

Cambridge Technicals

Applied Science

Unit 3: Scientific analysis and reporting

Level 3 Cambridge Technical in Applied Science
05848, 05849 & 05874

Mark Scheme for June 2025

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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.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.
5. **Crossed-Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM

Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the

candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award NR (No Response):

- if there is nothing written at all in the answer space
- OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
- OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501

To determine the level – start at the highest level and work down until you reach the level that matches the answer

To determine the mark within the level, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations** available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. **Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject -specific conventions).**

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Question			Answer	Marks	Guidance							
1	a	i	4 ✓	1								
		ii	<table border="1"><tr><td>50.0</td></tr><tr><td>60.3</td></tr><tr><td>44.9</td></tr><tr><td>47.2</td></tr><tr><td>41.8</td></tr><tr><td>40.1</td></tr><tr><td>34.8</td></tr></table> ✓	50.0	60.3	44.9	47.2	41.8	40.1	34.8	1	
50.0												
60.3												
44.9												
47.2												
41.8												
40.1												
34.8												
		iii	FIRST CHECK ANSWER ON ANSWER LINE If answer = 45.6 (µg m⁻³) award 2 marks 45.587142 ✓ 45.6 ✓	2	ALLOW ecf from values in (a)(ii) ALLOW any number of decimal places correctly rounded ALLOW any figure correctly rounded to 3sf							
		iv	median = 44.9 (µg m ⁻³) ✓ range = 25.5 (µg m ⁻³) ✓	2	ALLOW ecf from values in (a)(ii) ALLOW 45 ALLOW 26							
	b	i	FIRST CHECK ANSWER ON ANSWER LINE If answer = 4.01 x 10⁻⁵ (g m⁻³) award 2 marks $\frac{40.1}{10^6}$ ✓ =4.01 x 10 ⁻⁵ (g m ⁻³)✓	2	ALLOW ecf from 2018 value in (a)(ii)							

		ii	kilograms ✓ metres ✓	2	IGNORE symbols
	c		molar mass = 46 g mol ⁻¹ ✓ % O by mass = 69.6 (%)✓	2	
	d	i	Reasons Any two from: ✓✓ • legislation to improve air quality • clean air zones • more hybrid/electric cars • more efficient diesel/petrol cars • fewer cars / older cars scrapped / prohibition of older cars • more bicycles • more public transport • greater environmental awareness • increase in monitoring activity Supporting evidence: Any two from: ✓✓ • data from road traffic surveys • data about decreases in other pollutants caused by traffic • data about impacts on human health e.g. death rates due • sales figures for petrol/diesel/electric/hydrogen/LPG vehicles • maps of London areas showing low emission zones • information about number of monitoring sites • information about frequency of reporting • information about sales of petrol/diesel	4	Evidence must be appropriate to reason

		ii	Any three from: ✓✓✓ • more monitoring stations • more frequent monitoring e.g. real time monitoring / throughout the day • improved technology of monitoring e.g. sensors are more sensitive/reliable / don't need recalibrating / less instrument error • improved measurement e.g. measurements more accurate/precise / less measurement error • idea that with more data there is less distortion due to anomalous measurements / anomalies can be observed more easily / less distortion due to random error • idea that there is more historic data with which to predict or analyse trends • idea that there is a greater demand for/interest in for data driving provision of better quality data • idea of legal requirements / compliance with regulations driving demand for / provision of better quality data • idea that public is more environmentally/health conscious which is driving provision of better quality data	3	
			Total	19	

Question		Answer	Marks	Guidance
2	a	[Level 3] Candidate shows a high level of understanding and identifies both methods AND gives one advantage AND one limitation of each method (5 - 6 marks) [Level 2] Candidate shows an understanding and identifies one method AND gives one advantage AND one limitation of that method (3 – 4 marks) [Level 1] Candidate shows a basic understanding and identifies one method AND gives one advantage OR one limitation of that method (1 – 2 marks) [Level 0] Candidate includes fewer than two valid points (0 marks)	6	Indicative scientific points may include: Graphical methods - Method 1 – kite diagram - Method 2 – pie chart Advantages - Show clearly which months are wettest/driest - Show clearly how the pattern of rainfall changes through the year - Visual impact e.g. comparing small vs large values / easy to see how much wetter/drier one month is compared to another - Pie chart may be more familiar - Pie chart shows proportion of annual rain falling in each month Limitations - Kite diagram - need to find numerical difference between points to get the amount of rainfall mm - Pie chart – need to measure an angle and need to convert angle to mm - Pie chart – does not easily not easily reveal exact values - Pie chart – difficult to match the labels to the slices - Difficult to draw/construct - Kite diagram may be less familiar - No raw data to show if the method is suitable i.e. kite diagram suggests that the data is continuous / pie chart suggests that the data is discrete
	b	Any two from: ✓✓ - bar chart - line graph	2	ALLOW histogram
Total			8	

Question			Answer	Marks	Guidance
3	a		the adhesive material has mass ✓ measure total mass / mass of adhesive material and 100g mass ✓	2	ALLOW use a different adhesive material with very small mass
	b	i	1 mm ✓	1	ALLOW 0.1 cm DO NOT ALLOW +/-
		ii	(measurement taken) to the nearest mm ✓ at the edge of the bench and at the centre of the mass ✓	2	
		iii	Any three from: ✓✓✓ • hand not steady / hand moves • mass moves (up and down) • difficult to judge centre of mass / centre of mass should have been marked • parallax error • gap between ruler and beam • beam is not straight / bends down at the end	3	
		iv	FIRST CHECK ANSWER ON ANSWER LINE If answer = 2.9 [2 SF] (%) award 2 marks % uncertainty = $5/175 \times 100$ ✓ = 2.9 (%) ✓	2	ALLOW any calculated figure correctly rounded to 2sf

	c	i	time; s ✓	1	ALLOW sec/seconds
		ii	scatter graph ✓	1	ALLOW line graph
		iii	anomalous / anomaly / outlier ✓	1	ALLOW it does not fit the pattern
		iv	3 points are above the line and 1 point is below OR Idea that the anomaly/outlier should be ignored when drawing the line of best fit ✓	1	ALLOW uneven distribution of points above and below line
		v	x: <u>0.212</u> ✓ y: <u>0.026</u> ✓	2	
		vi	gradient = 0.173 ✓ s/m or sm^{-1} ✓	2	ALLOW 0.17 / 0.2
		vii	line through point at $L = 0.16$ extends 4 small squares above the point and 4 small squares below the point ✓	1	
	d		type of metal ✓ beam thickness and width ✓	2	ALLOW dimensions /size (of beam) IGNORE length
			Total	21	

Question			Answer	Marks	Guidance
4	a	i	Measurements Any two from: ✓✓ - any reference to (overall) length/size/width (max) diameter/width of aperture/opening - circumference of aperture/opening - number of spires/ridges - angles at apex/tip of shell - thickness of lip Ratios of measurements Any two from: ✓✓ - ratio of length of shell to (max) diameter of shell - ratio of length of shell to diameter of aperture/opening - ratio of angle at apex/tip of shell to diameter of aperture/opening - ratio of number of spires/ridges to length of shell	4	ALLOW dimensions of aperture opening only if neither diameter/width or circumference of opening stated ALLOW any two measurements from list above in either order
		ii	Advantage Any one from: ✓ - quick/easy to do - does not require extensive training/expertise - can be easily shared (via diagrams/photographs) Disadvantage Any one from: ✓ - many specimens must be observed (to identify a common measurement/feature) - sea snails get bigger as they grow - sea snails may be damaged	2	IGNORE references to visual without qualification as quick/easy

		iii	<i>Lophiotoma</i> is the genus / generic name ✓ <i>pseudoannulata</i> is the species / specific name ✓ AND Any one from: ✓ • system involves two names • names are in Latin	3	ALLOW first name is the genus / generic name ALLOW second name is the species /specific name								
		iv	Any two from: ✓✓ • Prokaryotae • Protoctista, • Fungi • Plantae	2	ALLOW phonetic spelling								
		v	<table><tr><td>class</td><td></td></tr><tr><td>family</td><td></td></tr><tr><td>order</td><td></td></tr><tr><td>phylum</td><td>✓</td></tr></table>	class		family		order		phylum	✓	1	
class													
family													
order													
phylum	✓												
	b	i	Any two from: ✓✓ • A • F • G	2	ALLOW named criterion								

		ii	Any two from: ✓✓ • B • C • D • E	2	ALLOW named criterion
			Total	16	

Question			Answer	Marks	Guidance
5	a	(i)	reference to actinium and americium and astatine ✓ idea that they had not been discovered until after 1917 ✓	2	
		(ii)	the higher the proton number (of the comparison element) the higher the atomic <u>weight</u> value / ORA ✓	1	ALLOW use of oxygen (as comparison element) results in higher atomic <u>weight</u> / use of hydrogen (as comparison element) results in lower atomic <u>weight</u>
		(iii)	No , idea that argon should have atomic mass less than 39.9 when comparing atomic mass in Table 5.1 with atomic weights in Table 5.2 ✓	1	
	b	(i)	mass number is the number of protons plus neutrons/number of nucleons in an atom/nucleus ✓ relative atomic mass is the average of the different isotopic masses ✓	2	
		(ii)	more Sb121 than Sb123 ✓ relative atomic mass is closer to 121 than 123 ✓	2	
	c	(i)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 794 (g Al) g award 2 marks 102 g Al ₂ O ₃ gives 54 (g Al) ✓ expected mass = $(\frac{1500 \times 54}{102}) = 794 \text{ (g Al)}$ ✓	2	ALLOW any calculated value correctly rounded to nearest whole number

		(ii)	$\% \text{ yield} = \frac{720 \times 100}{794} = 90.7(\%) \checkmark$	1	ALLOW ecf for value used from (c)(i) ALLOW any value correctly rounded from 90.68010076
			Total	11	

Question			Answer	Marks	Guidance
6	a	(i)	indicator: starch ✓ end point: blue-black ✓	2	ALLOW blue, dark blue, black
		(ii)	At least two readings within 0.05 cm ³ of each other ✓	1	
		(iii)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 53 (mg) award 5 marks $n_{I_2} = \frac{12.05 \times 0.005}{1000} = 6.025 \times 10^{-5} \checkmark$ $n \text{ ascorbic acid in } 20 \text{ cm}^3 = 6.025 \times 10^{-5} \checkmark$ $n \text{ ascorbic acid in } 100 \text{ cm}^3 = (6.025 \times 10^{-5} \times 5)$ $= 3.0125 \times 10^{-4} \checkmark$ - mass ascorbic acid in 100g orange $= 3.0125 \times 10^{-4} \times 176$ $= 0.05302\text{g} \checkmark$ $= 53 \text{ (mg)} \checkmark$	5	ALLOW 53.02 / 53.0 = 4 max ALLOW ecf ALLOW ecf ALLOW ecf ALLOW ecf if both conversion from g to mg and rounding to 2sf are correct
	b	(i)	(dark/intense) red/brown ✓	1	IGNORE pink ALLOW red-orange
		(ii)	0.045 (g dm ⁻³) ✓	1	ALLOW 0.45

		(iii)	the <u>iron</u> content falls rapidly over the first 4 minutes ✓ and then starts to level out ✓ % iron remaining = $\frac{0.24 \times 100}{1.2} = 20(\%)$ ✓	3	ALLOW the <u>iron</u> content falls / becomes less (unqualified with time) = 1 max DO NOT ALLOW plateaus
	(c)		✓ ✓	2	
				15	

Question			Answer	Marks	Guidance
7	a	(i)	graph/bar-chart/histogram/pictogram ✓ graph shows the trend in a visual way / is easy to process/understand ✓	2	ALLOW use of magazines/television/radio/podcasts if neither mark point awarded = 1 max
		(ii)	Public: make informed decisions about vehicle purchase / to expand knowledge ✓ Car manufacturers: plan how many BEVs to make / how much money to invest in BEV manufacture / market information ✓ Mechanic: decide whether to get trained in repairing BEVs / decide whether to invest in equipment needed for repairing BEVs ✓ Politicians: decide on policy / assess effects of policy / debate policy ✓	4	OWTTE OWTTE OWTTE OWTTE
	b	(i)	the data relies on information from a charging point App, not from the installers, so difficult to know with certainty how accurate and reliable the data is OR some devices charge more than one car at once but the reader does not know whether this information is included in the figures ✓	1	OWTTE OWTTE
		(ii)	the data shows that the number of charging devices is not keeping up with the increase in the number of BEVs on the road ✓ it is becoming more difficult to charge BEVs as there is more competition for each device ✓	2	OWTTE OWTTE

Question			Answer	Marks	Guidance
		(ii)	Any one from: ✓ • actual number of devices • number of connectors on each device • speed of charging • cost of charging • operator of charging point	1	
			Total	10	

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