

Cambridge National

Science

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

Level 2

Mark Scheme for June 2018

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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.














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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 |
| 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 RM Assessor 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

- 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.

| |
|-------------------------------------|
| <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

| | |
|--------------------|--|
| Edinburgh | |
| Manchester | |
| Paris | |
| Southampton | |

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).

| | | | | | | | | | | |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Edinburgh | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Manchester | ✓ | x | ✓ | ✓ | ✓ | | | | ✓ | |
| Paris | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| Southampton | ✓ | x | | ✓ | | ✓ | ✓ | | ✓ | |
| Score: | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | NR |

| Question | | Answer | Marks | Guidance |
|----------|-----|---|-----------|---|
| 1 | (a) | A snake has a similar temperature to the outside temperature / increases with increased outside temperature (1); A cat's temperature is always higher than the outside temperature/ higher than the snake's temperature / the cat's temperature falls at very low outside temperatures (1) | 2 | Must relate to a range not just a specific temperature Do not Allow: Cat is always 37°C Allow: Cat temperature does not change (much) |
| | (b) | (i) Cat 39 Snake 42 | 1 | Allow 38-40 Allow 40-44 |
| | | (ii) A cat can control body temperature independent of outside temperature / homeostasis (1); A snake has the same temperature as the outside (1) | 2 | Ignore: statement of warm blooded/cold blooded (taken from diagram) |
| | (c) | Fig 3 does support this statement because body temperature is higher than outside temperature (1); Fig1 does not support this statement because body temperature is similar to outside temperature (1) | 2 | Ignore: reference to cat/warm blooded |
| | (d) | when temperature is low, they shiver / hairs rise / capillaries contract (1); at high temperatures they sweat / capillaries increase in size (1) | 2 | |
| | (e) | <i>Any 3 from:</i> can manage for long periods of (moderate) cold; can manage for long periods without food; use less energy; can hibernate | 3 | |
| | (f) | humans can control internal temperature / keep constant temperature (1); can survive extreme temperature changes for short amounts of time (1); snake cannot control temperature / cannot get warm afterwards idea (1) | 3 | |
| | | Total | 15 | |

| Question | | Answer | Marks | Guidance |
|----------|-----|--|-------|--|
| 2 | (a) | <p>Any 2 from: Could not travel to other planets idea; Only had thermometer / could not use thermometer to measure temperature of other planets; Did not have the necessary measuring equipment</p> | 2 | |
| | (b) | <p>(yes because) Earth and moon should be the same temperature (based on distance from Sun) (1) ;</p> <p>Average surface temperature of the Earth is higher than the moon / The Earth is warmer than the Moon ORA (1);</p> <p>Earth has an atmosphere and moon does not (1)</p> | 3 | <p>Ignore 'they are the same distance from the Sun' alone</p> <p>Allow: Links atmosphere to hotter ORA if no other marks</p> |
| | (c) | (i) | 3 | Ignore 'planets with atmospheres have higher temperatures' alone |
| | | (ii) | 2 | |
| | (d) | <p>Advantage: takes readings directly / data is more accurate (1) ;</p> <p>Disadvantages: any ONE from: transport of robot to planet / journey time / needs a rocket ; cost of development / transport; Cannot repair or adapt idea; Problems with communication with Earth</p> | 2 | <p>Ignore references to human space travel / safety</p> <p>Ignore 'cost' alone</p> |

| Question | | Answer | Marks | Guidance |
|----------|-----|---|-----------|----------|
| 2 | (e) | <i>Any 2 from:</i> Can't go back in time idea; Can't measure God beliefs can't always be tested; Can't collect data/evidence | 2 | |
| | | Total | 14 | |

| Question | Answer | Marks | Guidance |
|----------|---|----------|---|
| 3 | <p>[Level 3] Describes some changes to the elephants which have happened over time <u>and</u> discusses both evolution and separation of continents as evidence for continental drift. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes some changes to the elephants which have happened over time OR States that changes happen over time and gives a link to continental drift. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Describes features of modern elephants which are different from primelephas or gives a link to continental drift. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to DD</p> <p>Indicative scientific points may include:</p> <p>Features of the elephants</p> <ul style="list-style-type: none"> • primelephas lowest weight, African largest. • primelephas smallest ears, African largest. • primelephas longer tusk than African/Asian • Back shape sloping for primelephas / rounded for Asian, hollow for African (compares 2) <p>Changing features over time</p> <ul style="list-style-type: none"> • Idea that changes have occurred over time • Elephants have become larger over time • Ears are larger over time • Tusks have shortened over time • Back shape has changed over time • Idea that evolution is caused by different environments <p>Links to Continental Drift</p> <ul style="list-style-type: none"> • Africa and Asia separated since 5 MYA • Fossil found on both continents • Evolution of two elephants is different <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p> |
| | Total | 6 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|--|-----------|---|
| 4 | (a) | (i) | <p>Any 2 from:</p> <p>Idea of doing exercises <u>over a period of time</u> (1);</p> <p>Each person exercises different body part / one twin exercises one does not (1);</p> <p>Control amount of other exercise that they do / same activity / same food (1)</p> | 2 | Ignore 'do exercise' alone |
| | | (ii) | <p>size of muscle / diameter of body part (1);</p> <p>muscle / body part exercised gets larger / muscle/body part not exercised stays the same/gets smaller (1)</p> | 2 | |
| | | (iii) | acts a control | 1 | Allow 'fair test' Ignore: same genes |
| | (b) | (i) | <p>rats got better at doing the maze through the generations (1);</p> <p>implying that the learned behaviour was passed on (1)</p> | 2 | |
| | | (ii) | <p>Any two from:</p> <p>for peer review ;</p> <p>Idea of checking ;</p> <p>Make sure results are repeatable / repeated results are the same / experiment is reliable</p> | 2 | |
| | (c) | | <p>Darwin did not think acquired characteristics were passed on (1);</p> <p>believed in natural selection / survival of the fittest (1)</p> | 2 | |
| | | | Total | 11 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|---|----------|--|
| 5 | (a) | (i) | black bear and grizzly bear (1); both in same genus (1) | 2 | Allow both bears Ignore both in the same groups / boxes etc |
| | | (ii) | they are not mammals | 1 | Allow named characteristics eg do not have legs / live young / warm blood etc. |
| | | (iii) | they do not have a backbone | 1 | Allow: They have an exoskeleton |
| | (b) | | Linnaeus based on appearance/external characteristics/physical features (1) ; cladistics based on evolution / uses DNA (1) | 2 | |
| | | | Total | 6 | |

| Question | | Answer | Marks | Guidance |
|--------------|-----|--|----------|--|
| 6 | (a) | <p>[Level 3] Describes how signals travel on both diagrams and gives reasons why Marconi's method is needed. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes how signals travel on both diagrams or describes one diagram with a reason why Marconi's method is needed. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Makes a statement either about how signals travel or about why Marconi's method is needed. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to D*D*</p> <p>Indicative scientific points may include:</p> <p>How signals travel</p> <ul style="list-style-type: none"> • travel in straight lines • in fig 1 travel directly from transmitter to receiver • in fig 2 they bounce off a layer in the atmosphere / bounce off the ionosphere • ignore mention of satellites <p>Why Marconi's method needed</p> <ul style="list-style-type: none"> • Marconi's method allows signals to travel much further / Fig 1 only worked over short distances. • curve of Earth blocks / reflects signal • signal cannot follow curve of Earth / cannot travel around corners idea <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p> |
| | (b) | Hertz → fixed speed (1) ; Maxwell →detecting waves (1) ; | 2 | |
| Total | | | 8 | |

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