

GCE

Biology A

Unit **H020/01**: Breadth in biology

Advanced Subsidiary GCE

Mark Scheme for June 2016

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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

Annotation	Meaning
DO NOT CREDIT	Answers which are not worthy of credit
IGNORE 	Statements which are irrelevant
ALLOW or ACCEPT	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
AW	Alternative wording
ORA	Or reverse argument
✓	Mark is awarded
X	Answer incorrect
	Omission mark
	Benefit of doubt
	Blank page
	Statement that contradicts a correct statement
	Use to indicate when part of a mark point has been achieved
	Error carried forward
	Mark has already been awarded (given mark)
	Horizontal wavy line to indicate incorrect statements
	Not giving the benefit of doubt

SECTION A

Question	Answer	Marks	Guidance
	Mark the letter that is in the box. Credit a letter that is clearly the intended answer if the letter in the box is crossed out. Do not credit ambiguous letters, unless the correction is clearly thicker than the original. If there is no letter in the box, credit a very clear indication of the correct answer.		
1	C	1	
2	B	1	
3	D	1	
4	C	1	
5	C	1	
6	D	1	
7	B	1	
8	C	1	
9	A	1	
10	A	1	
11	A	1	
12	C	1	
13	B	1	
14	B	1	
15	C	1	
16	A	1	
17	B	1	
18	B	1	
19	D	1	
20	A	1	
	Total	20	

SECTION B

Question			Answer	Marks	Guidance
21	(a)	(i)	<p>1 discs same , size / thickness / surface area / surface area to volume ratio / diameter ✓</p> <p>2 same (variety / part , of) potato ✓</p> <p>3 no skin on potato ✓</p> <p>4 <i>ref to</i> removing excess water before (re)weighing ✓</p> <p>5 same , number / amount , of discs (in each solution) ✓</p> <p>6 same <u>volume</u> (sucrose) <u>solution</u> ✓</p> <p>7 same temperature ✓</p> <p>8 cover the tubes ✓</p>	max 2	<p><i>Mark first two answers only, ignoring the numbered sections</i></p> <p>IGNORE mass / balance used / soak time / repeats</p> <p>IGNORE a list of variables unqualified</p> <p>1 ACCEPT same cork borer used</p> <p>ACCEPT 'pieces of potato' etc. for 'discs'</p> <p>ACCEPT 'length' as equivalent to 'diameter'</p> <p>IGNORE same shape / similar size etc</p> <p>4 e.g. blotting / shaking</p> <p>7 ACCEPT in context of room / environment / solution</p>

Question			Answer	Marks	Guidance
21	(a)	(ii)	<p>1 <i>idea that</i> no change of mass occurs when the water potential of (sucrose) <u>solution</u> = water potential of potato (tissue) ✓</p> <p>2 ref. to no change in mass (of potato) between 0.2 and 0.3 mol dm⁻³ ✓</p> <p>3 plot graph of concentration of , sucrose / solution , against (%) change in mass and find which (sucrose) concentration gives no change in mass of potato</p> <p>OR carry out the experiment again with more (sucrose) concentration intervals between 0.2 and 0.3 mol dm⁻³ ✓</p> <p>4 look up the water potential of the (sucrose) <u>solution</u> (e.g. on calibration curve or table) , of that concentration / of the concentration which gives no mass change ✓</p>	max 3	<p>ACCEPT Ψ for water potential throughout IGNORE ref to solute potential / isotonic</p> <p>2 correct units must be stated once ACCEPT 'between 0.2 and 0.3 mol dm⁻³ the water potential of the solution and the potato will be the same'</p> <p>3 x and y axes interchangeable When an axis has been identified it can be referred to by letter later. Needs some ref to the mass change being 0. If the change in mass axis has previously been identified, then ref to that axis value being 0 is equivalent to no change in mass e.g. 'Should draw a graph of sucrose concentration on the x axis and change in mass of potato discs on the y axis. The point where the line of best fit crosses the x axis (when the y axis = 0) is the concentration of sucrose in the potato discs.' will get the mark 'Draw a graph with change in mass of potato discs on the y axis and concentration of sucrose solution on the x axis and draw a line of best fit. Where the line intercepts the x axis is where the change in mass of potato discs is zero.' will get the mark</p> <p>3 correct units must be stated once</p>

Question			Answer	Marks	Guidance
21	(b)	(i)	X (cellulose) cell wall ✓ Y cell <u>surface</u> membrane / plasma membrane ✓ Z <u>vacuole membrane</u> / tonoplast ✓	max 3	If additional incorrect answer given, then 0 marks Y ACCEPT plasmalemma Z IGNORE vacuole
21	(b)	(ii)	sucrose <u>solution</u> ✓	1	If additional incorrect answer given, then 0 marks ACCEPT sugar solution / external solution / solution placed in DO NOT CREDIT 'solution' unqualified
21	(c)		there is a lower <u>water potential</u> inside root <u>hair</u> (cells) ✓ actively transport / pump , (mineral) ions / salts , into root <u>hair(s)</u> (cells) or root <u>hair(s)</u> (cells) store / contain , (mineral) ions / salts / solutes ✓	2	IGNORE ref to large surface area and short diffusion path IGNORE ref to solute potential / isotonic ACCEPT Ψ for water potential 'it' or 'they' = root hairs IGNORE ref to roots or root cells unqualified as hairs ACCEPT root hair , has / creates , a lower <u>water potential</u> (than soil) ACCEPT maintains / sets up / establishes , a (steep) <u>water potential</u> gradient Look for a comparison in water potential between the cell and the soil IGNORE solutes / sugars / hydrogen ions ACCEPT named ions ACCEPT named ions ACCEPT named solutes e.g. sugars
			Total	11	

Question			Answer	Marks	Guidance
22	(a)	(i)	164 706 ✓✓	2	<p>Correct answer with no working = 2 marks</p> <p>If the answer is incorrect, look for a working mark: either (incorrect rounding) ALLOW 1 mark for seeing 164 705 or 164 705.88 or 164 705.9 anywhere or ALLOW 1 mark for any ref to $56 \div 34$ (e.g. $5.6 \div 0.34$ or $5600 \div 34$)</p>
22	(a)	(ii)	28 ✓✓	2	<p>Correct answer with no working = 2 marks</p> <p>If answer incorrect, ALLOW 1 mark for seeing $100 - 44$ or $50 - 22$</p>
22	(b)	(i)	condensation ✓	1	<p><i>If additional incorrect answer given, then 0 marks</i> ACCEPT esterification</p>
22	(b)	(ii)	water ✓	1	<p><i>If additional incorrect answer given, then 0 marks</i> ACCEPT H₂O (correct formula only)</p>

Question			Answer	Marks	Guidance
22	(b)	(iii)	<p>1 phosphodiester bonds in , backbone / described ✓</p> <p>2 hydrogen / H , bonds / bonding (between chains / bases) ✓</p> <p>3 purine to pyrimidine / A to T and C to G ✓</p> <p>4 ref to correct number of bonds between base pairs (A-T & C-G) ✓</p>	max 3	<p>IGNORE antiparallel</p> <p>1 ACCEPT covalent bond in backbone</p> <p>2 DO NOT CREDIT if other bond mentioned to connect between the two chains DO NOT CREDIT H⁺ bonds IGNORE strength of bond</p> <p>3 DO NOT CREDIT thiamine / cysteine / adenosine</p> <p>Note: 'Two bonds between A and T and three bonds between C and G' = 2 marks (mp 3 and mp 4) 'Two hydrogen bonds between A and T and three hydrogen bonds between C and G' = 3 marks (mp 2, mp 3 and mp 4)</p>
			Total	9	

Question		Answer	Marks	Guidance
23	(a)	<p><i>Column 1</i></p> <p>Class Order Genus ✓</p>	<p><i>Column 2</i></p> <p>Animalia <i>sumatrensis</i> ✓</p>	<p>2</p> <p><i>If additional incorrect answer given, then 0 marks</i> One mark per correct column.</p> <p>ACCEPT Animal / phonetic spelling / in lower case</p> <p>'sumatrensis' must be all in lower case DO NOT CREDIT if the 's' is clearly upper case DO NOT CREDIT D. sumatrensis DO NOT CREDIT Sumatran / sumatran</p>
23	(b)	<p>universal / recognised worldwide / AW ✓</p> <p>know which , genus / species , it belongs to ✓</p> <p><i>idea of</i> different common name for the same organism ✓</p>	max 1	<p>ACCEPT no language barrier</p> <p>ACCEPT ref to showing evolutionary relationships (e.g. shows common ancestry)</p>
23	(c) (i)	<p>loss of , (rainforest) habitat / food source or deforestation ✓</p> <p>hunting / poaching (for horn) ✓</p> <p>climate change ✓</p>	max 2	<p>IGNORE disease</p> <p>ACCEPT loss of (rainforest) ecosystem IGNORE only lives in rainforest</p>

Question			Answer	Marks	Guidance
23	(c)	(ii)	1 hard to find a mate / may be gender imbalance ✓ 2 (inbreeding leading to) low genetic diversity / small gene pool / genetic bottleneck ✓ 3 cannot / less likely to , cope with / adapt to , (named) environmental change ✓ 4 all wiped out by the same disease ✓ 5 more vulnerable to , predators / poachers ✓ 6 natural disaster could wipe out , one / some , of the small populations ✓	max 2	1 ACCEPT few individuals of reproductive maturity 2 ACCEPT description 3 ACCEPT (population) unable to cope with new selection pressures 4 DO NOT CREDIT that they are more susceptible to disease in general
23	(c)	(iii)	education / awareness ✓ support for / promote , conservation projects / research ✓	max 1	IGNORE ref to cloning In the context of educating the general public e.g. information displayed in the zoo or on website / holding education days for schools 'support' could mean: raise money / provide funds / provide technical support / provide expertise / etc. CREDIT in the context of an example e.g. sending people to monitor populations in the wild e.g. supporting the setting up of nature reserve IGNORE zoo sets up nature reserves
			Total	8	

Question		Answer	Marks	Guidance
24	(a)	6 600 ✓✓	2	<p>Correct answer = 2 marks</p> <p>If answer is incorrect, ALLOW 1 mark for seeing $20.1 - 0.3 = 19.8$ or $(20.1 - 0.3) \div x$ or $19.8 \div x$ where $x =$ any number</p>
24	(b)	(i)	max 2	<p>Mark first answer only for advantage and disadvantage.</p> <p>A1 DO NOT CREDIT in context of larger surface area ACCEPT 'Hb' for haemoglobin</p> <p>A2 can squeeze through <u>capillaries</u> easily ✓</p> <p><i>disadvantages</i></p> <p>D1 limited life span / cannot divide / cannot reproduce / cannot undergo mitosis ✓</p> <p>D2 no , protein synthesis / repair ✓</p> <p>D3 no respiration , <u>in</u> / <u>by</u> , mitochondria or no mitochondria <u>for</u> respiration or limited respiration / no aerobic respiration / only anaerobic respiration ✓</p> <p>D1 max time of 120 days / 4 months</p> <p>D3 DO NOT CREDIT 'no mitochondria so no respiration' (as some respiration will still take place)</p> <p>ACCEPT 'ATP release' or 'energy provided' instead of 'respiration' e.g. no energy being provided from mitochondria ATP is not released by mitochondria</p> <p>DO NOT CREDIT ref to producing / creating , energy</p>

Question			Answer	Marks	Guidance
24	(b)	(ii)	<p><i>Virus</i></p> <p>virus is unable to / cannot , replicate / reproduce , on its own / outside a host cell</p> <p>or</p> <p>virus requires host cell , machinery / <u>DNA</u> / RER / ribosomes , for protein synthesis</p> <p>or</p> <p>virus does not contain , RER / ribosomes , for protein synthesis ✓</p> <p>-----</p> <p><i>Plasmodium</i></p> <p><i>idea that Plasmodium is using the host cell to hide from the immune system</i></p> <p>or</p> <p>for <i>Plasmodium</i> to <u>complete</u> its life cycle</p> <p>or</p> <p>for <i>Plasmodium</i> to use as a source of food (for , growth / reproduction) ✓</p>	2	<p>IGNORE ref to the erythrocyte not having membrane-bound organelles without ref to the <u>need</u> of the virus to use them inside the cell</p> <p>Must be a clear statement</p> <p>ACCEPT <u>needs</u> / <u>has to use</u> , host cell to , replicate / reproduce</p> <p>ACCEPT ‘malarial pathogen’ for <i>Plasmodium</i></p> <p>IGNORE eukaryotic / protoctist</p> <p>IGNORE it has its own , DNA / nucleus / protein synthesis apparatus</p> <p>IGNORE ref to just , part / stage , of life cycle</p> <p>IGNORE ref to organelles</p>

Question			Answer	Marks	Guidance
24	(b)	(iii)	<p>1 oxygen is bound to haemoglobin (while being transported) ✓</p> <p>2 lack mitochondria ✓</p> <p>3 (therefore) no <u>aerobic</u> respiration ✓</p> <p>4 (moved by mass flow so) doesn't need , energy / ATP , to move or needs less , energy / ATP (for metabolic processes) ✓</p>	2	<p>1 ACCEPT 'it' for 'oxygen' ACCEPT 'Hb' for haemoglobin</p> <p>3 ACCEPT <u>only</u> respire anaerobically IGNORE ref to energy</p> <p>4 DO NOT CREDIT 'does not need , energy / ATP' unqualified DO NOT CREDIT 'makes / produces , energy'</p>
24	(c)	(i)	1005 ✓✓	2	<p>Correct answer = 2 marks</p> <p>If answer is incorrect then ALLOW 1 mark for any ref to 201 x 5 (e.g. 2.01 x 5 or 2.01 x 50 or 0.201 x 0.5 etc)</p>

Question			Answer	Marks	Guidance
24	(c)	(ii)	<p>1 arteries / arterioles , have thick <u>wall</u></p> <p>or capillary <u>wall</u> is , thin / one cell thick / only endothelium ✓</p> <p>2 no <u>diffusion</u> (through artery wall) or <u>diffusion</u> distance (too) large for artery or <u>diffusion</u> occurs (through capillary wall) or short <u>diffusion</u> distance for capillary ✓</p>	2	<p>1 ACCEPT artery <u>walls</u> have , elastic fibres / muscle / collagen / (more) layers</p> <p>IGNORE ref to veins / venules</p> <p>DO NOT CREDIT ref to cell wall</p> <p>Note: 'artery walls too thick for diffusion to take place' = 2 marks</p>
24	(d)	(i)	<u>Bohr</u> (effect / shift) ✓	1	<p>Correct spelling only ACCEPT bohr / Bohr's / bohr's</p>

Question			Answer	Marks	Guidance
24	(d)	(ii)	<p><i>in actively respiring tissues</i></p> <p>1 more / high levels of , carbon dioxide (produced) or high pCO₂ ✓</p> <p>2 lowered <u>affinity</u> of haemoglobin for oxygen ✓</p> <p>3 (CO₂ results in) dissociation of carbonic acid / increase of H⁺ , leading to the release of oxygen ✓</p> <p>4 more oxygen released at same pO₂ / suitable data quote from graph ✓</p>	max 2	<p><i>If symbols used must be correct e.g. CO₂ not CO²</i></p> <p>1 ACCEPT ORA for resting tissue</p> <p>2 ACCEPT 'Hb' for haemoglobin ACCEPT weaker affinity</p> <p>4 (at , T / 3.2 kPa O₂) drops from 40% to 24% saturation / 16% reduction</p>
			Total	15	

Question		Answer	Marks	Guidance
25	(a)	B C ✓✓	2	<p>One mark for each correct answer e.g. B C = 2 B or C (only) = 1 B Dx = 1</p> <p>If one extra incorrect letter = max1 If two extra incorrect letters = 0 marks</p> <p>e.g. B C D x = 1 B C D x E x = 0</p>
		A D F ✓✓	2	<p>If any incorrect or extra letters are written, cross each one.</p> <p>e.g. A D Ex Then look at any correct letters written. We have 1 cross so only 1 more mark available, A and D both right so gets this 1 mark)</p> <p>e.g. A D Ex Cx We have 2 crosses so 0 marks even though the correct letters have also been given</p> <p>If no extra or incorrect letters are written: Three answers written, all correct = 2 marks A, D, F = 2 Two answers written, both correct = 1 mark A, D = 1 A, F = 1 D, F = 1 One answer written and correct = 0 A = 0 F = 0 D = 0</p>

Question		Answer	Marks	Guidance
25	(b)	<p>1 sugar / sucrose / assimilates , in the <u>sieve tube</u> (elements) ✓</p> <p>2 (assimilates) enter , sieve tube / phloem (at source) and lowers water potential (in sieve tube) ✓</p> <p>3 water enters (sieve tube) , by osmosis / down water potential gradient / described and increases <u>hydrostatic</u> pressure ✓</p> <p>4 (assimilates) leave , sieve tube / phloem (at sink) and increases water potential (inside sieve tube) ✓</p> <p>5 water leaves (sieve tube) , by osmosis / down water potential gradient / described and lowers <u>hydrostatic</u> pressure ✓</p> <p>6 (assimilates) move , from high to low (hydrostatic) pressure / down pressure gradient ✓</p>	max 3	<p>2 IGNORE details of loading mechanism and companion cells</p> <p>6 IGNORE 'mass flow' as given in Q</p>
		Total	7	

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