

**Wednesday 8 January 2014 – Morning**

**LEVEL 1 CAMBRIDGE NATIONAL IN SCIENCE**

**R072/01** How scientific ideas have developed

Candidates answer on the Question Paper.  
A calculator may be used for this paper.

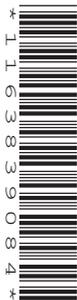
**OCR supplied materials:**

- Insert (R072/01/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. 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 **24** pages. Any blank pages are indicated.

Answer **all** the questions.

**This question is based on the case study ‘Insulin as a treatment for diabetes’.**

1 (a) Look at Figure 1.

What was the average blood glucose concentration for people with diabetes at 10:00?

.....mmol/l [1]

(b) Look at the statements below.

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

	True	False
Immediately after a meal, blood glucose concentration usually increases.		
None of the people with diabetes ever had a level higher than 15 mmol/l.		
Two hours after a meal, the blood glucose concentration is always below 4 mmol/l.		
People with diabetes will become unconscious after a meal.		
Blood glucose concentration for the group with diabetes is always higher than for the group without diabetes.		

[2]

(c) Look at Figure 1.

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

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

(d) Banting and Best injected their dog with a ‘pancreatic extract’.

Suggest what they expected to happen to the dog.

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

(e) (i) Banting and Best repeated their experiment with several more dogs with diabetes.

Put a tick (✓) in the box next to the best explanation of why they repeated their experiment.

They had lots of dogs with diabetes.

They had not found out about bovine insulin.

They needed more evidence to be confident.

They needed to make sure it was a fair test.

[1]

(ii) Banting and Best published their results.

Put a tick (✓) in the box next to the best explanation of why they published their results.

So all patients with diabetes would be cured.

So other scientists could confirm their results.

So they would get paid for their work.

So everyone would know what they had done.

[1]

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

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

<p><b>Joanna</b> Below the age of 34, 3.9% of the population have diabetes.</p> 	<p><b>Ayo</b> The risk of diabetes increases with age for men and women.</p> 	<p><b>Sean</b> Below the age of 16, no-one has diabetes.</p> 
<p><b>Barbara</b> Men always have a higher risk of diabetes than women of the same age.</p> 	<p><b>Corey</b> Old people never get diabetes.</p> 	<p><b>Roshanee</b> More than 10% of people over 65 have diabetes.</p> 

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

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

(g) The gene that 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.

Put **rings** around the **two** pairs of bases which bond together.

A-C      A-G      A-T      C-G      C-T      G-T

[2]

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

.....

.....

..... [2]

[Total: 15]

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**Question 2 begins on page 6**

**PLEASE DO NOT WRITE ON THIS PAGE**



(iii) At first, scientists did not agree with Wegener's theories.

Suggest an argument that was used against Wegener's theories.

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

(b) In 1944, Arthur Holmes published a book which supported Wegener's theories.  
How did Holmes suggest that a continent could move?

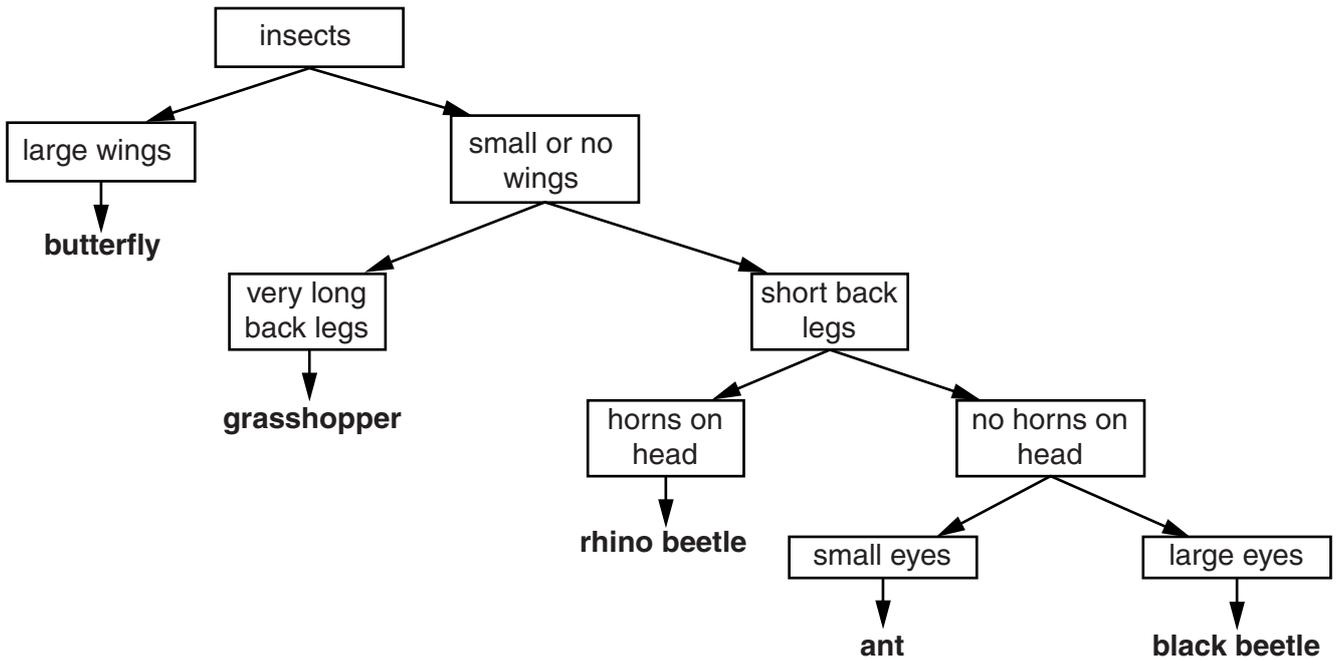
Put a tick (✓) in the box next to the correct answer.

- as a result of an earthquake in another continent
- as a result of a tsunami in the ocean
- as a result of a convection current in the mantle
- as a result of a hurricane in the atmosphere
- as a result of a forest fire on that continent

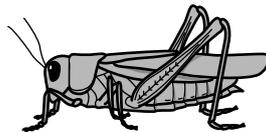
[1]

[Total: 8]

3 Joe is a scientist. He is interested in insects. He collects some insects and makes a classification key to identify them.



(a) Joe's friend Jack finds this insect.



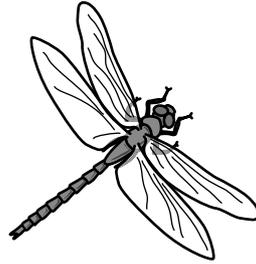
It has small wings and very long back legs.

What is the name of this insect?  
Use the key to help you.

answer ..... [1]



- (c) Joe finds an insect. The insect has big wings, but Joe does not think it is a butterfly. Joe thinks he may have found a new species of insect.



Joe publishes a photograph of the new insect in a scientific journal.

Why does he do this?

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

Another scientist might already know the identity of the new insect.

The picture of the new insect can be copied into public newspapers.

Another scientist might support Joe by finding other examples of the new insect.

Joe wants to warn other scientists not to do any work on the new insect.

If people know about the new insect it might save it from becoming extinct.

[2]

[Total: 9]

- 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.

The table shows his results.

Time spent driving in minutes	Experiment 1 reaction time in milliseconds
0	219
30	221
60	225
90	226
120	234
150	237
180	240

- (a) Calculate the change in Ken's reaction time during the test.

..... milliseconds [1]

(b) Eve asks Ken to repeat the experiment several times.

In Experiment 2 he eats a peppermint sweet while he is driving.

In Experiment 3 after each hour of driving he has a five minute break.

In Experiment 4 after each hour of driving he has a five minute break and a cup of coffee.

The table shows the results.

<b>Time spent driving in minutes</b>	<b>Experiment 1 reaction time in milliseconds</b>	<b>Experiment 2 reaction time in milliseconds</b>	<b>Experiment 3 reaction time in milliseconds</b>	<b>Experiment 4 reaction time in milliseconds</b>
<b>0</b>	219	217	220	217
<b>30</b>	221	221	224	220
<b>60</b>	225	227	226	227
	no break	no break eats a peppermint sweet	5 minute break	5 minute break drinking a cup of coffee
<b>90</b>	226	222	219	217
<b>120</b>	234	228	228	224
	no break	no break eats a peppermint sweet	5 minute break	5 minute break drinking a cup of coffee
<b>150</b>	237	223	224	218
<b>180</b>	240	230	229	224



(c) Ken does another experiment.

This time his reaction times are unusually fast.

He talks about the results with Eve.

I am sorry, I have spoiled the experiment. I opened a window and the room was much colder than usual.



Ken

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



Eve

How can Eve use this unexpected result to help her?

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

Eve can do more experiments to find out if opening a window makes reaction times faster.

Eve knows it is important to control the temperature of the room in future experiments.

Eve should throw away any data that was collected when the window was open.

Eve can make sure that the window is locked during all future experiments.

Eve has proved that opening a window always makes reaction times faster.

[2]

(d) 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.

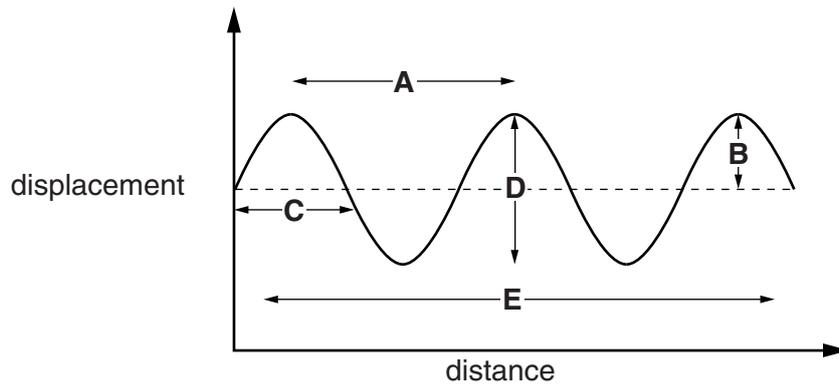
.....

.....

..... [2]

[Total: 11]

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



(a) (i) Which letter **A**, **B**, **C**, **D** or **E** shows the wavelength of the wave?

..... [1]

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

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

- Infra-red
- Microwaves
- Radio waves
- Visible light

[1]

(b) Many people contributed to the development of radio communications.

Draw **four** lines to link the name of the **person** with their **contribution**.

person	contribution
Hertz	suggested light was an electromagnetic wave
Marconi	first to send and receive radio waves
Maxwell	first to send radio waves beyond the horizon
Morse	invented a digital code to send words by radio

[2]

(c) 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 light?

Put a **ring** around the correct answer.

**0.3 km/s**

**30 km/s**

**3000 km/s**

**300 000 km/s**

[1]

(d) 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.

Which of these can explain how the message could be received 'over the horizon' in 1902?

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

Radio waves are bent by gravity.

The aerial was many kilometres up in the sky.

The radio waves were refracted by the ionosphere.

The radio waves had spread out to a large area.

[1]

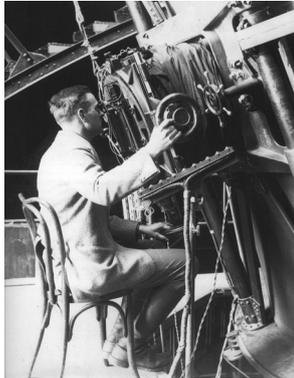
[Total: 7]

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

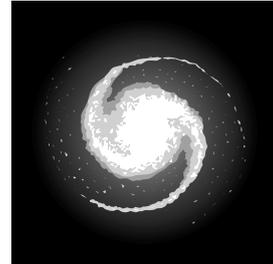
In 1924, Edwin Hubble published his ideas that the Universe contained many galaxies. He could tell that galaxies were not just stars because some galaxies had a spiral shape.

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



(a) Why was Hubble the first scientist to do research into many different galaxies?

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

- Scientists were not interested in studying astronomy before Hubble.
- The Hooker Telescope was more powerful than previous telescopes.
- Earlier scientists could not see that galaxies and stars have different shapes.
- The Milky Way was the only galaxy that existed before 1900.
- People thought that there were too many different galaxies to study.


[2]

(b) Hubble published his findings in a newspaper. He also made a presentation to a group of other scientists.

(i) Give **one** advantage of publishing scientific information in a newspaper.

.....

..... [1]

(ii) Why is it important that Hubble presented his results to other scientists?

.....

..... [1]

- (c) Hubble did further research into galaxies.  
What did he find out?

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

The Universe is shrinking as galaxies contract.

The Milky Way is the only galaxy that has any gravity.

All of the galaxies move in orbits around our Sun.

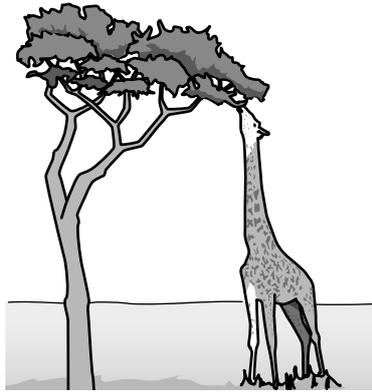
Most galaxies are moving away from each other.

[1]

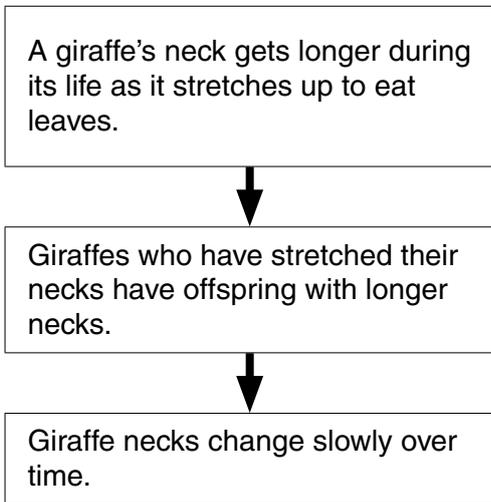
[Total: 5]

7 Lamarck and Darwin both developed theories about evolution.

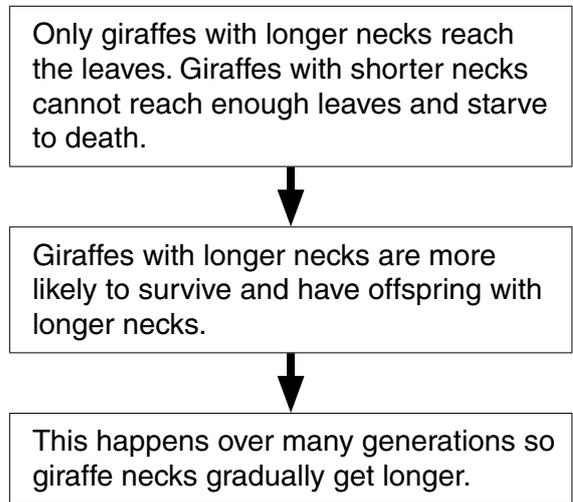
They both used their theories to explain why giraffes have long necks.



**Lamarck's theory**



**Darwin's theory**



(a) Look at Lamarck's and Darwin's theories of evolution.

(i) Give one similarity and one difference between the two theories.

similarity .....

.....

difference .....

.....

[2]

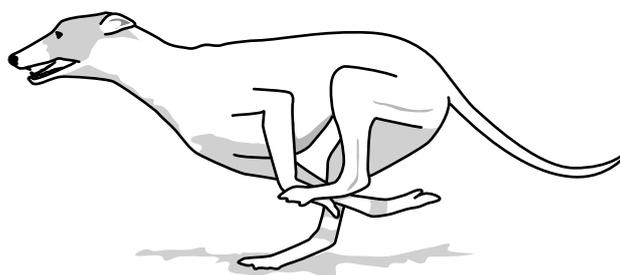
(ii) What is Darwin's theory called?

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

- |                   |                          |
|-------------------|--------------------------|
| homeostasis       | <input type="checkbox"/> |
| classification    | <input type="checkbox"/> |
| fossil record     | <input type="checkbox"/> |
| natural selection | <input type="checkbox"/> |

[1]

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



Selective breeding is used to produce faster greyhounds.  
Here are four statements about selective breeding.

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

	True	False
The fastest dogs are used for breeding.	<input type="checkbox"/>	<input type="checkbox"/>
Offspring bred from fast dogs are always faster than their parents.	<input type="checkbox"/>	<input type="checkbox"/>
Breeders make slower dogs run a lot of races so they are more likely to have fast offspring.	<input type="checkbox"/>	<input type="checkbox"/>
A fast dog can be born from slower parents.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

[Total: 5]

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