OCR
Oxford Cambridge and RSA

Cambridge National

Science

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

Level 2

Mark Scheme for January 2016

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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 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

L1 , L2 , L3	draw attention to particular part of candidate's response
^	information omitted

	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
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	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 <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)	any **TWO** from: same ratio of men to women all countries / all places / all teams unbiased / same make up as whole	2	**Allow** test male and female
		(ii)	Any **TWO** from: use clean / sterile equipment use gloves keep samples separate seal specimen / put lid on label store correctly	2	**Ignore** goggles **Allow** any name equipment eg needle, container
	(b)	(i)	graph for B same as graph for blood without drugs (1); extra part on graph A / does not match blood without drugs (1)	2	**Allow** A is different
		(ii)	look for graph of extra part (1); internet / book (1)	2	**Allow** do experiment on drugs for 1 mark
		(iii)	use a different technique	1	**Allow** name technique that would work. **Do not allow** idea of someone else using the same test
			Total	9	

Question			Answer	Marks	
2	(a)		add up and divide (1); ignore rough **and** titration 3 / use titrations 1, 2 and 4 only (1)	2	**Allow** (27.6 + 27.4 + 27.5)/3
	(b)		0.2 x 27.5/25 (1); 0.22 (mol/dm^3) (1)	2	**Allow** use of own average **Allow** 2 marks for 0.22 without working **Do not allow** 0.2 without working
			Total	4	

Question			Answer	Marks	Guidance
3	(a)	(i)	(qualitative) no numbers / subjective / colour differs for people	1	no mark for qualitative alone
		(ii)	same spot for both so same pigment / both contain (same) blue green spot which is chlorophyll-a (1); other pigment cannot be same as spots in different positions (1); carotene is yellow but could be other yellowish pigments (1)	3	
	(b)	(i)	measure from same place for all pigments / control starting place	1	**Allow** pencil line will not move
		(ii)	9.6/10 (1); 0.96 (1)	2	**Allow** 9.4 to 9.8 **Allow** 2 marks for 0.96 without working or by measurement instead of using scale **Allow** 0.94 to 0.98 **Allow** 0.64 to 0.67 for 1 mark
		(iii)	carotene	1	**Allow** ecf from (iii)
	(c)		spots further apart (so less error in measuring distances)	1	**Ignore** no ruler/scale on Jack's chromatogram **Allow** Adam let the solvent run for longer (for a larger spread of results)

Question			Answer	Marks	Guidance
3	(d)		**[Level 3]** Identifies all pigments in plants A and B **and** gives reason/evidence for choices. Explains difference. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies all pigments in plants A and B **and** gives reasons/evidence for choices. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies some of the pigments in plants A and B. 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:** **Plant A:** • chlorophyll-a • line at 430 • carotene • line at 450 • chlorophyll-b • line at 453 **Plant B:** • chlorophyll-a • line at 430 • chlorophyll-b • line at 453 • xanophyll • line at 493 **Difference:** • chlorophyll-b does not show on chromatogram • because the intensity is not great enough/might not be soluble in the solvent used • there is more chrlophyll-a in A than in B • the **amount** of chlorphyll-b is the same for both • because the absorbance spectrometer shows relative intensity but the chromatogram does not **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**15**	

Question			Answer	Marks	Guidance
4	(a)	(i)	Adv: quantitative / gives numbers / not subjective / objective (1); Dis: need to calibrate / takes longer (to set up) / expensive (1)	2	**Allow** more precise/exact **Ignore** accurate **Allow** need to be trained
		(ii)	Lucy: (agree) (river water) 8.7>8.1 (1); Matt: (agree) (well water) close to 7 (1); range 6.6 to 7.2 so includes pH7 (1); Amy: (disagree) (tap water) is most acidic / (6.4 to)6.6 is lowest pH	4	Answers must include justification Must have reasons to gain full marks, but **allow** 1 mark total if just just agree, agree, disagree (all three correct)
	(b)	(i)	to make the residue stick to the wire ☐ to find out what colour the acid gives ☐ to make the colour stronger ☐ to clean the wire ☑	1	
		(ii)	sodium	1	
		(iii)	colour is very strong / masks other colours / not enough of other metal / much more sodium	1	**Allow** some metal ions do not produce a colour in the flame
		(iv)	use **same** technique **and** gets **same** result	1	**Do not allow** just same results
		(v)	use more **sensitive** technique / correct named technique	1	**Do not allow** just alternative technique

Question			Answer	Marks	Guidance
	(c)	(i)	no ions / does not affect test	1	**Ignore** distilled water is neutral **Allow** tap water could be contaminated
		(ii)	sulfate ions are present (1); **no** chloride ions are present (1)	2	**Allow no** bromide or iodide ions present
		(iii)	Test: use limewater (1); Result: goes cloudy / milky (1)	2	

Question			Answer	Marks	Guidance
4	(d)		**[Level 3]** Finds Q value for all three means and all three ranges and makes conclusion about quality with mathematical justification. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Finds Q value for all three means and some of the ranges and makes conclusion about quality without mathematical justification. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Finds Q value for all three means and makes qualitative conclusion about quality. 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:** **pH** • mean Q 80 • range Q 65-88 **nitrates** • mean Q 75 • range 60-80 **Diss solids** • mean Q 70 • range 68-72 **Mean, Max and min** • Mean (80+75+70)/3=75 • Good • Max (88+80+72)/3=81 • Good • Min (65+60+68)/3=64 • Medium **Overall Q** • Mean values put it as good • Range extends to medium **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**22**	

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