OCR
RECOGNISING ACHIEVEMENT

Wednesday 8 January 2014 – 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 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 **20** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

Answer **all** the questions.

This question is based on the case study 'Insulin as a treatment for diabetes'.

1 (a) Look at Figure 1.

Describe the changes in blood glucose concentration during the day for the group **without** diabetes.

....

....

.... **[2]**

(b) Explain why the blood glucose concentration of the group **with** diabetes drops before 12:00.

....

....

.... **[2]**

(c) Look at Figure 1.

Suggest why the graph shows the average of each group of people and not individuals.

....

....

.... **[2]**

(d) A group of friends look at Figure 2.

They each make a statement about the information in the table.

Joanna
Below the age of 34, 3.9% of the population have diabetes.

Ayo
The risk of diabetes increases with age for men and women.

Sean
Below the age of 16, no-one has diabetes.

Barbara
Men always have a higher risk of diabetes than women of the same age.

Corey
Old people never get diabetes.

Roshanee
More than 10% of people over 65 have diabetes.
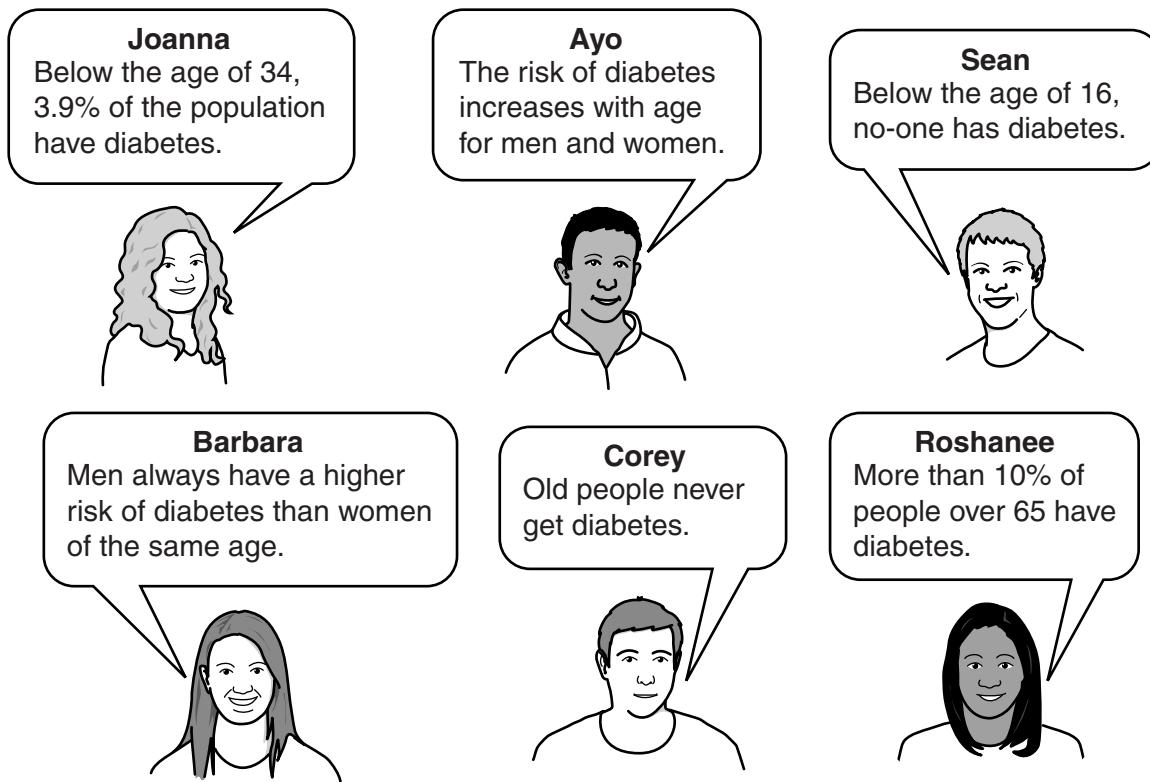
Which **two** people have made a correct statement?

answer .... and .... **[2]**

(e) (i) The gene which codes for insulin is a short length of DNA in a chromosome.
DNA is a double helix held together by pairs of bases.
These bases can be represented as A, C, G and T.

A part of one chain is shown below.

G	T	C	C	A	G

Fill in the letters for the bases in the matching chain. **[1]**

(ii) A set of three base pairs in the DNA chain is the code for one amino acid in the protein.

How many base pairs are needed to code for a whole insulin molecule?
Show how you worked out your answer.

.... **[2]**

(iii) Suggest why it is easier to modify the genes in a bacterium instead of changing the genes in a human being.

....

....

.... **[2]**

(f) Why did Banting and Best use bovine insulin and not human insulin?

....

....

.... **[2]**

[**Total: 15**]

2 Around 100 years ago, Wegener produced a map of a large ancient land mass, which he called Pangea.
Here is a part of a map of Pangea, showing several of the modern continents.
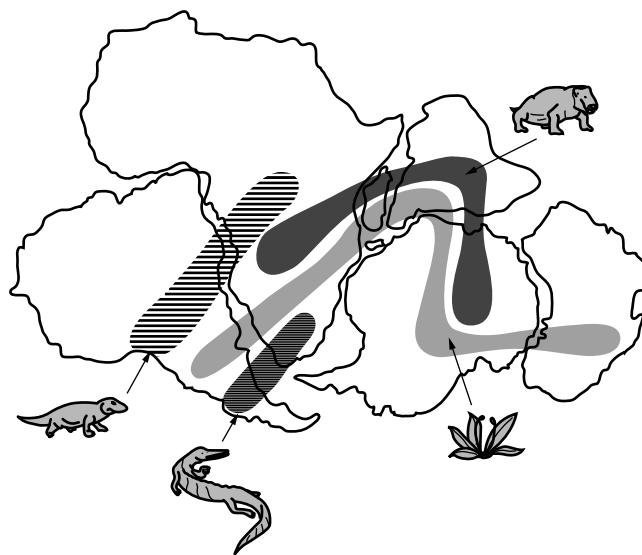
(a) Wegener used the shaded regions on the map to put forward a theory about continents.

   (i) What was his theory?

   .... **[1]**

   (ii) How did Wegener use evidence from fossils to support his theory?

   ....

   .... **[1]**

(b) In 1944, Arthur Holmes published a book which mentioned convection currents.
Explore how this supported Wegener's theory.

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

   ....

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   ....

   .... **[4]**

[Total: 6]

Turn over

3 Paul looks at the features of some different types of animals.
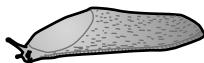
slug   **frog**   **mouse**
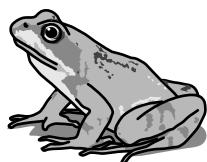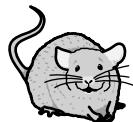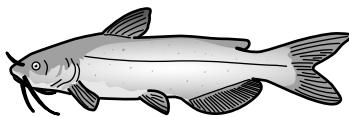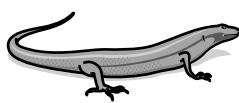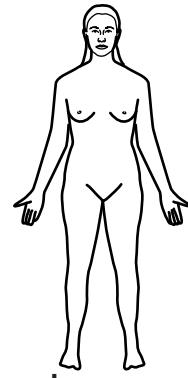
catfish   **lizard**   **human**

He records his results in a table.

Animal	Mouth	Backbone	Legs	Hair	Stands upright
slug	✓				
frog	✓	✓	✓		
mouse	✓	✓	✓	✓	
catfish	✓	✓			
lizard	✓	✓	✓		
human	✓	✓	✓	✓	✓

(a) Which animal is most likely to have evolved first?

Explain your reasoning.

animal ....

reason ....

.... **[2]**

(b) Paul uses the information in the table to produce a cladistics diagram.
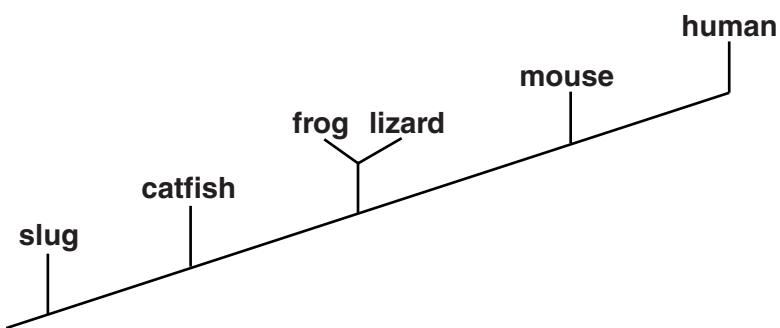
Explain how Paul used the information about each animal to decide its position in the diagram.

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

....

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.... **[6]**

(c) The science of cladistics uses information about the similarities between the genes of different animals.

Why has this science developed very quickly in the last 25 years?

Put ticks (✓) in the boxes next to each correct answer.

Scientists have only recently become interested in similarities between animals. ☐

Techniques to analyse DNA were developed in the late 1980s. ☐

Computer technology has improved to help analyse large amounts of data. ☐

Scientists started to share their work 25 years ago. ☐

Television programmes have made more people aware of cladistics. ☐

[2]

[Total: 10]

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Question 4 begins on page 10

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Turn over

4 Ken is a lorry driver.
Eve is a scientist. She does research about the reaction times of drivers who have been driving for several hours.

Ken takes part in Eve's research.
Ken uses a computer simulation to drive for several hours.

He tests his reaction time every 30 minutes.

He repeats the experiment on three different days.

The table shows the results.

Time spent driving in minutes	Day 1 reaction time in milliseconds	Day 2 reaction time in milliseconds	Day 3 reaction time in milliseconds
0	320	225	224
30	270	222	221
60	219	260	225
90	265	271	226
120	278	291	234
150	299	308	237
180	350	344	240

(a) Calculate the difference between the slowest and the fastest reaction time on Day 1.

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

(b) Ken and Eve discuss their ideas about the results.

I think the results show that my reaction time is affected when I am more tired.

Ken

I think there is a problem with the study. I think your reaction times are affected by how much practice you have had during the test.

Eve

How does the evidence in the table support Ken and Eve's ideas?

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

....

....

....

....

....

....

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....

....

.... **[6]**

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(c) Ken did a test on day 4.
He sucked a peppermint sweet during the study. His reaction time was shorter after he had done this.

I am sorry, I have spoiled the experiment. You will not be able to use the data.

Ken

Don't worry. This result was unexpected but I can use this result to help my research.

Eve
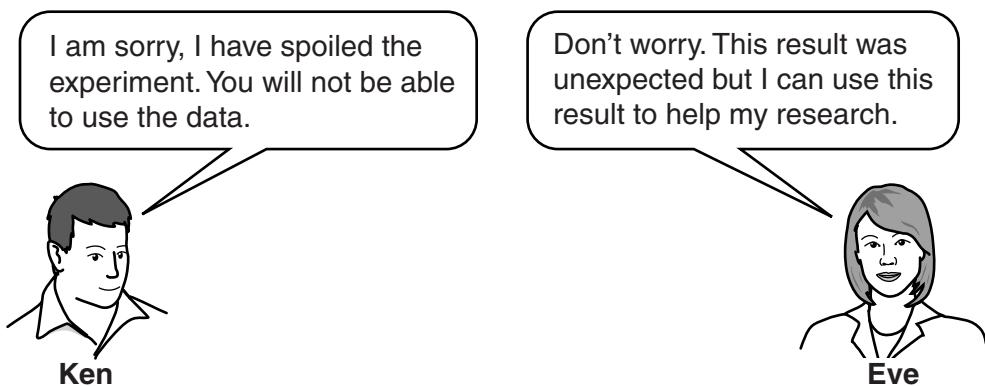
How could this unexpected result help Eve's future work?

....

....

.... **[1]**

(d) Ken tests his reaction times using a computer.
He presses a button as soon as he sees a light on the screen.
The diagram shows what happens in Ken's nervous system when he does the reaction times test.

Complete the diagram below by filling in the missing labels.
Choose words from this list.

motor neurone

sensory neurone

endocrine system

central nervous system (CNS)

hormone

Receptors in Ken's eye see the light on the screen.

An impulse travels through a

....

....

The impulse travels to the

....

....
(spinal cord and brain).

An impulse travels through a

....

....

Effectors in Ken's hand cause him to press a button.
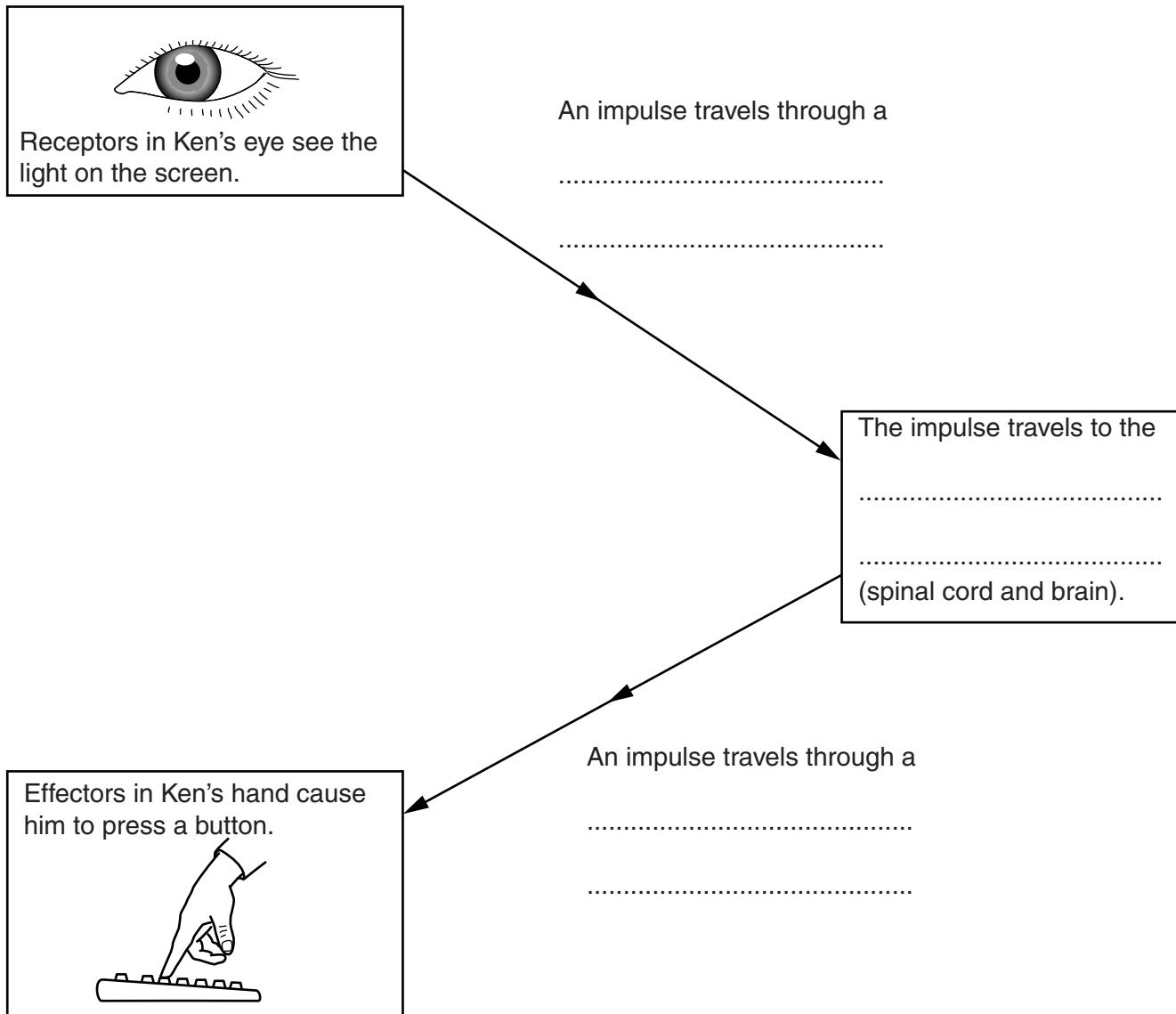
[2]

(e) Ken talks about his reaction times.

> I believe I have lived more than one life. I think my reaction times now are similar to my reaction times in a previous life.

Ken

Explain why this idea can **not** be investigated using science.

....

....

.... **[2]**

[Total: 12]

5 The diagram shows a wave form, representing an electromagnetic radiation.

displacement

distance
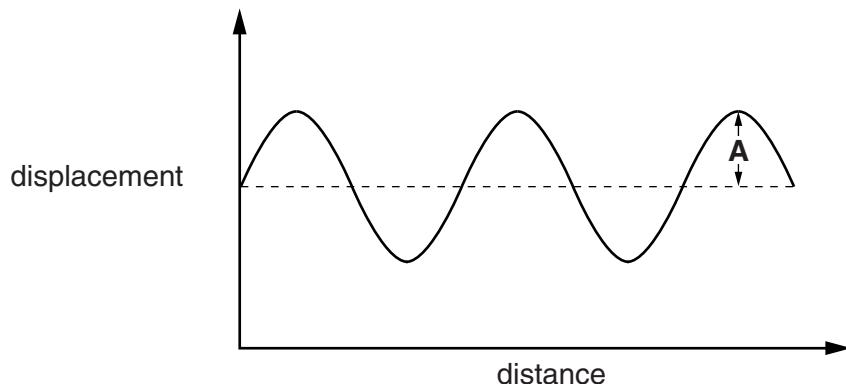
(a) (i) The arrow labelled **A** shows the amplitude of the wave.

Draw another arrow to show the wavelength of the wave. **[1]**

(ii) Which type of radiation in the electromagnetic spectrum has the longest wavelength?

.... **[1]**

(b) Maxwell could not measure the speed of light or other radiation. He thought that all radiation, including light, would travel at the same speed.

(i) Why could Maxwell not measure the speed at which radiation travels?

....

.... **[1]**

(ii) What is the speed of electromagnetic radiation?

.... **[1]**

(c) (i) Most scientists believed that radio waves would travel in straight lines like light. For messages to get to ships in mid-ocean, the radio waves had to go 'over the horizon'. Most scientists thought this was impossible, until a message was sent from Europe to North America in 1902.

Explain how a radio wave could go 'over the horizon' in 1902.

....

.... **[2]**

(ii) Who invented the digital code that Marconi used to send words by radio?

.... **[1]**

[Total: 7]

Turn over

6 In the early 1900s, scientists thought that our galaxy (the Milky Way) filled most of the Universe.

In 1924, Edwin Hubble published his ideas that the Universe contained many galaxies. He could tell that galaxies were not just stars because some galaxies had a spiral shape.

Hubble made his observations with a new telescope called the Hooker Telescope. At the time it was the biggest telescope in the world.

Edwin Hubble
and the Hooker
Telescope
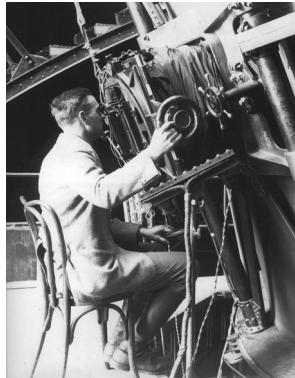
Spiral galaxy
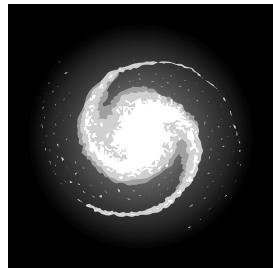
Hubble published his ideas in the New York Times newspaper. He also presented his data and ideas to other scientists at a scientific conference.

(a) Hubble made his observations using the Hooker Telescope.
Explain why the invention of this telescope was so important to Hubble's work.

....

....

.... **[2]**

(b) Explain why it is important that Hubble both published his work in a newspaper and presented his work at a scientific conference.

....

....

.... **[2]**

(c) Hubble developed the idea that the universe is expanding.

What evidence did he use to support this idea?

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

microwave background radiation ☐

movement patterns of wandering planets ☐

red shift ☐

the law of gravity ☐

[1]

[Total: 5]

7 Lamarck and Darwin both developed theories about evolution.

They both used their theories to explain why giraffes have long necks.
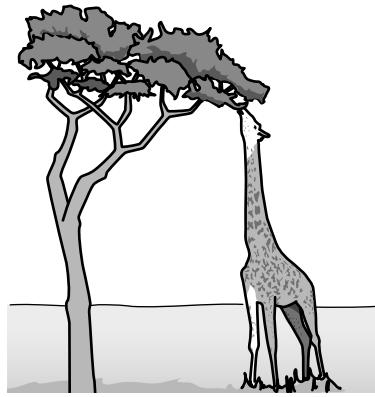
(a) Look at each statement about evolution.

Put a tick (✓) in one box in each row to show whether each statement only comes from **Lamarck's theory**, only comes from **Darwin's theory** or is included in **both**.

Statement	Only from Lamarck's theory	Only from Darwin's theory	From both theories
Giraffe necks became longer over time.			
A giraffe's neck becomes longer during its life because it stretches up to reach high leaves.			
Offspring inherit longer necks from parents.			
Giraffes with shorter necks are less likely to breed and so they die out.			

[2]

(b) Greyhounds are dogs that are bred for speed.

Ann is a greyhound breeder.
Ann thinks that greyhounds with longer necks run faster.

Selective breeding can be used to breed greyhounds with longer necks.
Describe this process.

....

....

....

.... **[3]**

[Total: 5]

END OF QUESTION PAPER

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