

**Level 1/2 Cambridge National Certificate in  
 SCIENCE**

**R072/01**

**R072: How scientific ideas have developed (Level 1)**

Candidates answer on the question paper

**OCR Supplied Materials:**

- Case study (inserted)

**Other Materials Required:**

- Pencil, ruler
- Calculator

**Duration: 1 hour**

Candidate Forename		Candidate Surname	
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Centre Number							Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** questions.

**This question is based on the case study 'Sweet foods, obesity and diabetes'.**

- 1 (a) (i) Until the 1920s, the only way of treating someone with diabetes was to control the amount of sugar in their diet. Describe the alternative modern treatment for diabetes.

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[2]

- (ii) In 1921, Banting began his research into diabetes. The university he worked at would only provide limited equipment and resources.

Explain why the university provided better resources after Banting completed his first experiment.

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.....

[2]

- (b) Look at the graph '**relative risk for Type 2 diabetes in women aged 30-55**'.  
How does the relative risk resulting from a BMI of 34 compare with a BMI of 30?

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.....  
.....  
.....

[2]

(c) Frances worries about her risk of contracting diabetes.

By calculating her BMI from the data below, assess her risk. Show your working.

age = 42 years

mass = 84 kg

height = 1.6 m

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[3]

(d) (i) Why is fructose used as an alternative to sucrose in diet foods?

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[2]

(ii) The case study describes a study of rats carried out by one group of researchers.

Their conclusion was 'fructose may make you think that you are hungry even when you do not need to eat'.

This statement is not a valid conclusion from the experiment carried out by the researchers.

Give a reason why it is **not** valid.


.....  
.....

[1]

(e) The Food Standards Agency has set an Acceptable Daily Intake (ADI) for aspartame.

Michael has sugar-free drinks containing aspartame.

How can he use the ADI to decide how many drinks he can safely consume each day?

 One mark will be for a clear, ordered answer.

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[3]

2 A group of students is discussing global warming.

**Andrew**  
The amount of carbon dioxide in the atmosphere has decreased in the past 200 years.

**Gemma**  
There will be more flooding in the future.

**Kate**  
We can grow crops in this country that wouldn't grow here 50 years ago.

**Tom**  
Burning down forests increases the amount of carbon dioxide in the atmosphere.

**Mike**  
How can there be global warming? My dad told me that 1976 was the hottest summer he remembers.

(a) Which **one** person has definitely got their facts wrong?  
answer ..... [1]

(b) Which **two** people are talking about possible consequences of global warming?  
answer ..... and ..... [2]

(c) Which **one** person has identified a correlation?  
answer ..... [1]

(d) Why should **Mike** get more evidence before making up his mind?

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

- His dad is wrong.
- There may have been hotter summers before his dad was born.
- You cannot make conclusions based on a single case.
- Some scientists say that global warming is definitely happening.

[1]

3 This question is about the movement of the Earth's continents.

In 1912, Alfred Wegener suggested that the position of the continents had changed over millions of years.

(a) Put a tick (✓) in the box next to each statement which supports this idea.

Africa and South America are on different sides of the Atlantic Ocean.

Africa and South America have shapes which seem to fit together.

Fossils are found in sedimentary rocks.

Fossils of similar animals have been found in Africa and South America.

[2]

(b) Other geologists did not accept Wegener's theory at the time.

Wegener's ideas have now been accepted.

Explain why geologists in Wegener's time thought differently to geologists today..

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.....

[3]

**4** Giraffes feed on tree leaves.

Giraffes have evolved from ancestors which had shorter necks.

Scientists have proposed two explanations of how this may have happened.

**Explanation A**

- when there was little food, giraffes with longer necks survived
- they passed on their genes
- over many generations, the neck length of giraffes increased

**Explanation B**

- male giraffes with longer necks are preferred as mates by female giraffes
- they passed on their genes
- over many generations, the neck length of giraffes increased

**(a)** Choose the best word from the list to complete the sentences.

**deductions**

**evidence**

**imagination**

**predictions**

**(i)** To think of their explanations, scientists need ..... **[1]**

**(ii)** Both explanations can be tested because they allow you to make  
..... **[1]**

**(iii)** Explanation B is becoming more widely accepted because it is supported by better  
..... **[1]**

- (b) Explanations A and B both use the idea of natural selection to explain the evolution of long necks in giraffes. Here is another explanation which uses another idea.

**Explanation C**

- giraffes who continually reached up to feed on leaves from tall trees developed long necks in their lifetime
- this characteristic was passed on to their offspring
- over many generations, the neck length of giraffes increased

Complete the sentences about the three explanations.

**Darwin**

**Lamarck**

**Linnaeus**

**Mendel**

Explanation C is based on a theory developed by .....

Both explanations A and B are based on a theory developed by .....

**[2]**

5 Selina is running in a marathon.



(a) During the race Selina gets hot.  
The sentences **A**, **B**, **C**, **D**, **E** and **F** describe how her body cools down.  
They are in the wrong order.

- A** The sweat evaporates from her body.
- B** Her brain stimulates her sweat glands.
- C** Her muscles are respiring and producing heat.
- D** The sweat glands produce more sweat.
- E** The sweat carries heat away from her body.
- F** Her brain detects an increase in body temperature.

Put the letters **A**, **B**, **C**, **D**, **E** and **F** in the boxes in the correct order.  
The first one has been done for you.

<b>C</b>						
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[4]



**(b)** Complete the sentence.

Choose from the list of words.

**a receptor      a processor      an effector**

A sweat gland is an example of .....

[1]

**(c)** Selina takes a drink of water while she is running.

Why does Selina need to drink?

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

To keep her body warm.

To replace the water lost by sweating.

To help her muscles contract efficiently.

[1]

**(d)** Complete the sentence.

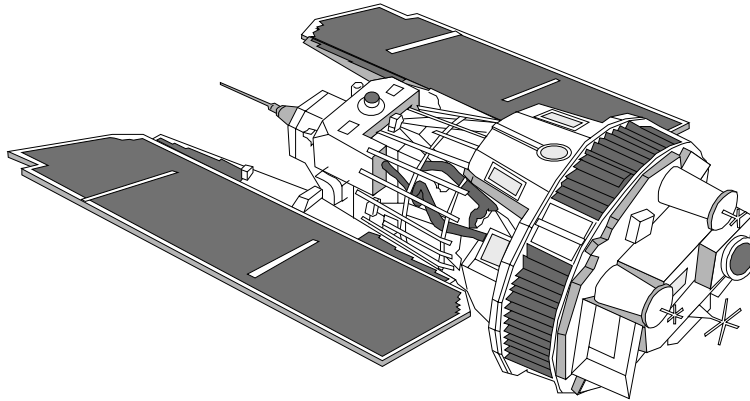
Choose a word from the list.

**negative      neutral      passive      positive**

Control of the temperature of Selina's body is an example of a.....  
feedback system.

[1]

6 Albert is an astronomer.



He uses a new type of telescope in orbit around the Earth.

It can make images of stars using infra-red radiation.

(a) What is the advantage of using the new type of telescope to study a star?

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

The image will be in a different colour.

New data can be collected about the star.

Telescopes using infra-red radiation are cheaper than those using visible light.

The image of the star will be the same as when using the visible part of the spectrum.

[1]

**(b)** Albert does not work on his own. He is part of a large team of astronomers.  
Explain why astronomers often work in teams.

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

**(c)** Albert and his team make a new discovery about some stars.  
They decide to share this discovery with other scientists.

**(i)** They submit a paper for publication in a scientific journal.  
Here are the stages **A**, **B**, **C** and **D** in getting their ideas published.

- A** The paper is published in the journal.
- B** Albert alters his paper in the light of the reports.
- C** They report on Albert's findings and conclusions.
- D** The editor of the journal sends the paper to some other scientists.

Fill in the boxes to show the correct order of the stages.

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first last

[2]

- (ii) Here are some reasons why Albert and his team publish their paper in a scientific journal.

Put ticks (✓) in the boxes next to **two** good reasons.

So that they can continue studying the same stars.

So that they can move on to studying different stars.

So that other scientists can check their observations.

So that other scientists can offer different conclusions.

So that they can ask for a telescope using ultraviolet radiation.

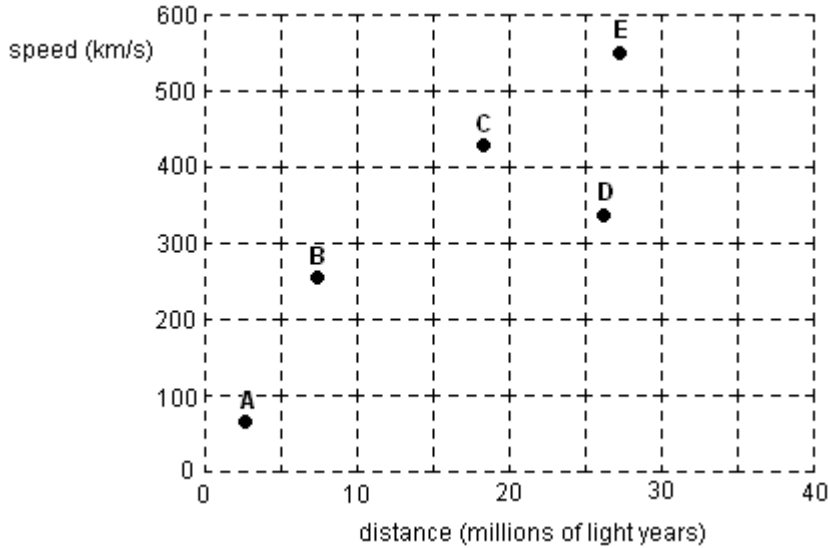
[2]

7 Suzy is an astronomy student. She investigates the motion of five different galaxies.

For each galaxy, she measures:

- how fast it is moving away from Earth
- how far away it is from Earth

Here are her results.



(a) What **overall** conclusion can Suzy make from this graph?

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

(b) Suzy made each pair of measurements in a single night.  
 Which pair is least likely to be accurate? Give a reason for your answer.

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

(c) Here are some possible explanations for Suzy's results.

Put a tick (✓) in the box next to the only one which could be correct.

The Universe has always been the same size.


The Universe is getting bigger all the time.

The Universe is getting smaller all the time.

The rotation of the Universe is slowing down.

[1]

8 The ancient Greeks made observations of the movement of the planets across the night sky. Scientific theories for the movement of the planets have changed over time. Explain how and why these theories have changed over time.

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

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**[6]**

9 Mendel carried out breeding experiments, using pea plants, to investigate inheritance. When he crossed pure-breeding tall and short pea plants, all the plants produced were tall. How did Mendel explain these observations?  
You may use diagrams in your answer.

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

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[6]

**END OF QUESTION PAPER**



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**Level 1/2 Cambridge National Certificate in  
SCIENCE**


**R072/01**

**R072: How scientific ideas have developed (Level 1)**

**MARK SCHEME**

**Duration: 1 hour**

**MAXIMUM MARK      60**

Question		Expected Answers	Marks	Additional Guidance
1	(a) (i)	(regular) injections; of insulin;	[2]	
	(ii)	one from the following, for [1] university not sure if Banting's ideas would work; idea that confidence increases;  because results support hypothesis/prediction; [1]	[2]	
	(b)	relative risk for BMI of 34 = 53, BMI of 30 = 28 [1];  53/28 = 1.9 [1];	[2]	<b>accept</b> +/- 1 for risk values;  <b>allow</b> ecf  <b>allow</b> risk at BMI of 34 is (approximately) twice the risk from BMI of 30 (ora) [2];
	(c)	BMI = $84/1.6^2$ ; = 32.8; EITHER Frances is obese OR relative risk is 40;	[3]	ecf on incorrect value of BMI
	(d) (i)	any two from the following, for [1] each it is sweeter; less is needed; less energy/calories (in food);	[2]	must be a comparison each time
	(ii)	(it was carried out) on rats / not on humans; or timescale too short;	[1]	either point
	(e) 	reference to 40 (mg/kg); Use of 40 mg(/kg) together with EITHER body weight OR contents of a drink can; QWC: A clear ordered answer - a logical sequence of at least two statements, clearly understood on first reading.	[3]	
<b>Total</b>			[15]	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	Andrew	[1]	
	(b)	Kate; Gemma;	[2]	
	(c)	Tom	[1]	
	(d)	You cannot make conclusions based on a single case.	[1]	
<b>Total</b>			<b>[5]</b>	


3	(a)	Africa and South America have shapes which seem to fit together; Fossils of similar animals have been found in Africa and South America;	[2]	
	(b)	explanation including any three from the following, for [1] each  In 1912 geologists could not measure any movement of the continents; Wegener was not trained in geology; New evidence has been discovered since 1912; New technology allows movement of continents to be measured; Sea floor spreading was discovered (in the 1960s);	[3]	
<b>Total</b>			<b>[5]</b>	


4	(a)	(i)	imagination	[1]	
		(ii)	predictions	[1]	
		(iii)	evidence	[1]	
	(b)		Lamarck; Darwin;	[2]	
<b>Total</b>				<b>[5]</b>	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	(C)FBDAE	[4]	F before B [1] B before D [1] D before A [1] A before E [1]
	(b)	an effector	[1]	
	(c)	To replace the water lost by sweating.	[1]	
	(d)	negative	[1]	
<b>Total</b>			<b>[7]</b>	

6	(a)	New data can be collected about the star.	[1]	
	(b)	explanation including any two from the following, for [1] each They can discuss their work with each other; They bring different expertise to the project; To share the cost/resources between different countries/organisations;	[2]	
	(c)	(i) DCBA	[2]	DCB in order anywhere for [1]
		(ii) So that other scientists can check their observations; So that other scientists can offer different conclusions.	[2]	
<b>Total</b>			<b>[7]</b>	

7	(a)	speed (of galaxy) increases as distance (to galaxy) increases	[1]	
	(b)	D; all others on a line on the graph;	[2]	
	(c)	The Universe is getting bigger all the time.	[1]	
<b>Total</b>			<b>[4]</b>	

Question	Expected Answers	Marks	Additional Guidance
8 	<p><b>Level 3</b> Clear and coherent descriptions of the models and an explanation of the reasons for the changes.that links observation/prediction to theory. Quality of written communication does not impede communication of the science at this level. [5 – 6 marks]</p> <p><b>Level 2</b> Description of changes in models of planetary movement. and idea of observations driving change. Quality of written communication partly impedes communication of the science at this level. [3 – 4 marks]</p> <p><b>Level 1</b> Mentions some points from different models of planetary movement. Quality of written communication impedes communication of the science at this level. [1 – 2 marks]</p> <p>0 marks = no response or no response worthy of credit.</p>	[6]	<p><b>Relevant points may include:</b></p> <p><b>Greek model</b></p> <ul style="list-style-type: none"> <li>• Earth is at the centre (of the solar system / universe)</li> <li>• Sun, moon and planets on spheres centred on Earth</li> <li>• spheres rotate at different speeds</li> </ul> <p><b>Copernican model</b></p> <ul style="list-style-type: none"> <li>• Sun at centre (of the solar system)</li> <li>• Earth and (other) planets orbit the Sun</li> <li>• at different distances/speeds</li> </ul> <p><b>Possible reference to Newton and Galileo</b></p> <ul style="list-style-type: none"> <li>• gravity pulls objects towards each other</li> <li>• which keeps planets in orbit around Sun</li> <li>• Laws of Motion predict correct relationship between orbit size and time for planets</li> </ul> <p><b>Reasons for change</b></p> <ul style="list-style-type: none"> <li>• (new) observations disagree with the current theory</li> <li>• new theories proposed to explain new observations</li> <li>• theories can be tested against predictions</li> <li>• as new observations are made, the process repeats</li> </ul>

Question	Expected Answers	Marks	Additional Guidance
9 	<p><b>Level 3</b> Shows clear understanding that inheritance is particulate and that the particles (genes) determine the appearance/structure of an organism. Explains the observations by showing that homozygous dominant and recessive individuals (these terms not required) when crossed produce all heterozygous (term not required) offspring (correct genetic diagrams accepted) and giving a clear explanation of why offspring are all tall. Quality of written communication does not impede communication of the science at this level. [5 – 6 marks]</p> <p><b>Level 2</b> Shows understanding that inheritance is particulate and makes an attempt (though not detailed) at a genetic explanation of the cross, including an explanation of why all offspring are tall. Quality of written communication partly impedes communication of the science at this level. [3 – 4 marks]</p> <p><b>Level 1</b> Shows limited understanding that inheritance is particulate. Quality of written communication impedes communication of the science at this level. [1 – 2 marks]</p> <p>0 marks = no response, or no response worthy of credit.</p>	[6]	<p><b>Relevant points include:</b></p> <ul style="list-style-type: none"> <li>• genetic particles (genes) hold information about inherited characteristic</li> <li>• contain instructions for to make the organism / idea that genotype influences phenotype</li> </ul> <p><b>Explanation</b></p> <ul style="list-style-type: none"> <li>• idea of one particle/gene for each characteristic inherited from each parent</li> <li>• idea that one particle/gene is dominant, the other recessive</li> <li>• idea that only one dominant particle/gene needed for its expression</li> <li>• recessive characteristic only expressed if no dominant particle/gene inherited</li> </ul> <p><b>accept</b> allele for gene and vice versa, or an understanding that inheritance is particulate (as the word 'gene' was not used by Mendel)</p>

## Learning Outcome (LO) Grid

Question			LO1	LO2	LO3	LO4	Total
1	(a)	(i)	2				2
1	(a)	(ii)	1	1			2
1	(b)				2		2
1	(c)				3		3
1	(d)	(i)			2		2
1	(d)	(ii)		1			1
1	(e)				2	1	3
2	(a)		1				1
2	(b)		2				2
2	(c)				1		1
2	(d)			1			1
3	(a)			2			2
3	(b)		2	1			3
4	(a)	(i)		1			1
4	(a)	(ii)		1			1
4	(a)	(iii)		1			1
4	(b)		2				2
5	(a)		4				4
5	(b)		1				1
5	(c)		1				1
5	(d)		1				1
6	(a)			1			1
6	(b)			2			2
6	(c)	(i)		2			2
6	(c)	(ii)		2			2
7	(a)				1		1
7	(b)				2		2
7	(c)				1		1
8			2	2		2	6
9			4			2	6
<b>Total</b>			<b>23</b>	<b>18</b>	<b>14</b>	<b>5</b>	<b>60</b>

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