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

Oxford Cambridge and RSA Examinations

Question			Answer	Marks	Guidance
1	**(a)**		Correct axes and units;	1	
			Points plotted correctly;	1	**Not** less than half of grid
			best fit line (2013 data);	1	**Allow** curves = **1 max** for two curves Equal number of points above/below line.
			best fit line (2016 data);	1	
	(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; 1×10^5;	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 =) ρ V / 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 x10^9 to 2.43 x10^9) • 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; Δy ÷ Δx 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**	3	
			***Staphylococcus aureus*;**		
			Any two from: Growth, <u>so can tolerate salt,</u> 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*;**	3	
			Any two from:		
			Growth, <u>so can tolerate salt,</u> 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;		
			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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