

**Friday 9 June 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



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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 **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question refers to the case study **Views of the Heavens** in the insert.

(a) (i) Ptolemy and Copernicus had different ideas about how the Sun, moon and Earth moved.

Describe a **difference** and a **similarity** between their ideas.

Difference .....

.....

Similarity .....

..... [2]

(ii) Ptolemy noticed that some objects in the sky seemed to move regularly.

Each came back to the same place after a fixed period of time.

Draw one straight line from each **period of time** to its correct **object in the sky**.

Period of time	Object in the sky
	The Moon
A year	The Sun
A month	Venus
	Stars

[2]

(b) (i) What observation did Brahe make which showed that the 'invisible spheres' did not exist?

.....

..... [1]

(ii) Kepler was able to show that the planets did not follow a circular path.

What evidence did he use to support this conclusion?

.....

.....

..... [2]

- (c) (i) What new invention allowed Galileo to see craters on the moon?

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

- (ii) How did Galileo show that Venus goes round the Sun in a smaller orbit than the Earth?

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

- (iii) Galileo did not publish his book on the Universe until many years after he collected his evidence.

Why did he delay publishing?

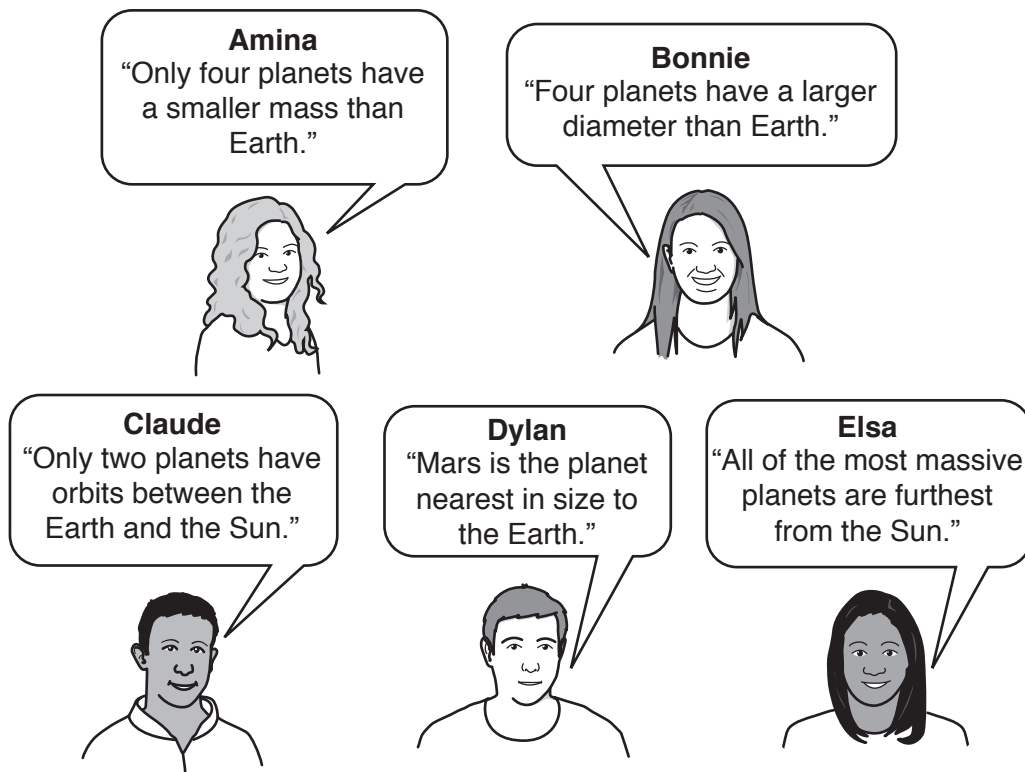
.....  
.....  
..... [2]

- (d) Newton suggested that every action has a reaction.

Explain why an apple falls down to Earth from a tree, but the Earth does not seem to move upwards to the apple.

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

(e) Five friends look at **Table 1** and make these statements.



Which **two** people have made a correct statement?

..... and ..... [2]

[Total: 15]

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2 The peppered moth is a species which has two forms.

There is a light, **speckled form** and a **dark form**.



**Speckled moth**



**Dark moth**

Bernie released large numbers of both forms of peppered moths in two different woodlands, **A** and **B**.

In woodland **A**, the bark of most of the trees is speckled.

In woodland **B**, the bark of the trees is dark.

After a few days, many of the moths in both woodlands had been eaten by birds.

Bernie recaptured as many as possible of the moths that were still alive.

He repeated these experiments three times in each woodland.

His results are shown below.

	Speckled moths		Dark moths	
	Number released	Number recaptured	Number released	Number recaptured
Woodland <b>A</b>	100	12	100	7
	100	12	100	9
	200	24	200	16
Woodland <b>B</b>	100	11	100	30
	100	14	100	31
	200	23	200	59

- (a) (i) Over the three experiments in woodland **A**, a total of 12% of the speckled moths were recaptured.

Show that a total of 8% of the dark moths were recaptured in woodland **A**.

[1]

- (ii) Bernie says that a higher percentage of dark moths survived in woodland **B** than in woodland **A**.

Is Bernie correct?

Use a calculation to support your answer.

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





- 3 Glyn investigates how eating food which has been prepared in different ways affects blood glucose levels of a group of people.

For three days the people ate a bowl of white pasta, topped with a simple tomato sauce.

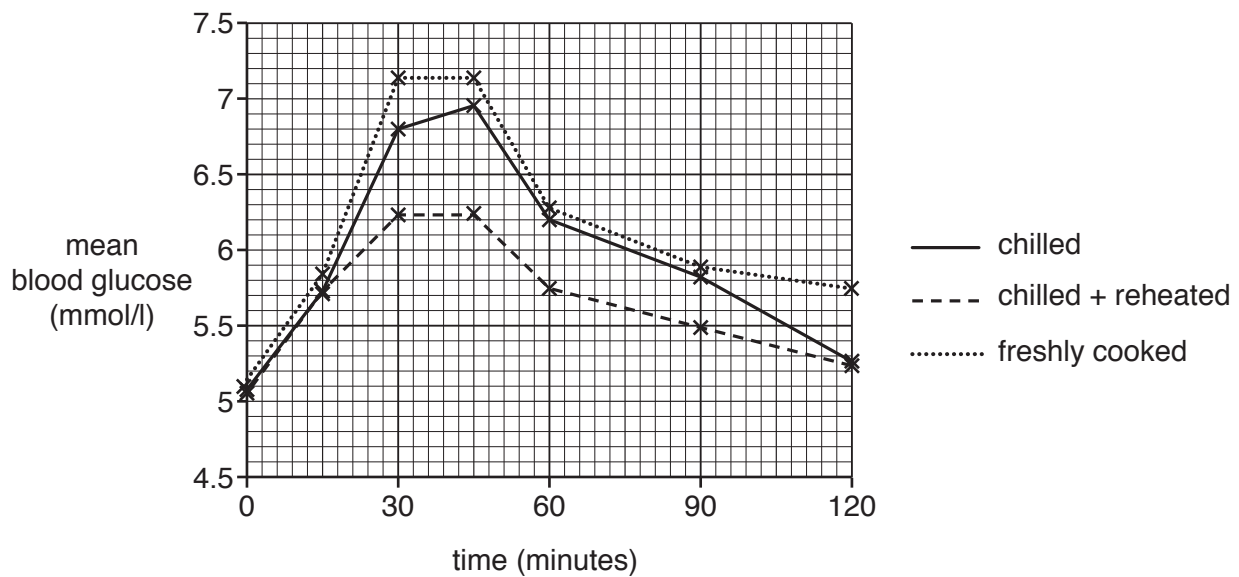
On the **first day** they ate the pasta hot, when it was **freshly cooked**.

On the **second day** they ate the pasta cold, after it had been **chilled** overnight.

On the **third day** they ate the pasta after it had been **chilled and then reheated**.

After eating the pasta, Glyn recorded the blood glucose levels for each volunteer during the next two hours.

The graph below shows his results.



- (a) State a variable which Glyn must control to make this a fair test.

..... [1]

- (b) Suggest why Glyn chose to use a group of people rather than just one person.

..... [2]

- (c) Describe and compare the differences in Glyn's blood glucose level after eating each type of meal.

..... [3]

[Total: 6]

**10**  
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- 4 Some tomato plants produce **red** tomatoes. Some tomato plants produce **yellow** tomatoes.

Thea did some breeding experiments with tomato plants.

She had some pure bred **red** tomato plants and some pure bred **yellow** tomato plants.



plant with red  
tomatoes



plant with yellow  
tomatoes

- (a) In **experiment 1**, Thea crossed a pure bred **red** tomato plant with another pure bred **red** tomato plant.

Explain why all the offspring plants had only red tomatoes.

.....

.....

..... [2]

- (b) In **experiment 2**, Thea crossed a pure bred **red** tomato plant with a pure bred **yellow** tomato plant.

All the offspring plants (the F1 generation) had red tomatoes.

What can you conclude about the **yellow** allele in tomato plants?

.....

..... [1]

(c) In experiment 3, Thea crossed red tomato plants from the F1 generation together.

She found that most of the offspring had red tomatoes, but a few had yellow tomatoes.

(i) What alleles do the parent F1 plants have?

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

Both parents have two red alleles.

☐

Both parents have two yellow alleles.

☐

Both parents have one red allele and one yellow allele.

☐

One parent has two red alleles and the other parent has two yellow alleles.

☐

[1]

(ii) If Thea took the **yellow** offspring plants from this experiment and crossed them together, what colour tomatoes would their offspring have?

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

All plants would have red tomatoes.

☐

All plants would have yellow tomatoes.

☐

A few of the plants would have red tomatoes.

☐

A few of the plants would have yellow tomatoes.

☐

[1]

(d) Gregor Mendel introduced his particulate theory of inheritance in the 19<sup>th</sup> century.

Before this, people believed that the characteristics of offspring were due to the blending of the parents' characteristics.

Mendel experimented with pea plants that had either purple or white flowers.

(i) He crossed pure bred plants with purple flowers with pure bred plants with white flowers.

He found that all the offspring (F1) had purple flowers.

Why does this result **not** fit the 'blending' idea?

.....

..... [1]

- (ii) All the F1 plants had purple flowers.

Mendel then crossed these F1 plants together and looked at the colours of the offspring.

Here are his results.

F1 plants	Offspring	
	purple	white
purple x purple	705	224

Mendel had the idea that the colour depends on 'particles' being passed from each parent to their offspring.

How do his results support this idea?

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

- (iii) Mendel used the idea that inheritance depends on particles to predict that the ratio of purple to white flowered plants in the offspring would be 3:1.

Explain how well these results agree with his prediction.

Use the data in your answer.

Show your working.

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

[Total: 11]

A line graph showing the increase in carbon dioxide concentration (ppm) from 1950 to 1990. The y-axis is labeled 'carbon dioxide concentration (ppm)' and ranges from 300 to 340 with major ticks every 20 units. The x-axis is labeled 'year' and ranges from 1950 to 1990 with major ticks every 10 years. The graph shows a steady, accelerating increase in CO2 levels over the 40-year period.

Year	Carbon Dioxide Concentration (ppm)
1950	310
1955	313
1960	317
1965	320
1970	325
1975	330
1980	338
1985	345
1990	355



[6]

**[Total: 6]**

6 Visible light, infra-red, microwaves and radio waves are types of electromagnetic waves.

(a) Which property do **all four** of these types of electromagnetic waves have?

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

They have the same wavelength.

☐

They all pass through concrete.

☐

They travel through space at the same speed.

☐

They pass through the atmosphere without being absorbed.

☐

[1]

(b) A spacecraft is  $2.1 \times 10^{10}$  km from the Earth and sends an electromagnetic signal to the Earth.

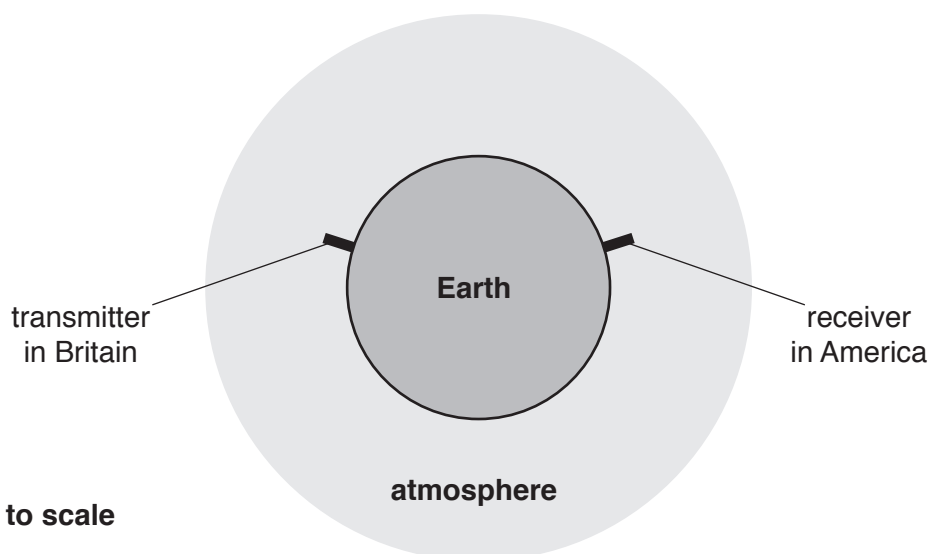
How long does it take the signal to reach the Earth?

Show your working.

time = ..... s [3]

(c) In 1901 Marconi sent the first message across the Atlantic ocean using radio waves.

(i) On the diagram, draw the path of the radio waves from the transmitter to the receiver.



[2]

(ii) Mobile phones use microwaves to send messages.

Suggest why Marconi did **not** use microwaves to send his message.

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

(d) Sam has a superfast broadband connection to his house.

(i) He tests the rate of data transfer by timing how long it takes to download a 10 minute film.

The film took 3 s to download.

He repeats the download four more times.

Here are his results.

Download	1st	2nd	3rd	4th	5th	mean
Time (s)	3	5	2	3	2	3

Why did Sam repeat the download?

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



- (ii) What could Sam have done to make his mean value more accurate?

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

[Total: 9]

- 7 In the early 20<sup>th</sup> century Alfred Wegener developed the theory of continental drift.

He proposed that all the continents were once joined together but had gradually drifted apart.

His theory was not accepted by other scientists.

One reason for rejecting his theory was that he could not account for the large force needed to move the continents.

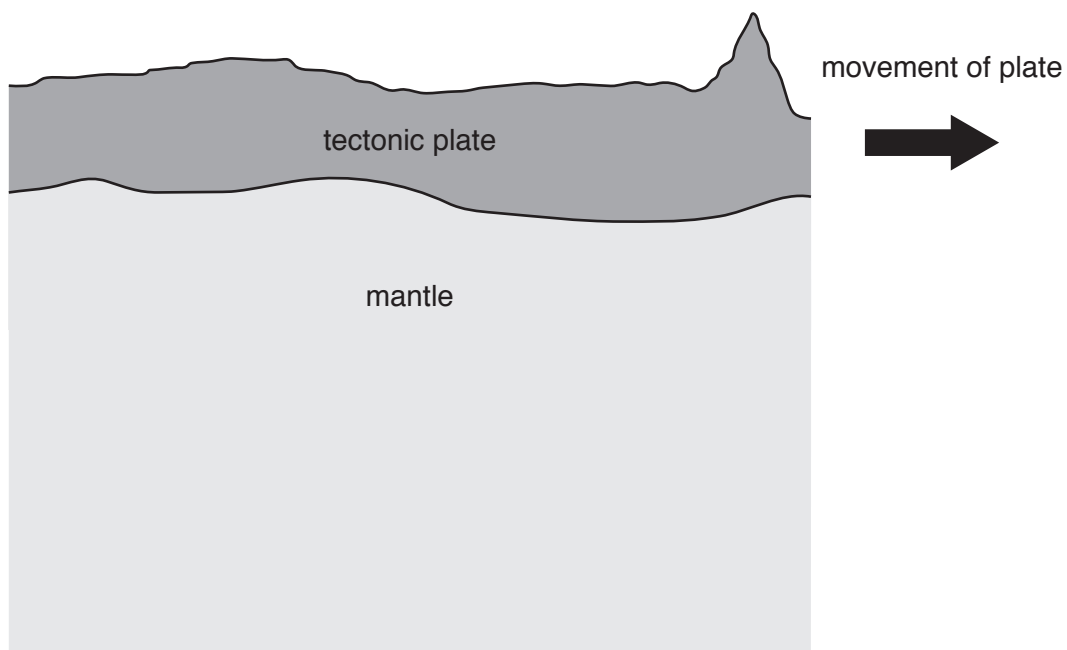
- (a) Give one **other** reason why Wegener's theory was not accepted.

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

- (b) Arthur Holmes suggested a mechanism to explain why the continents moved.

- (i) He said that the Earth has tectonic plates which sit on the mantle.

The diagram shows Holmes's idea.



Holmes said that convection currents caused the tectonic plates to move.

Draw a convection current on the diagram that would cause the plate to move in the direction shown.

[2]

- (ii) Which discovery gave evidence to support Holmes's suggestion about convection currents?

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

rise in sea levels

☐

sea floor spreading

☐

jig-saw fit of continents

☐

fossils common to different continents

☐

[1]

[Total: 4]

**END OF QUESTION PAPER**

This image shows a blank sheet of white paper designed for handwriting practice. It features a solid black vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced, horizontal dashed lines for writing. There are no other markings or text on the page.

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