OCR
Oxford Cambridge and RSA

Cambridge National

Science

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

Level 2

Mark Scheme for June 2017

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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
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
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 RM Assessor 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

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Subject-specific Marking Instructions

Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).

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.

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.

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 should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

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	i	Change in colour (of indicator)	1	
		ii	(in table) 39.1 ; 20.4 ; 18.7 ;	3	 **allow** ecf
		iii	yes because readings are not close ; identifies that titration 3 is too low / compares two titration results ; or no because some titration readings are close ; identifies titration 1 and 2 ;	2	**allow** results are different with ecf **allow** ecf from aii **allow (2**) for 'No, titrations 1 and 2 are close together'

Question			Answer	Marks	Guidance
b			**[Level 3]** Makes statements to link concentration or titres to safety for all five vinegars Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Makes statements about the concentration of most vinegars **OR** links concentration or titres to safety for more than two vinegar. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes statements about the concentration or safety of at least two vinegars. 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) I'm still uneasy about point marking but there is more to do here than in L1.	6	**This question is targeted at grades up to D** **Indicative scientific points may include:** **Concentrations** • Vinegar A 3% • Vinegar B just under 4% / allow 3.8-3.9% • Vinegar C just over 4% / 4.2 % • Vinegar D 5% • Vinegar E is more than 8% / allow values up to 9% Safety • **<u>Quotes concentration(above)</u>** and links to… o A/ B not safe o C/D safe o E not safe • OR **<u>Quotes titres</u>** 20cm^3 to 30cm^3 are safe' and links to .. o A/B not safe, titre below 20cm^3 o C/D safe, titre between 20-30cm^3 o E not safe, titre above 40cm^3 **For Level 1 only allow '**Vinegar C/vinegar D is safe (for use in food)' unqualified for 2 marks **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	6	

Question			Answer	Marks	Guidance
2	a		both contain chloride / both show contain sulfate; links white precipitate to test for chloride/sulfate; both show there is no carbonate present;	3	**Ignore** references to bromide
	b		Also shows that contains bromide (ions) / can be used to show how much of each ion present	1	
	c		qualitative tells you the composition / contents / what is in a sample ; quantitative tells you how much / numbers ;	2	
			Total	6	

Question			Answer	Marks	Guidance
3	a	i	(pH meter no mark) because it dips into each solution / same instrument used every time idea ;	1	
		ii	*Any 2 from:* accuracy / more accurate / automatic / gives a number / gives a reading automatically ; to decimal places / not just a whole number / can show small differences in pH ; don't need to compare colours / no need for a chart;	2	**allow** more sensitive **ignore** reliable **allow** more precise
	b		(primary)Test more (different types of) copper salts; (secondary) Look on the internet / use other people's research ;	2	**ignore** repeat the test
	c		flame tests ✓ adding dilute sodium hydroxide ✓ titration ☐ colorimetry ☐	2	
			Total	7	

Question			Answer	Marks	Guidance
4	(a)		sample from each place	1	**ignore** different places
	(b)	(i)	Any **two** from: quick / no training needed / no preparation of specimen; easy to use; easy to move; large field of view;	2	**allow** cheaper
		(ii)	3/50 (1); 0.06 (1)	2	correct answer without working gets 2 marks
			Total	5	

Question			Answer	Marks	Guidance
5	(a)		Any **TWO** from: looks purple because absorbs green light/otherv colours; greater concentration gives deeper/more intense purple colour; more intense purple absorbs more green light	2	
	(b)		(C=) 0.76 (1); 0.19 (1)	2	**allow** 0.75-0.77 ecf and answer correct to 1 dp correct answer without working gets 2 marks

Question			Answer	Marks	Guidance
5	(c)		**[Level 3]** Correctly comments on all three batches with data support from mean and range. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Correctly comments on at least two batches with some data support from mean and range. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Correctly comments on all three batches using mean only with some data support **OR** correctly comments on at least one batch with data support from mean and range. 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:** **Batch X:** • mean gives conc 0.62 • mean gives % 0.16 • mean reject >0.15 • range gives conc 0.56 to 0.69 • range gives % 0.14 to 0.17 • range is large – from acceptable to reject **Batch Y:** • mean gives conc 0.48 • mean gives % 0.12 • mean acceptable • range gives conc 0.46 to 0.50 • range gives % 0.11 to 0.13 • range is small and all < 0.15 • uncertain quality **Batch Z:** • mean gives conc 0.40 • mean gives % 0.10 • mean acceptable quality <0.15 • range gives conc 0.39 to 0.41 • range gives % 0.10 to 0.10 • range is very small and all < 0.15 • acceptable quality **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	**10**	

Question			Answer	Marks	Guidance
6	(a)		6.2/10 (1); 0.62 (1)	2	**allow** 0.61 to 0.64 correct answer without working gets 2 marks
	(b)		Any **THREE** from: Y- agree as spot for phenylalanine and no spot for tyrosine; X – agree as top of spot at 1.6cm/Rf 0.16 but not centre; W – agree for PKU as spot for tyrosine **and** agree for UCD as spot at 1.6cm/Rf 0.16 for arginine; Z – disagree for PKU as spot for tyrosine. uncertain for UCD as large spot covers 1.6cm/Rf 0.16 but	3	reasons must be given
	(c)		known value (1); comparison (1)	2	
	(d)		separates spots as much as possible (1); distances measured large **to reduce error** (1)	2	
	(e)		use different technique / use different solvent	1	
			Total	10	

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