

## **Cambridge National**

### **Science**

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

Level 2

## **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	Guidance
1	(a)	(i)	green-blue	1	Allow green/blue
		(ii)	follows standard procedure	1	
		(iii)	results same / same colour	1	
	(b)		precipitate (1); blue (1)	2	Allow cloudy
	(c)	(i)	copper present as line at 63 (1); other lines are present (1) other metals are sodium and potassium (1)	3	Ignore reference to other metals present Do not allow reference to lithium and calcium present
		(ii)	ANY TWO from can identify more than one metal in sample mass spectrometer is objective/quantitative (ORA) gives relative intensity digitally stored	2	Ignore more accurate  Allow shows different amounts
			<b>Total</b>	<b>10</b>	

Question		Answer	Marks	Guidance
2	(a)	<p><b>[Level 3]</b> Detailed method of sampling <b>AND</b> ways of avoiding contamination with explanation given. 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> Some detail of how to sample <b>AND</b> some way of avoiding contamination given. 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> Idea of how to sample <b>OR</b> avoid 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><b>This question is targeted at grades up to D*</b></p> <p><b>Indicative scientific points may include:</b> <b>How to sample:</b></p> <ul style="list-style-type: none"> <li>representative sample to include every colour made / every manufacturer</li> <li>random sample within colour and manufacturer</li> <li>sample every day</li> </ul> <p><b>Avoiding contamination:</b></p> <ul style="list-style-type: none"> <li>remove small amount of dye</li> <li>put sample in bottle/container</li> <li>seal bottle</li> <li>use clean bottle/container</li> <li>label sample with date, colour &amp; manufacturer</li> </ul> <p><b>Ignore</b> wear gloves/protective clothing</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>putting some dye in clean container avoids contamination by container</li> <li>use clean apparatus to remove samples from containers</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question			Answer	Marks	Guidance
2	(b)	(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	
	(c)	(i)	8.9/10 (1); 0.89 (1)	2	Allow 8.7 - 9.1 Allow 0.87 - 0.91 on its own gets 2 marks
		(ii)	there is another spot (1) contains more than one dye / not pure (1);	2	
			<b>Total</b>	<b>13</b>	

Question		Answer	Marks	Guidance
3	(a)	choose (objective) lens (1); low power/magnification (1)	2	<b>Ignore</b> zoom in/zoom out
	(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
<b>Total</b>			<b>7</b>	

Question		Answer	Marks	Guidance
4	(a)	fish – agree/yes because pH6 (is suitable for fish) (1);  snails – agree/yes because pH6 is below the range (suitable for snails) ORA (1)  plants – disagree/no because pH could be suitable for plants as pH 6 covers pH6.2 (1)	3	
	(b)	(Adv) – more precise (OWTTE) / gives pH with decimal places / not subjective (ORA) (1);  (Dis) – (time/need) to calibrate (1)	2	<b>Ignore</b> more accurate  <b>allow</b> more expensive
	(c) (i)	same volume of water (for each test) (1);  known concentration for sodium hydroxide / same concentration (1)	2	<b>Allow</b> same amount of water  <b>Allow</b> same sodium hydroxide
	(ii)	phenolphthalein (1);  (lake) water is a weak acid (1);  (dilute) sodium hydroxide is strong base (1)	3	
	(iii)	range (is wrong) (1);  do not include rough trial (1)	2	<b>Allow</b> range is 0.4
	(iv)	0.05/9.6 (1);  0.5 (%) (1)	2	0.5(%) alone gets 2 marks

Question	Answer	Marks	Guidance
4 (d)	<p><b>[Level 3]</b> Describes use of colorimeter <b>AND</b> calibration <b>AND</b> valid comments on results. 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> Some steps given for using colorimeter <b>OR</b> calibration described <b>AND</b> results valid comments on results. 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> Shows understanding of what a colorimeter is <b>OR</b> calibration <b>OR</b> makes valid comments on results. 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><b>This question is targeted at grades up to D*</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Use of colorimeter:</b></p> <ul style="list-style-type: none"> <li>• set to zero</li> <li>• put sample in tube</li> <li>• light shone through sample</li> <li>• measures absorbance or transmission of light</li> <li>• measure light level</li> </ul> <p><b>Calibration:</b></p> <ul style="list-style-type: none"> <li>• test known concentration</li> <li>• plot calibration graph</li> <li>• use graph to find concentration</li> <li>• check calibration each day</li> </ul> <p><b>Results:</b></p> <ul style="list-style-type: none"> <li>• concentration may have decreased</li> <li>• ranges overlap</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>20</b>	

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