GCE

Biology A

H020/02: Depth in biology

Advanced Subsidiary GCE

Mark Scheme for June 2019

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2019

Annotations

Marking Annotations

Annotation	Use
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	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_2SO_4, HNO_3 **IGNORE** spelling error e.g. hydrocholic
	(b)	(i)	*starch:* 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_2O 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)	*sucrose:* 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		**Correct answer = 2 marks** even if no working shown. **ALLOW** 11 / 13 for 2 marks **If answer is incorrect** then **award 1 mark:** *if answer to >2 s.f.:* **ALLOW** range from 11.2 to 12.8 *if answer in mm:* 0.011 / 0.012 / 0.013 *if answer in cm:* 0.0011 / 0.0012 / 0.0013 *if answer in m:* 1.1×10^{-5} / 1.2×10^{-5} / 1.3×10^{-5} *for working:* 14 or 15 or 16 ÷ 1250 x 1000 *for converting scale bar to µm:* 15 000 or in range from 14 000 to 16 000 *ECF from mis-measured figure:* answer to (*x* ÷ 1250 x 1000) e.g. 1cm gives an answer of 8 (µm) e.g. 1.5 mm gives an answer of 1.2 (µm)
	(b)	(i)	erythrocyte ✓	1		**ALLOW** red blood cell

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

Question			Answer	Marks		Guidance
3	(a)	(i)	*Felis* ✓	1		**Mark the first answer**. If any additional answer is given then = 0 marks Need first letter upper case, rest lower case.
		(ii)	intraspecific ✓ variation ✓	2		If additional terms are given then = max 1 for complete correct answer. **ALLOW** intra-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) *	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *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) A detailed description **and** explanation of the potential effects of small population size on genetic **and** species biodiversity. *There is a well-developed line of reasoning which is clear and logically structured. All the information presented is relevant and substantiated.* **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. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** A description of some potential effects for genetic **and** species biodiversity of small population size. *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 may include** *genetic biodiversity:* • 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 *species biodiversity* • 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)

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)*	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *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) A detailed description **and** explanation of the precautions needed when setting up **and** using the apparatus. *There is a well-developed line of reasoning which is clear and logically structured. All the information presented is relevant and substantiated.* **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. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** A description of some of the precautions needed when setting up **and** using the apparatus. *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 may include** *setting up:* • **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 *using:* • **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 ***Allow gas for 'air' throughout.*** ***Ignore oxygen.*** ***Ignore air / bubbles being present or leaving.***

Question			Answer	Marks		Guidance
	(b)	(i)	**1** 57 / trial 4 of condition 3 ✓ **2** has made mean higher ✓ **3** (ignoring / excluding 57) mean = 29.4 ✓ **4** (using 57) increases mean by, 4.6 (mm) / 15.6% ✓	**max 3**		**1 ALLOW** lower leaf covered / with jelly for 'condition 3' **1 ALLOW** 57, marked / circled, in table **ECF** for mps 2, 3 and 4 if figure other than 57 selected **2 ALLOW** if 57 not included mean would be less **4 ALLOW ora** ignoring 57 decreases mean by, 4.6 mm / 13.5% **ECF** from wrong mean calculated for mp 3
		(ii)	bubble was not (fully) returned to starting position **or** misread, scale / ruler / distance **or** timed for longer than five minutes **or** air movement / temperature / light increased ✓	**1**		**ALLOW** leaf not fully covered with petroleum jelly

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

	(c)		*capillary tube:* 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 ✓	**max 1**		**ALLOW ora** for calibrated pipette **throughout** **ALLOW** thinner / narrower for 'small diameter' **ALLOW AW** to give the idea of more marks or sub-divisions on measuring scale **ALLOW** (gives more) precise (readings) **ALLOW** lower / smaller, percentage error **IGNORE** accuracy
	(d)		find / control / standardise / account for, leaf <u>area</u> ✓ calculate / compare**,** transpiration <u>rate per unit area</u> ✓	**2**		**ALLOW** unit for 'area' e.g. mm^2 / cm^2 / m^2 **IGNORE** size / number of stomata **IGNORE** surface area to volume ratio **ALLOW** water, loss / uptake, for 'transpiration' **ALLOW** mm^2 / cm^2 / m^2 for 'unit area'
			Total	**18**		

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

		(ii)	*as NaCl concentration increases:* **1** (external) water potential decreases / solute potential increases ✓ **2** water potential gradient decreases ✓ **3** less water enters (*Paramecium* / cell / cytoplasm) ✓ **4** less water needs to be expelled ✓	**max 2**		**1 IGNORE** outside vacuole for external context **2 ALLOW** ψ difference decreases / ψ inside and out becomes more similar **3 ALLOW** water, enters / diffuses, more slowly **ALLOW** takes more time for water to enter **DO NOT ALLOW** solution for 'water' **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

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

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2019