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 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.

Annotations available in RM Assessor

Annotation	**Meaning**
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

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
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)		**Any three from:** Cells of multicellular organism / originally collected from one source ✓ Cells have the same genome/genes ✓ Removed and grown outside the body ✓ In specially-designed containers/suitable surface/agar ✓ Under precise conditions ✓	3	ALLOW from a single named source **ALLOW** any correctly named condition
	(b)	(i)	**Any two from:** Prepare growth medium (in unsterile conditions) ✓ Transfer to (screw-capped) bottle/named type of bottle ✓ (Sterilise in)autoclave ✓	2	Answers must be in this order
		(ii)	**Any three from:** Insert cotton wool into end (of Pasteur pipette) ✓ Wrap pipettes in (aluminium) foil ✓ (Sterilise in) autoclave ✓ Retain in (aluminium) foil prior to use ✓	3	Answers must be in this order
		(iii)	Heat(-sterilise) / (Sterilise in)autoclave	1	
	(c)		**Any three from:** Work in sterile/culture hood / leave hood running ✓ Position of hood/free from draughts/no through-traffic ✓ Avoid cluttered work area ✓ Spray/wipe surfaces with (70%) ethanol / wipe hands with ethanol ✓ Maintain good hygiene/wash hands regularly ✓	3	**ALLOW** controlled airflow/Lit Bunsen burner for updraft of air

Question			Answer	Marks	Guidance
	(d)		**Any four from:** Dip an inoculum loop (in alcohol and) flame ✓ Remove (bacteria) culture bottle lid and pass the neck of the bottle through a flame ✓ Collect a sample of bacteria on the inoculum loop ✓ Re-flame the neck of the culture bottle ✓ Replace the bottle lid ✓ Lift lid of the agar dish ✓ Streak the inoculum loop across surface of agar ✓ Avoid damaging the surface of the agar ✓ Turn agar plate to repeat streaking at a different angle ✓ Replace agar dish lid ✓ Re-flame the inoculum loop ✓ Seal edge of agar dish lid to base ✓ Store the inoculated agar dish upside down ✓ Label the base of the agar dish ✓	4	**The steps should be in a logical order.** Streak bacteria across surface of agar is insufficient for mark **ALLOW** close lid for 1 mark if neither bottle or dish lid mentioned
			Total	**16**	

Question			Answer	Marks	Guidance
2	(a)	(i)	Hand lens/magnifying glass ✓	1	**DO NOT ALLOW** reference to any type of microscope
		(ii)	Light/optical (microscope) ✓	1	
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 421 (µm) award 3 marks** Scale bar representing 100 µm measures 28 mm and Length X = 118 mm on micrograph ✓ ∴ Length X = $(\frac{118}{28} \times 100)$ (µm) ✓ = 421 (µm) ✓	3	**ECF** from incorrect measurements **ALLOW** measurements = 28 ± 1 mm = 118 ± 1 mm
		(iv)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = (×) 280 award 3 marks** Measurement Length of scale bar X = 28 (mm on page) Actual length of scale bar = 100 (µm) Conversion 28 (mm) = 28 000 (µm) ✓ **OR** 100 (µm) = 0.1 (mm) ✓ ∴ magnification = 28000 ÷ 100 ✓ = (×) 280 ✓ **OR** 28 ÷ 0.1 ✓ = (×) 280 ✓	3	**ALLOW** measurement of scale bar = 28 ± 1 mm **ECF** from incorrect measurements in Q2aiii ALLOW calculation form tardigrade length 118 x 1000 $\frac{118000}{421}$ = (x) 280

Question			Answer	Marks	Guidance
	(b)	**(i)**	Scanning electron microscope/SEM ✓	1	**DO NOT ALLOW** electron microscope (unqualified)
		(ii)	**Advantage:** Shows effect of dehydration on surface structure of tardigrade in detail, OWTTE ✓ **Disadvantage:** Gives no information on how dehydration affects internal structure OWTTE(of the tardigrade) ✓	2	
		(iii)	**Any four from:** Normal tardigrade elongated / dehydrated tardigrade globular/rounded in shape ✓ Sizes of normal (≈ 310 μm) and dehydrated (≈ 100 μm) tardigrades ✓ Relative sizes / normal approx. three times the length of dehydrated tardigrade ✓ Contracted segments in dehydrated tardigrade ✓ Retracted legs/claws in dehydrated tardigrade ✓ Retracted mouthparts in dehydrated tardigrade ✓	4	**ALLOW** approximations of size and relative size. **DO NOT ALLOW** loses its legs/claws/head **ALLOW** retracted head
			Total	**15**	

Question			Answer	Marks	Guidance
3	(a)	(i)	**[Level 3]** Candidate gives a detailed description of procedures at employee level **AND** can explain clearly why these measures are in place. ***(5 – 6 marks)*** **[Level 2]** Candidate gives a good description of procedures at employee level **AND** can explain why these measures are in place. ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding of health and safety procedures **AND** is able to explain why some of the health and safety procedures are carried out. ***(1 – 2 marks)*** **[Level 0]** Candidate includes **fewer than two** valid points. ***(0 marks)***	6	**Valid points:** **Employees' health and safety procedures** • Assess biosafety levels • Work within safety cabinet or other designated area • Keep work area uncluttered/clear of unnecessary equipment • Wear gloves and other PPE, e.g. eye protection and labcoat/apron • Perform operations in such a manner as to minimise splashing, spraying, spattering, and generation of droplets • Prohibit mouth pipetting of blood • Prohibit eating, smoking, drinking, applying cosmetics or lip balm • Cover cuts, grazes and broken skin on exposed skin with waterproof dressings • Avoid using sharps and glassware • In the event of accident/punctured skin, the wound should be gently encouraged to bleed while washing with running water/do not scrub a wound, and dress wound. • Follow designated standard procedures • Clean and disinfect bench surfaces and any equipment immediately on completing a work session • Put into action a satisfactory disinfection policy, e.g. hypochlorite, phenolic disinfectant, for dealing with spillages • Reference to storage/disposal procedures • Reference to decontamination procedures • Spillage and disinfectants should be mopped up with disposable paper towels, discarded into a clinical waste bag and the area disinfected again. **Explanations** • Avoid entry of pathogen into body through mouth • Avoid entry of pathogen into body through eyes or respiratory system • Avoid entry of pathogen into body through damaged skin

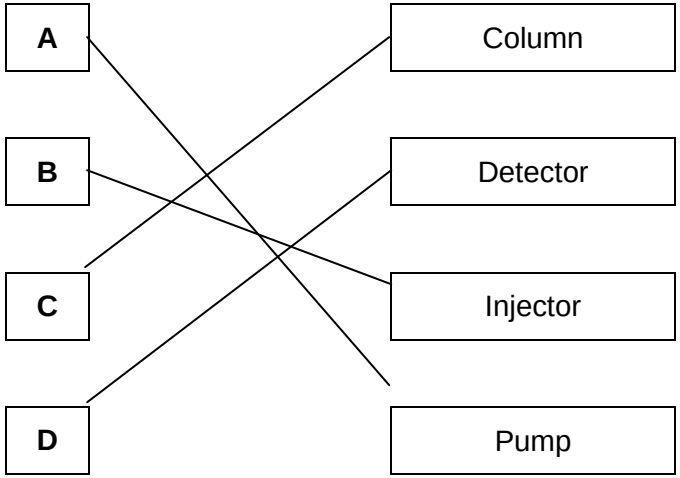
Question			Answer	Marks	Guidance
					• Avoid transfer of pathogen to work surfaces/other surfaces/retention of pathogen on work surfaces, where they may be transferred to others • Avoid transfer of pathogen to others
		(ii)	Answer relating to any chemical agent ✓	1	

Question			Answer	Marks	Guidance
	(b)	(i)		4	

Pictogram	Hazard
	Oxidising
	Toxic to the **aquatic** environment
	Health hazard
	Gas under pressure

✓✓✓✓

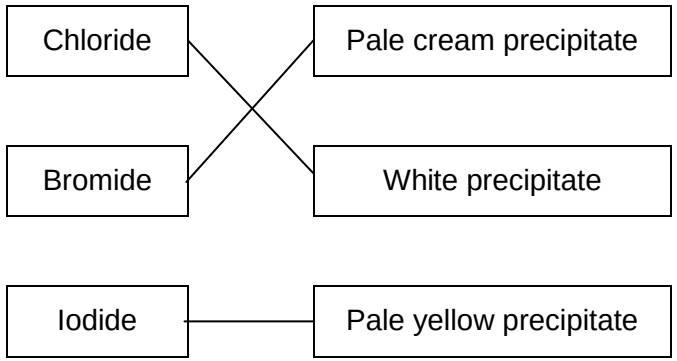
Question			Answer	Marks	Guidance
		(ii)	**Any four from:** Chemical / agent / activity / physical object that may be / likely to be hazardous ✓ (Definition of the) hazard ✓ (Associated) risk ✓ Measures to minimise risk ✓ Emergency procedures ✓ Review of risk assessment ✓ Date of risk assessment ✓ Name of person undertaking risk assessment ✓	4	**ALLOW** safety procedures for one mark if minimise risk and emergency procedures are not mentioned.
			Total	**15**	

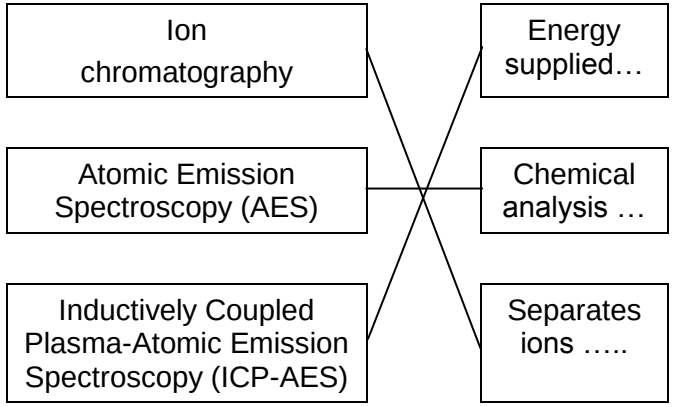
Question			Answer	Marks	Guidance
4	(a)	(i)	 ✓✓✓✓	4	One mark for each correctly linked box
		(ii)	X – (HPLC) solvents ✓ Y – sample ✓	2	ALLOW mobile phase
	(b)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 6.65/6.7 award 4 marks** Retention time of drug W – 15.3 (min) ✓ t_o = 2 ✓ Substitution into formula: $k = \frac{(15.3 - 2.0)}{2.0} = \frac{13.3}{2}$ ✓ = 6.65/6.7 ✓	4	**ECF** from incorrect t_R or t_o **Maximum 3 marks for** incorrect units

Question			Answer	Marks	Guidance
	(c)	**(i)**	Discovery RP-Amide 16 ✓	1	
		(ii)	Has largest selectivity factor / α ✓	1	
	(d)		Drugs and contaminants are / must be heat-labile / OWTTE ✓	1	
	(e)	**(i)**	HPLC-mass spectrometry ✓	1	
		(ii)	Thin-layer chromatography (TLC) ✓	1	
			Total	**15**	

Question			Answer	Marks	Guidance
5	(a)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 10.21(g) award 4 marks** 0.1 x 204.22 ✓ = 20.42 (g) ✓ ∴ 500 cm^3 of solution contains 20.42 ÷ 2 ✓ = 10.21 (g) ✓	4	**ECF** for the second and/or third marking point.
	(b)		**[Level 3]** Candidate shows a high level of understanding and gives a good description of how to standardise sodium hydroxide solution using potassium hydrogen phthalate. ***(5 – 6 marks)*** **[Level 2]** Candidate shows an understanding of how to standardise sodium hydroxide solution using potassium hydrogen phthalate. ***(3 – 4 marks)*** **[Level 1]** Candidate shows a basic understanding of how to standardise sodium hydroxide solution using potassium hydrogen phthalate, with little or no explanation. ***(1 – 2 marks)*** **[Level 0]** Candidate includes **fewer than two** valid points. ***(0 marks)***	6	**Valid points:** **preparation** • Rinse burette with deionised/distilled water • Rinse burette with standardised sodium hydroxide solution **technique** • Fill burette with standardised sodium hydroxide solution • Allow to drain so that reading is 0.00 cm^3/record volume reading • Rinse (250 cm^3) conical flask with deionised/distilled water • Pipette 25 cm^3/known volume of potassium hydrogen phthalate into the conical flask • Using one-mark pipette • Add two drops of phenolphthalein (indicator) • Titrate against sodium hydroxide/release sodium hydroxide from burette • Run in until swirls of pink appear • Titrate slowly/drop by drop • Until very pale pink colour appears • Take accurate reading • Repeat until concordant (owtte) results obtained

Question			Answer	Marks	Guidance
	(c)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 1.51 (g dm^{-3}) award 5 marks** $c = \frac{4.2 \times 10^{-4}}{0.025}$ ✓ = 0.0168 (mol dm^{-3}) ✓ = 0.0168 x 90.1 (g dm^{-3}) ✓ = 1.51 (g dm^{-3}) ✓ 2 decimal places ✓	5	**ECF** at any one stage. **ALLOW** 90.1 x 4.2 x 10^{-4} for 1 mark
			Total	**15**	

Question			Answer	Marks	Guidance
6	(a)	(i)	Test: Flame test ✓ Result: Brick-red (colour) ✓	2	
		(ii)	Test: Add nitric acid or hydrochloric acid **AND** then add limewater ✓ Result: (Carbon dioxide/gas produced) turns (limewater) milky ✓	2	**ALLOW** Add strong acid
		(iii)	Test: Flame test ✓ Result: Yellow/orange/yellow-orange (colour) ✓	2	
		(iv)	Test: Add silver nitrate solution ✓ Result: White precipitate is produced / precipitate darkens on exposure to light ✓	2	
	(b)			3	One mark for each correct line

Question			Answer	Marks	Guidance
	(c)			3	One mark for each correct line
			Total	**14**	

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