

Cambridge National

Science

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

Level 2

Mark Scheme for January 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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.













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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
<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

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	Guidance
1	(a)	an indicator (2 nd answer)	1	
	(b)	(i) the range of values is too large <input checked="" type="checkbox"/> the variables are not controlled <input type="checkbox"/> there are not enough results <input type="checkbox"/> the range of values are not large <input type="checkbox"/>	1	
		(ii) outlier (1); sample 3 very different from rest (1)	2	allow range of 8.2
		(iii) Any TWO from: reduce human error; objective / not subjective / does not rely on Ben's sight; more sensitive; more samples used	2	allow more accurate/precise
	(c)	correct substitution: $(5 \times 2.2) / 43.6$ (1); 0.25 (1); comment to show value lies within accepted range (1)	3	correct answer without working shown gets 2 allow $0.27 - 0.02 = 0.25$ for third marking point allow ecf from stated value
Total			9	

Question	Answer	Marks	
2 (a) (i)	width = 2.5 (mm) (1); (2.5/50 =) 0.05 (mm)	2	correct answer without working gets 2 marks
(ii)	Adv: greater magnification (OWTTTE) (1); Dis: damage to drawing when preparing sample / expensive / images only in black and white (1)	2	
(b) (i)	copper (1); both lines present / peak II & III present / peaks at 1420 and 1580 (1)	2	
(ii)	Any THREE from peak I at about 1000 could be silver or sodium (1); no iron present as no peak near 1200 (1); another substance present as no data for peak at just over 1600 (1); no lead found as not peak near 900 (1)	3	
(iii)	use a different technique <input checked="" type="checkbox"/> use a less powerful laser <input type="checkbox"/> repeat the same experiment <input type="checkbox"/> get someone else to do the same experiment <input type="checkbox"/>	1	
	Total	10	

Question	Answer	Marks	Guidance
3	<p>[Level 3] Calculates and names at least two dyes with reason. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Calculates R_f values for all spots in both solvents and names at least one dye. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] EITHER calculates an R_f value for at least two dyes in either solvent OR makes valid comments without calculations. 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>Comments:</p> <ul style="list-style-type: none"> • 4 different dyes • two dyes not soluble in solvent 1 • One dye not soluble in solvent 2 <p>Calculations:</p> <ul style="list-style-type: none"> • Solvent 1: top spot $R_f=4.5/5=0.90$ • Middle spot $R_f=2.7/5=0.54$ • Solvent 2: top spot $R_f=4.3/5=0.86$ • Next spot down $R_f=3/5=0.6$ • Next spot $R_f=2/5=0.4$ <p>Naming dyes with reason:</p> <ul style="list-style-type: none"> • Allura red-Solvent 1 0.54 & not soluble in solvent 2 • Erythrosine- solvent 1 0.9 & solvent 2 0.6 • Indigotine- not soluble in solvent 1 & 0.4 solvent 2 • Tartrazine- solvent 1 0.9 & solvent 2 0.86 <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p>
	Total	6	

Question		Answer	Marks	
4	(a)	<p>Either: Iron II to sodium hydroxide AND sulfate to barium chloride (1);</p> <p>Iron II line goes to green AND sulphate line goes to white (1)</p> <p>Or: Iron II to sodium hydroxide AND sodium hydroxide to green (1)</p> <p>sulfate to barium chloride AND barium chloride to white (1)</p>	2	allow mark even if test solution is incorrect
	(b)	mass spectrometry and flame testing	1	both needed
	(c)	<p>(Sam)</p> <p>Valid comment about colour or chart: eg eye cannot detect slight differences / qualitative / yellow may look same as yellow-green / colour on chart may be different to what is seen / colour chart is subjective (1);</p> <p>Valid comment on range of pH: eg 5 could be 4.5 to 5.5 / only integer values on chart / same pH to whole number but different acidity (1)</p>	2	No mark for person
Total			5	

Question		Answer	Marks	
5	(a)	Any TWO from: use clean/new needle; use clean/new tube; sterilise/clean patient's skin; wear gloves seal the tube	2	do NOT allow label tube
	(b)	(i) Any TWO from: avoids systematic error; compensates for any absorbance by cuvette; takes into account absorbance by solvent; so that reading only shows absorbance by blood	2	
		(ii) Any TWO from: idea that sample absorbs blue-green light; idea that amount of blue-green light absorbed varies with concentration of creatinine; gives highest reading; gives greatest spread of readings	2	
	(c)	use standard solutions/known concentrations (1); (a number of standards) from 1mg/dl to 7mg/dl / over range needed (1)	2	

Question		Answer	Marks	
	(d)	(i) 0.05 x 0.42 (1); 0.02 (1); Explanation that range=value =+/- 0.02 (1)	3	correct answer without working gains both marks
		(ii) 4.0	1	
		(iii) 4.0+/- 0.2	1	allow 0.4 allow ecf allow 3.8-4.2
	(e)	severe (3 rd answer)	1	

Question		Answer	Marks	Guidance
5	(f)	<p>[Level 3] Calculates kidney performances for both patients and makes valid comments supported by calculated data. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Calculates both kidney performance for one patient and makes valid comment using calculated data. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] EITHER calculates at least one kidney performance for either patients OR makes valid comment on severity of disease for one patient with reasoning but without calculation. 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>Bob:</p> <ul style="list-style-type: none"> • Wk1 creat 3.2; • $(140-55) \times 70 / (88 \times 3.2) = 21\%$; • severe • Wk2 creat 2.2; • 31%; • moderate <p>Tom:</p> <ul style="list-style-type: none"> • Wk1 creat 3.2; • $(140-75) \times 65 / (88 \times 3.2) = 15\%$; • severe • Wk2 creat 4.0; • 12%; • very severe <p>Comment with reasoning:</p> <ul style="list-style-type: none"> • Bob improving as absorbance/creatinine falls • Tom getting worse absorbance/creatinine rises <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p>
Total			20	

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