



Cambridge Technicals Laboratory Skills

Unit 2: Laboratory Techniques

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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Question			Answer	Marks	Guidance
1	(a)	(i)	whole ✓	1	
		(ii)	the strands of hair may have come from different sources ✓	1	ALLOW the strands of hair may have come from different people
	(b)	(i)	random ✓	1	
		(ii)	<p>Any one from: sample chosen without bias ✓</p> <p>if random, characteristic equally likely to occur in all samples ✓</p> <p>as true an estimate of probability as is possible ✓</p>	1	
	(c)		<p>freezer ✓</p> <p>to prevent degradation/decay (by microorganisms) ✓</p>	2	ALLOW frozen ignore refrigerator
	(d)	(i)	contamination with infectious agents/ pathogens ✓	1	ALLOW infection

Question		Answer	Marks	Guidance
	(ii)	<p>Any two from:</p> <p>staff trained in necessary procedures ✓</p> <p>vaccinated (against Hepatitis B) ✓</p> <p>carry out Risk Assessment ✓</p> <p>use PPE/gloves/labcoat/eye protection ✓</p>	2	
	(iii)	<p>Any one from:</p> <p>disposal using a sharps/specific bin ✓</p> <p>do not re-sheath needles ✓</p> <p>autoclaved/incinerated ✓</p>	1	
(e)	(i)	<p>Any two from:</p> <p>two containers limits possibility of (breakage and) <u>loss of sample</u> if one container broken ✓</p> <p>handler <u>protected</u> (from blood) if sample tubes broken ✓</p> <p>(waterproof container) eliminates possibility of influx of water into container/prevents contamination/ degradation by water ✓</p>	2	
	(ii)	<p>if transporting container is broken, sample (in the tube) is still labelled ✓</p>	1	

Question			Answer	Marks	Guidance
		(iii)	to reduce microbial degradation/degradation by microorganisms✓	1	
			Total	14	

Question		Answer	Marks	Guidance
2	(a)	A – carrier gas ✓ B – injection (port) ✓ C – column ✓ D – detector ✓ E – data system ✓	5	
	(b)	Any two from: (internal standard) is chemically related to chemicals in the beer/behaves similarly to chemicals in beer (in GC) ✓ (but) not present in beer ✓ has a different retention time to other possible components ✓	2	
	(c) (i)	A – ethanal ✓ B – ethanol ✓ C – propan-1-ol ✓ D – ethyl ethanoate ✓	4	
	(ii)	Any two from: known amount of <u>each</u> internal standard in mixture of standards ✓ peak areas measured of internal standards and sample ✓ amount in sample calculated ✓ concentration in beer calculated ✓	2	
Total			13	

Question			Answer	Marks	Guidance
3	(a)	(i)	MgCl ₂ ✓ 2H ₂ O ✓	2	
		(ii)	FIRST CHECK THE ANSWER If answer = 0.016 (moles) award 3 marks. Conversion of 16 cm ³ to 0.016 dm ³ ✓ = 1 × 0.016 ✓ = 0.016 (moles) ✓	3	ALLOW answers with two significant figures only. ALLOW answers in standard form
	(b)		FIRST CHECK THE ANSWER If answer = 0.002610 (moles) award 3 marks Conversion of 26.10 cm ³ to 0.02610 dm ³ ✓ = 0.1 × 0.02610 ✓ = 0.00261 (moles) ✓	3	ALLOW answers in standard form ALLOW rounding up to 3 decimal points.
	(c)	(i)	FIRST CHECK THE ANSWER If answer = 0.0067 (moles) award 4 marks. 1 mole NaOH ≡ 1 mole HCl ∴ Number of unreacted moles HCl = 0.00261 ∴ Number of moles of HCl that reacted = 0.016 – 0.00261 ✓ = 0.01339 (moles) ✓ Number of moles Mg(OH) ₂ = 0.01339 ÷ 2 ✓ = 0.0067 (moles) ✓	4	ALLOW answers in standard form ALLOW ECF ignore units

Question		Answer	Marks	Guidance
	(ii)	FIRST CHECK THE ANSWER If answer = 391 (mg), award 3 marks. = 0.0067×58.3 (g) ✓ = 0.39061 (g) ✓ = 391 (mg) ✓	3	ALLOW ECF
		Total	15	

Question			Answer	Marks	Guidance												
4	(a)	(i)	shows internal structures of body ✓ images are monochrome/black and white ✓	2	IGNORE answers not related to the <u>images</u> .												
		(ii)	Any two from: ultrasound produces real time/live/moving images, e.g. blood flow/X-ray fixed point ✓ ultrasound produces good resolution of soft tissue/X-ray usually for more dense tissues/bones ✓ ultrasound produces 3D images/X-ray 2D ✓	2	IGNORE answers not related to the <u>images</u> .												
	(b)	(i)	<table border="1"> <thead> <tr> <th>Part of microscope</th> <th>Label</th> </tr> </thead> <tbody> <tr> <td>Source of light</td> <td>E</td> </tr> <tr> <td>Location of microscope slide</td> <td>B</td> </tr> <tr> <td>Eye piece</td> <td>A</td> </tr> <tr> <td>Objective lens</td> <td>D</td> </tr> <tr> <td>Control used to focus the image</td> <td>C</td> </tr> </tbody> </table> ✓✓✓✓✓	Part of microscope	Label	Source of light	E	Location of microscope slide	B	Eye piece	A	Objective lens	D	Control used to focus the image	C	5	One mark for each correct label.
Part of microscope	Label																
Source of light	E																
Location of microscope slide	B																
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Question		Answer	Marks	Guidance
	(ii)	<p>Any three from:</p> <p>view live cells/tissues/specimens ✓</p> <p>images/cells/tissues are seen in colour ✓</p> <p>can highlight parts of cells/tissues using stains ✓</p> <p>not expensive ✓</p> <p>(relatively) quick to see cells/tissues ✓</p> <p>can be transported easily ✓</p>	3	
(c)	(i)	<p>FIRST CHECK ANSWER ON ANSWER LINE</p> <p>If answer = (x) 10800 award 3 marks</p> <p>width of mitochondrion = 27 mm on micrograph = 27 000 μm ✓</p> <p>= $\frac{27}{0.0025}$ ✓</p> <p>∴ magnification = (x) 10800 ✓</p>	3	<p>Allow measurement = 27 ± 1 mm.</p> <p>ignore units</p>
	(ii)	<p>Any two from:</p> <p>higher magnification ✓</p> <p>greater resolution ✓</p> <p>reveals cell ultrastructure/organelles ✓</p>	2	Allow greater detail
Total			17	

Question			Answer	Marks	Guidance
5	(a)	(i)	<p>[Level 3] Candidate shows a high level of understanding and gives a good description of the technique and principles of ion chromatography. <i>(5 – 6 marks)</i></p> <p>[Level 2] Candidate shows an understanding of the technique and principles of ion chromatography. <i>(3 – 4 marks)</i></p> <p>[Level 1] Candidate shows a basic understanding of the technique and principles of ion chromatography, with little or no explanation. <i>(1 – 2 marks)</i></p> <p>[Level 0] Candidate includes fewer than two valid points. <i>(0 marks)</i></p>	6	<p>valid points</p> <p>basic principles</p> <ul style="list-style-type: none"> • (Ion chromatography) based on ion exchange resin • Resin beads • Resin has ion exchange sites • Resins for cation analysis have negative charge <p>starting conditions</p> <ul style="list-style-type: none"> • Adsorbent/stationary phase selected • Eluent loading • Ionic interaction of cations in resin/displaces/flushes through/eliminates any cations on bonded onto resin/eluent cations retained on resin <p>analysis of unknown</p> <ul style="list-style-type: none"> • Sample injection • Of cations in eluent • Manually or automated process • Different cations replace cations/cations adsorbed on resin • Temperature and flow rate controlled • Reaction is different for different cations/adsorbed onto resin differently • Depends on affinity for resin/charge/size • Causes separation of sample <p>elution</p> <ul style="list-style-type: none"> • Addition of eluent/change in conditions causes elution of analytes • Involves change in pH/salt concentration, etc. • More than one eluent may be used

Question		Answer	Marks	Guidance
				detection and analysis <ul style="list-style-type: none"> • Detection of cations/type of detector, e.g. by change in conductivity as cations eluted • Conductivity of eluent suppressed to increase analyte sample • Each ion that emerges produces a peak • Plot of abundance of ion/time • Position of peak specific to ion
	(ii)	paper (chromatography) ✓ thin layer (chromatography) / TLC ✓ gas (chromatography) ✓ high performance liquid (chromatography) / HPLC ✓	4	Answers in any order Allow gas-liquid (GLC) Allow pressure for performance
	(b)	A – sodium/ Na^+ ✓ B – ammonium/ NH_4^+ ✓ C – potassium/ K^+ ✓	3	If formulae used, charges must be correct
	(c)	atomic absorption spectroscopy/AES ✓ atomic absorption spectroscopy-inductively coupled plasma/AES-ICP ✓	2	ALLOW atomic absorption spectroscopy/AAS IGNORE answers related to flame testing ALLOW ICP-AES

Question		Answer		Marks	Guidance
	(d)			3	
		Cation	Colour in flame		
		Barium	(light/pale) green		
		Copper	Green/blue		
		Lithium	Crimson/red		
			Total	18	

Question		Answer	Marks	Guidance
6	(a)	<p>prevent contamination (of explant with microorganisms) ✓</p> <p>(that would) cause decay/degradation/death of explant ✓</p>	2	<p>IGNORE references to infection.</p> <p>Allow bacteria/fungi compete for nutrients</p>
	(b)	(i)		
		<p>dip (the tips) in alcohol ✓</p> <p>insert into (Bunsen) flame ✓</p> <p>allow to cool before use ✓</p>	3	<p>ALLOW ethanol/methanol</p> <p>Must be suitable order</p>
		(ii)		
		<p>Any two from:</p> <p>immerse in disinfectant/ sodium hypochlorite/ dichloroisocyanurate (SDICN) ✓</p> <p>agitate/swirl gently periodically/every 2-3 minutes ✓</p> <p>for 15 minutes ✓</p> <p>rinse in sterilised water ✓</p>	3	
	(c)	<p>Any two from:</p> <p>wash hands before work ✓</p> <p>appropriate PPE/gloves/labcoat ✓</p> <p>use a flow-bench ✓</p>	2	<p>ALLOW air flow cabinet/ Sterile/lamina flow cabinet</p>

Question		Answer	Marks	Guidance
	(d)	<p>Any three from:</p> <p>Cell/tissue culture ✓</p> <p>preparation of medical test kits ✓</p> <p>pharmaceutical production ✓</p> <p>microbiological applications ✓</p> <p>medical procedures ✓</p> <p>surgical procedures ✓</p>	3	<p>ALLOW any other correct procedures.</p> <p>Allow growing bacterial cultures</p> <p>Allow blood sample analysis</p> <p>Allow biotechnology</p>
		Total	13	

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