OCR
Oxford Cambridge and RSA

Cambridge Technicals

Laboratory Skills

Unit **3:** Scientific analysis and reporting

Level 3 Cambridge Technical Certificate/Diploma in Laboratory Skills
05848 – 05849 05874 8

Mark Scheme for January 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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Question			Answer	Marks	Guidance
1	(a)		Correct axes and units; Points plotted correctly; best fit line (2013 data); best fit line (2016 data);	1 1 1 1	 **Not** less than half of grid **Allow** curves = **1 max** for two curves Equal number of points above/below line.
	(b)	(i)	Frequency = 250 to 8000; Loudness Level = 25 to 80;	2	
		(ii)	5;	1	
	(c)		Low frequency sounds are detected at lower levels of loudness ORA; Increase in loudness is proportional to increase in frequency; **OR** Small increases in frequency at lower end require greater increases in loudness to be heard;	2	**Allow** loudness increases with frequency **DO NOT ALLOW** frequency increases with loudness **Allow** if line of best fit drawn **Allow** if curve drawn
	(d)	(i)	3000 (Hz);	1	
		(ii)	Repeat the test;	1	
		(iii)	Random event; The patient may have pressed the button by accident;	2	
		(iv)	65 (dB);	1	**Allow** other value if correct for graph

Question			Answer	Marks	Guidance
	(e)		**Analysis of data** Range (of deterioration/change) is 5 -15 dB / Most deterioration/change at 1000 Hz / Least deterioration/change at 6000 Hz; **Conclusion** Hearing has deteriorated/is worse; **Justification** Loudness level has increased (at each frequency);	3	**Allow** no deterioration at 3000 Hz Conclusion **must** be an explicit statement about the quality of the patients hearing **Allow** e.g. the sounds have to be louder for the patient to hear them **Allow** a combined statement linking deterioration with correct justification = 2 marks
	(f)		50 (dB); 10 x 10 x 10 x 10 x 10 / 100,000; $1x10^5$;	3	
			Total	**20**	

Question			Answer	Marks	Guidance
2	(a)	(i)	5;	1	
		(ii)	No male parts present / it is a female flower;	1	
	(b)		**actinomorphic** Radially symmetrical / many lines of symmetry / petals are arranged equally around a central point / OWTTE; **zygomorphic** Bilaterally symmetrical / monosymmetric / one line of symmetry;	2	
	(c)	(i)	Binomial (nomenclature)	1	
		(ii)	Leaves possess two sets of 'teeth' (on the edge); Flower heads/flowering structures are 'hanging/nodding';	2	**Ignore** unqualified references to leaves and/or flowers **Allow** drooping
		(iii)	Secondary; Key features/structures can be emphasised;	2	
	(d)		**1st row:** 3, 4, 5; [from left to right] **2nd row:** 6, 6, 8, 5 to 10, 5 or 10; **3rd row:** Cruciferae, Caryophyllaceae, Guttiferae;	3	 **Allow** phonetic spelling for Latin terms

Question			Answer	Marks	Guidance
	(e)		It could be any of the families with 5 sepals and petals / it could be *Caryophyllaceae* or *Crassulaceae* or *Guttiferae*; It could be either *Crassulaceae* or *Carophyllaceae*; as both families can have 10 stamens; It could not be *Guttiferae* as does not have bunched stamens.	2	
			Total	**14**	

Question			Answer	Marks	Guidance
3	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2.2 x10^{10} km^3 award 3 marks** Substitution: $\frac{4}{3}$ x π x 1738.14^3 ; 2(.19959…) x10^{10} = 2.2 x10^{10}; km^3;	3	**DO NOT ALLOW** 2.0 **DO NOT ALLOW** ecf from incorrect substitution
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 99.9(%) award 3 marks** (Polar radius =) 1735.97; 1735.97/1738.14 / 0.99875; 99.9 (%)	3	**Allow** 99.875 / 99.88
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 7.3(48)x10^{13} (kg) award 3 mark** Conversion: (3.34g/cm^3 =) 3. 34 x10^3 kg/m^3; Change subject: (m =) ρV / 3.34 x10^3 x 2.2 x10^{10}; 7.3 x 10^{13} (kg);	3	**Allow** correct substitution of a(iii) and a(i) **Allow** ecf for substitution of incorrect conversion **Allow** ecf for substitution of 2.2 x 10^{10} from a(i) **Allow** 7.35 x 10^{13} / 7.348 x 10^{13}
	(b)	(i)	**Same** period/frequency / time between peaks/troughs;	1	**DO NOT ALLOW** wavelength / distance
		(ii)	Two more cycles with same frequency; Peaks around 408 000 **and** troughs below 370 000;	2	

Question			Answer	Marks	Guidance
		(iii)	**[Level 3]** Candidate shows a high level of understanding by extracting data from the graph to complete both calculations, **AND** gives at least one conclusion, including **at least six** valid points. ***(5 – 6 marks)*** **[Level 2]** Candidate shows an understanding by extracting data from the graph to complete one calculation **OR** attempts both calculations, **AND** gives at least one conclusion, including **at least four** valid points. ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding by extracting data from the graph **AND** attempts a calculation or a conversion **OR** gives at least one conclusion, including **at least two** valid points but with little or no explanation. ***(1 – 2 marks)*** **[Level 0]** Candidate includes **fewer than two** valid points. ***(0 marks)***	6	**Valid points** **Extracts data from graph:** • average distance from Earth to Moon = 380,000 to 386,000 km • maximum distance from E to M = c408 000 km • minimum distance from E to M = c358 000 km **Calculations** • Circumference/orbit distance = 2 x π x average distance from E to M (= 2 380 000 km to 2 430 000 km) • conversion to metres: (2.38×10^9 to 2.43×10^9) • conversion of days to seconds: 27.32 days = (27.32 x 24 x 60 x 60) = 2360448 seconds • Speed = distance ÷ time (= 1008 to 1029 m/s) **Conclusions supported by calculations**: • yes / yes almost / 1000 m/s is the approximate average speed / yes to 1 s.f. • correct conclusion based on erroneous calculation **Qualitative conclusions** • distance from Earth to Moon varies the circumference but time is constant so speed varies • the greater the circumference of M, the faster the speed ORA
			Total	**18**	

Question			Answer	Marks	Guidance
4	(a)	(i)	**Instrument error** Use the 'zero adjust' to point the needle to zero / OWTTE; **Measurement error** Adopt a line of sight directly above the scale (to avoid parallax error) / OWTTE;	2	**Ignore** references to 'zeroing' without procedure
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = ± 0.24 (A) award 2 marks** 12 x 0.02 / 1 ; ± 0.24 (A);	2	
	(b)	(i)	(Very) accurate; All within instrument error (0.24);	2	**Allow** correct **Allow** ecf from uncertainty calculated in (a)(ii)
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2.77(A) award 2 marks** (2.65 + 2.85 + 2.8)/3 / 8.3/3 ; = 2.77 (A);	2	**DO NOT ALLOW** 2.8 (response must be to 2dp)
		(iii)	Do a replica investigation/study / get somebody else to carry out the experiment; Use different apparatus/methods;	2	**Ignore** repeat the experiment
			Total	**10**	

Question			Answer	Marks	Guidance
5	(a)		Triangle tangent on graph at 750,60; $\Delta y \div \Delta x$ values from graph; $0.19 < g < 0.23$; %/day;	4	**Max 2 marks** if tangent drawn at incorrect point
	(b)	(i)	**Conclusion**: High dose increases mortality (compared to control group); **Justification**: Lowest percentage of survivors (at all times); **Conclusion**: Low dose decreases mortality up to 915 days (compared to control group); **Justification**: Highest percentage of survivors; **Conclusion**: Low does increases mortality after 915 days (compared to control group); **Justification**: Lower percentage of survivors;	4	**Only** award a justification mark if linked to a correct conclusion mark
		(ii)	Increase the number of mice used; Delete anomalous data; Introduce more levels of gamma radiation daily dosage, eg medium level; Increase the frequency of sampling dates; A mechanism to explain how gamma radiation affects mortality; Other studies that describe the negative effects on health of gamma radiation;	3	**Allow** secondary evidence

Question			Answer	Marks	Guidance
	(c)		**Advantage** *Any one from* Saving time; Accessibility/internet; Saving money; Longitudinal/international study; Generating new insights; **Disadvantage** *Any one from* Data not appropriate; Unsure of data quality; May be outdated;	2	
			Total	**13**	

Question			Answer	Marks	Guidance
6	(a)	(i)	(Contain) chemical substances in the media inhibit the growth of certain bacteria; While allowing others to grow; Growth on/in a certain medium will identify the species/range of species present;	3	
		(ii)	Metabolism of chemicals in the medium by specific bacteria/groups of bacteria; Cause changes in the medium, eg colour; Used to identify/distinguish groups/species of organisms biochemically/owing to appearance;	3	
		(iii)	Enriched/supplemented with nutritious/complex materials, eg blood, beef extracts; Essential for growth of fastidious bacteria/bacteria with complex nutrient requirements/certain bacteria will grow on these media;	2	
	(b)	(i)	Selective **and** differential;	1	Two correct boxes ticked = 1 mark More than two boxes ticked = 0 marks

Question			Answer	Marks	Guidance
		(ii)	**Patient 1** ***Staphylococcus aureus*;** *Any two from:* Growth, so can tolerate salt, confirming *Staphylococcus* sp.; Neutral red (in MSA) turns yellow, so bacterium must have fermented mannitol; Colony colour distinguishes from *S. saprophyticus* / *S. aureus* is **only** species with yellow colonies. **Patient 2** ***Staphylococcus epidermidis*;** *Any two from:* Growth, so can tolerate salt, confirming *Staphylococcus* sp.; No colour change (to agar) / agar stays pink, so bacterium cannot ferment mannitol; Colony density differentiates from *S. Saprophyticus* / *S. epidermidis* is **only** species with high colony density;	3 3	
			Total	**15**	

Question			Answer	Marks	Guidance
7	(a)	(i)	Peer (review);	1	
		(ii)	Repeat / increase the number of replicates; Increase the precision of recording the solvent front; Increase the precision of recording the spot/extract front; Use a different form of chromatography; Confirm that the pens belonged to suspect A and B; Run a DNA analysis for the paper and the suspects; Consider the relevance of the yellow spots from the paper and suspect A; Check the chromatogram for suspect A / chromatogram may be anomalous;	2	
		(iii)	Table; Graph; Photograph; Sketch; Video; Audio; 3D representation;	3	**Allow**: bar chart, histogram, pie chart, scatter graph cont

Question			Answer	Marks	Guidance
			Models; Diagram: Drawing;		
	(b)		**Included in report (content):** Affiliation of author/forensic scientist; Date of analyses; Date of report; How samples were collected; Details of procedure/method used; State that procedure/method is accepted/standard procedure; Reasons for the selection of procedure/method; Steps used to avoid contamination (of samples); Outcomes/results (of procedure/chromatograms); Discussion of findings/conclusion; Limitations of findings / conclusions that cannot be drawn **Style:** Present science in form that is understandable; Concise;	4	**If only content OR style included in response 3 marks max.** cont

Question			Answer	Marks	Guidance
			Idea of clarity; Organised into appropriate sections;		
			Total	**10**	

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