



Cambridge Technicals Laboratory Skills

Unit 3: Scientific Analysis and Reporting

Level 3 Cambridge Technical in Laboratory Skills

Mark Scheme for June 2018

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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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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

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

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	Mark	Guidance
1	(a)	29.2 ✓	1	
	(b)	<p>FIRST CHECK THE ANSWER LINE If answer = 28.65 OR 28.7 OR 28.6 award 2 marks</p> <p>372.4 ÷ 13 ✓ 28.65 OR 28.7 ✓</p>	2	<p>ALLOW 28.646 = 2 marks DO NOT ALLOW 28.63</p>
	(c)	<p>FIRST CHECK THE ANSWER LINE If answer = 21.9 award 6 marks</p> <p>calculates 13 $x_i - \bar{x}$ values ✓ calculates 13 $(x_i - \bar{x})^2$ values ✓ calculates sum of 13 $(x_i - \bar{x})^2$ values = 5742.9(33) ✓ calculates $1/(N-1)$ of 5742.933 = 478.5777 ✓ calculates square root of 478.5777 = $s = 21.87642$ ✓ = 21.9 (adjusted to 1 d.p) ✓</p>	6	<p>ALLOW correct s value without any working shown = 2 marks</p> <p>ALLOW eg. 21.88 OR 21.876 = 5 marks (not to 1 decimal place)</p>
	(d)	<p>Any two from:</p> <p>it may be very small/large / unsure of actual size ✓ a long way away ✓ moving very fast to measure ✓ limitations of technology / telescopes /equipment not powerful enough ✓ changing size/shape due to changing layer of ice ✓</p>	2	AWTTE

Question		Answer	Mark	Guidance
(e)	(i)	<p>FIRST CHECK THE ANSWER LINE If answer = 31400 m² award 2 marks</p> <p>$4 \times 3.14 \times 50^2 \checkmark$ 31400 m² \checkmark</p>	2	<p>MUST give correct units (m²) for both marks</p> <p>ALLOW some variation in π value due to use of different scientific or graphical calculators (instead of given value = 3.14)</p> <p>ALLOW range = 31,400 to 31,500</p>
	(ii)	<p>FIRST CHECK THE ANSWER LINE If answer = 523333.33 m³ OR 524317 m³ award 2 marks</p> <p>$(4 \div 3) \times 3.14 \times 50^3 \checkmark$ 523333.33 m³ \checkmark</p>	2	<p>ALLOW some variation in π value due to use of different scientific or graphical calculators (instead of given value = 3.14)</p> <p>ALLOW range = 523,333.33 to 524,320</p>
(f)		<p>FIRST CHECK THE ANSWER LINE If answer = $r = vT/2\pi$ OR $r = v \times T/(2 \times \pi)$ award 2 marks</p> <p>$v \times T = 2 \times \pi \times r \checkmark$ $v \times T/(2 \times \pi) = r$ OR $r = v \times T/(2 \times \pi) \checkmark$</p>	2	
Total			17	

Question		Answer	Mark	Guidance
2	(a)	(i)		
		x-axis (e) labelled with units AND y-axis (a) labelled with units ✓ appropriate scale on both axes ✓ all points to ½ sq. and appropriate best fit curve ✓	3	DO NOT ALLOW extrapolation to y-axis (from 0.2 to 0.00) – not appropriate best fit curve
		(ii)		
		FIRST CHECK THE ANSWER LINE If answer = 255 ±0.5 (cm s⁻¹) award 1 mark point circled at (1.6, 225) ✓	1	ALLOW any outlier as ecf in relation to actual curve drawn
		(iii)		
		225 ±0.5 (cm s ⁻¹) ✓	1	ALLOW ecf in relation to actual curve drawn
		(iv)		
		2.2 ✓ reduced friction / ball falls off ✓	2	ALLOW ecf in relation to actual curve drawn ALLOW as channel width increases the acceleration decreases
	(b)			
		FIRST CHECK THE ANSWER LINE If answer = -65.6 cm/s² OR cm s⁻² award 4 marks Drawn two vertical lines OR a triangle OR shown two appropriate values on y-axis ✓ $\Delta y \div \Delta x$ OR vertical distance \div horizontal distance ✓ - 65.6 ✓ cm/s ² OR cm s ⁻² ✓	4	ALLOW $\Delta y \div 0.4$ OR $y = mx + c$ ALLOW ecf in relation to actual curve drawn
	(c)			
		the wider the channel in the track ✓ the lower the acceleration ✓	2	ALLOW visa versa OWTTE IGNORE references to values

Question	Answer	Mark	Guidance
(d)	<p>Any two from:</p> <p>calculate the ratio/fraction/percentage (of Table 2.1 and Table 2.2 values) ✓</p> <p>interpolate / read values from same shape graph line (drawn or extrapolated using 15° slope data) ✓</p> <p>multiply Table 1 values by the ratio/fraction/percentage (to complete Table 2) ✓</p>	2	<p>ALLOW e.g. the values in Table 2.2 are (approx.) 51.6% OR half of the values in Table 2.1 = 2 marks</p> <p>ALLOW correct approx. values written in Table 2.2 (grey boxes)</p>
	Total	15	

Question		Answer	Mark	Guidance
3	(a)	(i)	3	OWTTE IGNORE repetition of generic and specific names (as in the stem)
		(ii)	6	One mark for each of the first two correct rows One mark for each of remaining correct specific names
	(b)		4	ALLOW any other realistic suggestion eg. missing features such as genome/biochemistry

Question	Answer	Mark	Guidance
(c)	<p>Any two from:</p> <p>both belong to, the same family / Labridae ✓</p> <p>they must (therefore) share some similarities ✓</p> <p>(however) <i>S.bailloni</i> will have many more similarities with other species of, the same genus (<i>Symphodus</i>)</p> <p>OR vice versa ✓</p>	2	<p>IGNORE references to data shown in the key</p> <p>DO NOT ALLOW both are Wrasse</p> <p>IGNORE unqualified references to genus/species</p>
	Total	15	

Question		Answer	Mark	Guidance
4	(a)	(i) Y is the most precise and accurate ✓	1	ALLOW best /high level / good = most OWTTE
		(ii) 59.7 – 60.3 OR 0.6 ✓	1	
		(iii) Any two from: Interval = ± 0.3 ✓ 0.3 as a % of expected value (60.0) ✓ (0.3 \div 60) \times 100 = 0.5% ✓	2	ALLOW reference to three intervals = 0.2, 0.4 and 0.2 (expressed as a calculation OR shown in Table 4.1)
	(b)	(i) Instrument ✓	1	
		(ii) (speedometer) only shows some of the divisions between whole numbers / does not show detailed values/speeds ✓	1	ALLOW correct reference to improvement eg. show intervals of 10 units DO NOT ALLOW error with equipment / not accurate
		(iii) Repeatable - same result is obtained using same method/equipment ✓ Reproducible - same result is obtained using a different method/equipment ✓	2	ALLOW repeatable uses the same method and reproducible uses a different method (no mention of results) = 1 mark max.
	(c)	(i) Any one from: reaction time ✓ when starting and stopping the stopwatch ✓	1	IGNORE distance / instrument error OWTTE
		(ii) increase the distance ✓	2	ALLOW any realistic suggestion to increase value >10m

Question		Answer	Mark	Guidance
		reaction time becomes smaller compared to the total time / less significant / has less impact ✓		OWTTE
	(iii)	the lowest count / smallest value measured / have more decimal points / higher resolution ✓	1	ALLOW it measures to 1/100 th of a second DO NOT ALLOW more accurate
		Total	12	

Question		Answer	Mark	Guidance
5	(a) (i)	$Y = 4.5 \div 0.81 = 5.56 (\Omega)$ AND $Z = 3.7 \div 1.34 = 2.76 (\Omega) \checkmark$ 1.0m of Y = 11.12 (Ω) \checkmark 1.0m of Z = 11.04 (Ω) \checkmark Use of 2 decimal places throughout \checkmark	4	First column correct = 1 mark ALLOW ecf from first column = 3 max.
	(ii)	Ali is not correct \checkmark EITHER conclusion: Rob and Ali are (probably) testing the same material of wire / Z and Y are same \checkmark justification: results are very similar / within experimental error \checkmark OR conclusion: Nina's wire is different material / X is not same as Y and Z \checkmark justification: 9.0 is much less than resistance of Y and Z / outside range of experimental error \checkmark	3	IGNORE reference to wire diameter / Nina's wire might be thinner/thicker (the conclusion must refer to the material being tested)
	(iii)	(to see) Nina's measurements (of voltage and current) \checkmark to calculate her resistance / to check if her calculation is correct / repeat testing wire X \checkmark	2	OWTTE

Question	Answer	Mark	Guidance
(b)	<p>resistivity is the same ✓</p> <p>cross-sectional areas / diameter is the same ✓</p>	2	<p>ALLOW they have the same thickness</p>
(c)	<p>Any two from:</p> <p>supporting evidence for wire X is different to Y and Z ✓</p> <p>supporting evidence - wires Y and Z are different ✓</p> <p>conflicting evidence - mass of wire Z is 2x mass of wire Y (should be half mass) ✓</p> <p>idea that if X, Y and Z are the same then their masses should be consistent with their lengths or X, Y, Z are not same as their masses are not consistent with their lengths ✓</p>	2	
(d)	<p>use their own calculations/results OR repeat the tests (primary source) ✓</p> <p>compare with other information in a text book/website OR other set of results (secondary source) ✓</p>	2	
	Total	15	

Question		Answer	Marks	Guidance						
6	(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>D</td> <td>F</td> <td>B</td> <td>C</td> <td>E</td> <td>A</td> </tr> </table>	D	F	B	C	E	A	4	F immediately before B = 1 mark B immediately before C = 1 mark C immediately before E = 1 mark E immediately before A = 1 mark
D	F	B	C	E	A					
	(b) (i)	<p>Any two from:</p> <p>to make the concentration lower ✓</p> <p>so that an appropriate titre (of thiosulfate) is obtained/the volume of thiosulfate required (for the titration) would be too large ✓</p> <p>the iodine produced in the reaction is not very soluble ✓</p>	2	ALLOW to improve the effectiveness of the reaction/titration						
	(ii)	<p>FIRST CHECK THE ANSWER LINE</p> <p>If answer = 0.20 (mol dm⁻³) award 3 marks</p> <p>concentration of sodium thiosulfate = $\frac{0.033 \times 25.0 \times 6}{24.25}$ ✓</p> <p>= 0.204 ✓</p> <p>= 0.20 (mol dm⁻³) (2 sig. figs) ✓</p>	3	ALLOW 0.204 final answer = 2 max.						
Total			9							

Question		Answer	Marks	Guidance												
7	(a)	<table border="1"> <thead> <tr> <th>Step</th> <th>Order</th> </tr> </thead> <tbody> <tr> <td>Add a drop of water to the plant root section.</td> <td>3</td> </tr> <tr> <td>Cut the plant root to obtain a thin section.</td> <td>1</td> </tr> <tr> <td>Place the section of plant root onto a dry microscope slide.</td> <td>2</td> </tr> <tr> <td>Put the microscope slide on the stage of a light microscope.</td> <td>5</td> </tr> <tr> <td>Place a coverslip above the root section.</td> <td>4</td> </tr> </tbody> </table>	Step	Order	Add a drop of water to the plant root section.	3	Cut the plant root to obtain a thin section.	1	Place the section of plant root onto a dry microscope slide.	2	Put the microscope slide on the stage of a light microscope.	5	Place a coverslip above the root section.	4	4	One mark for each correct order number in table.
Step	Order															
Add a drop of water to the plant root section.	3															
Cut the plant root to obtain a thin section.	1															
Place the section of plant root onto a dry microscope slide.	2															
Put the microscope slide on the stage of a light microscope.	5															
Place a coverslip above the root section.	4															
	(b)	Any two from: mounting (in wax) ✓ fixation ✓ dehydration/use of alcohol series ✓	2	IGNORE stain/dye (instruction in stem of question)												
	(c)	Any one from: distinguish different tissues/cell types/organelles ✓ identify specific materials/molecules ✓ clarify/enhance the arrangement of tissues ✓	1	ALLOW to see/view the tissues/cells more clearly												
Total			7													

Question		Answer	Marks	Guidance
8	(a)	Parkinson's disease = 1.5 (%) ✓ multiple sclerosis = 0.2 (%) ✓	2	ALLOW 1.46 OR 1.458 ALLOW 0.21 OR 0.211
	(b)	Any one of the statements ticked ✓	1	ALLOW one tick for any statement since the data are inconclusive with regards to the conclusions listed. No one conclusion can be drawn with confidence.
	(c)	Any one from: (neurological conditions) may be affected by any of these factors (or others) ✓ (such factors) cannot be controlled and may affect the results of the study ✓	1	OWTTE ALLOW correctly named example – lower income people may need to live in cheaper houses nearby major roads.
	(d)	(i) Any two from: Correct ref. to % incidence in Table 8.2 ✓ Correlation between distances and HR for dementia only ✓ HR increases with closeness to major roads ✓ (Unexpected) low HR for multiple sclerosis at 50-100 m distance ✓ HRs for Parkinson's disease/multiple sclerosis unaffected by distances between 101-300m ✓	2	ALLOW other realistic suggestions HR = hazard ratio

Question		Answer	Marks	Guidance
	(ii)	<p>Any two from:</p> <p>Factors (other than those listed) may affect the correlation between dementia and HR ✓</p> <p>Not possible to cover all variables ✓</p> <p>Conditions have multiple risk factors e.g. genetics ✓</p> <p>Differences between major roads e.g. traffic density ✓</p> <p>Differences in weather conditions may affect exposure to pollutants ✓</p> <p>Impact of undiagnosed neurological conditions ✓</p> <p>Age ranges do not encompass all cases ✓</p> <p>Participants may be taking medication ✓</p>	2	ALLOW any realistic suggestion.
	(iii)	<p>Any two from:</p> <p>Replicate studies elsewhere ✓</p> <p>Research effects of specific pollutants ✓</p> <p>Compare with data from rural areas ✓</p> <p>Include data for age/gender/background ✓</p>	2	ALLOW any realistic suggestion.
Total			10	

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