

## **Cambridge National**

### **Science**

Unit **R072/01**: How Scientific Ideas Have Developed

Level 1

### **Mark Scheme for June 2016**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.











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## Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
e cf	error carried forward
AW/owtte	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject

	correct response
	draw attention to particular part of candidate's response
	information omitted

### Subject-specific Marking Instructions

- If a candidate alters his/her response, examiners should accept the alteration.
- Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

E.g.

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 1 mark.

- c. The list principle:  
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

- d. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.

Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

<b>Edinburgh</b>	
<b>Manchester</b>	
<b>Paris</b>	
<b>Southampton</b>	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

<b>Edinburgh</b>			✓			✓	✓	✓	✓	
<b>Manchester</b>	✓	x	✓	✓	✓				✓	
<b>Paris</b>				✓	✓		✓	✓	✓	
<b>Southampton</b>	✓	x		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

Question			Answer	Mark	Guidance												
1	a	i	<table border="1"> <tr> <td>...both hot and cold</td> <td></td> </tr> <tr> <td>...volcanic</td> <td></td> </tr> <tr> <td>... a long way from other land</td> <td>✓</td> </tr> <tr> <td>...very small</td> <td></td> </tr> </table>	...both hot and cold		...volcanic		... a long way from other land	✓	...very small		1					
...both hot and cold																	
...volcanic																	
... a long way from other land	✓																
...very small																	
		ii	<p><b>Any two from:</b>            Idea of opposition from conventional scientists / religion;            Collecting more evidence;            “trying out” ideas on other people;            Challenged existing ideas;            Analysing data;            Identifying species;            Making certain / checking he was correct;            Too busy</p>	2	<b>Ignore</b> peer review												
		iii	<table border="1"> <thead> <tr> <th></th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>other scientists could check</td> <td>✓</td> <td></td> </tr> <tr> <td>prove that he was right</td> <td></td> <td>✓</td> </tr> <tr> <td>get the credit for his discoveries</td> <td>✓</td> <td></td> </tr> </tbody> </table>		True	False	other scientists could check	✓		prove that he was right		✓	get the credit for his discoveries	✓		1	All three correct for one mark
	True	False															
other scientists could check	✓																
prove that he was right		✓															
get the credit for his discoveries	✓																
	b	i	Type of food / shape /size of beak	1	<b>Allow</b> beak.												
		ii	Use of DNA	1													
	c		Same genus / Both <i>Geospiza</i> ; different species	2													
	d		<p><b>Any two from:</b>            A range of sizes / not all the same;            few small beaks / below 8mm;            few large beaks / above 12mm;            mostly in the middle / around 10mm;</p>	2													

Question		Answer			Mark	Guidance	
e			True	False	2	2 correct = 1mark 3 correct = 2 marks.	
		same size as parents		✓			
		same size beaks as mate					✓
		correlation between parents and offspring	✓				
f	i	decrease in the number of finches / fewer finches			1		
	ii	Less food / seeds available			1		
g		Idea that they collected lots of evidence;			1	<b>Allow</b> idea that there could be changes (in finch population).	
<b>Total</b>					<b>[15]</b>		

Question		Answer	Mark	Guidance
2	a	1600	1	
	b	<p><b>[Level 3]</b> Describes some quantitative changes up to <b>2015 AND</b> gives an effect on the environment. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Describes the graph <b>AND</b> gives an effect on the environment. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes the graph <b>OR</b> gives an effect on the environment <b>OR</b> gives a cause for the increase. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to Level 1 Distinction.</b> <b>Indicative scientific points may include:</b></p> <p>Describes shape of graph (to 2000)</p> <ul style="list-style-type: none"> <li>• Fluctuates</li> <li>• Fairly level (until ~1800)</li> <li>• Increases rapidly</li> <li>• Especially after 1850</li> </ul> <p>Describes quantitative changes to 2015</p> <ul style="list-style-type: none"> <li>• Increases to 330 by 2000</li> <li>• Increases to 400 by 2015 (even steeper)</li> </ul> <p>Effects on environment:</p> <ul style="list-style-type: none"> <li>• More extreme / more weather</li> <li>• Loss of polar ice / habitat</li> <li>• raised sea-level</li> <li>• changed crop / lifestyle viability</li> <li>• increased migration</li> </ul> <p>Causes of increase:</p> <ul style="list-style-type: none"> <li>• Burning fossil fuels</li> <li>• More cars</li> <li>• Deforestation</li> <li>• Industrialisation</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	c	Carbon dioxide absorbs IR radiation; stops heat leaving /radiated into space; causing (global) warming;	3	<p><b>Allow</b> use of labelled diagram. <b>Allow</b> 1 mark for greenhouse effect if no other mark awarded.</p>
<b>Total</b>			<b>[10]</b>	



Question		Answer	Mark	Guidance																				
3	a	Radio (waves); Microwaves; Infrared (waves)	3																					
	b	<table border="1"> <tr> <td></td> <td>Gal</td> <td>Her</td> <td>Mar</td> <td>Max</td> </tr> <tr> <td>radio waves</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>"Over the horizon"</td> <td></td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Modelling visible light</td> <td></td> <td></td> <td></td> <td>✓</td> </tr> </table>		Gal	Her	Mar	Max	radio waves		✓			"Over the horizon"			✓		Modelling visible light				✓	3	
	Gal	Her	Mar	Max																				
radio waves		✓																						
"Over the horizon"			✓																					
Modelling visible light				✓																				
	c	many different cells / masts / base stations; each phone using a different wavelength	2	<b>Allow:</b> Many frequencies / channels																				
<b>Total</b>			<b>[8]</b>																					

4	a	(Same) breakfast / food / amount of sugar / amount of glucose / amount of physical activity	1												
	b	i	9.0	1											
		ii	(9.0 / 10.0 ) x 100; =90%;	2	Correct answer gets both marks <b>Allow</b> ecf										
		iii	<table border="1"> <tr> <td>hunger</td> <td></td> </tr> <tr> <td>thirst</td> <td>✓</td> </tr> <tr> <td>urinating a lot</td> <td>✓</td> </tr> <tr> <td>unconsciousness</td> <td></td> </tr> <tr> <td>weight gain</td> <td></td> </tr> </table>	hunger		thirst	✓	urinating a lot	✓	unconsciousness		weight gain		2	
hunger															
thirst	✓														
urinating a lot	✓														
unconsciousness															
weight gain															
	c	i	Measure glucose /sugar levels again;	1											
		ii	look for (consistently) high level / slow recovery time	1											
	d		difficulty of extracting from human beings / danger to humans / unethical	1	<b>Allow</b> idea of some animals killed for meat										
	e	i	Insulin had not been discovered / equipment did not exist	1											
		ii	Frequent small meals; Adding (fenugreek) seeds ;	2											
<b>Total</b>			<b>[12]</b>												

Question	Answer	Mark	Guidance
5	<p><b>[Level 3]</b> Describes all stages of the process in the diagram AND explains why conscious reactions take longer than reflexes. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Describes most of the stages of the process in the diagram OR Describes some stages of the process in the diagram and explains why conscious reactions take longer than reflexes. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes at least two stages of the process in the diagram, OR Describes why conscious reactions take longer than reflex reactions. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to Level 1 Distinction.</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Diagram of reflex:</b></p> <ul style="list-style-type: none"> <li>• Receptor in knee</li> <li>• sensory neuron carries (electrical) signal</li> <li>• CNS is Central Nervous System</li> <li>• CNS is spinal cord (not brain)</li> <li>• motor neuron carries (electrical) signal</li> <li>• Effector is muscle</li> <li>• Causes lower leg to jerk</li> </ul> <p><b>Speed of reaction:</b></p> <ul style="list-style-type: none"> <li>• Conscious reactions involve brain / thought</li> <li>• Longer distance for signal to travel</li> <li>• Extra processing time</li> <li>• Reflex is automatic / involuntary</li> <li>• Reflex does not involve brain</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>[6]</b>	

Question		Answer	Mark	Guidance															
6	a	explained the evidence at the time	✓	2															
		wanted be the first to publish	✓																
		peer reviewed																	
		all the evidence they needed																	
		to see what was wrong																	
	b	Any two from: replicate experimental work / obtain similar data; idea of checking working / use of data / conclusions; popular credit / prizes; public knowledge / education; further development by other scientists;	2																
	c	<table border="1"> <thead> <tr> <th></th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>prevents mistake</td> <td></td> <td>✓</td> </tr> <tr> <td>work has to be checked</td> <td>✓</td> <td></td> </tr> <tr> <td>needs ideas from others</td> <td>✓</td> <td></td> </tr> <tr> <td>Individual scientists</td> <td></td> <td>✓</td> </tr> </tbody> </table>		True	False	prevents mistake		✓	work has to be checked	✓		needs ideas from others	✓		Individual scientists		✓	2	4 correct = 2 marks 3 or 2 correct = 1 mark
	True	False																	
prevents mistake		✓																	
work has to be checked	✓																		
needs ideas from others	✓																		
Individual scientists		✓																	
	d	<table border="1"> <thead> <tr> <th>A</th> <th>T</th> <th>C</th> <th>G</th> </tr> </thead> <tbody> <tr> <td></td> <td>30</td> <td>20</td> <td>20</td> </tr> </tbody> </table>	A	T	C	G		30	20	20	3	One mark for each number <b>Allow:</b> one mark for C=G If no other marks <b>allow</b> (1) if 3 values add up to 70%							
A	T	C	G																
	30	20	20																
			<b>Total</b>	<b>[9]</b>															
			<b>Total</b>	<b>[60]</b>															

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