

Cambridge National
Science in the Workplace

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

Level 2

Mark Scheme for January 2014

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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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For answers marked by levels of response:

- a. **Read through the whole answer from start to finish**
- b. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- c. **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

- d. 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.

Annotations

Annotation	Meaning
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt not given
ECF	error carried forward
	information omitted
I	ignore
R	reject
CON	contradiction
L1	Level 1
L2	Level 2
L3	Level 3

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
allow	=	answers that can be accepted
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
()	=	words which are not essential to gain credit
<u> </u>	=	underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

Question			Answer	Mark	Guidance
1	a	i	phenolphthalein	1	allow recognisable spelling
		ii	<p>some indicators would not change colour at the endpoint of the titration</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; vertical-align: middle;"> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	1	
	b	i	<p>sample 3 is very different / anomalous result / outlier / possible error / range (too) wide/large; (1)</p> <p>need to check again / repeatability; (1)</p>	2	<p>allow reliable</p> <p>do not allow accurate</p> <p>do not allow repeat or re-do</p>
		ii	<p>ignore sample 3 / only use 1,2 & 4; (1)</p> <p>evidence of correct addition and division; (1)</p> <p>3.5; (1)</p>	3	<p>ignore more than 1dp</p> <p>correct answer without working shown gains 3 marks</p> <p>allow 1 mark only for 3.3/3.275 with or without working shown</p> <p>allow ecf from (ii)</p>
		iii	<p>$3.5 \times 10 = 35$; (1)</p> <p>$120 \times 35 = 4200$; (1)</p>	2	<p>correct answer without working shown gains 2 marks</p>
			Total	9	

Question			Answer	Mark	Guidance
2	a	i	in case you make an error / in case of contamination / to take into account changing conditions/places ; (1) repeatability / to obtain a mean result / to obtain a representative result; (1)	2	allow (more) reliable ignore (more) accurate
		ii	different places / same place different depths / random places; (1)	1	
	b		<p>[Level 3] Describes some techniques with valid explanations. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Gives a technique with a valid explanation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Describes a technique. No explanations given. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targetted at grades up to D</p> <p>Techniques</p> <ul style="list-style-type: none"> • Dip in water at same depth at different places / different depths at same place (cv) • Use sterile/clean/new container (ac) • Idea of keeping samples separate (ac) • Put lid on container (ac) (as) • Idea of labelling (i) • Date, time and place (i) <p>Explanation</p> <ul style="list-style-type: none"> • Control variables (cv) • Avoid spillage (as) • Avoid contamination (ac) • Need for identification (i)

Question			Answer	Mark	Guidance
	c	i	avoid systematic error / accuracy / check the equipment works correctly/ to ensure correct results; (1) use of known/standard concentration; (1)	2	ignore fair test allow 'use distilled water and check the result is zero'
		ii	(blue sample) absorbs red light; (1) (sample) transmits blue light so intensity does not change using blue light; (1)	2	
			Total	13	

Question			Answer	Mark	Guidance
3	a	i	green	1	allow green-blue, but not blue
		ii	cleans the wire; (1) to avoid contamination / to ensure a valid result; (1)	2	allow sterilize
		iii	its colour is similar to the colour for copper / It is present in a much smaller amount than the copper / doesn't produce light which can be seen by humans / some (greenish) colours masked by copper; (1)	1	
	b	i	2.4 - 2.6	1	

Question			Answer	Mark	Guidance
3	b	ii	<p>[Level 3] Uses quantitative data from graphs to discuss evidence for copper and for other metals. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Uses quantitative data from graphs to discuss evidence for copper or for other metals. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Uses qualitative data from graphs to discuss evidence for copper or other metal(s). Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targetted at grades up to D*</p> <p>evidence for copper</p> <ul style="list-style-type: none"> • same pattern of three peaks in both graphs • so she can confirm the presence of copper • at 505 nm, 510 nm and 520 nm • also a peak at 460nm <p>evidence for other metals</p> <ul style="list-style-type: none"> • more peaks in (i) than in (ii) • so she can confirm that other metal(s) are present • arrowhead has 3 peaks about 570, 589 and 595 nm • copper has no peaks above 560 nm • arrowhead has two/some peaks below 500 nm • copper has only one peak at 460 nm • different pattern above 540 nm • accounts for increased intensity at 510 nm <p>further evidence of other metals</p> <ul style="list-style-type: none"> • graphs have different maximum intensity peaks • at 520 nm and 510 nm
		iii	<p>use the spectrophotometer / get the graph ; (1)</p> <p>for a sample of the other metal ; (1)</p>	2	<p>allow use secondary sources for spectrophotometer graph allow precipitation tests</p> <p>allow 1 mark only for test other metal</p> <p>do not allow repeat / more tests</p>
Total				13	

Question			Answer	Mark	Additional guidance
4	a	i	conductivity is 5.0 (S/m) / between 5.5 and 4.5; (1) so it is contaminated / contains ammonium sulfate and sodium carbonate; (1)	2	allow correct working on graph for first marking point allow 2 marks for 'if pure the sample would give a reading of 54 μ A'
		ii	repeat the test (on other samples) ; (1)	1	allow references to checking sources of secondary data e.g. reliable internet site do not allow send to another laboratory
		iii	make up a solution of pure ammonium sulfate; (1) should give reading of 54 μ A ; (1)	2	allow 5.5 S/m allow 1 mark only for use a solution of known value
	b		add silver nitrate (solution) to solution of fertiliser; (1) <u>white</u> precipitate indicates positive test; (1)	2	reference must be made to solution of/dissolved fertiliser, if only referred to fertiliser (minus any reference to solution of/dissolved) first marking point cannot be awarded
	c		add (hydrochloric) acid; (1) carbon dioxide gas given off / gas turns limewater cloudy/milky/chalky; (1)	2	
			Total	9	

Question			Answer	Mark	Additional guidance
5	a		measured diameter = 2(μm); (1) 2/4=0.5; (1)	2	allow 1.9 - 2.1 allow ecf from measured diameter correct answer without working shown gains 2 marks
	b	i	distance moved by solvent = 8 and distance moved by B = 6.6 ; (1) R_f value = 0.83; (1)	2	both values needed for 1 mark allow 7.9 – 8.1 cm / 6.5-6.8 allow value from 0.8(0) to 0.86 correct answer without working shown gains 2 marks
		ii	valine; (1) because it is only 0.02 different / because all others are further away / it is closest / most similar; (1)	2	allow valine circled in table
			Total	6	

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