OCR
RECOGNISING ACHIEVEMENT

Cambridge National

Science

Level 2

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

Mark Scheme for January 2013

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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

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
	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

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

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.

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

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	~~✓~~
☐	☐	~~✓~~
~~✓~~	✓	✓
~~✓~~	~~✓~~	✓
☐	☐	☐
This would be worth 1 mark.	This would be worth 0 marks.	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, eg 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, eg 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.

Eg 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)	(i)	took readings from warmer regions/locations; from cities; may have errors in measuring devices; time of day / at night / time of year / in summer;	2	**ignore**: human error Max 1 mark for causing a difference second mark must cause **higher** reading
		(ii)	**any 2 from** other scientists read / discuss / review the work; other scientists collect (more) data / compare; other scientists check (calculations);	2	**allow** repeat the work
	(b)		cities are warm due to human activity e.g. cars/heating/buildings; deserts are naturally warm / warm due to climate / due to the sun;	2	**ignore**: "cities are hotspots"
	(c)		no measurements taken / recorded; equipment was not available;	2	**ignore**: references to measuring temperature **ignore**: reference to technology unless qualified
	(d)		14.2–14.6	1	
	(e)		Any 2 from: (future) of atmosphere / concentrations of CO_2 uncertain; effect of CO_2 on temp is uncertain; population (distribution) is uncertain;	2	**allow:** other factors eg cloud cover/dust/ash/ocean currents; **allow:** uncertainty due to long timescale
	(f)		**any 3 from:** CO_2 connected to greenhouse effect / climate change; increased CO_2 leads to increased (global) temperatures; increased temperatures leads to ice caps/glaciers melting; therefore sea levels rise; results in flooding in low lying areas; QWC Answer addresses question & is clearly expressed;	4	
			Total	**15**	

Question			Answer	Marks	Guidance
2	(a)		(tall because) **all** the offspring are tall	1	
	(b)		(yes because) results are similar / no outliers ; Illustrated with data from table (eg consistent 3:1 ratio);	2	**ignore:** repetition of (same) experiment **ignore:** same number of seeds each time
	(c)	(i)	any 2 from: purple flowers yellow seeds green seed pods	1	any 2 correct = (1) **reject**: seed/seed pod etc without specifying colour
		(ii)	uses 3:1 ratio in answer; 450;	2	answer of 450 with no working is worth two marks **allow:** 50 for one mark
		(iii)	cross short white plants together; because short <u>and</u> white are recessive characteristic;	2	
	(d)	(i)	X ray diffraction ✓	1	
		(ii)	double helix ✓ bases arranged in pairs ✓	2	
			Total	**11**	

Question			Answer	Marks	Guidance
3	(a)		deeper rock is older	1	
	(b)		any two from same rocks (layers); in same order; similar depth of (layers); same age of layers;	2	 **ignore:** references to cliffs rather than rock layers **reject:** same depth of layers
	(c)		not a geologist ✓ ; continents fit together ✓ ; sea floor spreading ✓ ; fossils ✓ ; currents in mantle ✓ ;	2	All correct = 2 3 or 4 correct = 1 1 or 2 correct = 0
	(d)		earthquakes/volcanoes occur in clusters / lines idea; along the edge of plates;	2	
			Total	**7**	

Question			Answer	Marks	Guidance
4	(a)		idea of signals bouncing / can be shown on diagram; from ionosphere / layer in atmosphere / label on diagram;	2	
	(b)		Infra-red… ✓ ; Communication… ✓ ; Optical fibres… ✓ ; Rate of transfer… ✓ ; Both types… ✓ ;	2	All correct = 2 3 or 4 correct = 1 1 or 2 correct = 0
	(c)		data not lost / higher quality signal	1	**allow**: doesn't spread out **allow**: greater security / bandwidth
			Total	**5**	

Question			Answer	Marks	Guidance
5	(a)		**Level 3 (5–6 marks)** Gives a balanced argument for both the advantages and the disadvantages. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Gives detail for one 'side' of the argument and gives at least one statement for the opposing view. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Identifies EITHER some advantages OR some disadvantages OR gives a single advantage and a disadvantage. 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 level 2 Merit** **Indicative scientific points may include:** **Benefits** • Idea that it is an advantage to choose characteristics in pets • can make foxes for pets / idea that it is better for people if we can make calm foxes • foxes are dangerous to people • Commercial value of adapting animals. • Selective breeding gives relatively fast results. • Development of scientific knowledge **Drawbacks** • Selective breeding has ethical issues. • New foxes will not be able to survive in the wild • Other characteristics change / identifies example of characteristic that changes. • Maybe undesirable characteristics may also be bred into foxes. • Long term effects on foxes not well known • Idea of limiting the gene pool. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(b)		any 2 from idea that there is variation in any species; some foxes are better adapted to the environment than others / have longer legs / specific example of adaptation; these are more likely to survive; and breed; pass on characteristics to offspring; occurs over many generations;	2	**allow:** reverse argument **allow:** "survival of the fittest" for 1 mark
	(c)	**(i)**	any 2 from looking at different aspects / types of data; different skills / background; discussing ideas; pooling data / better overall picture;	2	e.g. Eve is testing genetic make up / physical data about the foxes; Joe is testing behaviour;
		(ii)	any 2 from data from different places; more data; checking / confirming his data; makes research more reliable;	2	**allow:** No DNA evidence with other people's images.
				12	

Question			Answer	Marks	Guidance
6	(a)		telescopes / suitable instruments were not invented; Ptolemy's ideas matched what people could see with the naked eye;	2	**ignore:** reference to technology **allow** resistance to new ideas from religion
	(b)		**Level 3 (5–6 marks)** Discusses how Galileo & Newton improved on previous models. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Compares ideas from at least two of Newton, Galileo & Ptolemy. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Describes aspects of Galileo's solar system. 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 level 2 Distinction** **Indicative scientific points may include:** **Galileo** • The Sun is the centre of the solar system • The Earth goes around the Sun • The planets also go around the Sun • The moon goes around the Earth • Other planets have moons which go around them. **Newton** • planets / objects in solar system are attracted to each other • travel in orbits / gravity pulls planets together. **Improvements** • Galileo explained no need for 'invisible spheres' • Galileo explained the movement of wanderers • Newton explained why planets do not 'fly off' • force of gravity leads to orbital motion. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	(c)	(i)	Ali	1	
		(ii)	Bea	1	
			Total	**10**	

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