Oxford Cambridge and RSA

Cambridge Technicals
Applied Science

Unit 3: Scientific Analysis and Reporting

Level 3 Cambridge Technical in Applied Science
05847 – 05849/05874/05879

Mark Scheme for January 2021

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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.

Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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

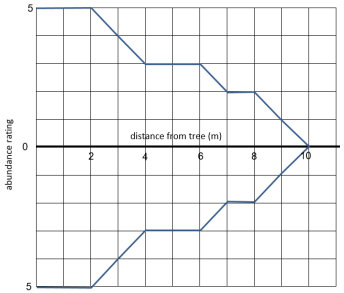
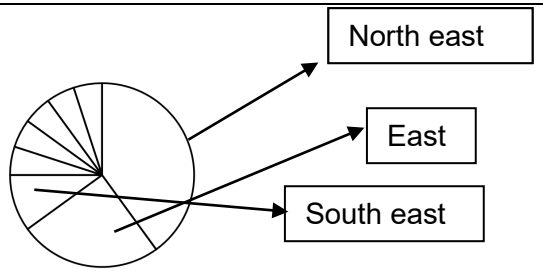
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- 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**.

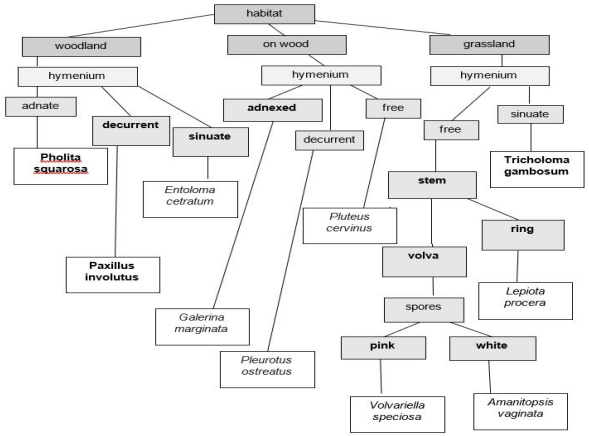
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Mark	Guidance
1	(a)	(i)	5 5 4 3 3 3 2 2 1 0 ✓	1	
		(ii)	vertical axis scale, label abundance rating ✓ horizontal axis ruled scale, label distance, units m ✓ all points plotted correctly, and joined ✓ symmetrical about horizontal axis ✓	4	e.g.  **ALLOW** 1 mark if both scales but no labels/units **OR** both labels/units but no scales (mp1) **ALLOW** correct symmetry from incorrect plotting
	(b)		sectors drawn to correct sizes (144°, 90°, 16°) ✓ sectors drawn in order of decreasing size clockwise ✓ correct labels in sectors ✓	3	
	(c)	(i)	May ✓ 59-65%✓ south-west ✓	3	

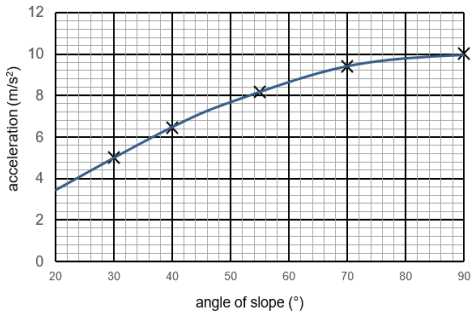
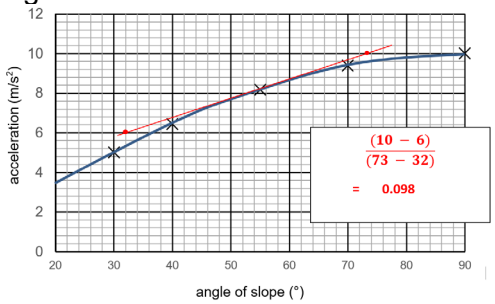
Question			Answer	Mark	Guidance
		(ii)	largest proportion/40% of seeds found in north-east ✓ idea that seeds are dispersed by wind ✓ wind from south-west blows towards north-east ✓ seeds fall in September to November ✓ wind blows from south-west 40% to 50% of time in September to November ✓	**5**	 **ALLOW** Autumn **ALLOW** Autumn
		(iii)	obtain frequency data for other wind directions ✓ collect seed dispersal data from more than one year ✓ obtain wind direction frequency data from more than one year ✓	**3**	
	(d)		(Table 1.4 shows only) 5% of seeds in south-west ✓ (but Fig. 1.5 shows) wind from north-east 20% of the time ✓	**2**	**ALLOW** idea of low percentage of seeds in south-west
			Total	**21**	

Question			Answer	Mark	Guidance
2	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4.2 award 2 marks** 4.188772… ✓ = 4.2 (2sf)✓	2	 **ALLOW** any calculated answer to 2sf
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.4× 10^{27} award 3 marks** 4.2 x $(7.0 \times 10^{8})^{3}$ ✓ 1.4…✓ × 10^{27} ✓	3	**ALLOW** ECF using the answer to 2(a)(i) **ALLOW** 2 marks if correct answer not expressed in standard form **ALLOW** any correctly calculated answer in standard form
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1400 kg m^{-3} award 3 marks** density = $\frac{2.0 \times 10^{30}}{1.44 \times 10^{27}}$ **OR** 1389 ✓ = 1400 **(**2sf) ✓ units kg m^{-3} ✓	3	**ALLOW** ECF using the answer to 2(a)(ii) for mp1 $\frac{2.0 \times 10^{30}}{1.4 \times 10^{27}}$ **OR** 1429 **ALLOW** any calculated density to 2sf
	(b)	(i)	magnitude ✓ blue (to) red ✓ temperature ✓ faint (to) bright ✓	4	

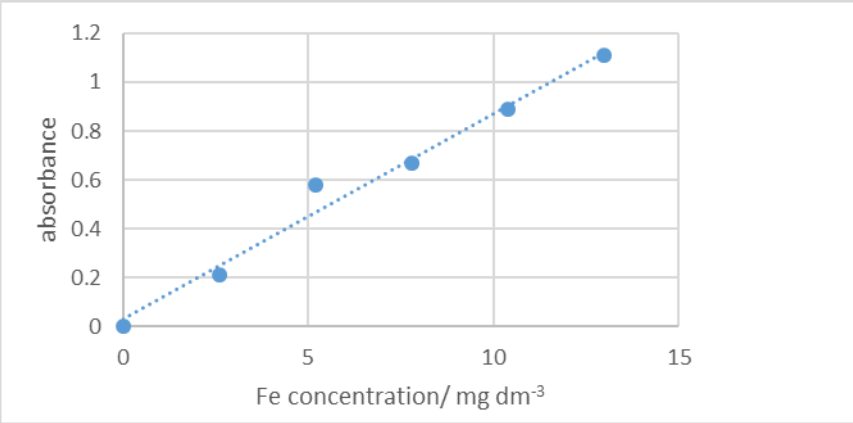
Question			Answer	Mark	Guidance
		(ii)	high temperature **and** faint luminosity ✓ blue colour **and** positive magnitude ✓	2	**DO NOT ALLOW** references to changes in temperature and luminosity **DO NOT ALLOW** references to changes in colour and magnitude
	(c)	(i)	0.008 ✓	1	**IGNORE** any units
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 5.12 × 10^{-5} (%) award 3 marks** $\frac{0.008^3}{1^3}$ **OR** = $\frac{4⁄3 \pi 0.008^3}{4⁄3 \pi 1^3}$ ✓ = 5.12 x 10^{-7} ✓ (5.12 x 10^{-7} x 100) = 5.12 x 10^{-5} (%) ✓	3	**ALLOW** = 5.1 × 10^{-5}
		(iii)	the greater the mass (White Dwarfs have) the smaller the radius / **ORA** ✓	1	**IGNORE** references to "negative correlation"
		(iv)	1.38 to 1.44 ✓	1	
			Total	20	

Question			Answer	Mark	Guidance
3	(a)		decurrent ✓ adnate ✓ adnate ✓	3	.
	(b)		to identify/classify species ✓ uses a series of choices / two choices at each stage ✓ based on more than one structural feature ✓ to make the process easy/simple / choices tell investigators which features to look for / can be used by non-specialists ✓	3	
	(c)		*Pholiota squarosa* ✓ *Paxillus involutus* ✓ *Tricholoma gambosum* ✓ pink ✓ white ✓	5	
	(d)	(i)	*Amanitopsis vaginata* ✓	1	
		(ii)	**Key features**: reference to genus **and** species ✓ **Advantage**: internationally recognised / no confusion (between users) ✓	2	
			Total	14	

Question			Answer	Mark	Guidance
4	(a)		the diameter of the coin ✓ the distance between the coin and the junction between the mirrors ✓ the position of the observer relative to the mirrors ✓	3	
	(b)	(i)	correct identification of both variables ✓ correct relationship between correct variables ✓	2	
		(ii)	**Range:** 98° to 165° ✓ **Interval:** 67° ✓	2	**ALLOW** 99º to 165º **ALLOW** 66º
	(c)	(i)	120° ✓	1	
		(ii)	1.2 ✓	1	
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = - 18.3(%) award 2 marks** [98-120] / 120 ✓ = –18.3 (%) ✓	2	**ALLOW** ECF from 4(c)(i)
			Total	11	

Question			Answer	Mark	Guidance
5	(a)	(i)	 ✓	1	Line must pass through all points, with reasonable intercept on vertical axis **DO NOT ALLOW** lines extending beyond 20° and/or 90° **DO NOT ALLOW** thick (>half square) / sketched / broken lines.
		(ii)	from 2.6 to 4.0 (m s^{-2}) ✓	1	**ALLOW** ECF from incorrectly-drawn graph in 5(a)(i)
		(iii)	straight line at a tangent to 55° ✓ coordinates **taken from tangent**, Δx at least 10° ✓ (coordinates substituted in Δy/Δx and) answer calculated = 0.098 +/- 0.005 ✓	3	e.g.  (= 3 marks) **DO NOT ALLOW** ECF from incorrectly drawn curve or tangent, answer **must** be within range
	(b)		g is not exactly 10 m s^{-2} ✓ the ball also accelerates in the vertical direction ✓ most values are determined by the best-fit line / intercept which may not be accurate ✓	2	**ALLOW** the equation **only** calculates the horizontal acceleration **ALLOW** there is friction/air resistance

Question			Answer	Mark	Guidance
	(c)		so that reasons for differences/similarites can be suggested ✓ so that actual results are supported by scientific theory ✓ to show that the method is valid ✓ to identify anomalous results ✓	1	**ALLOW** idea of knowing which results to repeat
			Total	8	

Question			Answer	Mark	Guidance
6	(a)	(i)	vertical axis label absorbance, units au/no units ✓ horizontal axis label Fe concentration, units mg dm^{-3} ✓ suitable scales for axes, axes ruled ✓ all plots correct to within ½ square ✓	4	 **ALLOW** mp3 if vertical axis and horizontal axis transposed
		(ii)	straight line of best fit, passing through 0 ✓ outlier circled at 5.2, 0.58 ✓	2	**DO NOT ALLOW** if thickness of LOBF is greater than ½ square / LOBF extends beyond 0 and/or 13 mg dm^{-3} / LOBF is broken/not ruled/sketched
	(b)	(i)	8.2 (mg dm^{-3}) **and** working shown on graph ✓	1	**ALLOW** ECF for drawn line
		(ii)	0.082 (mg) ✓	1	**ALLOW** ECF from 6b(i) i.e. b(i) ÷ 100
		(iii)	$\frac{0.082 \times 100}{3.6}$ = 2.27 (mg) ✓	1	**ALLOW** ECF from 6b(ii) i.e. $\frac{b(ii) \times 100}{3.6}$
	(c)		$\frac{2.27 \times 100}{14}$ = 16.2 (%) ✓	1	**ALLOW** ECF from 6b(iii) i.e. $\frac{b(iii) \times 100}{14}$

Question			Answer	Mark	Guidance
	(d)		**[Level 3]** Candidate shows a detailed understanding of the principles of titration **AND** names all required pieces of glassware ***(5 – 6 marks)*** **[Level 2]** Candidate shows some understanding of the principles **AND** names at least one piece of glassware ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding of the principles of titration **AND** names one piece of glassware ***(1 – 2 marks)*** **[Level 0]** Candidate response includes **fewer than two** valid points. ***(0 marks)***	**6**	Valid points may include: • Fill a **burette** with iodine solution • Measure a known volume of fruit juice using a (**graduated/bulb**) **pipette** • Transfer fruit juice to a **conical flask** • Add a few drops of starch solution as indicator • Add iodine from **burette** • Stop adding iodine when colour-change seen / end point reached • Record the volume of iodine added at the end-point • Repeat the titration until concordant results obtained • Calculate the <u>mean</u> titre (from concordant results) • Repeat the whole process with the other fruit juices • The fruit juice giving the highest titre contains the most vitamin C
			Total	**16**	

Question			Answer	Mark	Guidance
7	(a)		clearer / easier to understand ✓ allows comparison of data ✓	1	**ALLOW** 1 mark for "good way of summarising information" if no other mark awarded
	(b)		original/primary sources of data can be checked ✓	1	
	(c)		readers can see the researchers' original observations ✓ readers can draw their own conclusions ✓ the data are not easily described / put into a graph/table ✓	2	**ALLOW** easier to interpret (than graph/table/description)
	(d)		Idea that trends can be (clearly) seen ✓ Idea that data sets can be compared ✓ reference to mathematical manipulation of graphs (interpolation/extrapolation/gradients/intercepts) ✓	2	**IGNORE** references to "correlation"

Question			Answer	Mark	Guidance
	(e)		video/film recording ✓ audio recording ✓ 3-D representations/casts ✓ modelling ✓ diagrams/sketches/drawings ✓ tallies ✓ notes ✓ traces (barograph/seismograph) ✓	2	**DO NOT ALLOW** methods of storing data (note-books/microfiche/IT databases)
	(f)		**Validity:** how well the experimental test measures what it sets out to investigate / **AW** ✓ **Accuracy:** how close the measured value is to the actual value / **AW** ✓	2	**IGNORE** references to reliability **IGNORE** references to reliability
			Total	10	

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