



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 June 2019

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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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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.

Question		Answer	Marks	Guidance
1	(a)	<p>Any one from: To keep technicians safe ✓</p> <p>Allow technicians to identify hazards ✓</p> <p>Enable technicians to follow company safety procedures ✓</p>	1	<p>ALLOW It is a legal requirement</p> <p>IGNORE work safely</p> <p>IGNORE handle equipment/blood properly</p>
	(b)	<p>Health hazard ✓</p> <p>Toxic ✓</p>	2	<p>ALLOW Irritant/hazard to ozone layer/caution</p> <p>must be in correct order</p>
	(c)	<p>Hazard: (Stick injuries from contaminated) sharps ✓</p> <p>Precaution: Dispose of contaminated sharps in an appropriate container/immediately after use ✓</p> <p>Hazard: (biological) contamination/ infection / named disease / named pathogen ✓</p> <p>Precaution: wear appropriate PPE / wear named items of suitable PPE / wear gloves/ vaccination ✓</p>	4	<p>Precaution must match hazard</p> <p>IGNORE appropriate clothing unqualified</p>
	(d) (i)	To preserve the anonymity of the donor / confidentiality ✓	1	<p>AW</p> <p>ALLOW to prevent bias/prejudice</p>
	(ii)	<p>Any three from: Dates when fluids were taken ✓</p> <p>Name of person taking fluids ✓</p> <p>Location where sample was taken ✓</p> <p>Date of birth of person ✓</p>	3	<p>ALLOW any order</p> <p>ALLOW gender</p> <p>ALLOW any valid alternatives</p>

Question		Answer	Marks	Guidance
(e)	(i)	Measure / record temperature of melting ice/freezing water ✓ Temperature should be 0°C ✓ Measure temperature of boiling water ✓ Temperature should be 100°C ✓	4	ALLOW other substance of known and fixed melting and boiling points Temperatures must match material being measured IGNORE descriptions of marking scale on thermometer
	(ii)	(Digital stopwatch) Any three from: Both stopwatches have similar results/variability for 180s timings ✓ Digital stopwatch has much less variability than analogue stopwatch at 600 seconds ✓ Variability of digital stopwatch is similar at 180s and 600s ✓ Digital gives more precise readings ✓	3	No mark for choosing digital If analogue chosen, 1 mark max for Both stopwatches have similar results/variability for 180s timings ALLOW description of precise readings e.g. use of milliseconds

Question		Answer	Marks	Guidance
2	(a)	Lines drawn in ink will run with the solvent OR contaminate the chemicals separated in the solvent ✓ ORA	1	ALLOW pencil will not dissolve in the solvent ALLOW ink will separate
	(b)	To prevent contamination of the TLC ✓ To protect the employee/technician (from ninhydrin/solvents) ✓	2	ALLOW in correct responses in any order. AW
	(c)	X identifying the bottom spot ✓	1	
	(d)	71 (±2) (mm) ✓	1	
	(e)	Measures distance moved by spot Y as 41mm ±2mm ✓ Measures distance moved by solvent front as 77mm ±2mm ✓ Uses $R_f = \text{distance moved by spot} / \text{distance moved by sol}$ OR $R_f = 41 \div 77 (=0.53)$ ✓	3	
	(f)	The two amino acids share the same R_f values / 0.53 values / same solubility (and appear as one spot when separated from other amino acids with solvent A) (at Y) ✓	1	AW
	(g)	HPLC ✓ GC(MS) ✓	2	Answers in either order
	(h) (i)	<u>Positive</u> identification of components in a mixture ✓	1	
	(ii)	(Gas phase) molecules are ionised ✓ Ions are accelerated (by an electrical field) ✓ And deflected by a magnetic field ✓ Which sorts the ions according to their mass (or mass: charge ratio) ✓	4	

Question		Answer	Marks	Guidance
3	(a)	Alkali AND Base ✓	1	Both required for one mark
	(b) (i)	40 (g mol ⁻¹) ✓	1	
	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 20(g) award 2 marks 1 x 0.5 = 0.5 ✓ 0.5 x 40 = 20 (g in 1dm ³) ✓	2	ECF from 3bi
	(c) (i)	30.9, 30.45, 30.55 ✓	1	DO NOT ALLOW 31 for titration 1
	(ii)	Any one from: Perpendicular viewing (to avoid parallax error) ✓ Use of a contrast background (to improve viewing of graduations) ✓	1	ALLOW always read from the bottom of the meniscus/at eye level
	(d)	(Measuring cylinder) would not give high enough degree of accuracy ✓	1	AW
	(e)	Indicator = Bromothymol blue ✓ Colour change = yellow (in acid) to blue (in alkali) OR yellow to green (neutral) ✓	2	ALLOW Methyl orange: red to yellow OR Phenolphthalein: colourless to pink Both colours required for the mark Colour change mark is dependent on indicator used
	(f) (i)	30.5 (cm ³) ✓	1	ECF from table
	(ii)	n NaOH titrated = = 0.01525 (mol) ✓	1	ALLOW correct rounding to at least 2 sig figs ALLOW ECF from 3(f)(i)
	(iii)	n phosphoric acid in 10 cm ³ = $\frac{0.01525}{3}$ = 0.005083 (mol) ✓	1	ALLOW ECF from (f)(ii): n NaOH ÷ 3

Question		Answer	Marks	Guidance
	(iv)	Conc. of phosphoric acid = $100 \times 0.005083 (=0.5083)$ ✓ = 0.508 (3 sf) (mol dm ⁻³) ✓	2	ALLOW ECF conc = n(phosphoric acid) in 10 cm ³ x 100 (must be 3 sf) if answer to fi was given as 0.015 then full marks can only be awarded for 0.500 ALLOW a correctly calculated answer using 100 and answer from fiii given to 3 significant figures for 1 mark

Question			Answer	Marks	Guidance
4	(a)	(i)	Copper(II) bromide ✓	1	ALLOW Copper bromide
	(a)	(ii)	Cu ²⁺ ✓ Br ⁻ ✓	2	Case and superscription must be correct for each ALLOW ECF from (a)(i) ALLOW 2Br ⁻
	(b)		Any three from: Short analysis times ✓ Small sample sizes ✓ Can analyse multiple ions in same sample ✓ Very sensitive / can detect very small concentrations ✓ Quantitative analysis ✓ Sample is not degraded ✓	3	ALLOW concentration can be measured (of ions) AW
	(c)		Inductively coupled plasma ✓	1	
	(d)	(i)	Correct orientation of axes (ie conc lead on x axis, intensity on y axis) ✓ Correct labelling of both axes including units ✓ Appropriate scales on both axes ✓ Co-ordinates correctly plotted ✓ Appropriate line of best fit ✓	5	All plots correct to ½ square DO NOT ALLOW co-ordinate markers that are thicker than ½ square DO NOT ALLOW LOBF thicker than ½ square or hairy LOBF IGNORE line drawn after last plot

Question		Answer	Marks	Guidance
(d)	(ii)	7.5 ($\mu\text{g dm}^{-3}$) ✓ Evidence drawn on graph showing how above value was derived ✓	2	ALLOW answers in range 6.5 to 8.5 / answers read correctly off their graph

Question		Answer	Marks	Guidance
5	(a)	To allow the cells to be seen more clearly / to see the organelles/nuclei inside the cells ✓	1	AW
	(b) (i)	(x) 600 ✓	1	
	(b) (ii)	36(mm) ✓	1	ALLOW +/- 2mm
	(b) (iii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.06 (mm) award 2 marks 36 / 600 ✓ = 0.06(mm) ✓	2	ECF for (b)(i) and (b)(ii)
	(b) (iv)	Cell wall ✓ Cytoplasm ✓ Nucleus ✓	3	

Question	Answer	Marks	Guidance
(c)	<p>Level 3 Candidate shows a high level of understanding and gives a good description, by giving at least two advantages AND two disadvantages of both ultrasound AND X rays AND making a suggestion of suitability for BOTH (5–6 marks)</p> <p>Level 2 Candidate shows an understanding, by describing at least two advantages AND two disadvantages of BOTH ultrasound AND X rays OR by fully describing two advantages AND two disadvantages of one technique AND the suitability of this technique (3–4 marks)</p> <p>Level 1 Candidate shows a basic understanding by, describing at least two advantages AND two disadvantages of EITHER ultrasound or X rays OR by describing at least one advantage AND one disadvantage of BOTH ultrasound AND X rays (1–2 marks)</p> <p>Level 0 <i>No response or no response worthy of credit.</i> 0 marks</p>	6	<p>Valid points:</p> <p>Ultrasound</p> <p>Advantages No (ionising) radiation Can be used on moving structures Can be used more frequently Can be 3 D image</p> <p>Disadvantages Difficult to detect cracks in bones Cannot be used for diagnosing problems in the lungs or digestive tract Has limited use in detection of breast cancer Images have limited detail</p> <p>Suitability Monitoring gestation Doppler ultrasound of blood flow/monitoring blood flow in the heart</p> <p>X rays</p> <p>Advantages Can see structures of different densities clearly – eg bones and teeth Produce high quality images</p> <p>Disadvantages Exposure to (ionising) radiation which causes tissue damage Limit to the number of medical X rays that can be taken per year Screening required/more dangerous to radiographer Not suitable for imaging during pregnancy</p> <p>Suitability Can see broken bones Can view inside of teeth / fillings Can see cracks in bones</p>

Question			Answer	Marks	Guidance
6	(a)	(i)	To enable bacteria/colonies to be easily seen / to be spread (more evenly) across the plate ✓ To estimate the purity of a culture / to check for contamination ✓	2	ALLOW responses in any order. ALLOW ensure all bacteria have transgene
		(ii)	To sterilise the loop / to avoid contamination ✓	1	ALLOW kill bacteria on loop
		(iii)	To prevent killing the bacteria ✓ To avoid damaging / liquefying the agar ✓	2	ALLOW responses in any order
		(iv)	Any one from: To avoid contamination (from air borne contaminants) ✓ To kill the bacteria so the bacteria are diluted on each successive streak ✓	1	
		(v)	Any one from: Colonies of different morphology/ colour/ size ✓ Fungal/yeast/ mould growth ✓	1	
	(b)		D, C, A, B, E ✓✓✓✓	4	4 or 5 correct responses = 4 marks 3 correct responses = 3 marks 2 correct responses = 2 marks 1 correct response = 1 mark NOTE marking points include: D before C C before A A before B

Question	Answer	Marks	Guidance
(c)	<p>Any three from:</p> <p>Laminar flow hood turned on ~10 mins before use ✓</p> <p>Inside surfaces sprayed with disinfectant / ethanol before use ✓</p> <p>All equipment autoclaved/sterilised before use ✓</p> <p>Spraying bottles / vessels with ethanol and allow to evaporate prior to opening ✓</p> <p>Inside surfaces sprayed with disinfectant/ surfaces wiped with ethanol after use ✓</p> <p>Apply UV light during periods of non-use (during evenings) ✓</p>	3	<p>AW</p> <p>ALLOW air flow cabinet is turned on</p> <p>IGNORE PPE</p> <p>ALLOW one mark for disinfect/ethanol without stating when</p>

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