OCR
RECOGNISING ACHIEVEMENT

Tuesday 14 May 2013 – Morning

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02 How scientific ideas have developed

R038190613

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 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.

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Answer **all** the questions.

This question is based on the case study 'Cancer in children around Sutro Tower, San Francisco'.

1 **(a)** Look at the data in Table 1.

'A higher percentage of children living within 500 m of the mast developed cancer compared to the children in the control group.'

Use calculations to show that this statement is true.

[2]

(b) Before the study, the scientists discussed how to choose the control group of people to make sure that their test was fair.

(i) The scientists decided that they needed to choose a control group of people who did not live near the tower.

Explain why this was a good choice.

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

(ii) Some scientists suggested choosing a control group of people who lived 100 km away.

After discussion, the scientists chose a control group who lived between 4.8 km and 8 km away from the tower.

Explain why this is a better choice than a group that lived much further away.

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

(iii) Why is it a good idea that several scientists work together to choose a control group, instead of one scientist making the decision alone?

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

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(c) (i) Look at the original hypothesis for the study.

What evidence is there in the case study to support this hypothesis?

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

(ii) Look at the opinions in the article which **do not support** the hypothesis.

What further research is needed to make the hypothesis more secure?

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

(d) A newspaper uses Graph 2 in a story.

PROOF THAT RADIO MASTS CAUSE CANCER

Does the graph prove that radio masts cause cancer?

Explain your reasoning.

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

(e) The case study says that some types of radiation are **genotoxic** and may disrupt protein synthesis.

Explain why a 'genotoxic' substance may disrupt protein synthesis.

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

[Total: 15]

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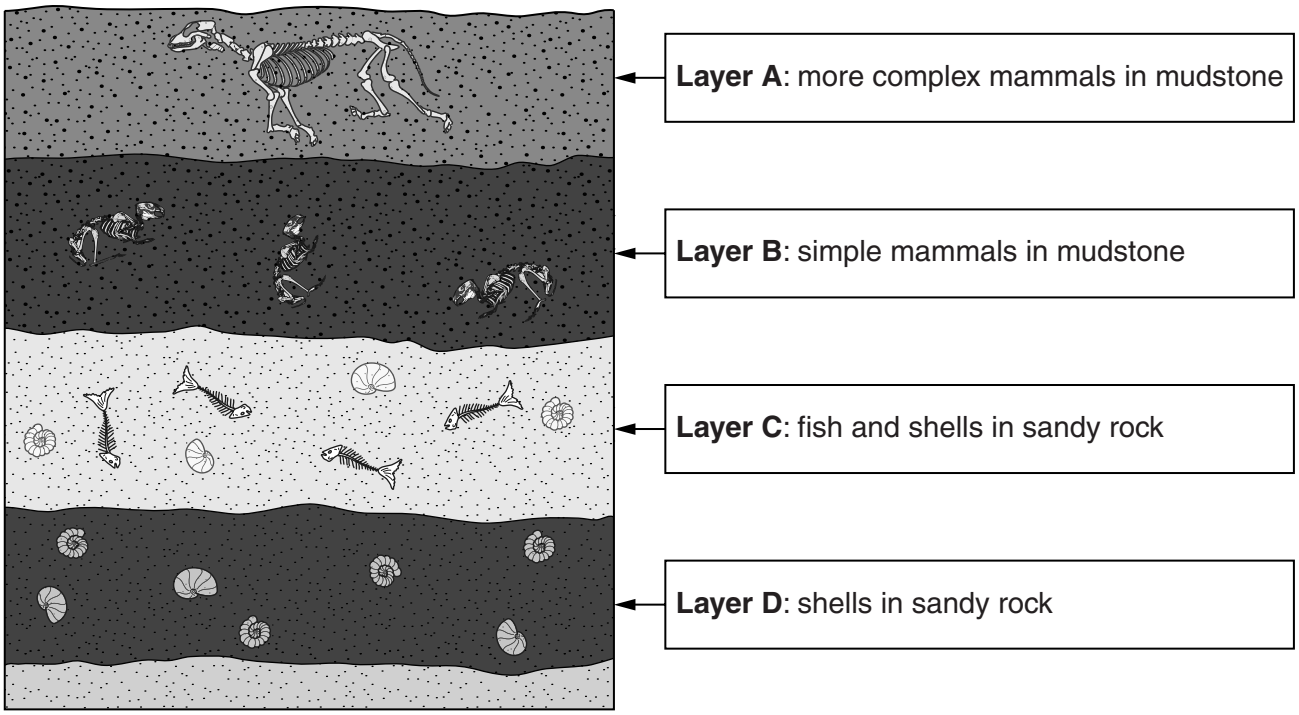
2 Scientists collect evidence from rock layers.



(a) Rock Layer **C** is 250 million years old.

Suggest the age of rock Layer **B**.

..... million years old **[1]**

(b) Darwin used fossils as evidence for his theory of evolution.

How do the fossils in these rock layers support Darwin's theory?

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

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(c) Other scientists used the rock layers as evidence of changing conditions over time.

What conclusions could be made from looking at these rock layers?

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

The area used to be under water.	☐
The area was flooded after a long time of dry land.	☐
There has always been a deep sea in the area.	☐
The area was a desert for a short time.	☐
The area had some dry land for millions of years.	☐

[2]

(d) Different scientists have put forward ideas about changes to the Earth.

Draw lines to connect each **scientist** with the **evidence** he collected and the **change to the Earth** he investigated.

Scientist	Evidence	Change to the Earth
Wegener	sudden changes in fossils in rock layers and marks of big stones being moved	Continental Drift
Lyell	carbon dioxide concentrations change over time	Ice Ages
Fourier	fossils in South America match fossils in Africa	changes to the Greenhouse Effect

[2]

[Total: 8]

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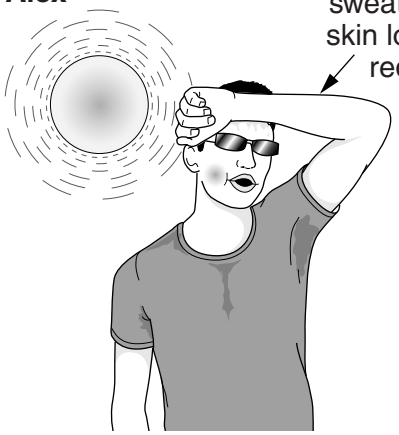
3 Alex goes on holiday to a very hot place. Ben goes on holiday to somewhere very cold.

Alex



outside temperature	40°C
skin temperature	39°C
core temperature	37°C

Ben

outside temperature	2°C
skin temperature	31°C
core temperature	37°C

(a) Temperature control in Alex and Ben uses a **negative feedback** system involving **receptors** and **effectors**.

Use ideas about negative feedback to explain what is happening to Alex and Ben.

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

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

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(b) Another control system in the body is involved in the control of glucose concentration in the blood.

Amir is a doctor. He uses a glucose monitor to test the glucose concentration in blood.

He tests the blood of a patient every half hour after the patient has eaten.

He repeats his test several times.

The table shows his results.

Time after eating in hours		**0.0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**
Glucose concentration in blood in mmol/l	**Test 1**	5.1	5.6	6.1	6.6	7.1	6.7	6.3	5.9	5.4
	Test 2	4.5	4.9	5.3	5.7	6.1	5.8	5.4	4.9	4.6
	Test 3	4.8	5.2	5.6	6.0	6.4	5.9	5.6	5.3	4.9

(i) Amir suggests some explanations for the results in the table above.

Explanation 1: Our bodies immediately release all of the glucose from a meal into our blood.

Explanation 2: Digestion takes time to convert food into glucose in our body.

Explanation 3: Our bodies use glucose from our blood for energy.

Explanation 4: Eating keeps the level of glucose in our blood constant.

Explanation 5: The glucose concentration falls from when we eat until we eat again.

Which **two** explanations give the best fit for the results in the table?

Explain your reasons.

Explanations ..... and .....

Reasons .....

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

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(ii) Amir thinks that the data from the tests is of good quality because it is reliable.

Why does he think this?

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

The results for all of the tests show a similar pattern.	☐
All of the measurements are to one decimal place.	☐
He took all of the measurements carefully.	☐
The values do not change very much over time.	☐

[1]

(c) To make the tests fair, Amir told the patient that he was **not** allowed to …

- eat snacks
- exercise.

Explain why it was important that the patient **did not** eat snacks or exercise during the tests.

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

(d) Glucose concentration in the blood and body temperature are controlled by different systems in the body.

Draw straight lines to link the correct **control system** for glucose concentration in the blood and body temperature.

	Control System
	reproductive system
glucose concentration in blood	endocrine system
body temperature	binomial system
	nervous system

[2]

[Total: 15]

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4 Scientists have studied the movement of moons, planets and stars for thousands of years.

(a) The ancient Greeks believed that the planets moved in orbits.

In the sixteenth century, Galileo put forward new ideas about the orbits of the planets.

How were Galileo's ideas different to the ideas of the ancient Greeks?

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

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

(b) Isaac Newton agreed with Galileo.

Newton proposed an explanation for the movement of the planets.

How did Newton explain the movement of planets?

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

The planets travel across the Universe in regular patterns.	☐
The movement of the planets follow mathematical laws of motion.	☐
The planets are kept in orbit by gravity.	☐
Cosmic radiation causes planets to travel in circular paths.	☐
All planets follow an identical path through the night sky.	☐

[2]

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(c) In the last century, scientists put forward theories that the Universe started with the Big Bang and that the Universe is still expanding.

Which statements give evidence for this theory?

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

'Red shift' means that light from stars appears more red than expected. ☐

Tectonic plates move apart every year. ☐

Background radiation shows that the Universe is still cooling. ☐

The diameter of the Earth is expanding. ☐

The temperature of the atmosphere of the Earth may be increasing. ☐ **[2]**

(d) Telescopes that observe objects in the Universe rely on different types of electromagnetic waves.

Visible light, microwaves and infra-red waves are all collected and processed by telescopes.

Which of the following statements are true for all three types of radiation, and which are true for one type of radiation?

Put a tick (✓) in one box in each row.

Statement	True for all three (✓)	True for visible light only (✓)	True for microwaves only (✓)	True for infra-red only (✓)
travels at 300 000 km/s				
used to transmit calls to mobile phones				
used to transmit data via optical fibre				
has the shortest wavelength				

[3]

[Total: 10]

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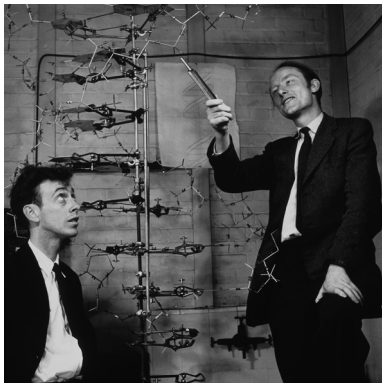
5 In 1953, Watson and Crick published ideas about the structure of DNA.



Watson and Crick

The information shows a timeline for some stages in the development of ideas about DNA.

Peer review comments for some of the ideas are also shown.

Development of ideas	Peer review comments
1951 Franklin gives a lecture showing her X-ray crystallography photographs of DNA.	Scientists believed that the photographs could help work out the structure of DNA.
1953 Watson and Crick publish their first ideas that DNA … • is a triple chain helix of sugar and phosphate • has bases on the outside • is held together by magnesium atoms.	Scientists rejected the model because the magnesium atoms could not hold the structure together. Scientists agreed that DNA was made of sugar, phosphate and four bases.
1953 Linus Pauling publishes his ideas that DNA … • is a triple chain helix of sugar and phosphate • has phosphate groups with hydrogens on them • has bases on the outside.	X-ray crystallography showed that the bases should be on the inside and other scientists pointed out that the hydrogen atoms were wrong.
Later in 1953 Watson and Crick published new ideas that DNA … • is a double helix of sugar and phosphate • has bases on the inside, holding the structure together.	Scientists accepted the new model because it explained how DNA could copy itself by splitting down the middle.

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(a) Explain how the **peer review comments** influenced the development of ideas about the structure of DNA.

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

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

(b) Two separate teams of scientists each worked out the structure of DNA at a similar time.

(i) Watson and Crick published their ideas very quickly.

Suggest reasons why some scientists want to publish their ideas very quickly.

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

(ii) Franklin worked out the structure of DNA at about the same time as Watson and Crick.

She took much longer to publish her ideas.

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

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

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(c) One of the features of the structure of DNA is how the four bases fit together.

Describe how the bases fit together.

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

(d) William Bragg developed the technique of X-ray crystallography in 1912.

Explain why this was important to the development of ideas about DNA.

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

[Total: 12]

END OF QUESTION PAPER

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