (ring) around the **two** correct answers.

**A** **B** **C** **D** **E**

**[1]**

**(g)** **(i)** Holmes suggested that the continents were moving due to convection currents.

Describe how convection currents cause the continents to move.

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

**(ii)** Suggest why other scientists did not accept Holmes' ideas straight away.

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

**[Total: 15]**

**2** Kevin investigates how different types of breakfast affect his blood glucose levels.

One morning he eats a high protein breakfast and another morning he has a high carbohydrate breakfast.

He knows that the body makes glucose from carbohydrates in his food.

Kevin measures his blood glucose level before his breakfast and every 30 minutes afterwards.

These are Kevin's results.

| | **Blood glucose level in mmol/L at these times** | | | | |
|---|---|---|---|---|---|
| **Type of breakfast** | **Before breakfast** | **07:30** | **08:00** | **08:30** | **09:00** |
| **High protein** | 4.6 | 5.4 | 5.2 | 5.1 | 5.2 |
| **High carbohydrate** | 4.5 | 9.1 | 7.4 | 7.2 | 5.4 |

**(a) (i)** Calculate the maximum percentage increase in Kevin's blood glucose level.

Show your working.

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

**(ii)** Kevin compares how the two types of breakfast affect his blood glucose levels.

What conclusions can he draw from his results?

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

**(iii)** Which of these factors is the most important to control in Kevin's investigation?

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

Eating breakfast at the same time. ☐

Same energy content of breakfast. ☐

Same mass of breakfast. ☐

Drinking the same volume of water. ☐

**[1]**

**(b)** Kevin's brother, Dave, has diabetes. One of the ways Dave controls his blood glucose level is by injecting insulin.

He checks his blood glucose level at the following times:

- before going to bed
- after vigorous exercise
- when he feels unwell after a meal.

Explain why it is important that Dave checks his blood glucose level at these times.

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

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

**(c)** Avicenna identified the symptoms of diabetes 1000 years ago.

One of the symptoms he identified was that people with diabetes produced urine which tasted sweet.

**(i)** Suggest why this could not be measured accurately.

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

**(ii)** Why was he unable to link the symptoms to blood glucose level?

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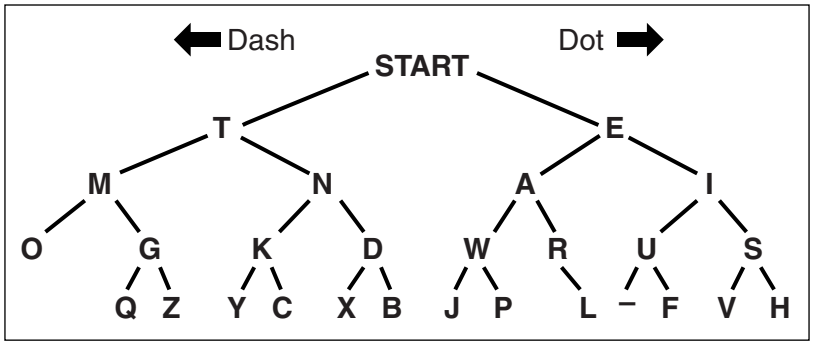
..... **[1]**

**[Total: 15]**

**3** **(a)** The below diagram is a way to decode Morse code messages.




From START, move to the left for a dash and to the right for a dot.

For example:
A single dash represents the letter 'T'.
A dot followed by a dash represents the letter 'A'.

**(i)** What letter is represented by a dash followed by a dot?

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

**(ii)** Marconi used radio to send messages in Morse code from England over the horizon to America in 1901.

Marconi's assistant sent a message of three dots (the letter 'S' in Morse code) at a certain time and Marconi claimed to have received this.

Some people said that he should not have known in advance what message was being sent. Suggest why.

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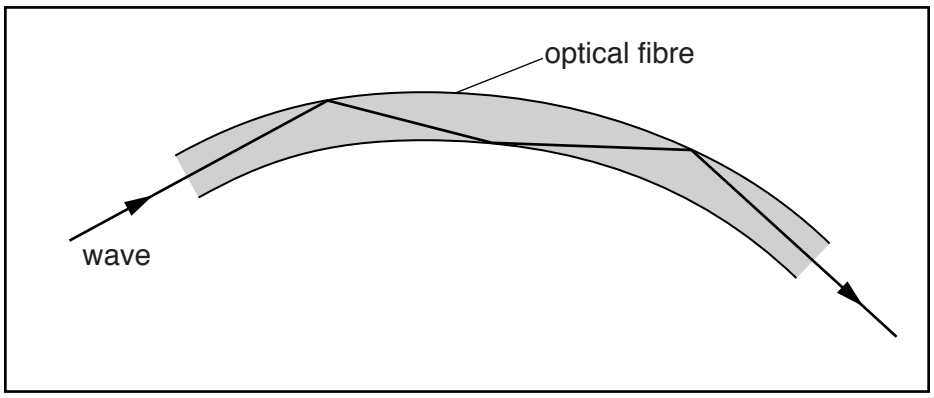
..... **[1]**

**(b)** Computers can pass digital data rapidly along optical fibres.




**(i)** What type of electromagnetic wave is sent along optical fibres?

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

**(ii)** Using the diagram, explain how digital data is not lost when information is passed along optical fibres.

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

**(iii)** A 2 megabyte photograph is sent as digital data along an optical fibre.

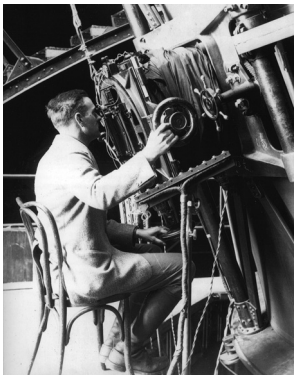
How many bits is this?

Show your working.

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

**[Total: 7]**

**4** Edwin Hubble was an astronomer working nearly 100 years ago.
He used a new telescope called the Hooker telescope.
This was the largest telescope in the world at that time.



**(a)** Hubble could see a spiral cloud or 'nebula' with his telescope.
The nebula seemed to be outside our own galaxy.

What did Hubble say this was?

Put a (ring) around the best answer.

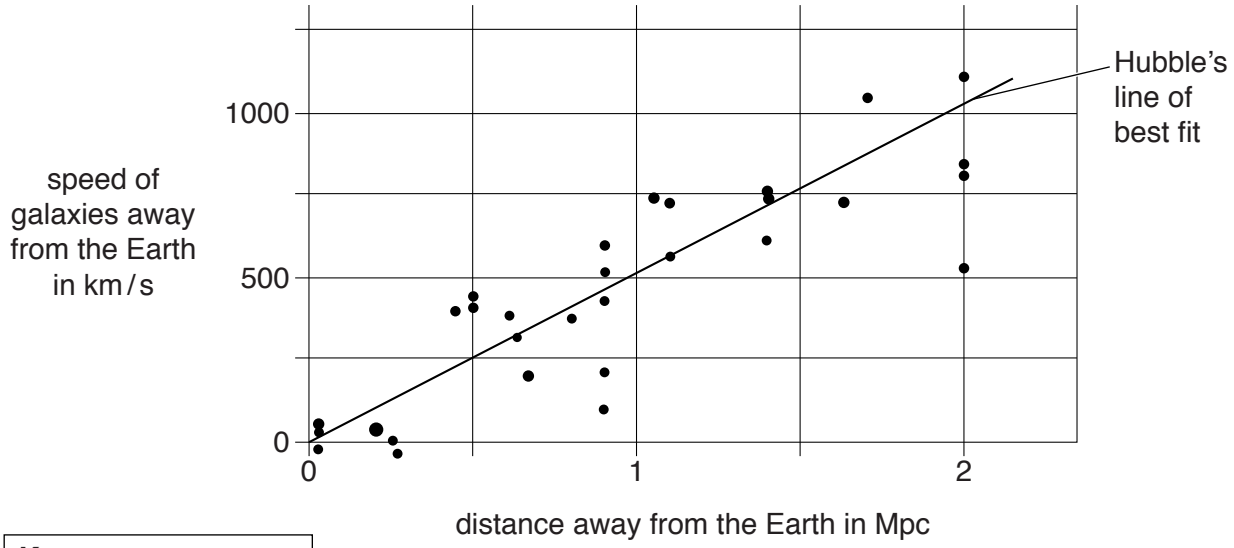
A galaxy  A planet  A star  A moon

**[1]**

**(b)** Hubble collected data about the distance to various galaxies.

He also calculated the speed with which they seemed to be moving away from the Earth.

Hubble used his data to plot a graph.




**Key:**
each point on the graph represents an individual galaxy

**(i)** Use the line on the graph to estimate the speed of a galaxy which is 1 Mpc from Earth.

.....km/s **[1]**

**(ii)** Explain what is shown by this graph and what it tells us about the development of the Universe.

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

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

**(c)** Many astronomers working 100 years after Hubble have made measurements for the same galaxies as Hubble. Their data produced a line of best fit with a much lower slope.

Explain why their measurements are different from those made by Hubble.

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

**(d)** Hubble collected data to support his ideas.

Use these phrases to complete the sentences.

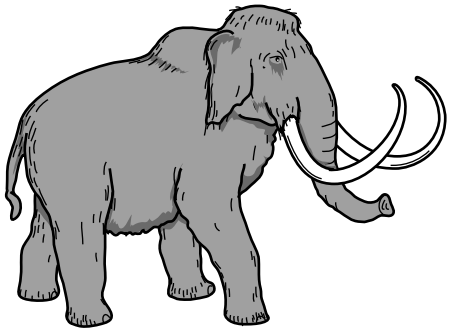
| | |
|---|---|
| **background radiation** | **climate change** |
| **the frequency of radio waves** | **orbits of planets** |
| **the intensity of infra-red radiation** | **speeds of galaxies** |
| **red shift** | **the cooling of the Universe** |

Hubble collected data about ..... and used this data to support his ideas about ..... .

Other scientists have provided support for Hubble's ideas and collected data about ..... and used this data to support ideas about ..... . **[4]**

**[Total: 15]**

**5** Mammoths were large animals which are now extinct.



Mammoths lived in cold climates.

They looked like elephants but had much more hair on their bodies.

**(a)** Lamarck had a theory that explained why mammoths had long hair.

**Lamarck's theory:**
- They all grew long hair during their lifetime to keep them warm.
- Mammoths who had grown long hair passed this characteristic on to their offspring.
- Over many generations all mammoths had offspring with long hair.

Modern scientists rejected Lamarck's explanation.

Explain which parts of **Lamarck's theory** were not correct.

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

**(b)** Charles Darwin suggested an alternative theory called **natural selection**.

How could Charles Darwin's theory of **natural selection** explain how mammoths evolved to have long hair?

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

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

**Question 5 continues on page 12**

**(c)** Darwin collected observations early in his life but published his ideas many years later.

Suggest reasons why some scientists take a long time to publish their ideas.

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

**[Total: 8]**

**END OF QUESTION PAPER**