



GCE

Biology A

H020/02: Depth in biology

Advanced Subsidiary GCE

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

Marking Annotations

Annotation	Use
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
	Benefit of the doubt not given
	Tick
	Omission Mark
	Blank Page
	Level 1 answer in Level of Response question
	Level 2 answer in Level of Response question
	Level 3 answer in Level of Response question

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)	(i)	sieve tube (cell / element / member) ✓	1	Mark the first answer. If an additional answer is given that is incorrect, then = 0 marks IGNORE vessel
		(ii)	Benedict's / Fehling's (solution / reagent) ✓ blue / turquoise ✓ orange / yellow / brown ✓ acid ✓	4	Mark the first answer in each space. If an additional answer is given that is incorrect, then = 0 marks IGNORE dark / light / cloudy / opaque IGNORE dark / light / cloudy / opaque ALLOW named e.g. HCl, H ₂ SO ₄ , HNO ₃ IGNORE spelling error e.g. hydrocholic
	(b)	(i)	<i>starch:</i> is not soluble / does not dissolve (in water) or does not affect osmosis / is osmotically inactive or cannot, enter / leave, cells ✓ makes, it / sap, thick / viscous / sticky / glue-like ✓	max 1	ALLOW could block, tubes / flow / phloem ALLOW H ₂ O would not follow to, increase hydrostatic pressure / set up pressure gradient ALLOW no co-transporter proteins for starch OR starch is too big to, enter cells / cross cell (surface) membranes / pass through cell wall IGNORE big / too big, unqualified
		(ii)	<i>sucrose:</i> entry / exit / loading / unloading, controlled / uses transport proteins or (is) less likely to, leave / exit / diffuse out of (sieve tubes) or (is) less, reactive / likely to be used (in respiration / by mitochondria / for energy) ✓	1	ALLOW ora throughout for glucose ALLOW co-transporters for 'transport protein' DO NOT ALLOW channels / pores IGNORE ref. osmosis / size / solubility / metabolically inactive
Total				7	

Question		Answer	Marks	Guidance
2	(a)	12 ✓ ✓	2	<p>Correct answer = 2 marks even if no working shown. ALLOW 11 / 13 for 2 marks</p> <p>If answer is incorrect then award 1 mark:</p> <p><i>if answer to >2 s.f.:</i> ALLOW range from 11.2 to 12.8</p> <p><i>if answer in mm:</i> 0.011 / 0.012 / 0.013</p> <p><i>if answer in cm:</i> 0.0011 / 0.0012 / 0.0013</p> <p><i>if answer in m:</i> 1.1×10^{-5} / 1.2×10^{-5} / 1.3×10^{-5}</p> <p><i>for working:</i> 14 or 15 or 16 \div 1250 x 1000</p> <p><i>for converting scale bar to μm:</i> 15 000 or in range from 14 000 to 16 000</p> <p><i>ECF from mis-measured figure:</i> answer to $(x \div 1250 \times 1000)$ e.g. 1cm gives an answer of 8 (μm) e.g. 1.5 mm gives an answer of 1.2 (μm)</p>
	(b) (i)	erythrocyte ✓	1	ALLOW red blood cell

	(ii)	immunity / immune system / immune response ✓	1	<p>Mark the first answer. If an additional answer is given that is incorrect, then = 0 marks</p> <p>ALLOW immune protection OR defence against / protection from / destroy / fight, pathogens / bacteria / protoctists / parasites / foreign antigens / non-self antigens / infection / infectious disease / malignant cells / cancer cells</p> <p>IGNORE details e.g. engulf pathogens / make antibodies / specific / non-specific / phagocytosis</p>
(c)	(i)	<p>1 to, see / identify, (differences between) cells ✓</p> <p>2 to, see / identify, (differences between) organelles ✓</p> <p>3 red blood cells visible, anyway / without stain (due to haemoglobin) ✓</p> <p>4 ref. <u>contrast</u> ✓</p> <p>5 allows, white cells / leucocytes, to be counted ✓</p>	max 3	<p>ALLOW so white blood cells / A / C / D can be seen or told apart from RBCs</p> <p>ALLOW named organelles e.g nucleus / cytoplasm</p> <p>ALLOW without stain white cells are, transparent / colourless</p>
	(ii)	<p>1 C (is, blue / purple, so) has (more) nucleic acid ✓</p> <p>2 (C has) (m / t / r) RNA ✓</p> <p>3 D (is red so) has (more) protein ✓</p> <p>4 (D has) enzyme / antibody / immunoglobulin ✓</p> <p>5 <i>idea that</i> different cells have different, roles / (concentrations of) biochemicals / levels of activity ✓</p>	max 4	<p>IGNORE suggested names for cells</p> <p>IGNORE some / no, protein present</p> <p>2 DO NOT ALLOW DNA</p> <p>3 IGNORE some / no, nucleic acid present</p> <p>4 ALLOW (named) hydrolases / (named) cytokines / perforins / granzymes</p>
Total			11	

Question			Answer	Marks	Guidance
3	(a)	(i)	<u>Felis</u> ✓	1	Mark the first answer. If any additional answer is given then = 0 marks Need first letter upper case, rest lower case.
		(ii)	<u>intraspecific</u> ✓ variation ✓	2	If additional terms are given then = max 1 for complete correct answer. ALLOW <u>intra</u> -species IGNORE phenotypic / genetic / species DO NOT ALLOW variance / variety
		(iii)	1 can produce fertile offspring ✓ 2 (still) similar in appearance / not enough phenotypic difference(s) ✓ 3 have only been, separated / isolated, for a short time ✓ 4 genetically similar ✓	max 2	2 ALLOW physically alike / similar characteristics 2 ALLOW similar cytochrome c (protein) sequence 3 ALLOW ora would need to be, separated / isolated, for a long(er) time 4 ALLOW genotypically similar
	(b)	(i)	for, fur / pelts / sport / trophies or to stop them, killing / eating, (named) birds / poultry / eggs / lambs / young goats ✓	1	Mark the first answer. If an additional incorrect answer is given then = 0 marks IGNORE for food / meat / commerce / commercial / cosmetic / aesthetic / dangerous ALLOW 'to protect' for 'stop them, killing / eating' named e.g: pheasant / grouse / partridge / chicken / duck DO NOT ALLOW large livestock e.g. cattle / horses / deer / pigs

Question	Answer	Marks	Guidance
(ii) *	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><i>In summary:</i> <i>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.</i></p> <p><i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> <p>• The science content determines the level. • The Communication Statement determines the mark within a level.</p>		

		<p>Level 3 (5–6 marks) A detailed description and explanation of the potential effects of small population size on genetic and species biodiversity. <i>There is a well-developed line of reasoning which is clear and logically structured. All the information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) A basic description and explanation of potential effects of small population size on genetic and species biodiversity. OR A detailed description and explanation of the potential effects of small population size on genetic or species biodiversity. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) A description of some potential effects for genetic and species biodiversity of small population size. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	<p>Indicative scientific points may include</p> <p><i>genetic biodiversity:</i></p> <ul style="list-style-type: none"> • genetic, diversity / variation, low / will decrease • small gene pool / few alleles (at each locus) • proportion of polymorphic loci is small • homozygosity increases / heterozygosity decreases • inbreeding (depression will occur) • (as closely-) related cats, mate / breed • loss of alleles / genetic erosion • by chance / genetic drift • correct ref. to disease susceptibility • low potential for adaptation (to future change) • new alleles may arise (slowly) • by mutation • (slow as) one / few, generation(s) per year <p><i>species biodiversity</i></p> <ul style="list-style-type: none"> • wildcats may go extinct (in Scotland) • one less species • correct ref. to species richness • correct ref. to species evenness • former prey species may, return / increase / extend range (increasing biodiversity) • affect food chain / example of food chain effect • conservation, efforts / effects • only one cat species (in Scotland)
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Question		Answer	Marks	Guidance
(c)	(i)	D ✓	1	Mark the first answer. If any additional answer is given then = 0 marks
	(ii)	A ✓	1	Mark the first answer. If any additional incorrect answer is given then = 0 marks IGNORE B
	(iii)	C ✓	1	Mark the first answer. If any additional answer is given then = 0 marks
	(iv)	B / D ✓	1	Mark the first answer. If any additional incorrect answer is given then = 0 marks
Total			16	

Question			Answer	Marks	Guidance
4	(a)	(i)	water loss / transpiration / evaporation, equals uptake ✓	1	ALLOW all the water taken up is, lost / transpired / evaporated ALLOW none of the water (taken up) is used
		(ii)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><i>In summary:</i> <i>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):</i></p> <ul style="list-style-type: none"> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> <p>• <i>The science content determines the level.</i> • <i>The Communication Statement determines the mark within a level.</i></p>		

	<p>Level 3 (5–6 marks) A detailed description and explanation of the precautions needed when setting up and using the apparatus. <i>There is a well-developed line of reasoning which is clear and logically structured. All the information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) A basic description and explanation of the precautions needed when setting up and using the apparatus. OR A detailed description and explanation of the precautions needed when setting up or using the apparatus. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) A description of some of the precautions needed when setting up and using the apparatus. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	<p>Indicative scientific points may include</p> <p><i>setting up:</i></p> <ul style="list-style-type: none"> • D cut stem under water • D have apparatus under water • D insert stem under water • D joint(s) must be, sealed / tight • E so no air can enter, stem / shoot / xylem / apparatus • E air / bubble, could block xylem • E obtain a continuous column of water <p><i>using:</i></p> <ul style="list-style-type: none"> • D do not allow the bubble to move too far • D use syringe to move bubble • E so air bubble does not enter, xylem / stem • E so same air bubble can be re-used • D place open end in water • E so no, air / (new) bubble, introduced • D keep shoot, still / supported • E to avoid breaking, seal / water column • E to measure transpiration accurately • E ensure validity <p>Allow gas for ‘air’ throughout. Ignore oxygen. Ignore air / bubbles being present or leaving.</p>
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Question		Answer	Marks	Guidance
(b)	(i)	<p>1 57 / trial 4 of condition 3 ✓</p> <p>2 has made mean higher ✓</p> <p>3 (ignoring / excluding 57) mean = 29.4 ✓</p> <p>4 (using 57) increases mean by, 4.6 (mm) / 15.6% ✓</p>	max 3	<p>1 ALLOW lower leaf covered / with jelly for 'condition 3'</p> <p>1 ALLOW 57, marked / circled, in table</p> <p>ECF for mps 2, 3 and 4 if figure other than 57 selected</p> <p>2 ALLOW if 57 not included mean would be less</p> <p>4 ALLOW ora ignoring 57 decreases mean by, 4.6 mm / 13.5%</p> <p>ECF from wrong mean calculated for mp 3</p>
	(ii)	<p>bubble was not (fully) returned to starting position</p> <p>or</p> <p>misread, scale / ruler / distance</p> <p>or</p> <p>timed for longer than five minutes</p> <p>or</p> <p>air movement / temperature / light increased ✓</p>	1	<p>ALLOW leaf not fully covered with petroleum jelly</p>

Question	Answer	Marks	Guidance
(iii)	6.63 ✓ ✓ ✓	3	<p>Correct answer = 3 marks even if no working shown. ALLOW answer in table 4.2</p> <p>ALLOW close figure showing, rounding error / error due to rounding during calculation, but deduct 1 mark</p> <p>If final answer incorrect award 2 marks for:</p> <p><i>answer not to 2 d.p:</i> 7 / 6.6 / 6.631 / 6.632 or more d.p.</p> <p><i>answer for 5 mins:</i> 33.16</p> <p><i>diameter used:</i> 26.53</p> <p><i>radius not squared:</i> 18.95</p> <p>Award 1 mark if two errors occur:</p> <p><i>wrong answer not to 2 d.p:</i> 33 / 33.2 / 27 / 26.5 / or more d.p.</p> <p><i>diameter used & 5 mins:</i> 132.63</p> <p>If no calculated answer then award 1 mark for working:</p> <p>$(3.14 \times 0.35^2) \times (86.2 \div 5)$ or $(3.14 \times 0.35^2) \times 17.24$</p> <p>ALLOW π for 3.14</p>
(iv)	to, see / compare, effect of, other (named) treatment(s) / changed conditions ✓	1	

	(c)	<p><i>capillary tube:</i> measures smaller volumes or small diameter so distance, greater / easier to measure or has, smaller units / finer gradations / closer scale (divisions) / more calibration marks ✓ less uncertainty ✓</p>	max 1	<p>ALLOW ora for calibrated pipette throughout</p> <p>ALLOW thinner / narrower for 'small diameter'</p> <p>ALLOW AW to give the idea of more marks or sub-divisions on measuring scale</p> <p>ALLOW (gives more) precise (readings) ALLOW lower / smaller, percentage error IGNORE accuracy</p>
	(d)	<p>find / control / standardise / account for, leaf <u>area</u> ✓ calculate / compare, transpiration <u>rate per unit area</u> ✓</p>	2	<p>ALLOW unit for 'area' e.g. mm² / cm² / m² IGNORE size / number of stomata IGNORE surface area to volume ratio ALLOW water, loss / uptake, for 'transpiration' ALLOW mm² / cm² / m² for 'unit area'</p>
		Total	18	

Question		Answer	Marks	Guidance	
5	(a)	<p>any two from: to maintain (normal / optimum) water potential (of cell / cytoplasm)</p> <p>or to stop, cell / it / <i>Paramecium</i>, bursting ✓</p> <p>water moves into, <i>Paramecium</i> / it / cell / cytoplasm, by <u>osmosis</u> ✓</p> <p>water potential / ψ, higher outside (cell) ✓</p>	2	<p>DO NOT ALLOW linked to plasmolysis</p> <p>ALLOW ora ψ lower inside (cell) IGNORE outside vacuole for external context</p>	
	(b)	(i)	40 ✓ ✓	2	<p>Correct answer = 2 marks even if no working shown. IGNORE minus sign</p> <p>If answer is incorrect, then award 1 mark for: <i>dividing by end fig:</i> 66.6 (recurring) / 67</p> <p><i>calculating with 0.20 NaCl fig:</i> 81.5 / 82</p> <p><i>working:</i> $(6.5 - 3.9) \div 6.5 \times 100$ or $2.6 \div 6.5 \times 100$</p>

		(ii)	<p>as NaCl concentration increases:</p> <p>1 (external) water potential decreases / solute potential increases ✓</p> <p>2 water potential gradient decreases ✓</p> <p>3 less water enters (<i>Paramecium</i> / cell / cytoplasm) ✓</p> <p>4 less water needs to be expelled ✓</p>	<p>max 2</p>	<p>1 IGNORE outside vacuole for external context</p> <p>2 ALLOW ψ difference decreases / ψ inside and out becomes more similar</p> <p>3 ALLOW water, enters / diffuses, more slowly ALLOW takes more time for water to enter DO NOT ALLOW solution for 'water'</p> <p>4 ALLOW removed / got rid of / ejected, for 'expelled' DO NOT ALLOW solution for 'water' but ECF from 3 IGNORE water expelled less, often / frequently or less contractions in a given time</p>

Question		Answer	Marks	Guidance
	(iii)	<p>1 making crystals, increases ψ / decreases ψ_s ✓</p> <p><i>benefit:</i></p> <p>2 decreases / less, water entry ✓</p> <p>3 (so) less need to expel water ✓</p> <p>4 (so) less use of energy ✓</p>	max 3	<p>1 ALLOW ora dissolving crystals, decreases ψ / increases ψ_s</p> <p>IGNORE removing / releasing, for 'dissolving'</p> <p>ALLOW 'adding' for 'making'</p> <p>ECF from wrong mp1 for an ora of mp 2-4 for 1 mark only</p>
	(iv)	<p>(less) oxygen for <u>aerobic</u> respiration ✓</p> <p>(less) energy / ATP, for (vacuole) contraction ✓</p>	2	<p>ALLOW is an active process for 'energy'</p> <p>IGNORE active transport</p> <p>DO NOT ALLOW energy created / produced</p>
		Total	11	

Question			Answer	Marks	Guidance
6	(a)	(i)	(cellulose) cell wall ✓	1	IGNORE cell (surface) membrane DO NOT ALLOW skin
		(ii)	damage / wound or carried by, insects / vectors / aphids ✓	1	
	(b)	(i)	<i>any two from:</i> 1 virus / foreign, <u>RNA</u> recognised (as incorrect) ✓ 2 virus / foreign, RNA / genome, cut / destroyed ✓ 3 virus, replication / reproduction, stopped ✓	2	ALLOW viral for 'virus' throughout ALLOW will not recognise, virus / foreign, RNA as correct DO NOT ALLOW DNA / viral mRNA DO NOT ALLOW DNA / viral mRNA, but ecf from 1 IGNORE viral RNA, will not survive / attacked
		(ii)	phospho(di)ester ✓	1	
		(iii)	faulty / incorrect, (m) RNA destroyed ✓ faulty / wrong, proteins not made or prevents errors in protein synthesis ✓	2	ALLOW mutated for 'faulty' e.g. stop wrong amino acid sequence forming / stop wrong primary structure
Total				7	

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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