

Wednesday 9 January 2013 – 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	
-----------------------	--	----------------------	--

Centre number						Candidate number				
---------------	--	--	--	--	--	------------------	--	--	--	--

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of 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 **16** pages. Any blank pages are indicated.

Answer **all** the questions.

This question is based on the article ‘**Collecting data and making predictions about climate**’.

1 (a) Two scientists working independently collect and analyse data.

They calculate different values for the average global temperature.

(i) Suggest reasons why one scientist may reach a value that is **higher** than the other scientist.

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

(ii) The two scientists each publish their work in a scientific journal.

What would you expect to happen after the work has been published?

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

(b) Scientists **do not use** data from cities when calculating average global temperatures.

Scientists **do** include temperature data from deserts.

Explain why they do this.

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

(c) We do **not** have reliable data about the composition of the atmosphere from hundreds of years ago.

Give reasons why there is no reliable data.

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

- (d) The article says that the average global temperature has increased by $0.6^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$ over the last hundred years.

If the average global temperature today is 15°C , what would the **range** of average global temperature have been 100 years ago?

Between $^{\circ}\text{C}$ and $^{\circ}\text{C}$ [1]

- (e) The predicted number of people who could be flooded each year in South Asia in the 2080s varies between 8 and 55 million people.

Explain why the scientists have made predictions that have such a broad range.

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

- (f) The graph shows a correlation between CO_2 levels and the number of people who could be flooded each year in the 2080s.

Explain how higher levels of CO_2 could lead to more people being flooded.



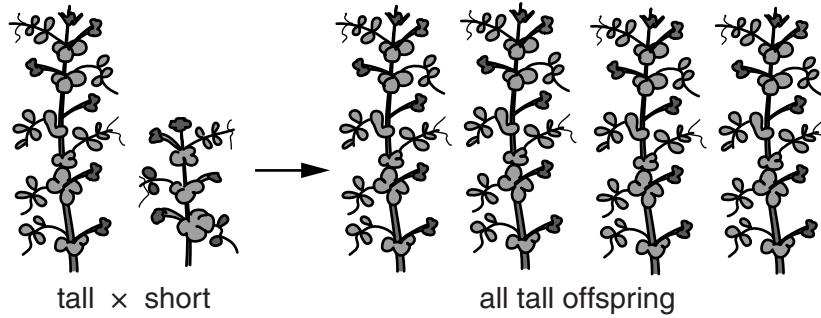
One mark will be for a clear, ordered answer.

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

[Total: 15]

2 Mendel is famous for his genetic experiments on pea plants.

In one experiment, he crossed pure breeding tall plants with pure breeding short plants. All of the offspring were tall.



(a) What are 'pure breeding tall plants'?

.....
 [1]

(b) Mendel crossed the offspring from his first experiment and collected the seeds.

He planted the seeds and measured the height of the plants (trial 1).
 He repeated both steps to give further data (trial 2 and trial 3).

This table shows his results.

Trial	Total number of seeds planted	Number of tall pea plants	Number of short pea plants
1	100	76	24
2	100	75	25
3	100	74	26

Do you think that the data from the trials is reliable?
 Explain your reasoning.

.....

 [2]

(c) Mendel used the same process to investigate how other characteristics were inherited in pea plants.

He crossed the offspring produced from parent plants that were pure breeding for each characteristic. He used 100 seeds in each trial.

This table shows his results.

Characteristic	Results
Colour of flower	76 purple 24 white
Colour of seed	74 yellow 26 green
Colour of seed pod	75 green 25 yellow

(i) Give **two** characteristics of pea plants that are dominant.

- 1
- 2

[1]

(ii) Mendel used the same process in another trial.
150 of the pea plants he grew produced green seeds.
Predict the number of plants that produced yellow seeds.

Show your working.

answer [2]

(iii) Some people prefer short, white plants.

What plants need to be crossed to produce only seeds that will grow into short, white plants?
Explain your reasoning.

-
-
-
- [2]

(d) Scientific understanding of how characteristics were inherited advanced in the 20th century when Franklin, Watson and Crick worked out the structure of DNA.

(i) The structure was worked out based on data that was gathered using a new technique. What was the new technique?

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

microscopy

X-ray diffraction

cladistics

transcription and translation

[1]

(ii) Which statements describe the structure of DNA?

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

DNA is a double helix.

DNA contains small individual molecules called ribosomes.

DNA contains bases arranged in pairs.

DNA contains bases and each base forms bonds with any other base.

DNA contains two different bases which hold the structure together.

[2]

[Total: 11]

BLANK PAGE

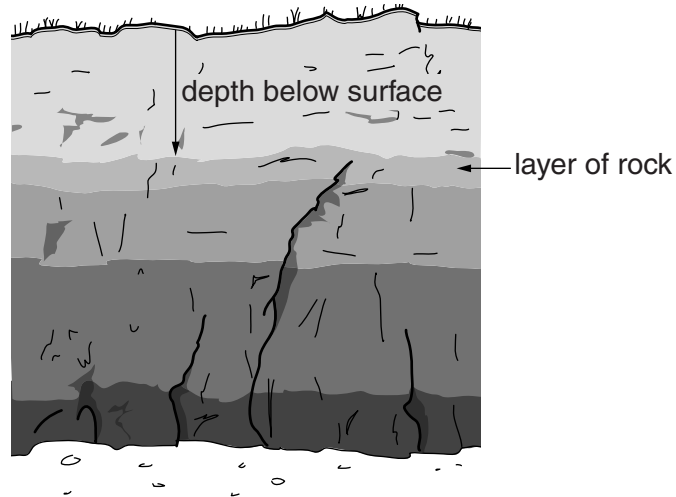
Question 3 begins on page 8

PLEASE DO NOT WRITE ON THIS PAGE

3 Rose is a scientist who studies rocks. She is interested in studying the layers of rock in a cliff.

She takes samples of rocks from different layers in the cliff face and tests them to find out their ages.

She measures how deep the bottom layer is from the top of the cliff.



This table shows her results.

	Type of rock in layer	Depth below surface in m	Age of rock in millions of years
Cliff 1	limestone	5	70
	chalk	7	75
	red sandstone	10	82
	red mudstone	16	91
	grey mudstone	18	96

(a) What **correlation** does the data suggest?

.....
 [1]

(b) Rose notices that the rock layers in another cliff look similar.

This table shows the results for **cliff 2**.

	Type of rock in layer	Depth below surface in m	Age of rock in millions of years
Cliff 2	limestone	5	70
	chalk	8	75
	red sandstone	11	82
	red mudstone	15	91
	grey mudstone	19	96

Cliff 2 is a few miles away from **cliff 1**, the first cliff she tested.

Rose thinks that **cliff 1** and **cliff 2** formed close together but have moved apart.

How do the results provide evidence to support Rose’s idea that the cliffs were formed close together?

.....

.....

.....

..... [2]

(c) Wegener was the first scientist to suggest a theory about the movement of large areas of land.

Which statements about Wegener are true and which are false?
Put a tick (✓) in the correct box for each statement to show whether it is **true** or **false**.

	true	false
Wegener’s ideas were rejected because he was not a geologist.	<input type="checkbox"/>	<input type="checkbox"/>
He noticed that the coast of Africa and South America appeared to fit together.	<input type="checkbox"/>	<input type="checkbox"/>
He gathered a large amount of data about sea floor spreading.	<input type="checkbox"/>	<input type="checkbox"/>
He looked at fossils from different continents.	<input type="checkbox"/>	<input type="checkbox"/>
He wrote about convection currents in the Earth’s mantle.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

(d) Data about earthquakes and volcanoes gave evidence to support Wegener's ideas.

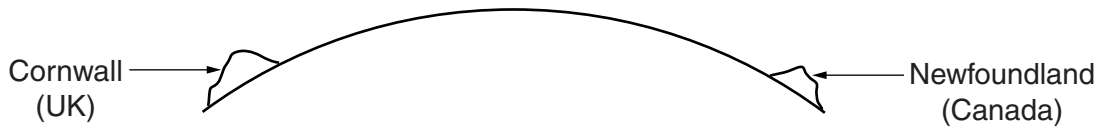
Explain why.

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

[Total: 7]

4 In 1901 Marconi was the first scientist to send a message across the Atlantic Ocean from the UK to Canada using a radio signal.

- (a) Explain how the signal travelled.
You may draw on the diagram to support your answer.



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

- (b) Modern communication uses both infra-red and microwave radiation for long distance communication.

Which of the statements about infra-red and microwave radiation are true and which are false?

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

	true	false
Infra-red radiation has a shorter wavelength than microwave radiation.	<input type="checkbox"/>	<input type="checkbox"/>
Communication using infra-red radiation depends on using satellites.	<input type="checkbox"/>	<input type="checkbox"/>
Optical fibres use pulses of infra-red radiation to communicate over long distances.	<input type="checkbox"/>	<input type="checkbox"/>
Rate of transfer of data for both types of communication is measured in bits per second.	<input type="checkbox"/>	<input type="checkbox"/>
Both types of radiation travel at 300 000 km/s in a vacuum.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

- (c) Give one advantage of transmitting data using optical fibres rather than microwave radiation.

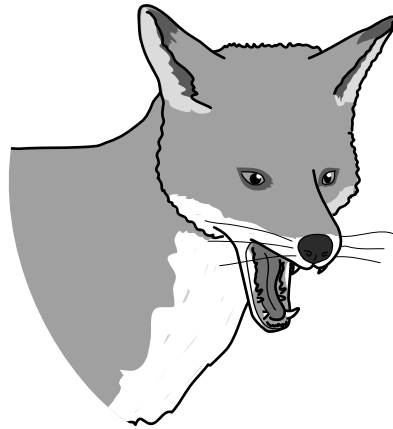
.....
..... [1]

[Total: 5]

Turn over

5 Read the information about a breeding experiment using wild foxes.

Adult foxes are too aggressive to make good pets, even if they are raised by people from birth. If foxes can be bred to be less aggressive, they could be sold as pets.



A group of scientists carried out an investigation into whether it was possible to breed out aggressive behaviour in wild foxes. They chose the calmest foxes from a population of wild foxes. After eight generations of selective breeding, the new foxes were gentle and calm enough to live with humans in the same way that dogs do.

When scientists compared the new foxes with wild foxes, they noticed that the foxes being born at the end of the experiment had much paler fur and shorter legs than their wild relatives. Wild foxes depend on their dark fur, long legs and aggression for survival. Some animal welfare groups do not agree that scientists should use wild foxes in selective breeding programmes.

- (a) Discuss the **advantages** and **disadvantages** of using selective breeding to breed pet foxes from wild foxes.



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

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

- (b) Wild foxes have evolved through **natural selection**. Explain how natural selection happens.

.....

.....

.....

..... [2]

- (c) Eve and Joe are scientists who work together to study the wild foxes. They talk about how they collect data.

I find out information about the foxes by collecting samples of faeces and fur from where the foxes live. I then test the DNA in the samples.



Eve

I put cameras in the holes where foxes live. The cameras record their behaviour which I later analyse.



Joe

- (i) Give **two** reasons why Eve and Joe should work together to study the foxes.

.....

.....

..... [2]

- (ii) Joe knows that other scientists are using cameras to study foxes in other areas of the country. He contacts them to offer to work together.

Explain how this is **different** to just working with Eve.

.....

.....

..... [2]

[Total: 12]

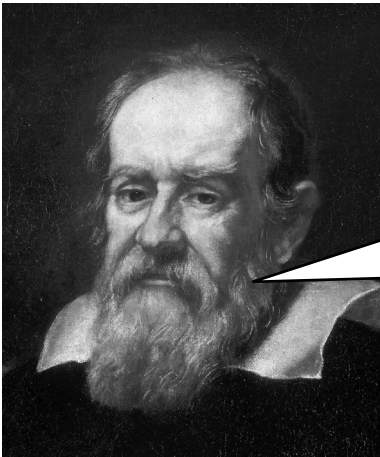
- 6 **Ptolemy** was an astronomer in ancient Greece.
These are his ideas about the Solar System.



I have spent many years watching the sky.

I think that the Earth is at the centre of the Universe.
The Moon, Sun and stars are all fixed to invisible
spheres that spin around the Earth.
There are wanderers in the sky that are not attached to
any spheres.

Galileo lived in the 16th century (about 2000 years later than Ptolemy)
He had different ideas.

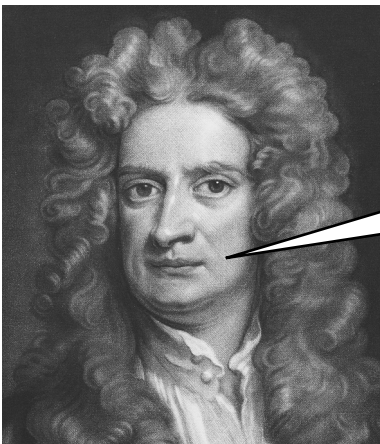


I have a telescope. It is one of the first telescopes in the
world.

The wanderers are planets. It isn't only Earth that has a
moon. Some of the other planets have moons
going around them.

I don't think that Ptolemy's ideas are right, but if the
planets are not attached to spheres, I do not
understand why they don't just fly off into space.

Newton lived just after Galileo.
He added to Galileo's ideas.



I think that large objects have a force, which I call gravity.
The force pulls large objects towards each other.

- (a) Galileo lived about 2000 years later than Ptolemy. Suggest reasons why ideas about the Solar System did not develop very much during that time.

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

- (b) Galileo and Newton did not agree with Ptolemy. They each had new ideas about how the objects in the Solar System move.

Explain how Galileo's and Newton's ideas improved our understanding of how objects in the Solar System move.



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

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

(c) Some friends are talking about the Universe.



Ali

The Universe obeys basic laws. I think that God put these laws in place before he created the Universe.



Bea

There may be another planet in another Solar System with conditions identical to Earth. A planet like that may have life similar to ours.



Carl

The development of new measuring techniques is not happening quickly enough to generate the data we need.



Di

Light from distant galaxies shows red shift. This is evidence for the expansion of the Universe.

(i) Who is making a statement that cannot be addressed using science?

..... [1]

(ii) Who is making a statement that we cannot evaluate using the equipment we have at the moment?

..... [1]

[Total: 10]

END OF QUESTION PAPER



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.