

Cambridge Technicals

Applied Science

Unit 3: Scientific analysis and reporting

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

Mark Scheme for January 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 questions 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:

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

13. **Subject-specific Marking Instructions****INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Marks	Guidance
1	(a)	(i)	(mean =) 62 ✓ (median =) 67 ✓ (range =) 40 ✓	3	ALLOW range = 40 to 80
		(ii)	FIRST CHECK ANSWER ON ANSWER LINE If answer for $s^2 = 251(.426)$ AND $s = 15.8565$ award 4 marks <ul style="list-style-type: none"> (Any $(X - \bar{X})$) e.g from row 1 (40 – 62) OR -22 ✓ then squared e.g. $-22^2 = 484$ then summed with one other e.g. = 484 + 400 (from row 2) $(\sum (X - \bar{X})^2 =)$ 1760 ✓ variance, $s^2 = 1760 \div (8 - 1) = 251(.426)$ ✓ standard deviation, $s = \sqrt{251(.426)} = 15.8565$ ✓ 	4	ALLOW $s = 15.9$ OR 15.86 OR 16 <p style="text-align: center;">—</p> ALLOW $X - \bar{X}$ anywhere in working space ALLOW 1760 anywhere in working space = 1 mark (for s^2) ALLOW ecf using answer to 1(a)(i) for mean = 2 marks max. e.g. ($s^2 =$) 1760 AND ($s =$) 42 = 2 marks max. ALLOW ecf for $\sqrt{\quad}$ incorrect value for $s^2 = 1$ mark for s
	(b)	(i)	(brand) 3 ✓	1	
		(ii)	Any two from: Bigger sample size ✓ Different year/age groups in the sample ✓ (Avoid responses/choice) influenced by others ✓	2	OWTTE e.g. more/different students in sample ALLOW ask teachers/others to participate OWTTE
		(iii)	Calculation Total volume = 0.6 + 1 or 1.6 dm ³ ✓ Concentration = 80 / 1.6 ✓ = 50 Explanation The concentration is the same as /similar to sample 3 / 50 g dm ⁻³ (which is the most preferred) ✓	3	ALLOW answer = 50 = 2 marks
		(iv)	Any one from: Fructose concentration is the only factor which determines people's preferences. ✓ (types 3 and 8 are made from the) same type of apple ✓	1	
Total				14	

Question		Answer	Marks	Guidance																		
2	(a)	<table border="1"> <tr> <td>A</td> <td>nasturtium ✓</td> <td>rotate ✓</td> </tr> <tr> <td>B</td> <td>tulip ✓</td> <td>parallel ✓</td> </tr> <tr> <td>C</td> <td>European beech ✓</td> <td>pinnate ✓</td> </tr> <tr> <td>D</td> <td>rose ✓</td> <td>reticulate ✓</td> </tr> <tr> <td>E</td> <td>dogwood ✓</td> <td>arcuate ✓</td> </tr> <tr> <td>F</td> <td>rhubarb ✓</td> <td>palmate ✓</td> </tr> </table>	A	nasturtium ✓	rotate ✓	B	tulip ✓	parallel ✓	C	European beech ✓	pinnate ✓	D	rose ✓	reticulate ✓	E	dogwood ✓	arcuate ✓	F	rhubarb ✓	palmate ✓	12	Mark each box independently
A	nasturtium ✓	rotate ✓																				
B	tulip ✓	parallel ✓																				
C	European beech ✓	pinnate ✓																				
D	rose ✓	reticulate ✓																				
E	dogwood ✓	arcuate ✓																				
F	rhubarb ✓	palmate ✓																				
	(b)	<p>ALLOW any three from:</p> <ul style="list-style-type: none"> • binomial ✓ • two-naming system ✓ • (the first part of the name is the) genus / generic name ✓ • (the second part of the name is the) species / specific name ✓ • (binomial name is) written in italics/underlined ✓ • use of latin ✓ • internationally-recognised language ✓ 	3	ALLOW phonetic spelling for binomial																		
Total			15																			

Question		Answer	Marks	Guidance	
3	(a)	<p>FIRST CHECK ANSWER ON ANSWER LINE If answer for B = 0.17 award 2 marks</p> <p>substitution: $B = \frac{6.24 \times 9.81}{1000 \times 1.2 \times 0.3}$ ✓ $= 0.17$ ✓</p>	2	<p>ALLOW 0.17004 = 2 marks</p> <p>ALLOW $\frac{6.24 \times 10^{-3} \times 9.81}{1.2 \times 0.3}$ ✓</p>	
	(b)	<p>Good quality</p> <p>Any one from: ✓</p> <ul style="list-style-type: none"> equal number of points above and below the line smooth curve <p>Appropriate</p> <ul style="list-style-type: none"> the data is/are continuous (so a scatter graph is appropriate) ✓ 	2	<p>IGNORE (line/curve) goes through most of the points</p> <p>ALLOW not zig-zagged/not join-the-dots / not feathery / no tramlines AW</p>	
	(c)	(i)	5.4 (mm) ✓	1	ALLOW +/- 0.1 i.e. 5.3 to 5.5
		(ii)	0.21 (T) ✓	1	ALLOW +/- 0.02 i.e. 0.19 to 0.23
		(iii)	0.37 (T) ✓	1	ALLOW +/- 0.1 i.e. 0.36 to 0.38
	(d)	(i)	(±) 0.002 (T) ✓	1	ALLOW 2×10^{-3}
		(ii)	(100 x 0.002 ÷ 0.150 =) 1.33 (%) ✓	1	ALLOW 1.3 ALLOW ecf for n [answer to (d)(i)] in calculation = 1 mark
		(iii)	<p>Any three from: ✓✓✓</p> <ul style="list-style-type: none"> measurement error systematic error instrumental/equipment error e.g. balance /ruler / ammeter 	3	<p>ALLOW two named examples of measurement errors m, d, I, or $l = 2$ marks</p> <p>IGNORE unqualified refs. to student/human error / making a mistake</p>
			Total	12	

Question			Answer	Marks	Guidance
4	(a)	(i)	<p>Any two from: ✓✓</p> <ul style="list-style-type: none"> line graph continuous data y-axis/ pH scale easily / accurately used to determine change in pH plotted area is a large part of the graph (extent of y-axis / pH) scale not too large / too low / too high data are/is spread out 	2	OWTTE
		(ii)	<p>pH decreases / more acidic over time ✓</p> <p>(until) pH stays constant when it reaches pH 7 ✓</p> <p>(pH decreases) faster when emulsifier is added ✓</p>	3	OWTTE ALLOW correct ref. to comparative values
		(iii)	<p>Any three from: ✓✓✓</p> <ul style="list-style-type: none"> (digestion of fat) lowers the pH fat breaks down / digested into fatty acids (and glycerol) activity of lipase decreases (as pH decreases) all fat is broken down when solution is pH 7 optimum pH for lipase is pH7 emulsifier increases the (surface) area of fat emulsifier allows lipase and fat droplet to mix 	3	ALLOW enzyme = lipase ALLOW increases acid level/conc. = lower pH ALLOW activity of lipase stops at pH 7
	(b)		<p>Any three from: ✓✓✓</p> <ul style="list-style-type: none"> amount of fat / fat concentration / % fat (in the milk) temperature (of water bath) type of emulsifier (%) concentration/amount/number of drops of emulsifier solution concentration of lipase/enzyme 	3	ALLOW type/brand of milk IGNORE ref. to sodium bicarbonate

Question		Answer	Marks	Guidance
	(c)	(If similar results are obtained) <ul style="list-style-type: none"> by different groups / others ✓ using different equipment ✓ using a different method / technique ✓ 	3	ALLOW food scientist = technician (ref. different group) OWTTE IGNORE unqualified ref. to peer review ALLOW correctly named equipment ALLOW a correctly named, alternative method
	(d)	(i) FIRST CHECK ANSWER ON ANSWER LINE If answer for G = 0.43 (2sf) award 3 marks $\Delta y/\Delta x = (9.4 - 6.4) \div (8 - 1)$ OR $3 \div 7$ ✓ $G = 0.42857$ ✓ $= 0.43$ (2sf) ✓	3	ALLOW $G = 0.429 / 0.4286 / 0.42857$ $= 2$ marks max. ALLOW values (other than A & B) from graph for $\Delta y/\Delta x$ calculation = 1 mark max. IGNORE units / negative value ALLOW correct 2sf for even if incorrect answer = 1 mark
		(ii) Any one from ✓ <ul style="list-style-type: none"> large values for Δy and Δx (reduce the error in G) the gradient of the curve is equal to the gradient of the tangent drawn at that point. 	1	ALLOW A and B are far apart OWTTE
Total			18	

Question		Answer	Marks	Guidance
5	(a)	(i) B, ✓ E, ✓ G ✓	3	

		(ii)	Any two from: ✓✓ <ul style="list-style-type: none"> less energy/heat is needed for the process the machinery/plant may be more readily available / cheaper the product is easier to store / transport for diesel production, pyrolysis involves one step, but gasification requires two steps 	2	ORA for each marking point, as applicable ALLOW lower temperature = less energy OWTTE IGNORE ref. to hydrogen / methane
		(iii)	Any three from: ✓✓✓ <ul style="list-style-type: none"> cost/price of processes (i.e. for recycling or the other processes) pollution generated suitability/demand of plastic for recycling property/range of recycled products demand for products (from recycled plastic) 	3	OWTTE ALLOW qualified ref. to landfill
	(b)	(i)	Red ✓	1	
		(ii)	<ul style="list-style-type: none"> measure (%) absorbance of each solution (known conc.) ✓ plot, graph of (%) absorption against concentration / calibration graph ✓ add potassium thiocyanate to test solution (water sample) and measure (%) absorbance ✓ use the graph to read off the concentration of the test solution ✓ 	4	ALLOW absorption = absorbance
			Total	13	

Question			Answer	Marks	Guidance
6	(a)	(i)	20 ✓	1	
		(ii)	<p>FIRST CHECK ANSWER ON ANSWER LINE If answer for number of living cells per cm³ = 4 x 10⁵ award 3 marks</p> <p>0.1 mm³ = 1 x 10⁻⁴ cm³ ✓</p> <p>No cells in 1 cm³ = 20 ÷ 1 x 10⁻⁴ = 2 x 10⁵ ✓</p> <p>x2 (dilution factor) = 4 x 10⁵ ✓</p>	3	<p>ALLOW 400,000</p> <p>ALLOW ecf for 2nd mp - EITHER for miscalculated mm³ / cm³ conversion OR use of <i>n</i> [answer to (a)(i)] ÷ 1 x 10⁻⁴ = 1 mark max.</p>
		(iii)	<p>FIRST CHECK ANSWER ON ANSWER LINE If answer for % living cells = 91 (%) award 3 marks</p> <p>% living cells = (20 ÷ 22) x 100 ✓</p> <p>= 91(%) ✓</p>	2	ALLOW 90.9 / 90.91 / 90.9090 = 2 marks
	(b)	(i)	Iodine ✓	1	ALLOW potassium iodide

Question	Answer	Marks	Guidance
	<p>(ii)*</p> <p>[Level 3] Candidate shows a high level of understanding by giving a good description for the preparation of permanent stained microscope slides AND explains the advantages AND disadvantages of permanent, stained microscope slides <i>(5 - 6 marks)</i></p> <p>[Level 2] Candidate shows an understanding by giving an adequate description for the preparation of permanent stained microscope slides AND/OR explains advantages and disadvantages of permanent, stained microscope slides <i>(3 – 4 marks)</i></p> <p>[Level 1] Candidate shows a basic understanding by giving a description of some of the steps for the preparation of permanent stained microscope slides OR states limited advantages and/or disadvantages of permanent, stained microscope slides, with little or no explanation. <i>(1 – 2 marks)</i></p> <p>[Level 0] Candidate includes fewer than two valid points. <i>(0 marks)</i></p>	6	<p>Indicative valid points may include:</p> <p>Preparation of permanent microscope slides</p> <ul style="list-style-type: none"> • kills cells/specimen • stopping reactions • named stopping / killing reagent (eg alcohol or osmic acid) • staining (to enhance specific cell contents) • nucleus, cell wall, starch granules, or chloroplasts stained • dehydration to remove water from cells, use of alcohol • clearing (of substances) to make staining easily visible. Use of eg xylene • mounting specimen on microscope slide, saline based buffer solution • use of cover slip • sealing cover slip • view slide/ check specimen under a microscope • labelling of slide (to indicate sample type, source, stain used and date) <p>Advantages and disadvantages</p> <p>Advantages</p> <ul style="list-style-type: none"> • can be preserved / kept for a long time • can be viewed/used many times • allows microscopic preparation of difficult-to-obtain biological materials <p>Disadvantages</p> <ul style="list-style-type: none"> • can be expensive • requires (more) specialist equipment (microtome) / resources • requires trained technicians/microscopists • takes longer to produce the slides
	Total	13	

Question			Answer	Marks	Guidance
7	(a)	(i)	units in table headings (for drop AND/OR bounce height) ✓ consistency with significant figures / 2 d.p ✓	2	
		(ii)	1.14 (circled) ✓	1	ALLOW clear use of tick/cross/underline
	(b)		Any three from: ✓✓✓ <ul style="list-style-type: none"> video the ball and the ruler in the same view video, perpendicular to / in line with, the expected bounce height to reduce parallax error (make sure) field of video allows for max. bounce height go through the video one frame at a time / stop/ pause the video at specific points (of bouncing) / replayed use this to measure/record the height when the ball is at its, heighest / highest bounce height 	3	OWTTE ALLOW trial run to cover max. bounce height
	(c)	(i)	y axis: (average) bounce height AND x axis: drop height ✓	1	ALLOW only both responses = 1 mark
		(ii)	bounce height is (directly) proportional to drop height ✓	1	ORA DO NOT ALLOW unqualified proportional
		(iii)	Any two from: ✓✓ <ul style="list-style-type: none"> range bars show max. and min. values for data plotted the smaller the range (between max. and min.) the greater the quality of their conclusion range bars can be used to determine the uncertainty of their data 	2	OWTTE ORA

	(d)	<p>Any three from: ✓✓✓</p> <ul style="list-style-type: none"> • present the main points, in different ways / clearly / use (simple) bullet points / combined points • expand on topics to supplement the slides • shift between topics more easily (no need to turn pages) • customise your slides/ create something visually appealing • use in different locations • adapt the presentation for different audiences • print out slides as handouts • e-mail presentation/upload presentation on-line 	3	<p>ALLOW named examples i.e. diagram of the apparatus, video of the experiment, table of results, text</p> <p>IGNORE audience can ask questions / easier to present data to larger audience</p>
	(e)	<p>Any two from: ✓✓</p> <ul style="list-style-type: none"> • type of surface • pressure in balls • how much the balls have been used / age of balls used • mass/weight/size of / volume of air in, the ball • material ball is made from • (impact of) air resistance/flow / weather • temperature of the ball / environment 	2	<p>IGNORE unqualified ref. to brand/type of ball</p>
		Total	15	

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