OCR
Oxford Cambridge and RSA

Cambridge National

Science

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

Level 2

Mark Scheme for June 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.

Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
do not allow	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
words	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
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	draw attention to particular part of candidate's response
^	information omitted
—	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
^	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 <u>and</u> 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	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
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:

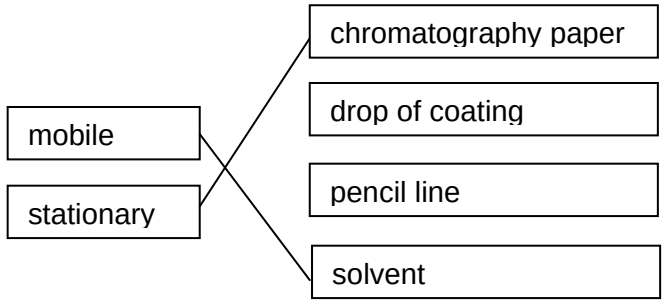
Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

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	Guidance
1	(a)	(i)	UI only gives integer values (OWTTE) / 5.8 to 6.2 could be orange or yellow (1); Colour is subjective (OWTTTE) (1)	2	**Allow** could be higher than 6.2 (within 6 integer range) / outside the range of yellow
		(ii)	Any **TWO** from: (more) accurate (more) sensitive (more) precise (more) quantitative not subjective	2	**Allow** no contamination (of sample)
	(b)		chloride (1); copper (1)	2	
			Total	6	

Question			Answer	Marks	Guidance
2	(a)			2	
	(b)		B – only one colour (1); C – two colours (1); B & C have one colour in common(1)	3	**Allow** has **at least** one colour **Allow** has **at least** two colours
	(c)	(i)	no spots / original drop still coloured	1	**Allow** spot hasn't moved from pencil line
		(ii)	use a different solvent √ use a larger drop on the pencil line use a longer piece of chromatogram paper use more of the same solvent	1	
	(d)	(i)	7.9 (1); 0.79 (1)	2	**Allow** 7.7 to 8.0 **Allow** ecf 0.79 without working gets 2 marks
		(ii)	lower spot has R_f =0.3 so is allura red (1); higher spot **might be** brilliant blue / **could be** sky blue (1); size of spot / R_f for brilliant blue and sky blue are close / covers a range OWTTE (1)	3	
			Total	12	

Question			Answer	Marks	Guidance
3	(a)		three types on B / one more type than on A	1	**Allow** B has a different type **Allow** two types in strip B are the same as in strip A
	(b)	(i)	increases the intensity of the light: ; moves the stage nearer the objective lens: ; pulls the eyepiece lens out further: ; selects a different objective lens: √	1	
		(ii)	(measured length = 32mm) 32/500 (1); 0.064 (1)	2	No mark for measured length (allow 31-33mm) **Allow** ecf measured length/500 for 1 mark max **Allow** 0.062 to 0.066 0.062 to 0.066 without working gets 2 marks **Do not allow** 0.06 (answer should not be rounded)
		(iii)	measure more grains (1); calculate the average (1)	2	 **Allow** a description of the calculation of an average.

Question	Answer	Marks	Guidance
3 (c)	**[Level 3]** Gives at least two advantages **AND** two limitations and explains each. No significant errors in science. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives an advantage **AND** a limitation together with explanations for each. Some errors in the use of scientific terms. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Mentions an advantage **AND** a limitation **OR** two advantages **OR** two limitations. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to D*** **Indicative scientific points may include:** **Advantages:** • see very small particles • see detail • 3D images **Limitations:** • Cannot view living organisms • Long set up time • Expensive to use • Requires training • Not portable **Explanations:** • Good magnification • Good resolving power • Preparation involves vacuum • Complex procedure to prepare specimens • High running and preparation costs • Apparatus is heavy **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**12**	

Question			Answer	Marks	Guidance
4	(a)		use a clean knife / put sample in clean container	1	**Do not allow** wear gloves **Allow** other clean implements
	(b)		not enough metal / colour too weak	1	**Allow** metal doesn't give colour / sample size too small
	(c)		calcium **and** copper	1	**Both** needed for mark
	(d)		lead and titanium have similar wavelengths/are very close (1); peak on graph covers both (1)	2	
	(e)	(i)	colour / no numbers / subjective	1	**Do not allow** not quantitative
		(ii)	can detect more than one metal / (more) sensitive / (more) accurate / precise	1	**Allow** automatically digitally stored / can have a print out
			Total	7	

Question			Answer	Marks	Guidance
5	(a)		**[Level 3]** Calculates both mean and range of concentration and makes a decision. 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) **[Level 2]** Calculates both mean and range of concentration **OR** calculates mean of concentration **AND** makes states dye can be used. Some errors in science. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Calculates mean absorbance **AND** uses graph to find mean concentration **OR** uses the graph to find the concentration of a dye and make a decision based on this value. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to D*** **Indicative scientific points may include:** **Calculation:** • Mean absorbance = 0.54 • Use of calibration graph • Mean concentration = 0.42 g/dm^3 • Range of absorbance is 0.50 to 0.58 • Range of concentration is 0.39 to 0.46 **Decision:** • Mean concentration is within tolerance • (mean concentration shows) dye can be used • Range of concentration outside tolerance • (range of concentration) shows dye cannot be used Working can be taken from the graph. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(b)</td><td>(i)</td><td>
<table>
<tr><th></th><th>CV</th><th>DV</th><th>IV</th><th>NAV</th></tr>
<tr><td>Volume of alkali added</td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>25cm^3 of solution used in each titration</td><td>√</td><td></td><td></td><td></td></tr>
</table>
</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>A=42.1 and B=40.3 (1);

Ignore outlier/48.4 in B (1)</td><td>2</td><td>Both means needed

Allow working showing how B is calculated
Allow 1 mark max for means A=42.1 and B=42.3</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>(2x0.05=)0.1 (1);
(0.1/41 x100=) 0.24 (1)</td><td>2</td><td>Ignore +/-
Allow 0.2
0.2(4) without working gets 2 marks
Do not allow 0.25</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>two readings taken</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>13</td><td></td></tr>
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