OCR
Oxford Cambridge and RSA

Cambridge Technicals
Applied Science

Unit 2: Laboratory Techniques

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

Mark Scheme for January 2020

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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

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

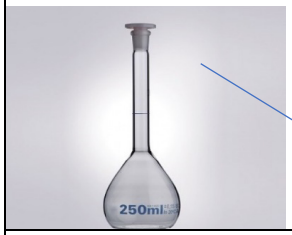
Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Question			Answer	Marks	Guidance
1	(a)		Explosive ✓ Serious health hazard✓	2	Answers must be in this order

Question			Answer	Marks	Guidance
	(b)	(i)	✓✓✓	3	all 4 correct =3 3 correct = 2 2 correct = 1

Conical flask

Graduated pipette

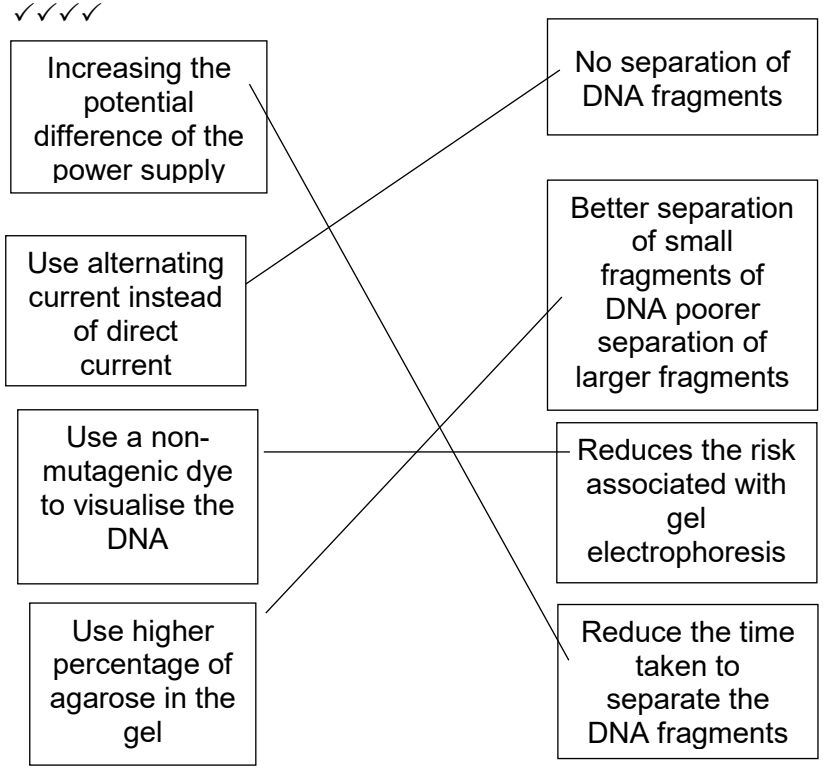


Measuring cylinder

Volumetric flask

Question			Answer	Marks	Guidance
	(b)	**(ii)**	(Cuts from) broken/sharp glass **OR** broken/sharp plastic ✓	1	**ALLOW** they can break **IGNORE** spillage
	(c)	**(i)**	Stored in a fire- resistant (metal) cabinet/box/container ✓	1	**ALLOW** flammables cupboard/cabinet
		(ii)	Volumetric flask ✓	1	
		(iii)	Measuring cylinder ✓	1	
		(iv)	The amount needed is approximate ✓	1	**OWTTE**
		(v)	No naked flames **OR** lab should be well-ventilated because ethanol is flammable✓ Wear gloves because sodium dichromate is toxic.✓	2	needs precaution with related explanation for mark **ALLOW both** precautions without explanations for a maximum of one mark
		(vi)	Graduated pipette✓	1	
		(vii)	Heat some water in a kettle **OR** use an electrical heater (i.e. water should **not** be heated using a Bunsen flame) ✓ Pour the water into a beaker and stand the boiling tube in the water ✓	2	**ALLOW** waterbath
			Total	**15**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>$\left(\frac{1.25 \times 70}{100} = 0.875\right) = 0.88$ (g) ✓</td><td>1</td><td>Must be 2 sf</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>To purify DNA from bacterial cells.</td><td></td></tr><tr><td>To amplify copies of a specific region DNA.</td><td>✓</td></tr><tr><td>To increase the total amount of DNA.</td><td></td></tr></table>✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Positive ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any four from:
DNA samples placed in pockets or wells in the gel ✓
Liquid / buffer solution (is used to complete the circuit) ✓
Negative electrode attached near well ORA ✓
Electric field / PD /current / voltage is applied (across 2 electrodes) ✓
Dye / radioactivity / inter-chelating agent used to help visualise the DNA</td><td>4</td><td>Marks can be awarded for clearly labelled diagram</td></tr>
<tr><td></td><td>(d)</td><td></td><td>(800 -200 =) 600 (bp) ✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
	(e)		✓✓✓✓  	4	
			Total	**12**	

Question			Answer	Marks	Guidance
3	(a)	(i)	methyl orange ✓	1	
		(ii)	phenolphthalein ✓	1	
	(b)	(i)	yellow ✓	1	**REJECT** colour change unless states yellow in acidic conditions
		(ii)	There would be no sharp colour change ✓ Which means that the endpoint can't be found precisely ✓	2	**ALLOW** Universal indicator has many different colours
	(c)	(i)	106 (g/mol) ✓	1	

Question			Answer	Marks	Guidance
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 1.59 (g) award 3 marks** $\frac{250}{1000}$ = 0.25 ✓ 0.25 x 0.06 = 0.015 ✓ 0.015 x 106 = 1.59 (g) ✓ OR Mass required to make 1dm^3 of 1mol dm^{-3} = 106 (g) ✓ 0.06 x 106 = 6.36 (g)✓ 6.36 x.25 = 1.59 (g) ✓	3	**ALLOW** n(Na_2CO_3) = $\frac{0.06 \times 250}{1000}$ =0.015 ✓✓ mass (Na_2CO_3) = 0.015 x 106 =1.59 (g) ✓ **ALLOW** Mass required to make 1dm^3 of 1mol dm^{-3}= 106 (g) ✓ Mass required to make 1dm^3 of 0.06 mol dm^{-3} = 6.36 (g)✓ Mass required to make 0.25dm^3 of 0.06 mol dm^{-3} = 1.59 (g) **ECF** from c(i) **ALLOW** 15 on answer line for 1 mark
	(d)	**(i)**	(10 cm^3) one-mark pipette ✓	1	**ALLOW** bulb/ graduated pipette
		(ii)	31.45 (cm^3) ✓	1	

Question			Answer	Marks	Guidance
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 31.4 (cm^3) award 2 marks** Concordant titres 2 and 3 selected = (31.35 + 31.45) ÷ 2 ✓ = 31.4 (cm^3) ✓	2	**ECF** from dii **ALLOW** 1 mark for a correct average of all 3 titres
		(iv)	n (Na_2CO_3) = $\frac{0.06 \times 31.4}{1000}$ = 0.001884 (mol) ✓	1	**ECF** from d(iii) **ALLOW** 0.00188 or 0.0019
		(v)	n (HC*l*) = 0.001884 × 2 = 0.003768 ✓	1	**ALLOW** 0.00376 or 0.0038 **ECF** from d(iv)
		(vi)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 0.377 (mol dm^{-3}) award 2 marks** c (HC*l*) = $\frac{0.003768 \times 1000}{10}$ ✓ = 0.377 (mol dm^{-3}) ✓	2	**ECF** d(iv) Must be 3 sf for second mark
			Total	**17**	

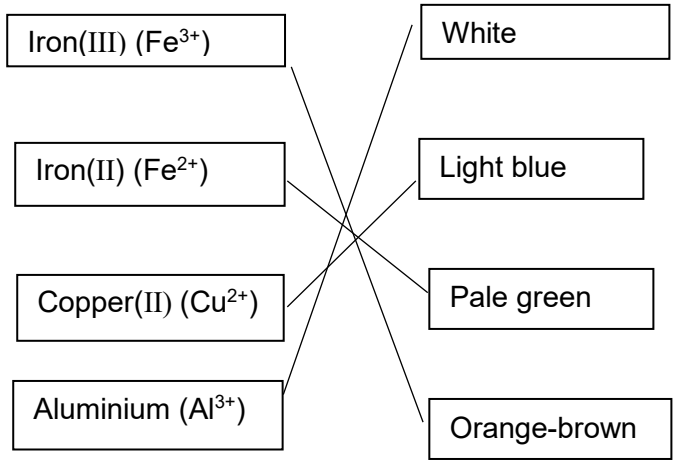
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>✓✓✓✓✓✓✓
<table>
<tr><th>Advantages or disadvantages</th><th>Light microscope</th><th>Electron microscope</th></tr>
<tr><td>Cheaper equipment cost</td><td>✓</td><td></td></tr>
<tr><td>Highest magnification is up to x 2000</td><td>✓</td><td></td></tr>
<tr><td>More skill required to prepare samples</td><td></td><td>✓</td></tr>
<tr><td>Produces colour images</td><td>✓</td><td></td></tr>
<tr><td>Smaller equipment size and easier to use</td><td>✓</td><td></td></tr>
<tr><td>Can view live specimens</td><td>✓</td><td></td></tr>
<tr><td>Image cannot be viewed directly by human eye</td><td></td><td>✓</td></tr>
</table></td><td>7</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(b)</td><td></td><td>✓✓✓✓

<table><tr><th>Uses</th><th>SEM</th><th>TEM</th></tr><tr><td>Viewing below-surface features</td><td></td><td>✓</td></tr><tr><td>Forming images from reflected electrons</td><td>✓</td><td></td></tr><tr><td>Showing the internal composition of a structure</td><td></td><td>✓</td></tr><tr><td>Showing the overall form or shape of a structure</td><td>✓</td><td></td></tr></table></td><td>4</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>52(mm) ✓</td><td>1</td><td>ALLOW values between 51-53</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>2 x10^{-4} OR 0.0002(mm) ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>(x) 260,000 OR 2.6 x 10^{5} ✓</td><td>1</td><td>ECF from c(i) and c(ii)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>14</td><td></td></tr>
</table>

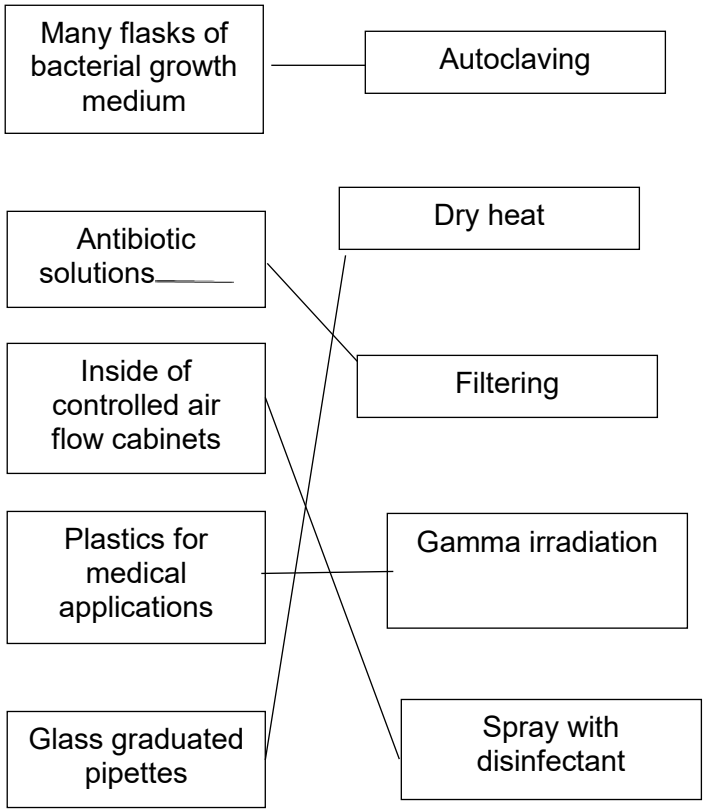
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>White solid</th><th>Flame colour</th></tr>
<tr><td>Lithium chloride</td><td>Crimson (red) ✓</td></tr>
<tr><td>Barium chloride</td><td>(pale) Green ✓</td></tr>
<tr><td>Sodium chloride</td><td>Yellow ✓</td></tr>
</table>
</td><td>3</td><td>DO NOT ALLOW Brick red or carmine red
DO NOT ALLOW Apple green

ALLOW orange</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any three from:
(Platinum/nichrome) wire /loop cleaned in flame ✓
Dipped into (concentrated hydrochloric) acid ✓
Loop dipped in powdered solid /sample solution✓
Placed in non-luminous/blue Bunsen flame ✓</td><td>3</td><td>ALLOW responses relating to other methods of flame test eg spraying a solute on of cations dissolved in a suitable solvent and spraying onto a naked flame

If wire is dipped in acid after being dipped in sample then a maximum of 2 marks awarded.</td></tr>
<tr><td></td><td>(b)</td><td></td><td> 

✓✓✓✓</td><td>4</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)	(i)	concentration on x axis peak area on y axis ✓ both axes labelled with correct units ✓ appropriate scale ✓ all point plotted correctly to ½ square tolerance ✓ straight line of best fit ✓	5	**DO NOT ALLOW** scales that are either not appropriate or not linear If scales are directly from table awarded a maximum of two marks for correct axes and correct labels **DO NOT ALLOW** the intersection of crosses or position of dots that are bigger than half a square. **DO NOT ALLOW** a line of best fit that is thicker than ½ square or hairy
		(ii)	120 (mg dm^{-3}) ✓ Clear demonstration on the graph as to how candidate obtained answer ✓	2	**ECF** for data presented on graph = 1 mark max.
			Total	**17**	

Question			Answer	Marks	Guidance
6	(a)		✓✓✓✓✓  	5	

Question			Answer	Marks	Guidance
	(b)		**[Level 3]** Candidate shows a high level of understanding and gives a good description of how to streak a plate for single colonies and following their method would probably be successful. ***(5 - 6 marks)*** **[Level 2]** Candidate shows an understanding of streaking a plate for single colonies. The description is incomplete but generally correct ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding of streaking a plate for single colonies. Salient points are missing and is not likely to be successful ***(1 – 2 marks)*** **[Level 0]** Candidate response includes **fewer than two** valid points. ***(0 marks)***	6	**Marking points may include:** • All work conducted in aseptic conditions around an open flame (allow a controlled air flow cabinet) • Use of sterile agar plates • Inoculation loop sterilised by heating till red hot • Inoculation loop cooled/allowed to cool • Flame used to sterilise top of inoculum flask • (sterile) inoculation loop dipped in inoculum • close flask lid • Inoculum look streaked on a limited portion of the plate • Inoculation loop re-sterilised in flame • Some of the initial streaking is then streaked over to a previously untreated area of the plate. • Previous 2 points repeated. • tape plate lid • Plate incubated at a suitable temperature
	(c)		To clone the bacteria / all bacteria in a single colony will be genetically identical /a single colony comes from a single cell/ for future sub-sampling ✓	1	**OWTTE**
	(d)	**(i)**	Different colony morphologies ✓	1	**OWTTE**

Question			Answer	Marks	Guidance
		(ii)	3 ✓	1	
		(iii)	Reduce the chances of people / cultures being contaminated/unknown microorganism maybe pathogenic ✓	1	**ALLOW** reduce chances of people getting sick (from contamination)
			Total	**15**	

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