

Cambridge National

Science

Unit **R075/02**: How Scientific Data is Used

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.

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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
<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 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
	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

2. 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:

✗
✗

*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, 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 RM Assessor 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)	<p>living human cells — Electron microscope the surface — Light microscope the writing — Magnifying glass</p>	3	all three lines correct 2 marks two or one line correct 1 mark
	(b)	(i) D (4th answer)	1	
		(ii) B (2nd answer)	1	
	(c)	<p>use of more than one space (1);</p> <p>divide scale reading by correct number of spaces (1);</p> <p>3 (micrometre) (1)</p>	3	seen in working or explained eg 5 eg 15/5 no ecf from line above
	(d)	<p>cannot view living things / expensive / need training</p> <p>takes time to set up / (only) black and white / needs electricity / not portable.</p>	1	
		Total	9	

Question			Answer	Marks	
2	(a)	(i)	each batch (1); each chemical (1)	2	
		(ii)	use clean apparatus (1);	1	ignore wearing protective clothing/gloves allow use a different container for each sample/keep separate
	(b)		coloured precipitate with sodium indicates copper (1) white precipitate/barium chloride test shows sulphate (1)	2	ignore green / white is copper sulfate allow could be iron
	(c)	(i)	make conclusion more secure	1	allow make conclusion more reliable/check if the result was correct
		(ii)	green (1 st answer)	1	

Question		Answer	Marks	Guidance
2	(d)	<p>[Level 3] Identifies sodium and bromide and makes a valid conclusion on purity using data from graphs. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Identifies sodium and bromide and explains how conclusion reached OR makes a valid conclusion on purity using data from graphs. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Identifies sodium and bromide. 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>Identification of ions:</p> <ul style="list-style-type: none"> • sodium • bromide <p>Explanation:</p> <ul style="list-style-type: none"> • line near 23 on ms graph • time near 13 on ic graph <p>Amounts:</p> <ul style="list-style-type: none"> • sodium about 1/9th of copper or 1/10th of whole • bromide less than 1/9th of chloride or less than 1/10th of whole • together less than 10% of whole <p>Conclusion:</p> <ul style="list-style-type: none"> • Less than 90% pure • it is technical purity <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p>
		Total	13	

Question			Answer	Marks	
3	(a)	(i)	A – correct 9 is blue (1); B – correct as 8.1 close to 8 (1); C – incorrect as 10.8 closer to 11 so purple (1)	3	if no correct reasons given allow 1 mark max for A – correct , B- correct and C – incorrect.
		(ii)	UI – quick / apparatus readily available / cheap / easy to use (1); pH meter – quantitative / precise (1)	2	allow accurate

Question		Answer	Marks	Guidance
3	(b)	<p>[Level 3] Makes a valid conclusion relating amount of acid to number of tablets supported by use of means and ranges data. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Makes a valid conclusion relating amount of acid to number of tablets supported by use of means data only. Some errors in science. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Makes a valid conclusion that relates amount of acid to number of tablets OR makes a valid comment about data for 1 tablet. 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>Comment on data for one tablet:</p> <ul style="list-style-type: none"> • variation of volume of acid between 3 titrations • use of range with mean <p>Relation between amount of acid and number of tablets:</p> <ul style="list-style-type: none"> • amount of acid increases with number of tablets • patients with more stomach acid should take more tablets <p>Reasoning</p> <ul style="list-style-type: none"> • using mean values only 2 tablets (44.8) close to/little more acid than 2x1 tablet (2x22.3=44.6) 3 tablets (67.2) close to/little more acid than 3x1 tablet (3x22.3=66.9) Conclude amount of acid neutralised increases with number of tablets • using mean and range 1 tablet 21.9-22.7 2 tablets 44.5-45.1 3 tablets 66.8-67.6 Conclude amount of acid neutralised proportional to number of tablets <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p>
Total			11	

Question			Answer	Marks	Guidance
4	(a)	(i)	put known concentration/(distilled) water/solvent in cuvette (1); (put cuvette in colorimeter) and press cal button (1)	2	
		(ii)	(ensure) results are accurate	1	allow make sure results are correct / valid
	(b)		orange transmits some green and red (1); blue light is absorbed (1); more blue light absorbed by anti-freeze with greater concentration (ORA)(1)	3	
	(c)	(i)	mean absorbance 0.33 OR 0.31 (1); mean concentration 1.65 OR 1.55 (1); Explanation any two from : ignore 0.25 (1); outlier/very different/anomalous (1); (then) use graph to find concentration from absorbance (1)	4	allow absorbance written in concentration for 1 mark 1.65 or 1.55 without working gets 2 marks

Question	Answer	Marks	Guidance
(ii)	<p>EITHER: Use concentration 0.1×1.65 (1); $0.16(5)$ (g/l) (1); yes, all results used within $1.65 \pm 0.16(5)$ (1)</p> <p>OR: Use absorbance 0.1×0.33 (1); $0.03(3)$ (1); Yes, all results used within $0.33 \pm 0.03(3)$</p>	3	<p>Use candidate's mean concentration from c(i) and apply ecf</p> <p>only award this mark if working shown</p> <p>Use candidate's mean absorbance from c(i) and apply ecf</p> <p>only award this mark if working shown</p> <p>eg of ecf from c(i) Conc: 1.55×0.1 0.155 No, result for 1.25 (abs 0.25) out of range</p> <p>Abs: 0.31×0.1 0.031 No, result for 0.25 out of range</p>
(d)	use another technique	1	allow consult secondary data eg book, supplier's data do not allow repeat
	Total	14	

Question		Answer	Marks	
5	(a)	methionine	1	Do not penalise wrong spelling
	(b)	dot covers 0.72 and 0.73 / isoleucine and leucine have R_f values very close (OWTTE)	1	
	(c)	correct positions of R_f (0.35 and 0.61) and on vertical dotted line	1	Needs both correct, judge R_f by eye
		Total	3	

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