OCR
Oxford Cambridge and RSA

GCE

Biology B (Advancing Biology)

Unit **H422A/03:** Practical skills in biology

Advanced GCE

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.

Annotations

Annotation	Meaning
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)		legume / leguminous ✓	1	**DO NOT ALLOW** dicots or dicotyledons **IGNORE** named examples of crops (as this is not relevant to the question)
	(b)	(i)	respiratory substrate ✓	1	**ALLOW** <u>respiratory</u> carbohydrate/sugar **ALLOW** energy source **DO NOT ALLOW** source of energy FOR respiration **DO NOT ALLOW** source of, carbohydrates /sugars

Question			Answer	Marks	Guidance
		(ii)*	*Summary of instructions to markers:* *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, **Level 1**, **Level 2** or **Level 3**, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the **Communication Statement** (shown in italics):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		
			Level 3 (5-6 marks) Details of method and hazard control with all important steps included. *There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.* **Level 2 (3-4 marks)** Outline of method and hazard control with some details missing. *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.* **Level 1 (1–2 marks)** Correct steps in method or hazard control are described but lack detail. *There is an attempt at a logical structure with a line of reasoning The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.	6	**Indicative scientific points could include:** **AO1.2: examples of knowledge of method** • locate a root nodule • use forceps to remove nodule • cut root nodule from plant using a scalpel / razor blade on a tile • wash and sterilise nodule • crush nodule and dilute with distilled water • incubate culture (for 3 days; temperature is given in 1biii and can be ignored). **AO2.7 examples of the application of risk assessment/hazard identification:** • potential hazards associated with forceps and scalpel & control (e.g. use of tile; blunt forceps) • sterilising the nodule using alcohol/distilled water • use of sterile petri dishes and other equipment (e.g. boiling; use of sodium hypochlorite / hydrogen peroxide solution) • potential microbial hazards (soil-borne microbes) & control (inoculating loop) • safe disposal of equipment

Question			Answer	Marks	Guidance
		(iii)	optimal temperature for (bacterial) enzymes ✓ allows rapid reproduction rates / **AW** ✓ prevent growth of <u>pathogenic</u> bacteria / **ORA** ✓	2 max	**ALLOW** 'doesn't denature bacteria enzymes' **ALLOW** faster (rate of) mitosis / quicker reproduction

(c)		(i)	0.104 ✓✓✓	3	If answer is incorrect or missing, a **maximum of 2 marks** can be given for intermediate stages as follows:
					    one mark for working such as
					• 4.0 – ((97.4 / 100) x 4.0)
					• 4 x 0.026
					• 100 – 97.4 = 2.6% with 2.6% of 4.0 = 0.104
					
					    one mark for incomplete calculation
					• 3.896
					
					    one mark for correct answer but not quoted to 3dp
					    e.g. 0.10

		(ii)	inhibits <u>translation</u> of mRNA ✓ (miRNA) binds at a <u>complementary</u> site (on mRNA) ✓ argonaute protein, breaks/cleaves, the mRNA strand ✓ AVP ✓	3 max	**IGNORE** references to 'miRNA inhibits mRNA' as this is given in the stem of the question **DO NOT ALLOW** references to inhibiting transcription Further detail e.g. • double stranded precursor binds to, dicer / endonuclease protein • dicer cuts precursor (into short segments) • dicer cuts precursor • (short double stranded) miRNA binds to argonaute protein • RNA induced silencing complex (RISC) formed • small sections of mRNA can be translated but will not result in formation of a, functional / complete, protein

Question			Answer	Marks	Guidance
		(iii)	miRNA less, precise / specific (than siRNA) ✓	1	**DO NOT ALLOW** 'miRNA is more accurate' **ALLOW** miRNA will bind to more than one mRNA **ALLOW** miRNA will inhibit, all / more, of the leghaemoglobin genes
			Total	17	

	Question		Answer	Marks	Guidance
2	**(a)**	**(i)**	to remove <u>chloride</u> ions **OR** to remove other chemicals, that could react with silver nitrate ✓ contamination would reduce, <u>validity</u> of results **OR** removes contamination to, increase, validity of the results ✓	**1 max**	**IGNORE** generic comments about contamination
		(ii)	(at 100°C) all (carrot) cell membranes will have broken down ✓ all chloride ions (from vacuole/cell) will have, been released/ diffused out ✓	**1 max**	**ALLOW** maximum precipitate formed
	(b)		(anomaly identified as) <u>0.018</u> **AND** (expected correct value as) <u>0.010</u> ✓	**1**	

Question			Answer	Marks	Guidance

	(c)		***Mark first 3 variables only***
			
			Variable
			    <u>volume</u> of distilled water in the boiling tube ✓
			Explanation
			    <u>larger</u> volume <u>reduce,</u> the concentration of chloride ions / precipitate formed / absorbance **ORA** ✓
			
			Variable
			    <u>volume</u> of distilled water removed in the sample ✓
			Explanation
			    <u>larger</u> volume will <u>increase,</u> number of chloride ions / precipitate formed / absorbance **ORA** ✓
			
			Variable
			    time boiling tube remains in water bath ✓
			Explanation
			    time in water bath should allow for desired temperature to be reached
			    OR
			    if time is too short, fewer chloride ions will have diffused across the membrane(s) / **ORA** ✓
			
			Variable
			    size / volume / number / surface area, of carrot sections ✓
			Explanation
			    larger <u>surface area</u> (to volume ratio) will <u>increase</u> diffusion (rate) / **ORA** ✓
			
			Variable
			    concentration/ volume/ number of drops, of silver nitrate ✓
			Explanation
			    larger concentration/ volume/ number will increase, the absorbance / precipitate formed **ORA** ✓
				6 max	**IGNORE** references to temperature as this is the independent variable in the investigation
					
					DO NOT ALLOW amount
					
					DO NOT ALLOW amount
					
					DO NOT ALLOW amount
					
					DO NOT ALLOW amount

Question			Answer	Marks	Guidance

			Variable
			     same filter used in colorimeter ✓
			 Explanation
			     the filter affects the wavelengths that reach, the sample / the detector ✓
			
			 Variable
			     same reference solution used in colorimeter ✓
			 Explanation
			     prevents zeroing errors ✓
			
			 Variable
			     sections of carrot / tissue, taken from same carrot ✓
			 Explanation
			     different carrots will, have/store, different chloride ion concentrations ✓		

	(d)	**(i)**	0.013 ✓	**1**	at 10°C, absorbance is 0.014 at 40°C absorbance is 0.027
		(ii)	 higher temperature(s) results in, more disruption to the membrane ✓ (rate of) diffusion increases with, an increase in temperature / increased <u>kinetic</u> energy (of chloride ions) ✓ hence more chloride ions diffuse out, so more precipitate is formed, so absorbance increases ✓	**2 max**	**DO NOT ALLOW** any ref to active transport as chloride ion movement at low temperatures is simple diffusion **ALLOW** higher temperature, increases permeability of the plasma membrane

Question			Answer	Marks	Guidance
		(iii)	200 ✓ AU ✓	2	*As the question asks for an estimate of the chloride ion concentration the value of 0.05 absorbance is used from Fig. 2.1*
			Total	14	

Question			Answer	Marks	Guidance
3	(a)	(i)	<u>smooth</u> muscle / elastic fibres / tunica media ✓	1	
		(ii)	*Explanation should link to correct tissue if named in provided for 3a(i)* (elastic fibres enable) recoil **OR** (muscle) <u>contracts</u> to, <u>reduce</u> the size of the lumen ✓	1	**DO NOT ALLOW** reference to elastic fibres 'relaxing/contracting' **ALLOW** regulates blood pressure by altering (width of lumen) **IGNORE** references to maintain blood pressure

	(b)	(i)	<u>x</u> 80 ✓✓	2	If incorrect answer then award **one mark maximum** for either
					   correct working i.e. 32/0.4
					     OR
					     '80'
					
					ALLOW one mark maximum for correct formula and correctly formatted answer if the candidate has measured incorrectly e.g. 32.5/0.4 = x 81.125 (accept a tolerance of +/-0.5 mm)

		(ii)	0.46 ✓✓	2	If answer is incorrect or missing: **ALLOW** one mark for correct working e.g. 1.143 x 0.4 or (14.3 / 100 x 0.4) + 0.4 **ALLOW** one mark for correct answer to incorrect number of d.p. e.g. 0.4572 mm

Question			Answer	Marks	Guidance
	(c)		hypertrophy/ hyperplasia (of smooth muscle cells) ✓ to withstand a higher blood pressure **OR** to enable greater, contraction (of the artery wall) ✓ more / thicker, elastic fibres ✓ to withstand a higher blood pressure **OR** for greater, recoil ✓ plaque formation/ atheroma / atherosclerosis / increased cholesterol <u>in</u> the artery wall ✓ cancer / uncontrolled cell division results in more cells ✓	2 max	**IGNORE** generic references to high blood pressure (as a sign of disease) **ALLOW** more / bigger, (smooth) muscle cells
	(d)	(i)	allows leakage of liquid through fenestrations ✓ reduces diffusion distance/ increases rate of diffusion, to meet the demand for nutrients / removal of waste products **AW** ✓	1	**ALLOW** 'gaps between cells' as alternative wording for fenestrations
		(ii)	arterial ✓ hydrostatic ✓ solute ✓ osmotic ✓	4	**ACCEPT** arteriole / artery **ACCEPT** protein **ACCEPT** oncotic (if protein is the given as mp3)
			Total	13	

Question			Answer	Marks	Guidance
4	(a)	(i)	could lead to, false positives / false negatives ✓ if false negative (AW) / has immunity, people receive vaccination when it is not required **OR** if false positive (AW) / has no immunity, may lead to people not receiving vaccination when it is required ✓ correct use of data to demonstrate percentage error ✓	2 max	**IGNORE** any reference to vaccination rate or cost of vaccination *e.g. 9mm induration is measured (incorrectly) as 9.9mm → recorded as 10mm → leading to false positive result* *e.g. 10mm induration is measured (incorrectly) as 9.1mm → recorded as 9mm → leading to false negative result*

		(ii)	suitable suggestion for improved measuring method ✓
			
			valid / appropriate reasoned argument ✓
				2	**IGNORE** references to 'reduce percentage error'
					
					e.g.
					• callipers
					   o give greater degree of precision
					• use scaled photograph of induration
					   o give greater degree of precision
					• cut-out stencil/ overlay / AW, used as a standard placed on induration
					   o more objective
					• take multiple readings (minimum of 3)
					   o calculate mean value

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Question			Answer	Marks	Guidance
4	(b)*		**Summary of instructions to markers:** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, **Level 1**, **Level 2** or **Level 3**, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the **Communication Statement** (shown in italics):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		
			Level 3 (5-6 marks) Advantages **and** disadvantages of **both** tests discussed. Use of data from Table 4.1 to support a conclusion. *There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.* **Level 2 (3-4 marks)** Advantages and/or disadvantages of **both** tests mentioned. A relevant reference to Table 4.1 is made. *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.* **Level 1 (1–2 marks)** Advantages and/or disadvantages of at least one test mentioned. No relevant, correct reference to Table 4.1. *There is an attempt at a logical structure with a line of reasoning The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.	6	**Indicative scientific points could include:** **Advantages of Mantoux test:** • results easy to measure • portable **Disadvantages of Mantoux test:** • requires sterile equipment • requires correct storage of tuberculin • subjectivity involved in measuring induration • gives, significant / AW, number of false results • requires longer period before test results are obtained **Advantages of ELISA test:** • enables measurement of antibody concentration (in response to administered antigen) • results are objective / more accurate • quicker test **Disadvantages of ELISA test:** • requires (more) specialist training • more expensive • not portable • more specialist equipment required

Question			Answer	Marks	Guidance
					Use of Table 4.1 to support conclusion • 65/ 89 samples give the same result with both tests • 73% (65/89 x 100) of the results are the same (in agreement) in both tests • 24 results are false results • 27% (24/89 x 100) are false results • ELISA have 45% testing positive (40/89) • ELISA have 55% testing negative (49/89)

Question			Answer	Marks	Guidance

(c)	**(i)**		r_s value
			-0.6394 ✓✓✓
				3	*Candidates should retain all decimal places and only round in the final stage of the calculation (see Mathematical Skills Handbook)*
					
					ALLOW 2 marks maximum for answer given to 3dp (-0.639)
					
					If incorrect r_s value is given, marks can be given for intermediate stages as follows:
					ALLOW one mark *for*
					   $\sum d^2 = 270.5$
					  OR
					  $6 \sum d^2 = 1623$ **AND** *for* $n(n^2 -1) = 990$

Patient	Age at vaccination	Rank	Length of time immune (years)	Rank	d	d^2
A	13	6.5	16	7.5	-1	1
B	12	8	17	5.5	2.5	6.25
C	14	4.5	18	3.5	1	1
D	1	9	22	2	7	49
E	30	2	4	9	-7	49
F	35	1	1	10	-9	81
G	15	3	18	3.5	-0.5	0.25
H	14	4.5	17	5.5	-1	1
I	0	10	23	1	9	81
J	13	6.5	16	7.5	-1	1
					Total	270.5

Question			Answer	Marks	Guidance
	(c)	(ii)	*Null hypothesis is supported because:* **Any three from:** degrees of freedom is 8 ✓ the $r_{calculated}$ value is less than the $r_{critical}$ value at 5% (p = 0.05) / AW ✓ the $r_{calculated}$ value is (also) less than the $r_{critical}$ value at 1% (p = 0.01) / AW ✓ accept the null hypothesis ✓ the difference in length of time immunity was effective is due to (random) chance / there is no significant negative correlation ✓	3 max	**ALLOW** ecf for each statement for miscalculated r_s value in c(i) **ALLOW 2 marks maximum** if the incorrect degrees of freedom have been used **ALLOW** correct reference to using 5% probability level **ALLOW** 0.6394 is less than 0.6429 **ALLOW** 0.6394 is less than 0.8333 **IGNORE** 'null hypothesis is correct'
			Total	16	

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