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 2022

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

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

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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>Any two from:
Perpendicular viewing/eye level (to reduce parallax error) ✓
Use of a contrast background ✓
Read from bottom of meniscus ✓</td><td>2</td><td>ALLOW correct responses in any order</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>7.2 (cm^3) ✓</td><td>1</td><td>ALLOW 7.1-7.2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>To ensure the accuracy of the equipment / equipment is accurate ✓</td><td>1</td><td>ALLOW prevent (systematic zero) error</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Place a known mass (close to the lower end of the working range) onto the balance and check the reading on the balance matches that of the known mass. ✓

Repeat with another mass towards the upper end of the working range ✓</td><td>2</td><td>ALLOW compare different known masses for 1 mark only
OWTTE</td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table><tr><th>Step</th><th></th></tr><tr><td>Place a weighing boat onto the balance</td><td>2</td></tr><tr><td>Transfer the powder from the weighing boat</td><td>5</td></tr><tr><td>Add powder to the weighing boat using a clean spatula to the correct mass</td><td>4</td></tr><tr><td>Ensure that the balance is clean and that there are no substances on the balance</td><td>1</td></tr><tr><td>Check that no powder is left on the weighing boat by placing it back on the balance</td><td>6</td></tr><tr><td>Press the tare button</td><td>3</td></tr></table>✓✓</td><td>2</td><td>4 or 5 correct = 2 marks
2 or 3 correct = 1 mark
1 correct = 0 marks</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th></th><th>Auto-clave</th><th>Sharps bin</th><th>Recycling</th><th>Rinsed down the sink</th></tr>
<tr><td>Broken glassware</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Low concentration hydrochloric acid</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>Petri dishes with microbes growing on them</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Old batteries</td><td></td><td></td><td>✓</td><td></td></tr>
</table>
✓✓✓✓</td><td>4</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>Any 4 from:
Name of product / formula of product/ product information ✓
Hazardous ingredients ✓
Physical data ✓
Fire or Explosion Hazard Data ✓
Reactivity Data: information on the chemical instability of a product and the substances it may react with ✓
Toxicological Properties: health effects ✓
Preventive Measures ✓
First Aid Measures ✓
Preparation Information: who is responsible for preparation and date of preparation of MSDS ✓
Safe disposal instructions ✓</td><td>4</td><td>ALLOW correct responses in any order
ALLOW Supplier details
DO NOT ALLOW ‘HAZARD’ unqualified
ALLOW control measures/storage</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>16</td><td></td></tr>
</table>

<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>
EITHER
<table>
<tr><th>Method</th><th>Identification and quantification</th></tr>
<tr><td>Paper chromatography</td><td>✓</td></tr>
<tr><td>PCR</td><td></td></tr>
<tr><td>GC</td><td>✓</td></tr>
<tr><td>TLC</td><td></td></tr>
</table>
OR
<table>
<tr><th>Method</th><th>Identification and quantification</th></tr>
<tr><td>Paper chromatography</td><td></td></tr>
<tr><td>PCR</td><td></td></tr>
<tr><td>GC</td><td>✓</td></tr>
<tr><td>TLC</td><td>✓</td></tr>
</table>
✓
</td><td>1</td><td>Both correct methods for 1 mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>7.2 (min) ✓
8.2 (min) ✓</td><td>2</td><td>ALLOW +/- 0.1</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)	(i)	Both axes labelled with units ✓ Concentration on x axis **AND** peak area on y axis ✓ Suitable scales ✓ All plots correct to half a square ✓ Suitable straight line of best fit ✓	5	**DO NOT ALLOW** • markers that are more than ½ a square from where they should be plotted • markers that have intersections thicker than half a square • lines of best fit thicker than half a square or that are hairy
		(ii)	It should be diluted (by a factor of 20) ✓	1	**IGNORE** other numbers
		(iii)	6.6 (mmol dm^{-3}) ✓	1	**ALLOW** +/- 0.1 to be checked at standardisation ECF from ci
		(iv)	6.6 × (10.4/0.52) = 132 (mmol dm^{-3}) ✓	1	**ECF** from calibration line in (c)(i) **ECF** from an incorrect dilution factor in 2cii
	(d)	(i)	• Ionisation ✓ • Acceleration by electric field ✓ • Separation by a magnetic field ✓ • Detection ✓	4	**IGNORE** vaporisation
		(ii)	molar mass ✓	1	
			Total	**16**	

Question			Answer	Marks	Guidance
3	(a)	(i)	40 (g mol^{-1}) ✓	1	
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 5 (g) award 2 marks** n NaOH = 0.25 x 0.5 = 0.125 ✓ mass = 0.125 x 40 = 5 (g) ✓	2	ECF from 3ai
	(b)	(i)	Phenolphthalein ✓	1	
		(ii)	Colourless to pink / magenta ✓	1	**DO NOT** apply **ECF**.**IGNORE** clear
	(c)	(i)	Burette ✓	1	
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 31.08 award 2 marks** Using titrations 2 and 3 ✓ (31.05 + 31.10 / 2 =) 31.08 (Answer to 2 decimal places) ✓	2	**ALLOW MAX** 1 mark for a correct average based on all three titres 31.15
		(iii)	(31.08 x 0.5) / 1000 = 1.554 x 10^{-2} ✓	1	**ECF** from (c)(ii) **ALLOW** 0.0155375 / 0.01554 / 0.0155 / 0.016
		(iv)	1.554 x 10^{-2} ✓ (same value as (iii))	1	
		(v)	1.554 x 10^{-2} x 60 = 0.9324 (g) ✓	1	**ECF** from (c)(iii)
		(vi)	0.9324 x 4 = 3.7 (%) ✓	1	Must be **2sf** for 1 mark **ECF** from (c)(v)
	(d)	(i)	He will not be able to see the colour change (at the end point because the vinegar is coloured). ✓	1	**ALLOW** the colour change will be red to pink, which will be difficult to see.
		(ii)	pH meter/probe ✓	1	**ALLOW** autotitrator
			Total	**14**	

<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>(i)</td><td>X-ray ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Broken bone/fibula/leg ✓</td><td>1</td><td>ALLOW fractured bone/fibula/leg
ALLOW fracture
IGNORE incorrect bone name</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Exposure to (ionising) radiation ✓</td><td>1</td><td>ALLOW onset of cancer following excessive use/ x rays can damage cells
ALLOW can only see hard structures</td></tr>
<tr><td></td><td></td><td>(iv)</td><td>White areas caused by shadow of bone / bone absorbing (incident) X rays ✓
Black areas caused by exposure to X rays ✓</td><td>2</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Ultrasound ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Foetus / (unborn) baby ✓</td><td>1</td><td>ALLOW pregnancy scan</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Technique used in Fig. 4.1</th><th>Technique used in Fig. 4.2</th></tr>
<tr><td>Uses reflected waves</td><td></td><td>✓</td></tr>
<tr><td>Requires protection for the radiographer</td><td>✓</td><td></td></tr>
<tr><td>Can show moving structures</td><td></td><td>✓</td></tr>
<tr><td>Can show soft tissues with a higher resolution</td><td></td><td>✓</td></tr>
<tr><td>No limit to the number of images a patient can have taken</td><td></td><td>✓</td></tr>
</table>
✓✓✓✓✓</td><td>5</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>12</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
5	(a)	(i)	Flame test ✓	1	
		(ii)	Dip a clean (flame test) loop into the powder ✓ Hold the (flame test) loop in the (edge of a blue Bunsen) flame ✓	2	**ALLOW** alternate methods e.g. spray bottle or using a splint **DO NOT ECF** from aii
		(iii)	Lilac (flame) ✓ Orange/ Yellow (flame) ✓	2	
	(b)	(i)	Dissolve (the unknown powder) in water/nitric acid ✓ Add silver nitrate solution **AND** observe the colour of the precipitate ✓	2	
		(ii)	Cream precipitate ✓ Yellow precipitate ✓	2	**Allow** 1 mark for cream and yellow in correct order
	(c)	(i)	Adding hydrochloric acid ✓	1	
		(ii)	Effervescence / bubbles (of carbon dioxide) ✓	1	**ALLOW** fizzes/gives off gas
		(iii)	(Bubble the gas through) limewater ✓ Turns milky ✓	2	**ALLOW** cloudy
	(d)	(i)	White precipitate (forms) ✓ Which dissolves in excess NaOH ✓ To give a colourless solution ✓	3	**ALLOW** excess hydroxide

Question			Answer	Marks	Guidance
		(ii)	**Colour of precipitate** / **Chemical name of compound** white – iron (II) hydroxide blue – iron (II) chloride green – barium sulphate ✓	1	
			Total	**17**	

Question			Answer	Marks	Guidance
6	(a)		**[Level 3]** Candidate shows a high level of understanding and gives a detailed explanation for the importance of aseptic technique **AND** range of sterilisation methods available. ***(5 - 6 marks)*** **[Level 2]** Candidate shows an understanding and gives an explanation for the importance of aseptic technique **AND** range of sterilisation methods available. The overall response is incomplete but generally correct. ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding and gives an explanation for the importance of aseptic technique **AND/OR** a range of sterilisation methods available. Salient points are missing. ***(1 – 2 marks)*** **[Level 0]** Candidate response includes **fewer than two** valid points. ***(0 marks)***	6	Indicative points include: **Importance of aseptic technique** • Avoiding contamination of tissue culture by the environment and by people • Preventing people coming into direct contact with pathogens • To retain the characteristics/genome of the original source of cells/tissue. **Range of sterilisation methods** • Autoclaving eg liquids and growth media • Use of sterilised equipment/culture dishes/tubes • Dry heat eg empty glassware • Spraying surfaces eg with 95% ethanol • Controlled airflow cabinets • Filtration eg heat labile solutions such as antibiotics • Gamma irradiation of heat sensitive materials such as plastic • Disinfect explants • Use UV to sterilise equipment

<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>Definition</th><th></th></tr><tr><td>All the same size</td><td></td></tr><tr><td>All the same species</td><td></td></tr><tr><td>All genetically engineered</td><td></td></tr><tr><td>All genetically identical</td><td>✓</td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>contaminated ✓
autoclaved ✓
pathogens ✓
cabinet ✓
environment/pathogens ✓</td><td>5</td><td>ALLOW only responses in the correct order.</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Heat the inoculating loop in a flame ✓
Until it glows read hot ✓
Cool it (in sterile water / agar) / allow it to cool. ✓</td><td>3</td><td>ALLOW dip loop in alcohol</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

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