

Cambridge National Science

Unit R075/01: How Scientific Data is Used

Level 1

Mark Scheme for January 2015

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2015

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 |
| <u>words</u> | underlined words must be present in answer to score a mark |
| ecf | error carried forward |
| AW/owtte | credit alternative wording / or words to that effect |
| 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 |
| | no benefit of doubt |
| | reject |
| | correct response |

| | |
|---|---|
|  ,  ,  | draw attention to particular part of candidate's response |
|  | information omitted |
|  | 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. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- 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 the third and fourth boxes are required for the mark:

| |
|-------------------------------------|
| <input type="checkbox"/> |
| <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> |
| <input type="checkbox"/> |

*This would be worth
1 mark.*

| |
|-------------------------------------|
| <input type="checkbox"/> |
| <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> |
| <input type="checkbox"/> |

*This would be worth
0 marks.*

| |
|-------------------------------------|
| <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-box questions:

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 and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. 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 cities in England:

| | |
|-------------|--------------------------|
| Edinburgh | <input type="checkbox"/> |
| Manchester | <input type="checkbox"/> |
| Paris | <input type="checkbox"/> |
| Southampton | <input type="checkbox"/> |

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 |

e. For answers marked by levels of response:

i. **Read through the whole answer from start to finish**

ii. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor

iii. **To determine the mark within the level**, consider the following:

| Descriptor | Award mark |
|--------------------------------------|------------------------------|
| A good match to the level descriptor | The higher mark in the level |
| Just matches the level descriptor | The lower mark in the level |

- iv. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

| Question | | | Answer | | | | | | Marks | |
|----------|-----|-------|--|--|--|--|--|--|-------|--|
| 1 | (a) | (i) | D A B A C | | | | | | 2 | If incorrect allow 1 mark for D first OR C last |
| | | (ii) | clean (loop) / avoid contamination | | | | | | 1 | |
| | | (iii) | green-blue ✓ purple yellow | | | | | | 1 | |
| | (b) | | further evidence to support answer / conclusion more secure | | | | | | 1 | Allow reliable Do not allow more accurate |
| | (c) | (i) | line at 63 | | | | | | 1 | Answer must refer to line on graph |
| | | (ii) | calcium lithium potassium ✓ sodium ✓ | | | | | | 2 | |
| | (d) | | copper gives brightest flame / copper most intense / highest concentration (ORA) / other colours masked by copper | | | | | | 1 | Do not allow others don't give coloured flame Ignore reference to accuracy of mass spectrometer |
| | (e) | | Flame: quick/easy to use / easy to see result (1); MS: quantitative data / not subjective / more data / can detect more than one metal / can detect small amounts / more accurate (1) | | | | | | 2 | Flame: does not require expensive equipment (ORA) (1) |
| | | | | | | | | | Total | 11 |

| Question | | Answer | Marks | Guidance |
|----------|-----|---|-------|--|
| 2 | (a) | <p>[Level 3] L3 Describes sampling in detail AND explains one way of avoiding contamination. No significant errors in science or use of scientific terms. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] L2 Gives some idea of how to sample AND describes one way of avoiding contamination OR describes in detail ways of avoiding contamination. Some errors in science. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Some idea of how to sample given OR one way of avoiding contamination. 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</p> <p>Indicative scientific points may include:</p> <p>Sampling</p> <ul style="list-style-type: none"> • representative sample to include every colour made • random sample within colour • sample same colour from different containers • sample every day/regular basis <p>Avoiding contamination</p> <ul style="list-style-type: none"> • remove small amount of dye • uses clean pipette/apparatus each time • put sample in bottle • seal bottle • use clean bottle • label sample with date & colour • keep samples separate <p>Ignore wear gloves</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |

| Question | | Answer | | Marks | Guidance |
|----------|---------|---|----|-------|--------------------------------|
| 2 | (b) | Component | | 1 | |
| | | chromatography paper | ✓ | | |
| | | drop of reference pure dye | | | |
| | | pencil line | | | |
| | | solvent | | | |
| | (c) (i) | (easy) comparison / don't need to calculate R_f | | 1 | |
| | (ii) | so dye does not disperse/dissolve/mix in solvent (before it hits the pencil line) | | 1 | Allow run |
| | (iii) | biggest spread of spots | | 1 | |
| | (d) (i) | correct position of spot vertically | | 1 | |
| | (ii) | spot same position as reference pure dye (1); (Impurity) another spot (1) | | 2 | Allow there are 2 spots (1) |
| | (iii) | 0.3 | | 1 | Allow 0.28 to 0.31 |
| | (iv) | compare R_f values (1); select a dye with same R_f / select a dye with an R_f of 0.28 – 0.31 (ecf diii) (1) | | 2 | Allow compare result with data |
| | | Total | 16 | | |

| Question | | Answer | Marks | Guidance | | | | | | | | | | |
|-----------|----------------------------------|---|----------|---|----------|------------------------|-----------|----------------------------------|----------|--------------------------|---------|-----------------------------|---|---|
| 3 | (a) | <table border="1"> <thead> <tr> <th>Step</th> <th>Reason</th> </tr> </thead> <tbody> <tr> <td>1 places</td> <td>to hold slide in place</td> </tr> <tr> <td>2 selects</td> <td>to avoid damaging lens and slide</td> </tr> <tr> <td>3 lowers</td> <td>to view a focussed image</td> </tr> <tr> <td>4 looks</td> <td>to choose the magnification</td> </tr> </tbody> </table> | Step | Reason | 1 places | to hold slide in place | 2 selects | to avoid damaging lens and slide | 3 lowers | to view a focussed image | 4 looks | to choose the magnification | 3 | <p>4 correct lines 3 marks 3 or 2 correct lines 2 marks 1 correct line 1 mark</p> |
| Step | Reason | | | | | | | | | | | | | |
| 1 places | to hold slide in place | | | | | | | | | | | | | |
| 2 selects | to avoid damaging lens and slide | | | | | | | | | | | | | |
| 3 lowers | to view a focussed image | | | | | | | | | | | | | |
| 4 looks | to choose the magnification | | | | | | | | | | | | | |
| | (b) (i) | attempt to measure more than one cell (1); length ÷ number of cells (1); (=) 0.06 (1) | 3 | <p>eg 5 cells in 0.3 mm Allow 0.05 - 0.07</p> | | | | | | | | | | |
| | (ii) | (estimate) judged by eye (1); (mean) not all cells same length (1) | 2 | <p>Ignore guess Allow description of how mean is calculated</p> | | | | | | | | | | |
| | (c) | higher resolution / greater magnification / more detail | 1 | <p>Allow clearer image / bigger image Ignore see better</p> | | | | | | | | | | |
| | | Total | 9 | | | | | | | | | | | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|--|-------|------------------------------|
| 4 | (a) | (i) | 6 | 1 | |
| | | (ii) | fish – agree (pH6 suitable for fish) (1); snails – agree pH6 too low (ORA) (1); plants – agree as pH6 covers 6.2 (1) | 3 | |
| | (b) | (i) | volume of water / temperature / location / time / depth | 1 | Allow amount of water |
| | | (ii) | someone else follows same procedure / follows standard procedure | 1 | |
| | (c) | (i) | rough idea of what volume should be | 1 | |
| | | (ii) | all about the same / small range / no anomalies/outlier | 1 | |

| Question | Answer | Marks | Guidance |
|----------|---|-----------|--|
| 4 (d) | <p>[Level 3] Calculates range, mean AND finds concentration ignoring test 3 AND comments on data. No significant errors in science. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Calculates BOTH range AND mean by either method AND comments on data. Some errors in the use of scientific terms. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Calculated either range OR mean OR comments on data. 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</p> <p>Indicative scientific points may include:</p> <p>Ignoring test 3</p> <ul style="list-style-type: none"> • range 0.39 to 0.45 / 0.46 • mean 0.42 • omit 0.14 • test 3 is outlier / made mistake in reading • concentration 0.56g/dm³ (+/- 0.01) • concentration has decreased / water quality improving • ranges overlap, so cannot be certain • selection of appropriate wavelength of light <p>Not ignoring test 3</p> <ul style="list-style-type: none"> • range 0.14 to 0.45 / 0.31 • mean 0.35 • include all tests • concentration 0.46g/dm³ (+/- 0.01) • concentration has decreased / water quality improving • very large range makes data unreliable <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |
| | Total | 14 | |

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

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2015

