

## **Cambridge National**

### **Science**

Unit **R072/02**: How Scientific Ideas Have Developed

Level 2

## **Mark Scheme for January 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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## 1. 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
ecf	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

## 2. 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>

## MARK SCHEME:

Question			Answer	Mark	Guidance
1	a	i	Phylum	1	
		ii	Idea that it/DNA was not known / had not been discovered	1	<b>ignore</b> did not have technology
	b		(both have) webbed feet;  pelican has a larger beak (ORA)	2	<b>Allow</b> have same type/similar feet <b>Ignore</b> both have feet and beak / same beak <b>Allow</b> different size beaks
	c	i	Any <b>two</b> from: Other <b>scientists</b> check / replicate / review /criticise his work; Linnaeus gets credit for his work; Basis for future work;	2	<b>Allow</b> to improve it
		ii	Any <b>two</b> from: Work had continued; (Many) more species discovered; New species to be classified	2	
	d		Any <b>two</b> from: Biodiversity / variety / many species; species adapt; species become extinct	2	
	e	i	vertebrae	1	<b>Allow</b> backbone/spine
		ii	sharks	1	
		iii	similarities from: vertebrae / bony skeleton / four limbs / amniotic egg  differences from: rabbits have hair / lizards have eggs with shells	3	At least one similarity and one difference  <b>Do not allow</b> one has hair / one has eggs with shells
			<b>Total</b>	<b>[15]</b>	

Question		Answer	Mark	Guidance
2	a	Tall: 75; Short: 25;	2	<b>Allow</b> any 3:1 ratio for 1 mark
	b	<p><b>[Level 3]</b> Both conclusions stated and explanation given for both. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Both conclusions stated with explanation for one of them. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Both conclusions are stated. 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 2 Distinction.</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Conclusion:</b></p> <ul style="list-style-type: none"> <li>• Pure breeding tall with short gives all tall</li> <li>• Breeding two F1s gives ration 3:1 tall:short</li> </ul> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Pure breeding plants are homozygous</li> <li>• Pure breeding Tall plants have two Tall alleles</li> <li>• Pure breeding Short plants have two Short alleles</li> <li>• F1 generation is heterozygous.</li> <li>• F1 generation have one Tall and one Short allele</li> <li>• Tall allele is dominant / short is recessive so all F1 plants are tall</li> </ul> <p>Use of Punnett Square or other genetic diagram TT, Tt and tT are tall tt is short.</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	c	Repeated; consistent / same/similar results	2	<b>Allow</b> tried 4 times <b>Allow</b> same ratio
		<b>Total</b>	<b>10</b>	

Question		Answer	Mark	Guidance										
3	a	<table border="1"> <tr><td>Moon</td></tr> <tr><td>Planets</td></tr> <tr><td>Stars</td></tr> <tr><td>Galaxies</td></tr> </table>	Moon	Planets	Stars	Galaxies	3	Moon before planets (1) Planets before stars (1) Stars before galaxies (1)						
Moon														
Planets														
Stars														
Galaxies														
	b	The movement of the planets follow mathematical laws of motion; The planets are kept in orbit by gravity	2											
	c	i <table border="1"> <tr><td>light from the stars is red</td><td></td></tr> <tr><td>light from the sky is blue</td><td></td></tr> <tr><td>longer wavelength</td><td>✓</td></tr> <tr><td>red light travels faster than blue light</td><td></td></tr> </table>	light from the stars is red		light from the sky is blue		longer wavelength	✓	red light travels faster than blue light		1			
light from the stars is red														
light from the sky is blue														
longer wavelength	✓													
red light travels faster than blue light														
		ii <table border="1"> <tr><td>moving away from Earth</td><td>✓</td></tr> <tr><td>moving towards Earth</td><td></td></tr> <tr><td>nearest to Earth</td><td></td></tr> <tr><td>faster than light</td><td></td></tr> </table>	moving away from Earth	✓	moving towards Earth		nearest to Earth		faster than light		1			
moving away from Earth	✓													
moving towards Earth														
nearest to Earth														
faster than light														
	d	<table border="1"> <tr><td>cooling of the universe</td><td>✓</td></tr> <tr><td>heating of the stars</td><td></td></tr> <tr><td>movement of the galaxies</td><td></td></tr> <tr><td>the force of gravity</td><td></td></tr> <tr><td>climate change</td><td></td></tr> </table>	cooling of the universe	✓	heating of the stars		movement of the galaxies		the force of gravity		climate change		1	
cooling of the universe	✓													
heating of the stars														
movement of the galaxies														
the force of gravity														
climate change														
	e	Any <b>two</b> from: making it widely known / promote discussion / share ideas; (allowing others) to repeat work; (allowing others) to check data / conclusions; (allowing others) to do further research / extend work; ensure he gets the credit	2											
	f	i	D	1										
		ii	A has the smallest <b>range</b>	1										
			<b>Total</b>	<b>[12]</b>										



Question		Answer	Mark	Guidance
4	a	<p><b>[Level 3]</b> Explains in detail all changes in temperature. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Explains in detail one of the changes in temperature <b>OR</b> gives a brief explanation of two changes. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes the temperature changes and gives at least one factor causing a change. 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 2 Distinction*.</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Temperature changes:</b> Increase, decrease and back to normal</p> <p><b>Explanations:</b> Temperature Increases: Caused by increased respiration / muscle use Using glucose (&amp; oxygen) for energy Increased pulse/heart beat Limited by Negative Feedback / sweating etc</p> <p>Temperature decreases: No excess respiration Sweating Evaporation reduces temperature Vasodilation Increases heat loss</p> <p>Temperature recovers to normal: shivering / vasoconstriction</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	b	Idea of Literature/internet search; Repeat measurements on more occasions (for same person); Repeat measurements with other people; Answer addresses question and is clear	4	
<b>Total</b>			<b>[10]</b>	

Question			Answer	Mark	Guidance
5	a	i	Eye	1	<b>Allow</b> retina
		ii	Brain / Spinal (cord);	1	
		iii	Muscles (in arm / hand )	1	
	b	i	Any <b>two</b> from: Increased confidence / reliability; identify outliers; work out a mean	2	<b>Ignore</b> fair test / accuracy
		ii	$(280+310+290+310+310) / 5$ ; 300 (ms)	2	Look in table for answer Correct answer without working gets both marks
	c	i	His <b>mean</b> is the lowest	1	<b>Ignore</b> just quoting data from table
		ii	His sister's mean is almost the same / overlap with sister's range	1	<b>Allow</b> some results similar to sister
	d	i	Older people have slower reactions OWTTE	1	
		ii	Not enough data / correlation doesn't mean cause	1	
	e		Any <b>two</b> from: Age; Gender; Type of game; Amount of time spent playing game; Time of day	2	<b>Allow</b> sex
			<b>Total</b>	<b>[13]</b>	
			<b>Overall Total</b>	<b>[60]</b>	

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