OCR
Oxford Cambridge and RSA

Cambridge National

Science

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

Level 2

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.

Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	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

	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

a. If a candidate alters his/her response, examiners should accept the alteration.

b. 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.

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

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

Edinburgh	
Manchester	
Paris	
Southampton	

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

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>idea of geographic Isolation;
preventing species spreading to other places</td><td>2</td><td>Accept: Adapted to local environment ORA
Accept: prevents predation/interbreeding/other sensible ideas</td></tr>
<tr><td></td><td>b</td><td>i</td><td>DNA not known (in 19th Century)</td><td>1</td><td>Allow: inadequate knowledge/equipment etc</td></tr>
<tr><td></td><td></td><td>ii</td><td>Any two from:
Different size beaks;
Different food source;
Do not compete</td><td>2</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>Same genus / Both Geospiza;
different species</td><td>2</td><td></td></tr>
<tr><td></td><td>d</td><td></td><td>Any two from:
idea of (positive) correlation;
beak size is not exactly the same (in offspring as parents);
parents beak size is similar to offspring;
offspring may inherit beak size;</td><td>2</td><td>Accept: any sensible interpretation of data.</td></tr>
<tr><td></td><td>e</td><td></td><td>Any four from:
No / Fewer seeds available / idea of limited food;
Many finches died / starved / did not survive/ smaller population
Finches with small beaks not likely to survive ORA;
Beak size of survivors passed on to offspring;
Mean beak depth (of survivors) increases;</td><td>4</td><td></td></tr>
<tr><td></td><td>f</td><td></td><td>
<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>beak size for Geospiza fortis</td><td>✓</td><td></td></tr>
<tr><td>beak size for Geospiza scandens</td><td></td><td>✓</td></tr>
<tr><td>The total rainfall</td><td>✓</td><td></td></tr>
<tr><td>number of Geospiza fortis</td><td>✓</td><td></td></tr>
<tr><td>number of Geospiza scandens</td><td></td><td>✓</td></tr>
<tr><td>number of cactus plants</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>Six correct = 2 marks
four or five correct = 1 mark.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[15]</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
2	a		**[Level 3]** Explains the greenhouse effect with description of the mechanism AND explanation of why CO_2 is more significant than water vapour & methane. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Explains the greenhouse effect with description of the mechanism OR explanation of why CO_2 is more significant than water vapour & methane. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Gives a basic explanation of the meaning of the greenhouse effect OR significance of CO_2 Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to Level 2 Distinction *.** **Indicative scientific points may include:** **Significance:** • water vapour is (largely) not man-made • water vapour cannot be controlled • methane is much lower amounts most methane from natural processes • methane has short life-time in the atmosphere • Significant amount of CO_2 is man made • Rapid/recent increase in CO_2 **Mechanism:** • Gases absorb IR radiation • IR is being emitted from Earth's surface • Gases are transparent to visible light **Greenhouse effect:** • Atmospheric / surface <u>warming</u> • reducing rate of heat/energy loss (to space) • not affecting incoming energy Ignore mention of ozone depletion. **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**

Question			Answer	Mark	Guidance
2	b		Earthquakes: ; Melting ice-caps: ✓; Sea-floor spreading: ; Sea-level rise: ✓; Volcanoes:	2	
	c		**Any two from:** correlation may not indicate cause; temperature change may have other causes; natural variability (of change in temperature); inability to measure change accurately; inability to measure change globally; personal experience of weather; changes seem small;	2	Accept: vested interest (in fossil fuels)
			Total	**10**	

Question			Answer	Mark	Guidance
3	a	i	Infra-red	1	
		ii	microwave;	1	
		iii	different wavelength	1	Accept different frequency / energy
		iv	(optical fibre) little/no energy loss; (Microwave) spreads out / loses energy	2	
	b	i	4	1	
		ii	1 000 000 000	1	
		iii	8	1	
	c	i	5 x 1 000 000 / 2; 2 500 000;	2	
		ii	same size picture / amount of data / 5 megabits	1	Accept uploaded to same site or any other sensible control
		iii	**Any two from:** not a scientific journal; not reviewed by scientists / opinion not professional judgement; not before publication;	2	
			Total	**[13]**	

Question			Answer	Mark	Guidance
4	a		**[Level 3]** Describes why blood glucose increases AND how insulin works AND the diabetic reaction Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes why blood glucose increases and how insulin works OR why blood glucose increases and the diabetic reaction OR how insulin works and the diabetic reaction. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes why blood glucose increases or mechanism for Insulin or diabetic reaction Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to Level 2 Distinction*. Indicative scientific points may include: Why blood glucose increases: • Food contains sugars • Broken down to glucose • Glucose absorbed from gut • leads to increase How insulin works (Ian): • Pancreas secretes insulin • Insulin causes liver cells to store glucose as glycogen • reducing levels (for Ian) Diabetic reaction (Helen) • Body may not make (enough) insulin • Body may not react to insulin • Glucose is not stored • So goes higher • Takes longer to recover Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.
	b		**Any two from:** Increased thirst; Excessive urination (especially at night); Extreme tiredness; Unexplained weight loss;	2	accept: slow healing of cuts; blurred vision; genital itching; sweet tasting urine; recurring infections;
	c		Repeat measurements on other days / at other times of day / on other diabetic patients	1	
	d	i	Equipment/technology not yet developed	1	
		ii	Pancreas	1	Accept varied spelling
			Total	**[11]**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>a</td><td></td><td><table><tr><td>explained the evidence at the time</td><td>✓</td></tr><tr><td>wanted be the first to publish</td><td>✓</td></tr><tr><td>peer reviewed</td><td></td></tr><tr><td>just discovered DNA</td><td></td></tr><tr><td>to see what was wrong</td><td></td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>Any two from:
replicate experimental work / obtain similar data;
idea of checking working / use of data / conclusions;
Popular credit / prizes;
public knowledge / education;
further developments by other scientists</td><td>2</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>idea of checking data / making sure it is correct</td><td>1</td><td>Ignore Peer review</td></tr>
<tr><td></td><td>d</td><td></td><td><table><tr><td>A</td><td>T</td><td>C</td><td>G</td></tr><tr><td></td><td>30</td><td>20</td><td>20</td></tr></table></td><td>3</td><td>One mark for each number
Allow: one mark for C=G
If no other marks, allow (1) if three values add up to 70%</td></tr>
<tr><td></td><td>e</td><td></td><td>trlplets / sets of bases;
code for each amino-acid;
amino acids in sequence (in the protein);</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[11]</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Overall Total</td><td>[60]</td><td></td></tr>
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