OCR
RECOGNISING ACHIEVEMENT

Cambridge National

Science

Level 2

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

Mark Scheme for June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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.

1. **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

Available in scoris to annotate scripts

Annotation	Meaning
	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

Annotation	Meaning
	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**

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**

Question			Answer	Marks	Guidance
1	(a)		2 / 144 x 100 = 1.38 / 1.39%; 19 / 27500 x 100 = 0.06(9) / 0.07%	2	Allow two correct ratios for (1) Allow: 1 in 72 (chance); 1 in 1447 (chance);
	(b)	(i)	not affected by radiation (from the tower) idea; idea of comparing / comparison / difference	2	
		(ii)	Other factors may affect people who live further away / too different	1	
		(iii)	idea of sharing ideas / joint decision	1	Allow: to reduce bias but ignore "fair test". Allow: Reduce chance of errors
	(c)	(i)	any 3 from: (more) cancers occur near the mast / gives examples; lower rate of cancers further from mast; more relative risk of cancers nearer the mast; less relative risk of cancer further away from the mast; pattern of exposure matches relative risk; correlation between exposure and incidence of cancer;	3	Allow: UK study supports hypothesis Reject: lower **number** of cancers further from the mast Allow: exposure largest near the tower / falls with distance Allow: None, as correlation does not prove causation (1)
		(ii)	any 2 from: larger study / more people / longer time; do the same study for other places (with masts); idea of collecting more data	2	Allow: compare radiation from other sources / appliances. Eg collecting genetic / ethnic data
	(d)		any 2 from: Correlation (between RR & exposure); (correlation) does not prove a cause; other risk factors may exist;	2	Allow: Correlation (between RR/exposure & distance) Allow: only one source of data
	(e)		any 2 from: Changes / mutations to the DNA; DNA is responsible for protein synthesis; Changed DNA may produce different proteins	2	
			Total	**15**	

Question			Answer	Marks	Guidance
2	(a)		up to 250 million years	1	
	(b)		Any 3 from: fossils different in each layer; fossils change over time; (more recent fossils are) more complex; specific example: fish after shells, mammals after fish	3	Allow: Animals have developed;
	(c)		under water ✓ flooded deep sea desert dry land ✓	2	-1 for each additional tick
	(d)		Wegener → sudden changes in animal fossils and marks of big stones being moved Lyell → carbon dioxide concentrations change over time Fourier → fossils in South America match fossils in Africa sudden changes in animal fossils and marks of big stones being moved → Continental Drift carbon dioxide concentrations change over time → ice ages fossils in South America match fossils in Africa → changes to the Greenhouse Effect	2	LHS correct = 1 RHS correct = 1
			Total	**8**	

Question			Answer	Marks	Guidance
3	(a)		**Level 3 (5–6 marks)** Gives points to address all aspects of answer; **receptors and effectors** AND **negative feedback** AND **a comparison of temperature**. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Compares temperatures** AND describes **negative feedback** or describes the role **of receptors and/or effectors.** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Compares temperatures** or indicates a need to control core/body temperature (but not skin temperature). Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to D*** **Indicative scientific points may include:** **Receptors & Effectors:** • receptors detect temperature • receptors detect skin temperature • receptors detect blood temperature • processed by the brain • messages sent to effectors • effectors cause response • operates by vasoconstriction/vasodilation. • operation of shivering/sweating **Negative feedback** • idea of negative feedback returning / reversing a change • to a normal level • by losing / gaining heat (eg by shivering/sweating) • keeps core temperature constant (when skin temperature varies). **Comparison of temperature** • Alex skin/air temperature is above core temperature • Ben skin/air temperature is below core temperature • Idea that temperature of skin is affected by surroundings. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(b)	(i)	explanation 2 and explanation 3; glucose level rises after eating the meal; falls because we use glucose for energy.	3	**Allow** 'rises and falls' / 'highest after two hours' if no 'reason' marks (1)
		(ii)	pattern ✓ decimal place carefully not change	1	
	(c)		eating provides more glucose / increases glucose levels; exercise uses glucose / decreases glucose levels; idea that results or data would be changed / less reliable / could not be compared	3	
	(d)		glucose → endocrine temperature → nervous (reproductive, binomial)	2	
			Total	**15**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>ancient Greeks believed Earth was centre / planets moved around Earth / planets moved on crystal spheres;
Galileo believed Sun was the centre/ planets moved around Sun

QWC: Response addresses the question and is easily understood.</td><td>3</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>regular pattern</td><td></td></tr><tr><td>mathematical</td><td>✓</td></tr><tr><td>gravity</td><td>✓</td></tr><tr><td>cosmic radiation</td><td></td></tr><tr><td>identical path</td><td></td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><td>red shift</td><td>✓</td></tr><tr><td>tectonic plates</td><td></td></tr><tr><td>background radiation</td><td>✓</td></tr><tr><td>diameter expanding</td><td></td></tr><tr><td>temperature increasing</td><td></td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><td></td><td>All</td><td>Visible</td><td>micro.</td><td>IR</td></tr><tr><td>300000</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>mobiles</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>optical</td><td></td><td></td><td></td><td>✓</td></tr><tr><td>shortest</td><td></td><td>✓</td><td></td><td></td></tr></table></td><td>3</td><td>All correct = 3
3 correct = 2
2 correct = 1

Any row with more than one tick does not score.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
5	(a)		**Level 3 (5–6 marks)** Describes development of models including examples of both **support** and **rejection** from peer review. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Describes development of models including example(s) of refinements from peer review. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Describes development of models including effect of peer review. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to D*** **Indicative scientific points may include:** **Support from peer review** • X-ray crystallography /photographs can be used to work out structure • DNA contains sugar • DNA contains phosphate • DNA contains (4) bases. **Models rejected by peer review** • Watson and Crick's model rejected because of magnesium atoms • Both early models rejected because bases on outside; • Pauling model rejected because hydrogen atoms wrong. **Effect of peer review** • meant scientists refined model • scientists came up with new ideas. • final model accepted because it shows how DNA can copy itself. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(b)	**(i)**	to make sure other scientists don't publish first / keen to make their discoveries known.	1	ignore: peer review / allow others to comment
		(ii)	idea of checking data / checking explanations / making sure they are right / discussing (within the team)	1	
	(c)		any 2 from: in pairs idea ; A to T ; C to G	2	
	(d)		any 2 from: examine DNA structure; shows where bases / chains are; evidence against (Pauling's) structure; evidence for double helix;	2	
			Total	**12**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Facsimile: 01223 552553