OCR
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 2019

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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
	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.

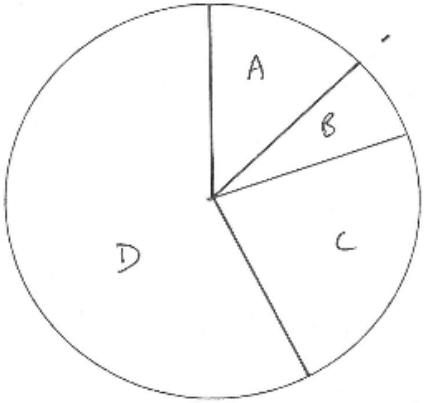
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New 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)		40	1	
	(b)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 51.08/51.1 award 2 marks** 664 ÷ 13 ✓ = 51 ✓	2	**DO NOT ALLOW** ecf
	(c)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 43.4 award 6 marks** 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 = 22598.92 or 22599 ✓ calculates (1/(N-1) of 22599 = 1883.2 ✓ calculates square root of 1883.2 = s = 43.3963585234 ✓ = 43.4 (1 decimal place) ✓	6	**ALLOW** ecf from (b) for mean **ALLOW** ecf from previou. mark-point
	(d)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = $g = \frac{1}{10}(\frac{R}{k} - s)$ award 2 marks** $\frac{1}{10}$ **or** $\frac{R}{k}$ **or** $-s$ ✓ $g = \frac{1}{10}(\frac{R}{k} - s)$ ✓	2	
	(e)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 1.73 x10^{14} (kJs^{-1}) award 3 marks** (π x (6371x10^3) ^{2} = 1.27451…. x 10^{14} (m^2) ✓ 1.27451…. x 10^{14} x 1.361 ✓ = 1.73 x10^{14} (kJs^{-1}) ✓	3	**ALLOW** some variation in final answer to allow for value used for π due to the use of different scientific or graphical calculators (instead of the value of 3.14) **ALLOW** ecf **ALLOW** ecf

Question			Answer	Mark	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 1.853 x10^{13} (kJ) award 3 marks** total variation = 2 x1.7% = 3.4(%) ✓ 0.034 x 5.44 x10^{14} (kJ) ✓ = 1.8496 x10^{13} (kJ) ✓	3	**ALLOW** ECF using e(i) value for (total) radiation
			Total	**17**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td><table><tr><th>Distance</th><th>Species total</th><th>% total</th></tr><tr><td>A</td><td>(5)</td><td>(10)</td></tr><tr><td>B</td><td>3</td><td>6</td></tr><tr><td>C</td><td>10</td><td>20</td></tr><tr><td>D</td><td>32</td><td>64</td></tr><tr><td>Total</td><td>(50)</td><td>(100)</td></tr></table>✓✓✓</td><td>3</td><td>One mark per row</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>four sectors with correct (by eye) proportions ✓

labels A-D correspond to proportions ✓</td><td>2</td><td>  </td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>smooth curve with increasing gradient up to between 6 and 7 m and then decreasing gradient to constant value between 8 and 10 m or peaking at 9 m. ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>7m circled ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>880 (lux) ✓</td><td>1</td><td>ALLOW values within range 860 to 900 lux

ALLOW other values, based on curve drawn in (b)(i) and outlier identified in (b)(ii)</td></tr>
</table>

Question			Answer	Mark	Guidance
		(iv)	drawn two vertical lines OR a triangle OR show two appropriate values on y-axis at around 4.0m ✓ Δy ÷ Δx OR vertical distance ÷ horizontal distance ✓ = 74.3 ✓ lux/m ✓	4	**ALLOW** ECF for the values plotted as a smooth curve **ALLOW** y = mx + c
			Total	**12**	

Question			Answer	Mark	Guidance
3	(a)	(i)	genus / generic name ✓	1	ALLOW references to etymology (shallow dish) or resemblance to knee-cap
		(ii)	recognised everywhere ✓	1	**ALLOW** many species have different common names that do not identify species uniquely
		(iii)	C ✓ it is the smallest AND the point is more to the left of centre (owtte) than the others ✓ A ✓ the width of the front (one end) is noticeably less than the width of the back (other end) ✓	4	If incorrect limpet identified do not award linked mark point **MUST** be comparative **MUST** be comparative
	(b)		dichotomous key ✓	1	
	(c)	(i)	secondary ✓	1	
		(ii)	**advantage** idea that the images exemplify the differences between each of the species ✓ **disadvantage** idea that the juveniles may be different to the adults ✓	2	**ALLOW** e.g. a young limpet A might look similar to an adult limpet C ORA
	(d)		it is not possible to see the under surface for identification purposes ✓ idea that the muscular foot may different in each species ✓	2	

Question			Answer	Mark	Guidance
	(e)		idea of different habitats ✓ idea that one of the species may only occur in one of the zones / species are specific to each zone ✓ detached/shells of limpets may have been washed into the zone (from other parts of the coastline) by the tide ✓	3	**ALLOW** different zones have different environments /environmental conditions **ALLOW** different species prefer different habitats (2) **ALLOW** idea of movement by tide
			Total	**15**	

Question			Answer	Mark	Guidance
4	(a)	(i)	temperature 20°C ±0.5 at 0 m ✓ 13°C ±1 at 500 m ✓ 3°C ±1 at 1000 m ✓	3	
		(ii)	35ppt ±1.75 ✓	1	
		(iii)	(T and D) temperature decreases as depth increases ✓ (T and c) speed increases as temperature increases ✓ (S and c) speed increases as salinity increases at each depth ✓	3	ORA ORA
	(b)	(i)	systematic error ✓	1	
		(ii)	contaminated probe ✓	1	
		(iii)	random error✓	1	
		(iv)	repeat and obtain an average/mean value ✓	1	**ALLOW** ecf correct explanation of incorrect error identified in (b)(iii) eg systematic error = clean probe / recalibrate;
		(v)	adjust the salinometer ✓ so that the readings are the same ✓	2	
	(c)	(i)	2700 ✓ 2738 ✓ 2741 ✓	3	**ALLOW** any number of figures correctly rounded 1955.59 1985.676 1988.6846
		(ii)	idea that the improvement from opt2 to opt3 is very small (0.1%) in context of the overall depth ✓	1	
			Total	**17**	

Question			Answer	Mark	Guidance
5	(a)	(i)	Field 1 and 5 – apply 200 kg N/ha ✓ Field 2, 3 and 4 – apply (only) 40 kg N/ha ✓	2	
		(ii)	The anomaly is in field **3** ✓ **Any two from:** (the value) does not fit within the range ✓ range is 100 to 140 ✓ other values have a maximum of 40 (kg N/ha) difference between each other / anomaly is 70 (kg N/ha) more than the maximum of other values ✓	3	**ALLOW** if field 5 selected.
		(iii)	repeat the soil test in field 3 ✓ repeat the soil tests for the other four fields (to ensure that the original values are correct) ✓	2	Idea of retesting all fields gains 2 marks.
	(b)		**Any four from:** economic rate (of fertiliser application) must achieve an increased crop yield with an increased net profit ✓ analyse the overall cost of fertiliser applications under different field conditions ✓ perform a series of field investigations for wheat crops ✓ repeat the investigations under standard/controlled conditions / vary only one feature at a time ✓ consider the impact of varying one feature in relation to different fertiliser levels✓	4	**ALLOW** other realistic suggestions

Question			Answer	Mark	Guidance
	(c)			2	

The application of NPK at 90-30-30 is not affected by the addition of B at 1% or 2%.	
The application of twice as much N within NPK fertiliser has the greatest impact on wheat yield.	
The application of NPK fertiliser increases wheat yield in relation to the control (untreated).	✓
Changing the nitrogen content of NPK does not have an effect on wheat yield.	
The application of B at 2% causes a greater increase in wheat yield than the application of B at 1%.	✓

			Total	**13**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>FIRST CHECK THE ANSWER ON THE ANSWER LINE
If answer = 94 (%) award 3 marks

823 ÷ 877 ✓
= 93.84264 ✓
= 94 (%) ✓</td><td>3</td><td>ALLOW any number of figures</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>appropriate line of best fit ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>7 (days) ✓</td><td>1</td><td>ALLOW 7 days ± 0.5 day</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>lactophenol blue ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Lin's Cupric Sulfate Medium ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>catalase production ✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><td>(F)</td><td>D</td><td>B</td><td>E</td><td>A</td><td>C</td></tr></table>✓✓✓✓</td><td>4</td><td>D - B = 1 mark
B - E = 1 mark
E - A = 1 mark
A - C = 1 mark</td></tr>
</table>

Question			Answer	Marks	Guidance
	(e)		**Any four from:** pipette a known volume/specified suitable volume of water into a conical flask ✓ add sodium hydroxide solution ✓ measure pH/check that pH >10/add buffer solution ✓ add indicator/suitable indicator, e.g. Patton-Reeder indicator (HHSNNA), Eriochrome Black T ✓ titrate against standard EDTA solution✓ until end-point/blue/purple colour produced ✓ use 1 mole Ca^{2+}] ≡ 1 mole EDTA to calculate [Ca^{2+}] ✓ repeat until concordancy achieved ✓	4	
			Total	**16**	

Question			Answer	Marks	Guidance
7	(a)	(i)	**Any two from:** photographs ✓ sketches ✓ notebooks/logbooks ✓ tally-charts ✓ spreadsheets/database ✓	2	**ALLOW** reasonable alternative suggestions
		(ii)	geographical Information system/GIS ✓	1	**ALLOW** reasonable alternative suggestions
		(iii)	**Any one from:** bar chart/bar graph ✓ pie chart ✓	1	**ALLOW** answers that address reaching a wide audience e. g. television programme
	(b)		**[Level 3]** Describes two findings/conclusions from both studies and includes reference to feeding behaviour of fish or accumulation of microplastics. ***(5 – 6 marks)*** **[Level 2]** Describes two findings/conclusions from both studies. ***(3 – 4 marks)*** **[Level 1]** Describes two findings/conclusions from one study. ***(1 – 2 marks)*** **[Level 0]** Candidate includes **fewer than two** valid points. ***(0 marks)***	6	**Results/conclusions** • larger quantity/amount quantified of secondary microplastics in the environment than primary microplastics • most/amount quantified come from plastic football pitches and abrasion of tyres • most microparticles found in mackerel • mackerel in coastal waters and yet herring in the same location did not contain microparticles • cod live on sea floor and contain relatively few microparticles • microparticles may accumulate less on sea floor • or cod may have different feeding habits • mackerel and herring are likely to have different feeding habits
			Total	**10**	

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