

## **Cambridge National**

### **Science**

Unit **R075/01**: How Scientific Data is Used

Level 1

## **Mark Scheme for January 2015**

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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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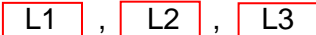














## Annotations

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 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:*

<del>✗</del>
<del>✗</del>

*This would be worth  
1 mark.*

✓
<del>✗</del>

*This would be worth  
0 marks.*

<del>✗</del>
<del>✗</del>
✓
✓

*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		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

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 <b>allow</b> 1 mark for D first <b>OR</b> C last
		(ii)	clean (loop) / avoid contamination					1	
		(iii)	green-blue ✓ purple yellow					1	
	(b)		further evidence to support answer / conclusion more secure					1	<b>Allow</b> reliable <b>Do not allow</b> 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	<b>Do not allow</b> others don't give coloured flame <b>Ignore</b> 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)
			<b>Total</b>					<b>11</b>	



Question		Answer	Marks	Guidance
2	(a)	<p><b>[Level 3]</b> L3 Describes sampling in detail <b>AND</b> 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><b>[Level 2]</b> L2 Gives some idea of how to sample <b>AND</b> describes one way of avoiding contamination <b>OR</b> 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><b>[Level 1]</b> Some idea of how to sample given <b>OR</b> one way of avoiding contamination. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> 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><b>Indicative scientific points may include:</b></p> <p><b>Sampling</b></p> <ul style="list-style-type: none"> <li>representative sample to include every colour made</li> <li>random sample within colour</li> <li>sample same colour from different containers</li> <li>sample every day/regular basis</li> </ul> <p><b>Avoiding contamination</b></p> <ul style="list-style-type: none"> <li>remove small amount of dye</li> <li>uses clean pipette/apparatus each time</li> <li>put sample in bottle</li> <li>seal bottle</li> <li>use clean bottle</li> <li>label sample with date &amp; colour</li> <li>keep samples separate</li> </ul> <p><b>Ignore</b> wear gloves</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question		Answer		Marks	Guidance
2	(b)	<b>Component</b>		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	<b>Allow</b> 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	<b>Allow</b> there are 2 spots (1)
		(iii)	0.3	1	<b>Allow</b> 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	<b>Allow</b> compare result with data
<b>Total</b>				<b>16</b>	

Question			Answer	Marks	Guidance										
3	(a)		<table border="0"> <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	4 correct lines 3 marks 3 or 2 correct lines 2 marks 1 correct line 1 mark
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	eg 5 cells in 0.3 mm <b>Allow</b> 0.05 - 0.07										
		(ii)	(estimate) judged by eye (1); (mean) not all cells same length (1)	2	<b>Ignore</b> guess <b>Allow</b> description of how mean is calculated										
	(c)		higher resolution / greater magnification / more detail	1	<b>Allow</b> clearer image / bigger image <b>Ignore</b> see better										
			<b>Total</b>	<b>9</b>											

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	<b>Allow</b> 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><b>[Level 3]</b> Calculates range, mean <b>AND</b> finds concentration ignoring test 3 <b>AND</b> 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><b>[Level 2]</b> Calculates <b>BOTH</b> range <b>AND</b> mean by either method <b>AND</b> 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><b>[Level 1]</b> Calculated either range <b>OR</b> mean <b>OR</b> comments on data. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> 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><b>Indicative scientific points may include:</b></p> <p><b>Ignoring test 3</b></p> <ul style="list-style-type: none"> <li>• range 0.39 to 0.45 / 0.46</li> <li>• mean 0.42</li> <li>• omit 0.14</li> <li>• test 3 is outlier / made mistake in reading</li> <li>• concentration 0.56g/dm<sup>3</sup> (+/- 0.01)</li> <li>• concentration has decreased / water quality improving</li> <li>• ranges overlap, so cannot be certain</li> <li>• selection of appropriate wavelength of light</li> </ul> <p><b>Not ignoring test 3</b></p> <ul style="list-style-type: none"> <li>• range 0.14 to 0.45 / 0.31</li> <li>• mean 0.35</li> <li>• include all tests</li> <li>• concentration 0.46g/dm<sup>3</sup> (+/- 0.01)</li> <li>• concentration has decreased / water quality improving</li> <li>• very large range makes data unreliable</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>14</b>	

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