



Cambridge IGCSE™

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2022

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **3** printed pages.

Question	Answer	Marks
1	C	1
2	C	1
3	B	1
4	A	1
5	B	1
6	C	1
7	B	1
8	C	1
9	D	1
10	D	1
11	B	1
12	D	1
13	C	1
14	C	1
15	C	1
16	A	1
17	D	1
18	B	1
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22	A	1
23	C	1
24	B	1
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26	B	1
27	A	1
28	D	1

Question	Answer	Marks
29	D	1
30	C	1
31	C	1
32	A	1
33	C	1
34	C	1
35	D	1
36	C	1
37	D	1
38	C	1
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40	A	1



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These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
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- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark scheme abbreviations

- ; separates marking points
- / alternative responses for the same marking point
- R reject the response
- A accept the response
- I ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- () the word / phrase in brackets is not required but sets the context

Question	Answer	Marks	Guidance																
1(a)(i)	mechanical / physical, digestion ;	1																	
1(a)(ii)	<u>enamel</u> ;	1																	
1(a)(iii)	<i>any three from:</i> sugar / food / plaque, left on teeth ; respiration (of sugar) by bacteria ; produce (lactic) acid ; dissolves, enamel / dentine / AW ; AVP ;	3	e.g. dentine is exposed / AW or dentine, is softer / dissolves more rapidly (than enamel) or ref. to, pulp / nerve endings, being exposed or (decay reaches nerve endings) leading to pain																
1(b)(i)	<table border="1"> <tr><td><i>Orcinus orca</i></td><td>E</td></tr> <tr><td><i>Myrmecophaga tridactyla</i></td><td>F</td></tr> <tr><td><i>Cervus elephas</i></td><td>G</td></tr> <tr><td>Go to 5</td><td></td></tr> <tr><td><i>Macropus rufus</i></td><td>B</td></tr> <tr><td><i>Equus ferus</i></td><td>A</td></tr> <tr><td><i>Lemur catta</i></td><td>C</td></tr> <tr><td><i>Pteropus niger</i></td><td>D</td></tr> </table> <p>;;;;</p>	<i>Orcinus orca</i>	E	<i>Myrmecophaga tridactyla</i>	F	<i>Cervus elephas</i>	G	Go to 5		<i>Macropus rufus</i>	B	<i>Equus ferus</i>	A	<i>Lemur catta</i>	C	<i>Pteropus niger</i>	D	4	7 correct = 4 marks 5 or 6 correct = 3 marks 3 or 4 correct = 2 marks 1 or 2 correct = 1 mark
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Question	Answer	Marks	Guidance
1(b)(ii)	<i>any two from:</i> double circulation ; four-chambered heart ; lungs / any named part of lungs ; diaphragm ; red blood cells without nuclei ; AVP ;	2	
1(b)(iii)	vertebrates ;	1	

Question	Answer	Marks	Guidance
2(a)(i)	<i>any two from:</i> become soluble ; for absorption ; small enough, for diffusion / active transport ;	2	
2(a)(ii)	water ;	1	
2(b)	<i>any six from:</i> 1 protein → amino acids ; 2 ref to specificity ; 3 both enzymes are active between pH 3 and pH5 ; A at pH4 4 A is pepsin ; 5 optimum pH at 2 ; 6 enzyme shows, no activity / is denatured, from pH 5 ; 7 (functions) in stomach ; 8 where HCl is present / in acid conditions ; 9 B is trypsin ; 10 optimum pH at 10 ; 11 enzyme shows, no activity / is denatured, from pH 3 ; 12 (functions) in small intestine / secreted from pancreas ; 13 bile neutralises (stomach) acid / in alkaline conditions ;	6	MP1 A breaks down proteins (to, polypeptides / peptides) MP13 A pancreatic juice neutralises stomach acid
2(c)	(membrane of) epithelium ;	1	

Question	Answer	Marks	Guidance
3(a)(i)	transpiration ;	1	
3(a)(ii)	ensure continuous column of water / prevents air bubbles / prevents airlock ;	1	
3(a)(iii)	prevent, evaporation / condensation (from the top of the burette, affecting the volume of water in the burette) / AW ;	1	
3(a)(iv)	measure the decrease in the volume of water (in burette over a period of time) / record the decrease in mass (over time) ;	1	
3(b)(i)	12 096 g (per m ²) / 12.096 kg (per m ²) ;;;	3	<p>A 12 / 12.1 kg (per m²)</p> <p>MP1 correct reading from graph 0.28 (g per m² per s) MP2 correct calculation $0.28 \times 60 \times 60 \times 12 = 12\,096 \text{ g}$ MP3 correct unit – g or kg ;</p> <p>ecf for MP2 from incorrect MP1</p>
3(b)(ii)	<p>any five from:</p> <p>1 as temperature increases, (rate of) water loss increases ; 2 ref to steeper rate / greater loss of water, after 37 / 38 °C ; 3 any correct comparative data quote (with units at least once) ; 4 <u>water vapour</u> lost, through stomata / between guard cells ; 5 evaporation from mesophyll into air spaces ; 6 (diffusion) down a, water potential, gradient ; 7 increasing temperature increases kinetic energy (of water molecule) ; 8 faster (rate of) more, diffusion ; 9 stomata open wider / more stomata open in high(er) temperatures ; 10 AVP ;</p>	5	e.g. transpiration / evaporation, cools the plant

Question	Answer	Marks	Guidance
3(c)(i)	no diffusion (of water vapour) ; (because) no water potential gradient / described ;	2	
3(c)(ii)	(it has a) continuous supply of water / AW ;	1	
3(c)(iii)	line drawn below original line ;	1	

Question	Answer	Marks	Guidance
4(a)	<p><i>any four from:</i></p> <p>two strands ; formed into (double) helix ; ref. to four bases / A and T and C and G ; pairing of, A with T / C with G ; cross links between bases ;</p>	4	A as an annotated drawing
4(b)(i)	<p><i>any three from:</i></p> <p>1 variation (in the bacteria) ; 2 ref. to mutations / described ; 3 mutations, give bacteria an advantage ; 4 non-resistant bacteria, killed / inhibited / AW (by antibiotic) ; 5 competition with non-resistant bacteria ; 6 resistant bacteria reproduce ; 7 pass on, gene / allele (for resistance) ; 8 <u>natural selection</u> ; 9 AVP ;</p>	3	<p>e.g. horizontal gene transmission / described as gene(s) passed from one bacterium to another</p>
4(b)(ii)	<p><i>any one from:</i></p> <p>1 no difference in appearance (of different strains of MRSA) / AW ; 2 no need to culture the bacteria ; 3 (gene sequencing is an) automated process / AW ; / easy to do / AW ; 4 only need small, number / quantity / amount (of bacteria) ; 5 more, accurate / precise (than traditional methods) / AW ; 6 explained in terms of comparing base sequences of different, strains / AW ; 7 AVP ;</p>	1	<p>e.g. (DNA sequences) within a species are very similar</p>

Question	Answer	Marks	Guidance
4(b)(iii)	<p><i>any two from:</i> (resistant) bacteria will not be killed by antibiotics / AW ; <i>idea that no antibiotic of last resort / AW ;</i> (bacterial diseases) cannot be treated / AW ; infection / disease / (resistant) bacteria, will spread ; AVP ;;</p>	2	<p>e.g. new antibiotics need to be developed it takes time to make new antibiotics</p>
4(c)(i)	<p><i>any two from:</i> antibiotics used only when essential ; ensuring people, follow instructions / complete course of antibiotics ; do not prescribe antibiotics for, viral / fungal, infections ; AVP ;;</p>	2	<p>e.g. develop new antibiotics</p>
4(c)(ii)	placenta forms a barrier between mother and fetus / AW ;	1	
4(d)	<p><i>any three from:</i> nitrogen fixation ; decomposition / decay ; nitrification ; denitrification ; deamination ; fermentation ; AVP ;;</p>	3	<p>e.g. nitrogen cycle / carbon cycle / <u>aerobic</u> or <u>anaerobic</u> respiration</p>

Question	Answer	Marks	Guidance
5(a)(i)	<i>any one from:</i> respiration ; decomposition ; volcanic eruptions ; release of carbon dioxide from oceans (ocean-atmosphere exchange) ;	1	
5(a)(ii)	methane / AVP ;	1	
5(b)(i)	<i>any three from:</i> 1 (total) number of fires in natural ecosystems is higher than (total) number of fires in managed land or <i>idea that the savannah (alone) has more fires than the (total) fires in managed land ;</i> 2 fires on managed land, have a lower expansion rate / spread more slowly (than other fires) ; 3 fires on managed land, have a shorter duration / last less time (than other fires) ; 4 more fires on land being deforested than in natural forest ; 5 comparative data quote (with units at least once) ; 6 AVP ;	3	MP5 e.g. approx. 20% of all fires occur on land managed by humans
5(b)(ii)	multiply ; number of fires by expansion rate by duration (for each row) ;	2	

Question	Answer	Marks	Guidance
5(b)(iii)	<p><i>any three from:</i></p> <p>1 reduction in population sizes of organisms ; 2 organisms / animals / plants, become endangered ; 3 organisms / animals / plants, become extinct ; 4 loss of biodiversity ; 5 loss of genetic diversity ; 6 ref. to negative effect on, food chains / food webs ; 7 ref. to negative effect on, nutrient / water, cycling ; 8 AVP ;</p>	3	e.g. migration of organisms / flooding / soil erosion / leaching / desertification

Question	Answer			Marks	Guidance																								
6(a)(i)	<table border="1"> <thead> <tr> <th>function</th><th>name of the structure</th><th>letter on Fig. 6.1</th></tr> </thead> <tbody> <tr> <td>traps particles (before they enter the airway) / mechanical barrier to pathogens / AW</td><td>hairs in the nose</td><td>A</td></tr> <tr> <td>prevents collapse of the airway</td><td>cartilage</td><td>J / B</td></tr> <tr> <td>contracts to decrease the pressure in the thorax</td><td>external intercostal muscles</td><td>F</td></tr> <tr> <td>contracts to, reduce the pressure / increase the volume, in the thorax</td><td>diaphragm</td><td>C</td></tr> <tr> <td>protects the lungs from mechanical damage</td><td>rib(cage)</td><td>E</td></tr> <tr> <td>contain cilia to move mucus out of the airway</td><td>trachea / bronchi / bronchiole</td><td>J / B / G</td></tr> <tr> <td>site of gas exchange / AW</td><td>alveoli</td><td>H</td></tr> </tbody> </table> <p>, , , , ,</p>	function	name of the structure	letter on Fig. 6.1	traps particles (before they enter the airway) / mechanical barrier to pathogens / AW	hairs in the nose	A	prevents collapse of the airway	cartilage	J / B	contracts to decrease the pressure in the thorax	external intercostal muscles	F	contracts to, reduce the pressure / increase the volume, in the thorax	diaphragm	C	protects the lungs from mechanical damage	rib(cage)	E	contain cilia to move mucus out of the airway	trachea / bronchi / bronchiole	J / B / G	site of gas exchange / AW	alveoli	H	7	<i>one mark for each correct row</i>		
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Question	Answer	Marks	Guidance
6(a)(ii)	<i>any three from:</i> thin / one cell thick ; large surface area ; (which) reduces diffusion distance / AW ; good blood supply ; AVP ;	3	e.g. moist lining / presence of surfactant
6(b)(i)	<i>any three from:</i> less oxygen and more carbon dioxide in expired air (than inspired air) ; (as) oxygen is required for <u>aerobic</u> respiration ; carbon dioxide is released by respiration ; water vapour increases (as it is released by respiration) ; AVP ;	3	
6(b)(ii)	<i>detected:</i> <i>either</i> (carbon dioxide is) in the blood <i>or</i> by the brain ; <i>response:</i> <i>either</i> increases, rate / depth, of breathing <i>or</i> increases heart rate / AW ;	2	
6(b)(iii)	limewater / hydrogencarbonate indicator (solution) / AVP ;	1	



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Question	Answer	Marks	Guidance
1(a)(i)	Fungus / Fungi ;	1	
1(a)(ii)	<u>aerobic respiration</u> ;	1	
1(b)	<i>any two from:</i> ref. to specificity (of enzyme) ; shape of <u>active site</u> is <u>complementary</u> to, substrate / sucrose ; for, substrate / sucrose, to bind / fit, enzyme / sucrase / active site ;	2	
1(c)	<i>total of six from:</i> <i>max. four for description:</i> 1 sucrase / enzyme, is active between pH2 and pH12 ; 2 activity, increases and decreases / reaches a peak ; 3 peak / maximum or 100% activity, at pH 6 ; 4 steeper increase between pH 5–6 / steeper decrease in activity between pH 9–10 ; 5 minimum / 10%, activity at pH 12 ; 6 more activity in, acidic conditions / low pH, than, alkaline conditions / high pH ; <i>explanation:</i> 7 (change in) pH affects the shape of, sucrase / active site / enzyme ; 8 at pH 6, most enzyme-substrate complexes form / AW ; 9 at, low / high / extremes of, pH, enzyme is (partially) <u>denatured</u> ; 10 ref to substrate molecules can no longer bind with enzyme (at low / high / extreme pH, so activity decreases) ; 11 AVP ;	6	

Question	Answer	Marks	Guidance
2(a)(i)	<u>left</u> ventricle ;	1	
2(a)(ii)	<p><i>total of three from:</i> vena cava ;</p> <p><i>max. two from:</i> has valves ; wide, lumen / AW ; thin wall ; (wall) lined by single layer of cells ; (wall) contains muscle (fibres) ; (wall) contains elastic (fibres) ;</p>	3	
2(a)(iii)	semilunar <u>valve</u> ; prevents backflow of blood (correctly described) / ensures that blood flows in one direction ;	2	
2(b)(i)	shading in any part of the pulmonary vein only ;	1	
2(b)(ii)	<i>any two from:</i> heart has, two / left and right, sides / AW ; blood must flow through the heart twice in one (complete) circuit / AW (of the body) ; pulmonary and systemic circuits / circuits from heart to lungs and from heart to rest of body ;	2	

Question	Answer	Marks	Guidance
2(b)(iii)	<p><i>any four from:</i></p> <p>1 oxygenated and deoxygenated blood, are kept separate / do not mix / separated by septum ; 2 ensures efficient supply of oxygen (to, body / AW) ; 3 ensures efficient supply of (named) nutrients (to, body / AW) ; 4 low(er) pressure in, pulmonary, artery / circuit / AW ; 5 to prevent damage to (capillaries in the) lungs ; 6 allows more time for gas exchange ; 7 allows high(er) pressure (in body) ; 8 to ensure efficient, blood supply to (rest of) body ; 9 to allow filtration in kidneys (for excretion) ; 10 to allow / maintain, a high, metabolic rate / rate of respiration ; 11 AVP ;</p>	4	e.g., larger diffusion gradient between capillaries and respiring tissues

Question	Answer	Marks	Guidance
3(a)	J – liver ; K – gall bladder ; L – duodenum / small intestine ;	3	
3(b)	<p><i>hormones:</i> insulin ; glucagon ;</p> <p><i>enzymes:</i> amylase / carbohydrase ; trypsin / protease ; lipase ;</p>	5	<i>enzymes and hormones can be in any order in each column</i>

Question	Answer	Marks	Guidance
3(c)	<p><i>any three from:</i> active transport ; against a concentration gradient / from low concentration to high concentration ; protein changes shape to move (chloride) ions ; uses energy ; AVP ;</p>	3	e.g., ref. to carrier proteins
3(d)	<p><i>any three from:</i> idea of presence of chloride ions (in duct) decreases water potential ; (water moves by) <u>osmosis</u> ; down water potential gradient / from high water potential to low water potential ; (movement of water) through partially permeable membrane ;</p>	3	
3(e)(i)	parents of 5 and 7 / parents of people with cystic fibrosis / 2 and 3, do not have cystic fibrosis ; parents / 2 and 3 must be, heterozygous / carriers (of the mutant allele) ;	2	

Question	Answer	Marks	Guidance																							
3(e)(ii)	<p>1 correct parental genotype aa ; 2 correct parental genotype Aa ; 3 correct gametes from the parental genotypes ; 4 correct offspring genotypes from their gametes / parental genotypes (in any order) ; 5 correct offspring phenotypes and correct probability ;</p>	5	<p><i>MP1 and MP2 parents may be either way round but following rows must match</i></p> <p>ecf from MP1 <u>and</u> MP2 ecf from MP3</p> <p>ecf from MP4</p> <p>expected answer:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right; padding-right: 10px;"><i>parent 7 man who is heterozygous</i></td> <td style="border-bottom: 1px solid black;"></td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><i>parental genotypes</i></td> <td style="text-align: center; padding: 0 10px;">aa</td> <td style="text-align: center; padding: 0 10px;">×</td> <td style="text-align: center; padding: 0 10px;">Aa</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><i>gametes</i></td> <td style="text-align: center; padding: 0 10px;">a a</td> <td style="text-align: center; padding: 0 10px;">+</td> <td style="text-align: center; padding: 0 10px;">A a</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><i>offspring genotypes</i></td> <td style="text-align: center; padding: 0 10px;">Aa</td> <td style="text-align: center; padding: 0 10px;">(Aa)</td> <td style="text-align: center; padding: 0 10px;">aa</td> <td style="text-align: center; padding: 0 10px;">(aa)</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><i>offspring phenotypes</i></td> <td style="text-align: center; padding: 0 10px;">without cystic fibrosis</td> <td style="text-align: center; padding: 0 10px;">with cystic fibrosis</td> <td style="text-align: center; padding: 0 10px;"></td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><i>probability</i></td> <td style="text-align: center; padding: 0 10px;">50% / 1 in 2 / 0.5</td> <td style="text-align: center; padding: 0 10px;"></td> <td style="text-align: center; padding: 0 10px;">cystic fibrosis</td> </tr> </table>	<i>parent 7 man who is heterozygous</i>		<i>parental genotypes</i>	aa	×	Aa	<i>gametes</i>	a a	+	A a	<i>offspring genotypes</i>	Aa	(Aa)	aa	(aa)	<i>offspring phenotypes</i>	without cystic fibrosis	with cystic fibrosis		<i>probability</i>	50% / 1 in 2 / 0.5		cystic fibrosis
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<i>probability</i>	50% / 1 in 2 / 0.5		cystic fibrosis																							

Question	Answer	Marks	Guidance
4(a)	<p><i>any five from:</i></p> <p>1 protein, broken down / digested / decomposed, to amino acids ; 2 by decomposers / fungi / bacteria in terms (in context of breakdown of manure / protein) ; 3 ref to use of proteases ; 4 deamination (of amino acids / proteins) / described ; 5 production of, ammonia / ammonium ions / NH_3 / NH_4^+ ; 6 ammonium (ions), converted to, nitrite / nitrate (ions) / NO_3^- / NO_2^- ; 7 ref. to, <u>nitrification</u> / <u>nitrifying</u> bacteria ; 8 AVP ; e.g., nitrite to nitrate ions</p>	5	<i>points must be given in a correct context</i>
4(b)(i)	<p><i>any one from:</i></p> <p>farmers, do not have to add (nitrogen) fertiliser / use less fertiliser ; <i>idea of increased yield / more profit per hectare ;</i> (snap beans / beans / plants) grow, faster / better ;</p>	1	
4(b)(ii)	63 (%) ;;;	3	MP1 correct readings from graph: 96 and 156 MP2 correct answer calculated MP3 answer correctly rounded to two significant figures ecf MP2 and MP3 from wrong readings / calculation
4(b)(iii)	<p><i>any four from:</i></p> <p>1 breakdown / decomposition, of <u>manure</u> / AW ; 2 increase in (availability of named), ions (in streams/rivers) ; 3 (increased) growth of, (named) plants / producers / algae ; 4 increased competition for, light / AW ; 5 no photosynthesis causing death of, producers / plants / algae ; 6 increase in, (number of) bacteria / decomposers ; 7 respiration (by decomposers) reduces (dissolved) oxygen (leads to death of fish) ;</p>	4	

Question	Answer	Marks	Guidance
5(a)	<i>Widdringtonia</i> ;	1	
5(b)	<p><i>any three from:</i></p> <p>1 no roots, to absorb water / bind soil / hold soil together ; 2 <i>idea of:</i> no canopy / AW, to protect (soil) from rainfall ; 3 increase in run off / AW ; 4 ref. to soil erosion ; 5 loss of, mineral content / ions / nutrients / AW, in the soil ; 6 flooding (in the valleys) ; 7 landslides / mudslides ; 8 ref. to visual pollution / dead tree stumps / bare ground / AW ; 9 loss of biodiversity / disruption of food chains / disruption of food webs / (species) extinction ; 10 AVP ;</p>	3	
5(c)	<p>food source(s) ; nesting / breeding, sites ; shelter / shade / protection from predators ; leaf litter for decomposers ; ref. to nutrient cycling ; (named) resources for humans ; AVP ;</p>	2	
5(d)	<p><i>any two from:</i></p> <p>ref. to genetic, diversity / variation ;</p> <p><i>importance of genetic diversity:</i></p> <p>plants (grown from seeds) may be adapted to changes in the environment ; plants (grown from seeds) may be resistant to, diseases / pests ; (seeds collected) may not, be viable / germinate ; (seeds collected) may, be diseased / have parasites / AW ; (seeds collected) may have harmful, alleles / mutations ; AVP ; e.g., increase in fitness</p>	2	

Question	Answer	Marks	Guidance
6(a)	P – testis ; S – <u>zygote</u> ; Q – meiosis ; R – fertilisation ; T – mitosis ; U – implantation ;	6	
6(b)(i)	<i>idea of maintenance of the same number of chromosomes (from generation to generation) / so (diploid) number of chromosomes does not double at fertilisation (described) ;</i>	1	
6(b)(ii)	to prevent more than one sperm fertilising the egg / stops other sperm entering ;	1	
6(c)	1 diffusion / exchange ; 2 amino / fatty ; 3&4 ;; <i>max. two from:</i> glucose (named) vitamins (named) minerals / ions / salts glycerol fatty acids amino acids 5 passive ; 6 antigens ; 7 pathogen / (micro)organism ;	7	A fatty acids or amino acids only once, i.e. MP2 OR MP3/4



Cambridge IGCSE™

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **3** printed pages.

Question	Answer	Marks
1	D	1
2	D	1
3	C	1
4	C	1
5	C	1
6	D	1
7	B	1
8	D	1
9	C	1
10	A	1
11	C	1
12	B	1
13	D	1
14	C	1
15	C	1
16	D	1
17	B	1
18	A	1
19	C	1
20	A	1
21	B	1
22	D	1
23	D	1
24	C	1
25	A	1
26	B	1
27	C	1
28	A	1

Question	Answer	Marks
29	B	1
30	C	1
31	C	1
32	D	1
33	C	1
34	B	1
35	C	1
36	B	1
37	C	1
38	A	1
39	C	1
40	C	1



Cambridge IGCSE™

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of **12** printed pages.

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
- 5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark scheme abbreviations

- ; separates marking points
- / alternative responses for the same marking point
- R reject the response
- A accept the response
- I ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- () the word / phrase in brackets is not required but sets the context

Question	Answer	Marks	Guidance																				
1(a)(i)	reptiles <i>and</i> amphibians ;	1																					
1(a)(ii)	<p><i>one mark per row:</i></p> <table border="1"> <thead> <tr> <th>feature</th> <th>fish</th> <th>mammals</th> <th>birds</th> </tr> </thead> <tbody> <tr> <td>organ involved in gas exchange</td> <td>gills</td> <td>lungs</td> <td>lungs</td> </tr> <tr> <td>circulatory system</td> <td>single</td> <td>double</td> <td>double</td> </tr> <tr> <td>body covering</td> <td>scales</td> <td>fur</td> <td>feathers</td> </tr> <tr> <td>presence of external ears (pinnae)</td> <td>no</td> <td>yes</td> <td>no</td> </tr> </tbody> </table> ;	feature	fish	mammals	birds	organ involved in gas exchange	gills	lungs	lungs	circulatory system	single	double	double	body covering	scales	fur	feathers	presence of external ears (pinnae)	no	yes	no	3	
feature	fish	mammals	birds																				
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1(b)(i)	(net) movement of particles, from a region of their higher concentration to a region of their lower concentration / down a concentration gradient ; as a result of their <u>random</u> movement ;	2																					
1(b)(ii)	<i>any one from:</i> large surface (area) / AW ; thin ;	1																					
1(c)(i)	nitrate (ions) / sewage / fertilisers / AVP ;	1																					
1(c)(ii)	$15^{\circ}\text{C} - 8.9 \pm 0.1 \text{ (mg per dm}^3\text{)}$ and $25^{\circ}\text{C} - 7.3 \pm 0.1 \text{ (mg per dm}^3\text{)}$; $2.35 \pm 0.05 \text{ (\mu m)}$ and $1.95 \pm 0.05 \text{ (\mu m)}$; $(-)0.4 \text{ (in } \mu\text{m)}$;	3	ecf from readings in MP1 for MP2 and MP3																				

Question	Answer	Marks	Guidance
2(a)	<p>selection of suitable letter and case for alleles, e.g. R and r ;</p> <p><i>parental phenotypes:</i> red fruit x red fruit</p> <p>parental genotypes: Rr ; x Rr ;</p> <p>gametes: R r x R r ;</p> <p>offspring genotypes: (1)RR and (2)Rr and (1)rr ;</p> <p>expected ratio: 3 (red fruit) : 1 (yellow fruit) ;</p>	6	
2(b)	(perform a) test cross ;	1	
2(c)(i)	<p><i>any two from:</i></p> <p>ref. to photosynthesis ;</p> <p>transfers light <u>energy</u> into chemical energy ;</p> <p>to make, carbohydrates / glucose / starch / AW ;</p>	2	
2(c)(ii)	magnesium ;	1	
2(c)(iii)	<p><i>any three from:</i></p> <p>1 chlorophyll concentration decreases in both ;</p> <p>2 lycopene concentration increases in both ;</p> <p>3 (lycopene) increases from zero (in unripe fruit) ;</p> <p>4 ref to lycopene change being much larger than chlorophyll change / AW ;</p> <p>5 comparative data quote to support observations (with units used at least once) ;</p> <p>6 AVP ;</p>	3	
2(d)(i)	DNA ;	1	

Question	Answer	Marks	Guidance
2(d)(ii)	<i>any two from:</i> cross-breeding with wild populations of plants ; expensive ; (named) unknown long-term effects (on the environment / populations) ; ethical considerations with manipulating ‘nature’ ; AVP ;	2	

Question	Answer	Marks	Guidance
3(a)(i)	<i>any three from:</i> protease / trypsin / pepsin ; chemical) digestion ; (protein) digested to amino acids ; insoluble to soluble molecules ;	3	
3(a)(ii)	<i>any four from:</i> enzymes have, a specific shape / complementary shape to substrate ; correct ref. to active site ; 30°C is optimum temperature ; above 50 °C (these) enzymes denature ; ref. to active site changing (shape) ; (below 30 °C,) less kinetic energy / lower frequency of effective collisions (between substrate and enzyme) ; ora	4	

Question	Answer	Marks	Guidance
3(b)	<p><i>any four from:</i> <u>emulsification</u> ; increased surface area of fat (globules) ; faster, digestion / breakdown (of fat) ; by <u>lipase</u> / to fatty acids <u>and</u> glycerol ; neutralises, (stomach) acid / chyme / gastric juice ; alters / increases, pH for (pancreatic / intestinal) enzymes / AW ; denatures, pepsin / stomach, enzymes ; AVP ;</p>	4	

Question	Answer	Marks	Guidance
4(a)	bacteria ;	1	
4(b)(i)	<p><i>any one from:</i> weakened / dead / AW, bacteria / pathogen ; antigen(s) (of the pathogen) ; AVP ;</p>	1	
4(b)(ii)	<p><i>any three from:</i> <i>idea that</i> the immune response takes time to occur ; lymphocytes release antibodies ; ref. to (lymphocytes) produce specific antibodies to the (cholera) antigens / AW ; <u>memory</u> cells (form) ; long-term immunity ;</p>	3	
4(b)(iii)	<p><i>idea that</i> they did not have (active) immunity / memory cells before the start of the study / AW ;</p>	1	

Question	Answer	Marks	Guidance
4(b)(iv)	<p><i>any two from:</i> more, pathogens / diarrhoea / fever, in non-vaccinated group ; ora some vaccinated people did get symptoms so vaccine not 100% effective ; ora comparative data quote between vaccinated and not vaccinated ; AVP ;</p>	2	
4(c)(i)	<p><i>any four from:</i> cholera / pathogen, releases toxin ; (toxin) causes (more) chloride released (into small intestine) ; lowering water potential (in lumen) ; ref. to, osmosis / movement of water (into the lumen) ; (diarrhoea is) loss of watery faeces ; loss of salts / loss of minerals / dehydration ;</p>	4	
4(c)(ii)	<p><i>any two from:</i> <u>oral rehydration therapy</u> ; drink mixture of, sugar / nutrients and, salt / ions ; replace lost, water / fluids ; AVP ;</p>	2	

Question	Answer	Marks	Guidance
5(a)	<p><i>any four from:</i> valves in, heart / (main) veins ; correct sequence, of open / closing, of valves ; prevention of backflow / description ; semi-lunar valves ; atrioventricular valves ; heart, pumping / contracting ; AVP ;</p>	4	

Question	Answer			Marks	Guidance																				
5(b)	<p>one mark per row:</p> <table border="1"> <thead> <tr> <th>function</th><th>type of blood vessel</th><th>letter on Fig. 5.1</th></tr> </thead> <tbody> <tr> <td>regulates blood flow by constricting and dilating</td><td>arteriole / artery</td><td>P N</td></tr> <tr> <td>collects blood from a network of the narrowest blood vessels</td><td>venule</td><td>K</td></tr> <tr> <td>withstands the highest blood pressure</td><td>artery</td><td>N</td></tr> <tr> <td>allows the transfer of substances to and from tissue fluid</td><td>capillary</td><td>J</td></tr> <tr> <td>transports blood towards the heart</td><td>vein / venule</td><td>M K</td></tr> <tr> <td>redirects blood under the surface of the skin</td><td>shunt vessel</td><td>L</td></tr> </tbody> </table>	function	type of blood vessel	letter on Fig. 5.1	regulates blood flow by constricting and dilating	arteriole / artery	P N	collects blood from a network of the narrowest blood vessels	venule	K	withstands the highest blood pressure	artery	N	allows the transfer of substances to and from tissue fluid	capillary	J	transports blood towards the heart	vein / venule	M K	redirects blood under the surface of the skin	shunt vessel	L	<p>;</p> <p>;</p> <p>;</p> <p>;</p> <p>;</p> <p>;</p>	6	
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5(c)	<p><u>renal artery</u> ; <u>coronary artery</u> ;</p>	<p>;</p>	2																						

Question	Answer	Marks	Guidance
5(d)	<p><i>any four from:</i></p> <p>stent ; (small) mesh / gauze, tube inserted in artery ; opens / supports, (narrow / weak) artery ; (balloon) angioplasty / dilatation ; (tube / catheter with) balloon inserted into artery ; inflate balloon to widen artery ; by-pass ; (another / shunt) blood vessel, joined to / grafted to / replaces, artery ; AVP ; e.g. aspirin / warfarin / ref to treatment of clots</p>	4	A blood vessel for artery throughout

Question	Answer	Marks	Guidance
6(a)	<p><i>any three from:</i></p> <p>loss of biodiversity / AW ; habitat destruction ; damage to, food chains / food webs ; soil erosion ; by, water / wind ; infertility of soil ; competition for resources ; ref to pollution ; AVP ;; e.g. desertification / flooding / diseases or pests spreading to wild-varieties / migration (of species)</p>	3	
6(b)	<p><i>any two from:</i></p> <p>more / number / amount (of), fruits / seeds / kernels ; size of, fruits / seeds / kernels ; ref. to colour (of, fruits / seeds / kernels / cobs) ; length / size / width, of cobs ; ref. to arrangement of, fruits / seeds / kernels ;</p>	2	
6(c)(i)	to prevent (natural) pollination / AW ;	1	

Question	Answer	Marks	Guidance
6(c)(ii)	<i>any two from:</i> aerobic respiration ; for energy ; for growth ;	2	
6(c)(iii)	the plants may be heterozygous ; recessive traits only visible if plants are homozygous ;	1	
6(c)(iv)	<i>any two from:</i> reduce variation (in a population) / create uniformity ; become more homozygous ; to, improve / maintain, the desirable feature ; produce more seeds ; AVP ; e.g. ensure trait continues on subsequent generations / to ensure no other alleles are present / does not result in unforeseen effects	2	
6(c)(v)	mutation(s) ;	1	



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1	D	1
2	A	1
3	D	1
4	C	1
5	C	1
6	B	1
7	B	1
8	A	1
9	C	1
10	D	1
11	B	1
12	D	1
13	A	1
14	B	1
15	C	1
16	A	1
17	B	1
18	B	1
19	C	1
20	C	1
21	A	1
22	A	1
23	A	1
24	C	1
25	D	1
26	C	1
27	D	1
28	D	1

Question	Answer	Marks
29	A	1
30	C	1
31	B	1
32	D	1
33	D	1
34	B	1
35	D	1
36	B	1
37	C	1
38	A	1
39	C	1
40	C	1



Cambridge IGCSE™

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of 13 printed pages.

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
- 5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer			Marks	Guidance												
1(a)(i)	prokaryote / plant ;			1													
1(a)(ii)	<table border="1"> <tr> <td>cell function</td> <td>cell structure</td> <td>letter from Fig. 1.1</td> </tr> <tr> <td>storage of genes</td> <td>nucleus</td> <td>G</td> </tr> <tr> <td>aerobic respiration</td> <td>mitochondria</td> <td>E</td> </tr> <tr> <td>amino acids are assembled to make protein</td> <td>ribosome(s) OR (rough) endoplasmic reticulum / (R)ER</td> <td>H/F F</td> </tr> </table>			cell function	cell structure	letter from Fig. 1.1	storage of genes	nucleus	G	aerobic respiration	mitochondria	E	amino acids are assembled to make protein	ribosome(s) OR (rough) endoplasmic reticulum / (R)ER	H/F F	3	one mark per row
cell function	cell structure	letter from Fig. 1.1															
storage of genes	nucleus	G															
aerobic respiration	mitochondria	E															
amino acids are assembled to make protein	ribosome(s) OR (rough) endoplasmic reticulum / (R)ER	H/F F															
1(b)(i)	0.002 (mm) ;			1													
1(b)(ii)	length of, drawing / image / Fig. 1.2 (in mm) ;			1													

Question	Answer	Marks	Guidance																
1(c)	<p><i>total of six from:</i></p> <p><i>similarities, max four from:</i> single cell / unicellular / AW ; (cell) wall / A ; cytoplasm / D ; ribosomes / H ; cell membrane / B ; DNA / genetic material ;</p> <p><i>differences, max four from: ;;;;</i></p> <table border="1"> <tr> <td>(bacteria have)</td><td>(yeast have)</td></tr> <tr> <td>no nucleus / no G / has nucleoid</td><td>nucleus / G</td></tr> <tr> <td>loop / coil / AW, of DNA</td><td>linear DNA / chromosome</td></tr> <tr> <td>no, (rough) endoplasmic reticulum / ER</td><td>(rough) endoplasmic reticulum</td></tr> <tr> <td>no mitochondria / no E</td><td>mitochondria / E</td></tr> <tr> <td>no (large / permanent) vacuole / no C</td><td>(large / permanent) vacuole / C</td></tr> <tr> <td>plasmid(s)</td><td>no plasmids</td></tr> <tr> <td>no membrane-bound, cell structures / organelles</td><td>membrane-bound, cell structures / organelles</td></tr> </table>	(bacteria have)	(yeast have)	no nucleus / no G / has nucleoid	nucleus / G	loop / coil / AW, of DNA	linear DNA / chromosome	no, (rough) endoplasmic reticulum / ER	(rough) endoplasmic reticulum	no mitochondria / no E	mitochondria / E	no (large / permanent) vacuole / no C	(large / permanent) vacuole / C	plasmid(s)	no plasmids	no membrane-bound, cell structures / organelles	membrane-bound, cell structures / organelles	6	
(bacteria have)	(yeast have)																		
no nucleus / no G / has nucleoid	nucleus / G																		
loop / coil / AW, of DNA	linear DNA / chromosome																		
no, (rough) endoplasmic reticulum / ER	(rough) endoplasmic reticulum																		
no mitochondria / no E	mitochondria / E																		
no (large / permanent) vacuole / no C	(large / permanent) vacuole / C																		
plasmid(s)	no plasmids																		
no membrane-bound, cell structures / organelles	membrane-bound, cell structures / organelles																		

Question	Answer	Marks	Guidance
1(d)	1 = nitrogen fixation ; 2 = deamination ; 3 = nitrification ;	3	

Question	Answer	Marks	Guidance
2(a)	<i>any four from:</i> quantity of plastic waste always higher inside GPGP than outside it ; ora quantity inside GPGP constant (from 1965) to, any year 1975 to 1994 ; quantity increases in GPGP, steeply ; smaller (overall) increase outside the GPGP ; ora quantity of plastic waste outside the GPGP, fluctuates / AW ; comparative data quote with years and unit ;	4	
2(b)(i)	<i>any one from:</i> leathery / hard / scaly, skin ; hard(er) / rubbery / leathery / AW, eggs ; lay eggs on land (not in water) ; internal fertilisation ;	1	

Question	Answer	Marks	Guidance
2(b)(ii)	<p><i>any four from:</i></p> <p><i>direct effects</i> (non-biodegradable plastic) does not break down ; <i>idea that</i> ability to breathe affected ; <i>idea that</i> ability to move affected ; <i>idea that</i> ability to gain nutrition affected ; damage / injury / infection / death ; toxic / poisonous ;</p> <p><i>indirect effects</i> blocks (sun)light, so algae / plants / producers, cannot photosynthesise ; (so) less, food / energy, enters, food chains / food webs ; loss of (named), habitat / feeding / breeding area ; more likely to be predated ; <i>idea that</i> (plastic) accumulates up the food chain / bioaccumulation ;</p> <p>AVP ;</p>	4	
2(b)(iii)	<p><i>any two from:</i></p> <p>use (named) alternatives for plastic ; reduce, use of / manufacture, single-use plastic ; use biodegradable plastics instead of non-biodegradable plastics ; reduce unnecessary packaging ; reuse plastic product(s) ; recycle / described ; education / awareness campaigns ; AVP ; e.g. idea of fines / punishment, for unregulated disposal of plastic waste / legislation / taxation / charging for using plastic / money-back schemes / quotas or limits for production / international treaties</p>	2	

Question	Answer	Marks	Guidance
3(a)	<i>any three from:</i> (small so do) not need much space ; rapid reproduction rate / AW ; can make complex molecule(s) ; no ethical concerns over use ; <i>idea that</i> genetic code is universal ; they have plasmids ; <i>idea that</i> plasmids are used, as vectors / in genetic engineering ; simple requirements / AW, so, easy / cheap, to grow ; AVP ;	3	
3(b)(i)	pancreas ;	1	
3(b)(ii)	(type 1) diabetes ;	1	
3(b)(iii)	reduces blood sugar concentration ;	1	
3(c)(i)	1 y-axis = number / population, of (living) bacteria per (1.0) mm ³ and 2 x-axis = time / hours / days ;	1	
3(c)(ii)	P – <u>lag</u> Q – exponential / <u>log</u> R – stationary S – death / decline	2 ;;	four correct = 2 marks two or three correct = 1 mark one correct = 0
3(c)(iii)	<i>any three from:</i> limiting factor(s) / factors that limit ; not enough space / overpopulation ; competition ; fewer / no, (named) nutrient(s) / food ; not enough oxygen ; change in pH / increase in acidity ; increase in temperature ; build-up of, (named) toxic / waste, substances ;	3	

Question	Answer	Marks	Guidance
3(d)	<p><i>total of three from:</i></p> <p><i>importance of iron to max 2</i> to make / for, haemoglobin ; to make / for, red blood cells ; for transport of oxygen ; AVP ;</p> <p><i>effects of iron deficiency</i> (iron-deficiency) anaemia ; any symptom of anaemia ;</p>	3	
3(e)(i)	<u>restriction</u> (enzyme) ;	1	
3(e)(ii)	<p><i>any two from:</i></p> <p>use <u>same</u> (restriction) enzyme to cut cassava DNA ; sticky ends are, formed / joined ; ref. to complementary, ends / base pairs ; (joined by) ligase ;</p>	2	
3(e)(iii)	<p><i>any two from:</i></p> <p><i>idea that</i> need to check that offspring inherit ‘new’ gene / trait ; ensure new (GM) variety can grow in field conditions / AW ; make sure the ‘new’ gene does not cause any adverse effects ; make sure (GM) plants have, the same / a high enough, yield ; <i>idea of</i> building up a large quantity of, seed / plants, to sell to farmers ; AVP ;</p>	2	

Question	Answer	Marks	Guidance
4(a)	gravitropism ;	1	
4(b)	<p><i>idea of</i> negating the effect of gravitational pull / gravity, on one side of the plant (only) ; (used as a control) to compare with (the response of) plant B ;</p>	2	

Question	Answer	Marks	Guidance
4(c)(i)	auxin ;	1	
4(c)(ii)	<i>any three from:</i> (auxin / hormone produced in the tip) moves / diffuses, away from tip / down the, stem or shoot or plant ; moves to / collects on, one / lower side (of stem / plant) ; stimulates <u>cell</u> elongation ; stem / plant, bends / grows / turns, upwards ; AVP ;	3	
4(d)	<i>any three from:</i> reach light for photosynthesis ; (reach air for) carbon dioxide for photosynthesis ; (reach air for) oxygen for respiration ; <i>idea that they grow tall so that flowers are exposed for, (wind / insect)</i> pollination ; AVPs e.g. roots grow downwards / towards (direction of) gravity ; to reach, water / ions or minerals ; to anchor plant in the soil ;	3	

Question	Answer	Marks	Guidance
5(a)	lumen or wall of left or right oviduct labelled Q ; area of uterus with darkest shading labelled R ; ovary labelled S ; vagina labelled T ;	4	
5(b)(i)	<i>any three from:</i> ref. to making new cells after fertilisation ; making membranes ; (protein for) making enzymes ; making new, (named) cell structures / cytoplasm ; (fat / protein) provide / source of, energy ; energy for, cell division / mitosis / growth (of cell) / metabolism / AW ;	3	

Question	Answer	Marks	Guidance
5(b)(ii)	<i>any two from:</i> hardens / changes, after fertilisation / entry of sperm ; prevents more sperm entering ; AVP ;	2	
5(c)	<i>any four from:</i> chromosomes / DNA, duplicate(s) / replicate(s) ; chromosomes separate ; mitosis / nuclear division ; (zygote / fertilised egg) divides / splits (into two) ; (nuclear / cell) division / mitosis, repeated / AW ; forming a, ball / cluster, of cells ; cells are genetically identical ; AVP ; e.g. cell, specialisation / differentiation / ref. to stem cells	4	

Question	Answer	Marks	Guidance
6(a)(i)	<i>any two from:</i> ref. to <u>passive immunity</u> ; <i>idea of immediate / fast, protection / response / AW</i> ; AVP ; e.g. idea that gives time for immune system to produce own, antibodies / antitoxins	2	
6(a)(ii)	<i>any three from:</i> ref. to <u>active immunity</u> ; (more) memory cells are produced ; long-term, immunity / protection ; after second injection higher concentration of antibodies than passive immunity ; reduces the chance of catching the disease (again) / AW ; response to second injection is, <u>faster</u> / <u>greater</u> , than first ; AVP ;	3	

Question	Answer	Marks	Guidance
6(b)	<p><i>any four from:</i> pathogens have antigens ; antibodies, lock on to, antigens / pathogens ; antibody is <u>specific</u> (to antigen / pathogen) ; antibody has a complementary (shape) to antigen / AW ; antibody marks pathogen for, destruction by phagocytes / phagocytosis ; antibodies destroy pathogens / described ; AVP ;</p>	4	
6(c)	<p><i>any two from:</i> absorbs / transports, fat / fatty acids (and glycerol from lacteals) ; drains / AW, tissue fluid ; returns, fluid / lymph, to, blood / plasma ; AVP ;</p>	2	



Cambridge IGCSE™

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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This document consists of **3** printed pages.

Question	Answer	Marks
1	D	1
2	B	1
3	D	1
4	C	1
5	A	1
6	D	1
7	A	1
8	B	1
9	D	1
10	D	1
11	A	1
12	D	1
13	B	1
14	A	1
15	D	1
16	D	1
17	D	1
18	D	1
19	A	1
20	B	1
21	C	1
22	B	1
23	D	1
24	D	1
25	C	1
26	A	1
27	A	1

Question	Answer	Marks
28	B	1
29	A	1
30	D	1
31	B	1
32	B	1
33	B	1
34	B	1
35	A	1
36	A	1
37	C	1
38	A	1
39	D	1
40	C	1



Cambridge IGCSE™

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 80

Published

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5 'List rule' guidance

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- Any response marked *ignore* in the mark scheme should not count towards ***n***.
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Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

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For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- R reject
- I mark as if this material was not present
- A accept (a less than ideal answer which should be marked correct)
- AW alternative wording (accept other ways of expressing the same idea)
- underline words underlined (or grammatical variants of them) must be present
- max indicates the maximum number of marks that can be awarded
- ecf credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- ora or reverse argument
- AVP any valid point

Question	Answer	Marks	Guidance
1(a)	osmosis ; solvent ;	2	
1(b)	<i>drawing with:</i> arrow showing water movement into cell ; <i>max. two from:</i> no space between cell membrane and cell wall ; cell wall, slightly bent outwards / straight ; vacuole larger in proportion than in Fig 1.1 ;	3	
1(c)	wilting ; lack of turgor pressure (at the end of the week) ; ora no longer a push against cell wall / AW ; ora (mesophyll) cells not providing support / cell collapses / AW ; (lack of water means cells become) <u>flaccid</u> / <u>plasmolyse</u> ;	3	

Question	Answer	Marks	Guidance
2(a)	<p>Q / pathogen, are recognized as foreign ; Q / pathogen, will have specific / unique / AW, antigen ; S and R are white (blood) cells ; S / lymphocytes, make <u>antibodies</u> ; T are antibodies ; T / antibodies are as specific shape / complementary to, antigen / pathogen / Q ; T / antibodies bind to, antigen / pathogen / Q ; ref. to forming memory cells ; ref. to, active / long-term, immunity ; R / phagocytes, engulf, pathogens / antigens ; R / phagocytes, have enzymes / digest pathogens OR antigens ; AVP ;</p>	6	
2(b)	<p><i>support of conclusion:</i> general decrease, from 1942 / vaccination ; cases do not return to pre-vaccine levels / AW ; no cases from 1974 ;</p> <p><i>against conclusion:</i> number of cases increased, (during the 2 years) after the vaccine was introduced / until government made its conclusion ; took 32 years after vaccine introduced before no cases of disease ; but there are (small) peaks (in cases) / fluctuation (in cases) ;</p> <p>comparative data quote ;</p>	4	
3(a)(i)	<p><i>any one from:</i> nucleus ; membrane-bound (named) organelle / has internal membranes ; vesicles ; no cell wall ;</p>	1	
3(a)(ii)	(cell) membrane ; controls what, enters / leaves, the cell ;	2	

Question	Answer	Marks	Guidance																		
3(a)(iii)	diffusion (through cell membrane / A) ;	1																			
3(b)	<i>any three from:</i> breakdown of (excess) amino acids ; (by) deamination ; removal of nitrogen containing part (of amino acid) ; in the liver ;	3																			
3(c)(i)	X marked on either kidney in the outer / edge region ;	1																			
3(c)(ii)	<table border="1"> <thead> <tr> <th>function</th> <th>name of structure</th> <th>letter from Fig. 3.2</th> </tr> </thead> <tbody> <tr> <td>organ that stores urine</td> <td>bladder</td> <td>G ;</td> </tr> <tr> <td>tube that carries urine out of the kidney</td> <td>ureter</td> <td>F ;</td> </tr> <tr> <td>blood vessel with the lowest concentration of urea</td> <td>renal vein</td> <td>D ;</td> </tr> <tr> <td>blood vessel with the lowest concentration of carbon dioxide</td> <td>renal artery</td> <td>E ;</td> </tr> <tr> <td>tube that carries urine out of the body</td> <td>urethra</td> <td>H ;</td> </tr> </tbody> </table>	function	name of structure	letter from Fig. 3.2	organ that stores urine	bladder	G ;	tube that carries urine out of the kidney	ureter	F ;	blood vessel with the lowest concentration of urea	renal vein	D ;	blood vessel with the lowest concentration of carbon dioxide	renal artery	E ;	tube that carries urine out of the body	urethra	H ;	5	one mark per correct row
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organ that stores urine	bladder	G ;																			
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blood vessel with the lowest concentration of carbon dioxide	renal artery	E ;																			
tube that carries urine out of the body	urethra	H ;																			
3(d)(i)	<i>any two from:</i> sweat more / lost more water (while running) ; do not drink as much / reduced intake of water (while running) ; ref. to homeostasis / negative feedback ; AVP ;	2																			

Question	Answer	Marks	Guidance
3(d)(ii)	9(%) ;;;	3	MP1 correct values selected i.e. 78.2 and 85.6 MP2 correct calculation MP3 correct rounding to one significant figure ecf for MP2 and MP3 for incorrect MP1
3(d)(iii)	<i>any three from:</i> salts are in the blood / move from the blood into the tubule / AW ; ref. to glomerulus ; (ultra)filters / allows through ; pores / gaps, in capillary wall / narrow capillaries ; small molecules are filtered / large are not filtered / AW ; (some salt) reabsorption ; ref. to active transport / diffusion ; excess (salt) remains in the, urine / filtrate ; AVP ;	3	
3(e)	<i>any one from:</i> fibrinogen / fibrin ; (named) hormone ; antibodies ;	1	

Question	Answer	Marks	Guidance
4(a)(i)	<i>any three from:</i> large / obvious / AW, petals / sepals ; anthers / stigmas, inside flower ; filaments are stronger / thicker / AW ; pollinators must touch anthers, to reach nectar / AW ; sticky stigma ; pollen, large ; pollen, sticky / spiky ; AVP ; honey guides / landing platforms / mimic insects	3	
4(a)(ii)	anther ;	1	A stamen
4(a)(iii)	meiosis / reduction division ;	1	
4(a)(iv)	<i>any one from:</i> so that diploid number restored (after fertilisation) / AW ; to enable sexual reproduction ; (so that the offspring) are genetically different / to allow variation ;	1	
4(b)(i)	<i>any five from:</i> pollen transferred to stigma ; ref to (pollen) <u>tube</u> ; (pollen) tube, growth / germination ; (pollen tube grows) down style ; (pollen tube) enters ovule ; (ovule is) in the ovary / carpel ; pollen / male, <u>nucleus</u> fuses with ovule / female, <u>nucleus</u> ; ref. to fertilisation ; to form zygote ; (zygote divides by) mitosis to form an embryo ; AVP ; e.g. (fertilised) ovule becomes the seed	5	MP4 A pollen nucleus moves down style

Question	Answer	Marks	Guidance
4(b)(ii)	<p><i>any two from:</i></p> <p>allows, variation / genetic diversity ; plant more likely to survive (named) environmental change ; resistance to disease ; (ability to) evolve ; ref. to fitness ; AVP ;</p>	2	
4(c)(i)	<p><i>any one from:</i></p> <p>grow, GM / wild varieties, in glasshouses ; cover flowers ; remove stamens ; plant another species around the crop ; make a large, gap / wall, around the field ; use sterile GM plants ; grow female plants (only) ; AVP ;</p>	1	MP1 A isolate plants
4(c)(ii)	<p><i>any two from:</i></p> <p>confer resistance, to a (named) factor ; provide additional, nutrients / AW (to humans) ; improved, shelf life / flavour / yield / AW ; environmental protection idea A less use of pesticides / pollution ; AVP ;</p>	2	

Question	Answer	Marks	Guidance
5(a)	<p><i>calcium:</i> (formation of) bones ; (formation of) teeth ; prevents rickets ; AVP ;</p> <p><i>protein:</i> repair, cells / tissues ; growth ; used to make, muscle / enzyme / antibodies / protein, channels / carrier ; prevents marasmus ; AVP ;</p>	4	max. three from either section
5(b)	<i>any two from:</i> salivary glands ; stomach ; pancreas ; small intestine / named part of small intestine ;	2	
5(c)(i)	kills, bacteria / microorganisms / pathogens ;	1	
5(c)(ii)	<i>any two from:</i> (heat) <u>denatures</u> enzymes ; so lactose, not broken down / not digested ; changes shape of <u>active site</u> ; enzyme will not fit substrate ;	2	MP2 A not optimum temperature, for digestion / AW
5(c)(iii)	lactase ;	1	

Question	Answer	Marks	Guidance
5(c)(iv)	<i>any one from:</i> can reuse the enzyme ; cheaper ; no enzymes left in milk ; so milk does not need to be purified ; AVP ; e.g. enzymes more stable / less likely to denature / affects taste / drinking the enzyme might trigger allergies	1	ora throughout
5(d)(i)	<i>any four from:</i> contains antibodies / ref. to colostrum / provides protection against, pathogens / diseases / microorganisms ; provides passive immunity ; nutrient requirements met / change with age / change with development ; easy to digest / AW ; no additives / less risk of allergies ; sterile / less risk of infection / AW ; is at, body / correct, temperature ; no preparation / always available / convenient ; bonding with mother / AW ; free / cheap ; idea of volume is controlled / no over-feeding ; AVP ;	4	
5(d)(ii)	<i>any two from:</i> water needed to, produce breast milk / stay hydrated / AW ; alcohol can pass to the baby in breast milk / AW ; alcohol can harm / delay development of, baby / AW ; AVP ;	2	
6(a)	(the ability to) detect <u>stimuli</u> (in the internal / external environment) ; to make (appropriate) responses ;	2	
6(b)(i)	groups of receptor cells ; responding to specific stimuli ;	2	

Question	Answer		Marks	Guidance
6(b)(ii)	action	structure	3	
	relaxes	circular muscles (of the iris) ;		
	contracts	radial muscles (of the iris) ;		
	widens	pupil ;		



Cambridge IGCSE™

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 40

Published

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This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **3** printed pages.

Question	Answer	Marks
1	D	1
2	A	1
3	D	1
4	A	1
5	A	1
6	B	1
7	B	1
8	B	1
9	D	1
10	C	1
11	C	1
12	C	1
13	C	1
14	B	1
15	A	1
16	B	1
17	C	1
18	B	1
19	C	1
20	C	1
21	B	1
22	B	1
23	A	1
24	C	1
25	D	1
26	D	1
27	B	1
28	A	1

Question	Answer	Marks
29	D	1
30	B	1
31	B	1
32	C	1
33	B	1
34	C	1
35	C	1
36	A	1
37	B	1
38	B	1
39	A	1
40	C	1



Cambridge IGCSE™

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 80

Published

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This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

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GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance (see examples below)

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (*a*) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

mark scheme abbreviations

- ; separates marking points
- / alternatives
- **R** reject
- **A** accept (for answers correctly cued by the question, or guidance for examiners)
- **I** ignore as irrelevant
- **AW** alternative wording (where responses vary more than usual)
- **AVP** alternative valid point
- **ora** or reverse argument
- underline actual word given must be used by candidate (grammatical variants excepted)

Question	Answer	Marks																	
1(a)	<p>one mark for each column:</p> <table border="1"> <thead> <tr> <th colspan="2">diaphragm</th> <th colspan="2">intercostal muscles</th> <th rowspan="2">pressure change in the thorax</th> </tr> <tr> <th>internal</th> <th>external</th> <th>breathing in</th> <th>contract</th> <th>relax</th> <th>contract</th> <th>decreases (A increases)</th> </tr> </thead> <tbody> <tr> <th>breathing out</th> <th>relax</th> <th>contract / relax</th> <th>relax</th> <th>increases (A decreases)</th> </tr> </tbody> </table>	diaphragm		intercostal muscles		pressure change in the thorax	internal	external	breathing in	contract	relax	contract	decreases (A increases)	breathing out	relax	contract / relax	relax	increases (A decreases)	4
diaphragm		intercostal muscles		pressure change in the thorax															
internal	external	breathing in	contract		relax	contract	decreases (A increases)												
breathing out	relax	contract / relax	relax	increases (A decreases)															
1(b)	<p>any two from:</p> <p>thin / short distance (for diffusion) ;</p> <p>well supplied by blood / surrounded by capillaries / AW ;</p> <p>good ventilation with air ;</p>	2																	
1(c)(i)	<p>a group of cells with similar structures ;</p> <p>working together to perform a shared function ;</p>	2																	
1(c)(ii)	<p>any two from:</p> <p>forms incomplete rings around, trachea / bronchi ;</p> <p>keeps (named) airways open ;</p> <p>reduces resistance to movement of air ;</p> <p>protects (named) airways ;</p> <p>sound production in larynx ;</p>	2																	

Question	Answer			Marks
2(a)	<i>one mark per row:</i>	substance	enzyme	product(s)
	starch	amylase	maltose / glucose / (simple) sugar(s)	
	fat	lipase	fatty acid(s) and glycerol	
	protein	protease / pepsin / trypsin	amino acids	
				;;;

Question	Answer	Marks
2(b)	<p><i>any four from:</i> biological washing powder is more effective, at lower temperatures / between 10 °C and 40 °C / 10 °C and 43 °C ; comparative data quote for the difference at a stated temperature ; biological washing powder removes all stain between 30 °C and 40 °C ; non-biological removes all stain only at 60 °C ; effectiveness is similar, at high temperatures / between 50 and 60 °C ; same trend, below 30 °C / at low temperatures / from 50 °C ; <i>idea of effectiveness of biological washing powder decreases between 40 °C and 44 °C, no such decrease for non-biological washing powder ;</i></p>	4
2(c)	<p><i>any two from:</i> <u>active site</u> changes shape ; substrate no longer fits into, enzyme / active site ; no enzyme-substrate complex / no successful collisions ;</p>	2

Question	Answer	Marks
2(d)	<i>any two from:</i> individual people have, different / unique, DNA ; DNA has genes or alleles have, sequences of bases ; AVP ;	2

Question	Answer	Marks
3(a)(i)	<i>any three from:</i> blue at time 0 indicates no glucose present ; ensures that no glucose on outer surface of dialysis tubing / in water, as a result of an error ; green / yellow / red, indicates presence of glucose ; glucose, diffuses / moves, out of dialysis tubing / into water ; (movement is) <u>down the concentration gradient</u> / high to low concentration ; dialysis tubing is permeable to glucose ; AVP ;	3
3(a)(ii)	<i>idea that</i> (Benedict's solution) changes colour quicker / gives more intense colour / AW ;	1
3(b)	A are microvilli ; <i>function:</i> allow movement of substances into the cell / increase surface area for absorption by diffusion OR active transport / have proteins in the membrane for active transport ; B is the (rough) endoplasmic reticulum / (R)ER ; <i>function:</i> site of protein synthesis / modify proteins / assemble amino acids in a specific sequence to make (named) protein ; C is a mitochondrion ; <i>function:</i> <u>aerobic respiration</u> / provides energy for (named) cell process(es) ;	6
3(c)(i)	<u>chloride</u> ;	1

Question	Answer	Marks
3(c)(ii)	<i>any four from:</i> loss of water ; by osmosis / down water potential gradient ; diarrhoea ; dehydration ; loss of other, (named) ions / salt(s) ; AVP ;	4

Question	Answer	Marks
4(a)(i)	<i>Sorghum</i> ;	1
4(a)(ii)	feathery stigma / stigma with large surface area ; stigma / anthers, hang outside the flower(s) ;	2
4(b)(i)	C ovary (wall) ; D ovule ; E style ;	3
4(b)(ii)	meiosis / reduction division ; haploid ; fuses / joins / combines ; diploid ; fertilisation ; zygote ; mitosis ;	7

Question	Answer	Marks
4(c)	<p><i>any five from:</i></p> <p>(gives) genetic variation / diversity ; ref to, alleles / genes / DNA, from different, plants / parents ; allows mutations to be, expressed / AW ; allows adaptation to, new conditions / changed environment / AW ; (new species) can evolve / allows natural selection to occur ; pollen exchanged between individuals / cross pollination ; seeds are dispersed ; can colonise new areas / AW ; less competition (with parent plant / among offspring) ; seeds may be dormant ; survival through, harsh / adverse, conditions ; AVP ;</p>	5
4(d)	<p><i>any three from:</i></p> <p>protein synthesis ; transport in the phloem ; cell division / mitosis / meiosis ; active transport / absorption of ions (from the soil) ; growth ; movement / muscular contraction ; sensitivity ; nerve impulses ; AVP ;;;</p>	3

Question	Answer	Marks
5(a)	<i>any two from:</i> assume features are of prototists unless told otherwise nucleus / nuclear membrane / nuclear envelope ; (named) organelle(s) / internal membranes ; cell walls (if present) have different composition ; linear chromosomes ; AVP ;	2
5(b)	box 2: (organism) has two rings of cilia / (organism) stalk absent / AVP ; box 4: (organism) has a covering of cilia / (organism) fused cilia absent / AVP ;	2
5(c)	movement AND nutrition ticked ;	1
5(d)(i)	bacteria → <i>Paramecium</i> → <i>Didinium</i> ;	1
5(d)(ii)	<i>any two from:</i> ciliates eat (many) bacteria ; <i>Didinium</i> / predatory ciliates, eat other (named) ciliates ; ciliates may eat, dead / decomposing, material ;	2
5(d)(iii)	<i>any three from:</i> removal of, harmful bacteria /pathogens, from sewage ; e.g. cholera bacteria or any other water born disease / parasites ; stop spread of pathogens via water ; use of chlorination / chemical treatment ;	3
5(d)(iv)	<i>any three from:</i> conversion of ammonia / ammonium (ions), to <u>nitrate</u> (ions) ; convert ammonium ions to <u>nitrite</u> ions ; make nitrate ions available to plants ; nitrate ions are absorbed by plants ; nitrate ions are used to make, amino acids / proteins ;	3

Question	Answer	Marks
6(a)	transmission of genetic information from generation to generation ;	1
6(b)(i)	1 correct use of X and Y in responses for individual 5 and individual 8 ; 2 correct X allele given for individual 5: X^bY / b ; 3 correct X allele given for individual 8: X^BY / B ;	3
6(b)(ii)	<i>any three from:</i> colour blindness is a sex-linked characteristic ; she is, heterozygous for the gene / Bb ; she has, normal allele / B , so has normal colour vision ; but has passed on the, recessive allele / b , to her sons / 5 and 7 ; she has two X chromosomes which have the gene for colour vision ; father / 4, passes on his Y chromosome ;	3
6(b)(iii)	<i>any two from:</i> mutation ; to give, recessive allele / b ; occurred in 3 or in one of her parents / 1 or 2 or her grandparents ; AVP ; e.g. other reason such as donated gamete	2

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2019

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of 3 printed pages.

Question	Answer	Marks
1	D	1
2	B	1
3	C	1
4	C	1
5	C	1
6	A	1
7	B	1
8	A	1
9	C	1
10	A	1
11	A	1
12	B	1
13	C	1
14	A	1
15	B	1
16	D	1
17	B	1
18	A	1
19	B	1
20	D	1
21	A	1
22	C	1
23	B	1
24	C	1
25	B	1
26	B	1
27	A	1
28	C	1

Question	Answer	Marks
29	B	1
30	C	1
31	A	1
32	D	1
33	C	1
34	B	1
35	C	1
36	B	1
37	D	1
38	D	1
39	A	1
40	A	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2019

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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GENERIC MARKING PRINCIPLE 2:

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Question	Answer		Marks	Guidance Notes										
1(a)	many (body) segments ; head and, body (segments) / AW ; many legs / many pairs of legs; elongated bodies ;		2											
1(b)	crustaceans ; arachnids ; insects ;		2											
1(c)	<table border="1"> <tr> <td>class</td> <td>letter(s) of species from Fig. 1.3 in each class</td> </tr> <tr> <td>1</td> <td>J</td> </tr> <tr> <td>2</td> <td>L</td> </tr> <tr> <td>3</td> <td>M,</td> </tr> <tr> <td>4</td> <td>K,N,O</td> </tr> </table>		class	letter(s) of species from Fig. 1.3 in each class	1	J	2	L	3	M,	4	K,N,O	3	4 rows correct = 3 2 or 3 rows correct = 2 1 row correct = 1 ;;;
class	letter(s) of species from Fig. 1.3 in each class													
1	J													
2	L													
3	M,													
4	K,N,O													
1(d)(i)	(genus) <i>Apheloria</i> ; (kingdom) animal ;		2											
1(d)(ii)	no (aerobic) respiration ; ora cannot release energy ; ora		1											

Question	Answer	Marks	Guidance Notes
2(a)	<p><i>carbohydrates</i> cellulose ; for cell walls ; starch ; for energy/respiration ; to attract insects to flowers / nectar / fruits ;</p> <p><i>amino acids</i> to make (named) proteins ; for enzymes ; for growth ;</p> <p>AVP ;</p>	4	
2(b)	correct position labelled on the leaf ; correct position labelled on the stem ; correct position labelled on the root ;	3	
2(c)(i)	higher concentration in the stem / aphid D is nearer the root / is before the branching of the plant ; (sucrose moves by) <u>translocation</u> ; sucrose moves up the plant ; root / tuber, is a source ; (leaves / stems / AW) are a sink ; no photosynthesis (in the dark) ; no / less, glucose/sucrose (made in the leaves) ; plant uses stored starch (from root) / AW ;	3	
2(c)(ii)	insert gene / ref. to genetic engineering / ref. to genetic modification ; gene, for insect / aphid resistance ; ref. to insecticide / described ; AVP ; description of how insecticide applied / biological control / grow in glasshouses / netting	3	

Question	Answer	Marks	Guidance Notes
2(c)(iii)	pollination ; AVP ; e.g. biological control described / insect products e.g. honey	1	

Question	Answer	Marks	Guidance Notes
3(a)	remove from the, body / organism / cell ; waste / poisons / toxins / harmful substances ; (waste products) of metabolism / respiration ; (named) substances in excess ;	2	
3(b)	the outline shape of a kidney, with one tube attached, drawn ; tube labelled ureter, outer portion of kidney labelled as cortex, medulla labelled inside the kidney ;	2	
3(c)(i)	ref. to capillaries ; (capillaries are) one cell thick / thin / AW ; <i>idea of fenestrations / pores</i> ; network (of capillaries) / tangled / knotted / tightly packed tubes ; description of shape e.g. round / ball-shaped ;	2	
3(c)(ii)	provides blood at high pressure ; provides a large surface area ; (ultra)filtration ; <i>ref. to small or soluble molecules / water / glucose / urea / salts, (are filtered) out</i> ; <i>ref. to (named) large OR insoluble (molecules) / blood cells, stay in the glomerulus</i> ; AVP ;	2	
3(d)(i)	(by) active transport ; from a low to a high concentration / AW ; (through cell) membrane ; <i>ref. to proteins (pumps / channels / AW)</i> ; uses energy ; from respiration ;	4	

Question	Answer	Marks	Guidance Notes
3(d)(ii)	<p><i>human</i> <i>mouse</i> $575 \div 320$ $0.551 \div 0.31$; $=1.797$ or 1.8 $=1.778$ or 1.8 ; g (salt) per day per g (kidney) ;</p> <p>similar or the same, results / rates / ratios, so hypothesis is supported ;</p>	4	
3(d)(iii)	osmosis ;	1	
3(d)(iv)	glucose / AVP ;	1	

Question	Answer	Marks	Guidance Notes
4(a)	(named) mechanical (barriers) ; (named) chemical barriers ; ref. to active immunity ; white blood cells / lymphocytes / phagocytes ; (phagocytes) engulf (named) microorganisms / phagocytosis ; lymphocytes produce antibodies ; ref. to specific, antigens / pathogens ; ref. to long term immunity / memory cells ; AVP ;	5	
4(b)	antibiotics ;	1	

Question	Answer	Marks	Guidance Notes
5(a)(i)	coronary artery ;	1	
5(a)(ii)	ref. to platelets ; fibrinogen converted to fibrin ; soluble to insoluble ; forms a mesh ; traps, (red blood) cells ;	3	
5(a)(iii)	aspirin / AVP ;	1	
5(b)(i)	98 (%) ;;;	3	one mark for correct readings from graph one mark for correct calculation one mark for correctly rounding to a whole number

Question	Answer	Marks	Guidance Notes
5(b)(ii)	<p><i>argument for:</i> as exercise increased CHD deaths decreased ; ora comparative data quote with units ; the same group of people were studied ; regular measurements were taken ; large benefit for doing only a small amount of exercise (therefore easy to do) ; even if there are some doubts about the benefits no harm will be done / AW ;</p> <p><i>argument against:</i> only women in the study ; ora none younger than 35 (at the start of the study) ; ora actual number of deaths per 10 000 is very small even for those that do not exercise ; other risk factors not considered ; named examples of other risk factors ;; e.g. diet / smoking / alcohol / genetics some women may have forgotten / not answered correctly about how much exercise they did / AW ; some women may have been successfully treated for CHD / not died from the condition / AW ; other variables not considered ; e.g. pre-existing conditions / medication / type of exercise / length of exercise</p>	5	
5(c)	more <u>blood</u> , to muscles ; to deliver more, oxygen / glucose ; for muscle <u>contraction</u> ; for (aerobic) respiration ; more <u>energy</u> required ; ref. to adrenaline ;	3	

Question	Answer	Marks	Guidance Notes
6(a)	poor absorption of calcium / weak bones / weak teeth / depression / fatigue / muscle pain / joint pain / rickets / osteomalacia / AVP ;	1	
6(b)	<p><i>reasons why endangered:</i> (described) overfishing / hunting ; food chain disrupted (described); overconsumption (by humans) ; (named) pollution ; introduced diseases / species ; habitat destruction ; climate change ;</p> <p><i>risks if populations drop:</i> reduced variation ; reproduction rate is lower / harder to find a mate ; extinction ; AVP ;</p> <p><i>how to maintain fish stocks:</i> education ; quotas ; no-catch zones / nursery zones / seasonal fishing / protected areas / MPAs / Marine Protected Areas ; fines ; restocking ; fish farms ; method of fishing (described) ; AVP ;</p>	6	

Question	Answer	Marks	Guidance Notes
7(a)(i)	(named) bacteria ; lightning ; AVP ;	2	
7(a)(ii)	<i>process A</i> denitrification ; <i>process B</i> nitrification ;	2	
7(a)(iii)	ammonia / ammonium (ions) ;	1	A nitrite (ions)
7(a)(iv)	removal of nitrogen containing part of amino acids ; to form urea ;	2	
7(b)	ribosome / rough endoplasmic reticulum ;	1	
7(c)	protease / pepsin / trypsin ;	1	

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

May/June 2019

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of 3 printed pages.

Question	Answer	Marks
1	B	1
2	C	1
3	B	1
4	B	1
5	B	1
6	C	1
7	D	1
8	C	1
9	C	1
10	C	1
11	C	1
12	B	1
13	D	1
14	C	1
15	A	1
16	B	1
17	B	1
18	C	1
19	C	1
20	C	1
21	A	1
22	A	1
23	A	1
24	D	1
25	C	1
26	C	1
27	C	1
28	A	1

Question	Answer	Marks
29	D	1
30	A	1
31	D	1
32	C	1
33	D	1
34	D	1
35	B	1
36	D	1
37	D	1
38	D	1
39	D	1
40	C	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2019

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of **14** printed pages.

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GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

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GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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- marks are awarded when candidates clearly demonstrate what they know and can do
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- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks	Guidance
1(a)	(group of) organisms that can reproduce ; to produce fertile offspring ;	2	
1(b)	pinna(e) / external ears ; mammary glands / milk glands / production of milk / lactating / suckling / breast feeding / nipples / AW ; diaphragm ; (three) <u>bones</u> in the middle ear ; (four) different types of teeth / two sets of teeth ; sweat glands ; enucleated red blood cells ; uterus / placenta / navel / AW ; AVP ;	2	
1(c)	select, parent(s) / sheep / AW, with, fine / thin, hairs (in wool) OR use Merino sheep from South Africa and NZ sheep ; cross them together / use artificial insemination / IVF / AW ; measure / AW, the hairs in the wool of all the offspring ; select offspring with, fine / thin, hairs (in wool) ; cross / AW, offspring together ; continue / repeat, selection and/or breeding ; over many generations ; AVP ;	5	max 4 if no reference to quality of wool
1(d)	features are, adaptive / adaptations (for environment) ; caused by / AW, the, environment / surroundings ; competition between individuals for (named) resource(s) ; reference to named selective agent(s) ; slow(er) ; increase in fitness ; explained: ability to survive AND reproduce (in natural environment) ; maintains (genetic) variation / less (genetic) variation in selective breeding ; random mating ;	3	

Question	Answer	Marks	Guidance
2(a)	carbon dioxide is, raw material / substrate / reactant / AW ; concentration of carbon dioxide is higher outside leaf than inside (so carbon dioxide diffuses into the leaf) ;	2	
2(b)	subtract the concentration of carbon dioxide at the end from the concentration at the start / AW ; divide by the time (taken) / per unit time ; ref. to taking (rate of) respiration into account ;	2	
2(c)(i)	light <u>intensity</u> ; water (supply) ; humidity ;	1	
2(c)(ii)	increases and, reaches a plateau / remains constant / 'levels off' ; increases (between 10 °C) to 30 °C / levels off at 30 °C ; any comparative use of figures for rate with units at least once ;	3	
2(c)(iii)	36 ;;	2	

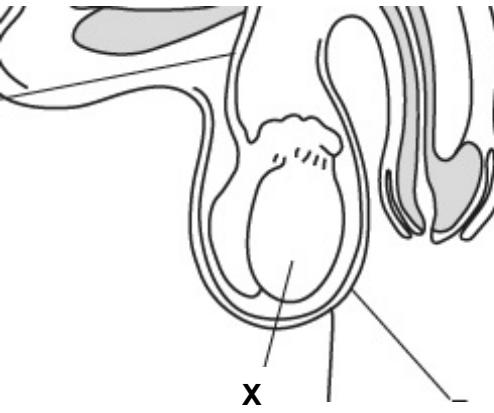
Question	Answer	Marks	Guidance
2(c)(iv)	<p><u>temperature</u> is the limiting factor (over whole range) ; increased temperature increases, <u>kinetic energy / KE</u>, (of molecules) ; increases rate of diffusion of carbon dioxide (into leaf) ; temperature, influences / affects, (activity of) <u>enzymes</u> ; <i>idea of more (effective) collisions between substrate molecules and enzymes (in plant) / more enzyme-substrate complexes formed</i> ; more carbon dioxide is, fixed / used in photosynthesis / converted into sugar / AW ; carbon dioxide (concentration) is not limiting ;</p>	3	
2(c)(v)	<p>B shows that: rate of photosynthesis is, higher / continues to increase, if carbon dioxide is increased (at all temperatures / AW) ;</p>	1	
2(d)	<p><i>prediction:</i> rate of photosynthesis, remains constant / decreases / slows ;</p> <p><i>any explanation one from:</i> enzymes / active sites, are denatured (at high temperatures) ; stomata close, so, little / no, carbon dioxide can enter leaves ; plant is adapted to survive at high temperatures ;</p>	2	

Question	Answer	Marks	Guidance
3(a)	accommodation ; antagonistic ; peripheral ; optic ; brain ;	5	
3(b)	involves, proteins / carriers / pumps (in neurone membrane) ; (named) ion(s) bind to, proteins / carriers / pumps, to move ions / AW ; move ions, against concentration gradient / from low to high concentration ; using energy ; AVP ; e.g. change in shape of carrier (protein)	3	

Question	Answer	Marks	Guidance
3(c)	<p><i>general marking point</i> neurotransmitters move across, synapse / gap / junction / AW ;</p> <p><i>atropine</i> neurotransmitter cannot, bind to / enter / reach, receptors ; therefore no impulses (along, next / postsynaptic, neurone) / no impulses reach the CNS ; no sensitivity to stimuli / feels no pain / painkiller ; no, contraction of muscle / response ; depressant ;</p> <p><i>eserine</i> neurotransmitter stays in, synapse / synaptic gap ; neurotransmitter can bind to receptor (rather than stay in synapse) ; continuously stimulates the, next / postsynaptic, neurone ; (more) impulses are sent (in, next / postsynaptic, neurone) ; repeated, contraction of muscle / response ; stimulant ;</p>	6	<p>A reaction time is longer / no reflex</p>

Question	Answer	Marks	Guidance
3(d)	anabolic steroids increase, muscle mass / AW ; gives athletes unfair advantage / ref. to cheating / unethical / immoral ; (named), side effect / effect on health ; can be banned from taking part in sport if found using them ; ref. to illegality ; AVP ; e.g. can lose sponsorship / loss of reputation / AW	3	

Question	Answer			Marks	Guidance																		
4(a)	tissue ; cell structure ; cell ; organ ;			4																			
4(b)	<table border="1"> <thead> <tr> <th>name of structure</th><th>function</th><th>letter on Fig. 4.1</th></tr> </thead> <tbody> <tr> <td>testis</td><td>production of sperm / produces or releases testosterone</td><td>C ;</td></tr> <tr> <td>sperm duct</td><td>transports sperm but not urine</td><td>D ;</td></tr> <tr> <td><u>urethra</u></td><td>passage for urine and seminal fluid through the penis</td><td>A ;</td></tr> <tr> <td>prostate gland</td><td>secretes / produces, seminal fluid / nutrient-rich fluid / alkaline fluid / AW</td><td>E ;</td></tr> <tr> <td>scrotum / scrotal sac</td><td>contains testes</td><td>B ;</td></tr> </tbody> </table>			name of structure	function	letter on Fig. 4.1	testis	production of sperm / produces or releases testosterone	C ;	sperm duct	transports sperm but not urine	D ;	<u>urethra</u>	passage for urine and seminal fluid through the penis	A ;	prostate gland	secretes / produces, seminal fluid / nutrient-rich fluid / alkaline fluid / AW	E ;	scrotum / scrotal sac	contains testes	B ;	5	one mark per row
name of structure	function	letter on Fig. 4.1																					
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sperm duct	transports sperm but not urine	D ;																					
<u>urethra</u>	passage for urine and seminal fluid through the penis	A ;																					
prostate gland	secretes / produces, seminal fluid / nutrient-rich fluid / alkaline fluid / AW	E ;																					
scrotum / scrotal sac	contains testes	B ;																					

Question	Answer	Marks	Guidance
4(c)	X on testis / label line on testis with X ; 	1	
4(d)(i)	one set of chromosomes ;	1	
4(d)(ii)	23 ;	1	

Question	Answer	Marks	Guidance
5(a)(i)	liquid / fluid / watery, part of blood ;	1	
5(a)(ii)	amino acid(s) ;	1	
5(b)(i)	plasmid ;	1	
5(b)(ii)	<u>restriction</u> (enzyme) ;	1	
5(b)(iii)	cutting / opening, A / the plasmid, with <u>same</u> (restriction) enzyme(s) ; forming, sticky ends ; <i>idea that</i> (sticky) ends of human DNA and plasmid DNA are <u>complementary</u> ; reference to, bases / base sequences (of sticky ends) ; correct reference to (DNA) ligase ; e.g. inserting gene / sticky ends joining / splicing AVP ; e.g. B is a recombinant (plasmid / DNA)	3	
5(b)(iv)	reliable / constant, supply ; produce, large(er) quantities / in a fermenter / bacteria reproduce quickly (to make more genetically engineered bacteria) ; not dependent on blood donations ; idea that no (named) health risk(s) ; higher quality of product ; AVP ;	1	
5(b)(v)	mRNA moves through the cytoplasm ; mRNA molecules, move to / through, ribosomes ; sequence of bases in mRNA determines order of amino acids (in TPA) ; for protein synthesis / to make proteins ; AVP ;	2	
6(a)(i)	cell wall ; cells are a regular shape / described ; vacuole(s) ; AVP ;	1	

Question	Answer	Marks	Guidance
6(a)(ii)	growth ; producing cells ; increase length of shoot / elongation of shoot ;	1	
6(b)	dividing cell / cell division / mitosis, needs (lot of) energy ; carry out <u>aerobic respiration</u> ; provide / release, energy ; (for) a named function in dividing cells ; e.g. movement of chromosomes making cell wall making new (named) molecules (e.g. protein / DNA) making (named) organelle(s)	3	

Question	Answer	Marks	Guidance
6(c)(i)	auxin ;	1	
6(c)(ii)	<i>auxin / hormone:</i> made in the, shoot / stem, tip ; moves away from the tip ; moves to / collects on, lower side of stem ; stimulates cell elongation ; stem, bends / grows, upwards ; AVP ;	4	
6(d)	plants have different, structures / parts / specialised cells ; <i>idea that</i> different parts / specialised cells, have different, functions / roles / features ; <i>idea that</i> specific proteins are required in, parts / specialised cells ; genes code for proteins ; therefore some genes, are required / are not required ; AVP ; e.g. <i>idea that</i> waste of (named) resource(s) if all genes expressed	3	

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2018

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of 3 printed pages.

Question	Answer	Marks
1	D	1
2	B	1
3	A	1
4	B	1
5	B	1
6	D	1
7	D	1
8	B	1
9	D	1
10	A	1
11	C	1
12	C	1
13	C	1
14	C	1
15	D	1
16	A	1
17	D	1
18	B	1
19	A	1
20	C	1
21	D	1
22	C	1
23	A	1
24	C	1
25	B	1
26	D	1
27	C	1
28	D	1

Question	Answer	Marks
29	C	1
30	B	1
31	B	1
32	D	1
33	C	1
34	D	1
35	B	1
36	C	1
37	D	1
38	C	1
39	B	1
40	B	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2018

MARK SCHEME

Maximum Mark: 80

Published

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Mark scheme abbreviations

- ; separates marking points
- / alternative responses for the same marking point
- R reject the response
- A accept the response
- I ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- () the word / phrase in brackets is not required but sets the context

Question	Answer	Marks	Guidance
1(a)(i)	sun / light ;	1	
1(a)(ii)	C ;	1	
1(a)(iii)	ingestion / feeding / AW ;	1	
1(a)(iv)	energy is lost (from the food chain as it is transferred from one trophic level to the next) / energy decreases up the trophic levels ; only 10% energy transferred ; ora energy is lost as heat / in respiration / in (named) metabolic processes / movement ; not all organisms (in one trophic level) are eaten / not all parts of the organisms are eaten ; not all nutrients in the organisms are, eaten / digested / absorbed some energy is lost in, excretion / urine / faeces ; some energy is transferred to decomposers ;	3	A energy transfer is inefficient A egestion
1(b)(i)	organisms that get energy from dead / waste, (organic) material ;	1	
1(b)(ii)	respiration ;	1	
1(c)	combustion / burning ; (more / less) fossil fuel is used ; concentration of (atmospheric) carbon dioxide is increasing ; deforestation described ; trees not replanted / fewer trees ; ora described effect on photosynthesis ; carbon dioxide released (into the atmosphere), as the trees are burnt / decay ; causing, global warming / <u>enhanced</u> greenhouse effect ; <i>ref. to</i> tundra thaw and methane ; rate of fossilisation is slower than rate of combustion / fossil fuels are non-renewable ; positive human activities / carbon capture technology ; (idea of) loss of equilibrium / balance ;	5	

Question	Answer	Marks	Guidance
2(a)	fungus ;	1	
2(b)	small / no, clear area / AW ; ora (antibiotic in disc), not killing bacteria / (continued) reproduction ; ora	2	A more bacteria growing
2(c)(i)	<p>1 correct ref. to mutation (of bacteria) / have resistance gene ;</p> <p>2 mutation is a change in the DNA / base sequence ;</p> <p>3 mutations can be caused by, (ionising) radiation / (named) chemicals ;</p> <p>4 <u>variation</u> (in ability of bacteria to survive antibiotic treatment) ;</p> <p>5 ref. to (natural) selection / evolution ;</p> <p>6 bacteria with resistance (survive and) reproduce / breed / multiply / produce offspring ;</p> <p>7 bacteria with, no / little, resistance, die / do not reproduce ;</p> <p>8 (bacteria that survive) pass on the resistance, <u>allele / gene</u>, to more bacteria ;</p> <p>9 bacteria reproduce quickly ;</p> <p>10 exposure to antibiotics acts as a selection pressure ;</p> <p>11 only use antibiotics when essential ;</p> <p>12 complete the full course of prescribed antibiotics ;</p> <p>13 isolation of patients with infections ;</p> <p>14 improved, healthcare / sanitation / nutrition / good diet / hygiene / cleanliness / screening / AW ;</p> <p>15 and 16 AVP ;;</p>	6	
2(c)(ii)	viruses, are not alive / not made of cells / AW ; ora viruses do not have, a cell wall / named cell component ;	1	

Question	Answer	Marks	Guidance
2(d)	small / take up little space ; reproduce rapidly / easy to grow ; contain plasmids ; transformation described / genetic modification / inserting genes ; no ethical concerns ; same genetic code as other organisms ; same DNA ; can make complex molecules / AW ; AVP ;	3	

Question	Answer	Marks	Guidance Notes
3(a)	no, cytoplasm / (named organelle) / hollow ; <i>ref. to lignin (in walls)</i> (cell walls) are waterproof / water impermeable / AW (secondary) thickening of cell wall ; long / elongated (cells / vessels / tubes) ; (bordered) pits (for water movement between vessels) ; no, (perforated) end / cross walls (between cells) / end plates to connect vessels (end to end) ;	3	
3(b)	(water enters) root hair (cells) / M ; by <u>osmosis</u> ; the soil has a higher <u>water potential</u> than the root (cells) ; ora water moves from an area of high(er) water potential to low(er) water potential ; active transport of ions to create a water potential gradient ; (across / through partially permeable), membrane(s) ; <i>ref to root cortex / L – cortex / M to L to (K) to J</i> ; AVP ;	5	
3(c)(i)	87 ;;	2	

Question	Answer	Marks	Guidance
3(c)(ii)	the nearer the tip / zone 1, the lower flow rate ; ora flow rate increases (from tip to bulb) in both treated and healthy roots ; flow rate is greater in zone 1 in the treated roots ; flow rate is lower in zones 2 and 3 in the treated roots ; ora comparative data quote with units ;	3	
3(c)(iii)	xylem vessels are dead, so toxins / treatment have no effect ; osmosis / water flow into root, does not rely on living cells / energy / is passive / AW ; AVP ;	2	

Question	Answer	Marks	Guidance																		
4(a)	<table border="1"> <thead> <tr> <th>function</th> <th>name of part</th> <th>letter on Fig. 4.1</th> </tr> </thead> <tbody> <tr> <td>carries impulses to the brain</td> <td>optic nerve</td> <td>Y ;</td> </tr> <tr> <td>focuses light onto the back of the eye</td> <td>lens</td> <td>S ;</td> </tr> <tr> <td>controls the tension of the suspensory ligaments</td> <td>ciliary, muscles / body</td> <td>Q ;</td> </tr> <tr> <td>tissue that detects light and colour</td> <td>retina</td> <td>W ;</td> </tr> <tr> <td>location of most cone cells</td> <td>fovea</td> <td>X ;</td> </tr> </tbody> </table>	function	name of part	letter on Fig. 4.1	carries impulses to the brain	optic nerve	Y ;	focuses light onto the back of the eye	lens	S ;	controls the tension of the suspensory ligaments	ciliary, muscles / body	Q ;	tissue that detects light and colour	retina	W ;	location of most cone cells	fovea	X ;	5	one mark for each correct row
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location of most cone cells	fovea	X ;																			
4(b)(i)	antagonistic ;	1																			
4(b)(ii)	accommodation ;	1																			

Question	Answer	Marks	Guidance
4(c)	<u>cones</u> are less sensitive in <u>low</u> light ; <u>cones</u> detect colour ; rods work in low light but can't detect colour / AW ;	2	
4(d)(i)	$X^B X^b$;	1	
4(d)(ii)	$X^b Y$;	1	
4(d)(iii)	solid shaded square on Fig. 4.2 ;	1	
4(d)(iv)	one X chromosome from each parent / an X from father ; mother does not have any colour-blind alleles / father passes on one colour-blind allele ; (all female offspring are) heterozygous / $X^B X^b$;	2	

Question	Answer	Marks	Guidance Notes
5(a)(i)	chemical substance produced by a (endocrine) gland ; carried by the blood ; alters the activity of specific target organs / AW ;	3	
5(a)(ii)	(insulin) stimulates enzymes (production) ; conversion of glucose to <u>glycogen</u> ; <u>glycogen</u> is stored / insoluble ; increased, uptake / absorption / respiration, of glucose by liver (cells) ;	2	
5(b)(i)	<u>deamination</u> / removal of nitrogen containing part (of amino acids) ; to form urea ; (part of) amino acid converted to ammonia ; ammonia converted to urea ;	2	
5(b)(ii)	(protein) synthesis ;	1	

Question	Answer	Marks	Guidance
5(c)(i)	aerobic / using oxygen ; respiration / (to produce) carbon dioxide and water; <i>ref. to enzymes</i> ; AVP ; converted back to, glucose	2	
5(c)(ii)	as alcohol consumption increases risk of dying of liver disease increases ; similar trend in males and females ; comparative data quote with units for g per day ; men exponential / women are not exponential / AW ; at low consumption females have higher risk ; ora same risk at 112 g per day ;	4	

Question	Answer	Marks	Guidance
6(a)(i)	reflex (action) ;	1	
6(a)(ii)	contains antibodies / passive immunity / <i>idea of</i> fighting infections ; bonding with mother /AW ; is at a suitable body temperature ; sterile / less risk of infection / contamination ; convenience / always available / no preparation ; cheap / free ; easy to digest / less risk of colic / less risk of diabetes in child ; no additives / less risk of allergies ; <i>idea of</i> volume is controlled / no over-feeding ; nutrient requirements met / change with age / change with development ; AVP ;;	4	

Question	Answer			Marks	Guidance												
6(b)(i)	<table border="1"> <tr> <td>enzyme</td> <td>substrate</td> <td>product(s)</td> </tr> <tr> <td>amylase</td> <td>starch</td> <td>glucose / maltose ;</td> </tr> <tr> <td>maltase</td> <td>maltose</td> <td>glucose ;</td> </tr> <tr> <td>protease</td> <td>protein</td> <td>amino acids ;</td> </tr> </table>			enzyme	substrate	product(s)	amylase	starch	glucose / maltose ;	maltase	maltose	glucose ;	protease	protein	amino acids ;	3	
enzyme	substrate	product(s)															
amylase	starch	glucose / maltose ;															
maltase	maltose	glucose ;															
protease	protein	amino acids ;															
6(b)(ii)	<p>high temperatures denature enzymes / AW ; low temperatures result in low energy / fewer collisions / slower reactions / AW ; enzymes work best / most efficient at optimum temperature ;</p>			2													
6(b)(iii)	<p>pH ; enzyme concentration ; substrate concentration ;</p>			1													

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

May/June 2018

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of 3 printed pages.

Question	Answer	Marks
1	A	1
2	B	1
3	C	1
4	D	1
5	B	1
6	B	1
7	A	1
8	B	1
9	C	1
10	A	1
11	B	1
12	B	1
13	B	1
14	A	1
15	C	1
16	C	1
17	B	1
18	D	1
19	A	1
20	A	1
21	B	1
22	D	1
23	C	1
24	B	1
25	C	1
26	C	1
27	D	1
28	A	1

Question	Answer	Marks
29	B	1
30	D	1
31	B	1
32	B	1
33	B	1
34	D	1
35	C	1
36	B	1
37	C	1
38	A	1
39	C	1
40	D	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2018

MARK SCHEME

Maximum Mark: 80

Published

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These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **R** reject
- **ignore** mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **AW** alternative wording (accept other ways of expressing the same idea)
- **underline** words underlined (or grammatical variants of them) must be present
- max indicates the maximum number of marks that can be awarded
- mark independently the second mark may be given even if the first mark is wrong
- ecf credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context or reverse argument
- **ora** any valid point
- AVP

Question	Answer			Marks	Guidance																								
1(a)	A substrate ; B active site ; C enzyme-substrate complex ; D product(s) ;			4																									
1(b)	production of, small(er) / soluble / simple(r), <u>molecules</u> ; (small molecules can be) absorbed / ref. to absorption ; ora (moves through) cell membranes / wall of intestine / into blood / into cells ;			2																									
1(c)	<table border="1"> <thead> <tr> <th>function</th> <th>letter from Fig. 2.1</th> <th>name of structure</th> </tr> </thead> <tbody> <tr> <td>site of starch digestion</td> <td>A J / E</td> <td>mouth / buccal cavity small intestine</td> </tr> <tr> <td>reabsorption of water</td> <td>J / E H F</td> <td>small intestine colon / large intestine rectum</td> </tr> <tr> <td>secretion of pepsin</td> <td>C</td> <td>stomach</td> </tr> <tr> <td>site of maltose digestion</td> <td>J / E</td> <td>small intestine</td> </tr> <tr> <td>secretion of bile</td> <td>K L</td> <td>liver gall bladder</td> </tr> <tr> <td>storage of faeces</td> <td>F</td> <td>rectum</td> </tr> <tr> <td>secretion of lipase and trypsin</td> <td>D</td> <td>pancreas</td> </tr> </tbody> </table>			function	letter from Fig. 2.1	name of structure	site of starch digestion	A J / E	mouth / buccal cavity small intestine	reabsorption of water	J / E H F	small intestine colon / large intestine rectum	secretion of pepsin	C	stomach	site of maltose digestion	J / E	small intestine	secretion of bile	K L	liver gall bladder	storage of faeces	F	rectum	secretion of lipase and trypsin	D	pancreas	6	<i>one mark per row</i> <i>the letter must agree with the name</i> <i>if more than one letter or name mark first one only</i>
function	letter from Fig. 2.1	name of structure																											
site of starch digestion	A J / E	mouth / buccal cavity small intestine																											
reabsorption of water	J / E H F	small intestine colon / large intestine rectum																											
secretion of pepsin	C	stomach																											
site of maltose digestion	J / E	small intestine																											
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storage of faeces	F	rectum																											
secretion of lipase and trypsin	D	pancreas																											
				; ; ; ; ; ; ; ;	A J/E small intestine																								

Question	Answer	Marks	Guidance
2(a)	(the probability that an organism will) survive <u>and</u> , reproduce / AW ;	1	
2(b)(i)	(during the day they) remain in a burrow / stay in the shade / stay inactive / sleep / AW ; light colour / pale / yellow / white (fur / hair) / AW ; thin / long, tail / legs ; thin / short / little, fur ; no fur on legs ; fur on feet ; large, ears / pinna(e) ; little / no, fat ; large surface area: volume ratio ; produces, little / concentrated, urine ; AVP ;	2	A nocturnal (habit) A ref. to long kidney tubules / AW
2(b)(ii)	big eyes / large pupils / good eyesight ; whiskers ; lots of rods (in the retina / fovea) ; large ears / good sense of hearing / sensitive ears ; good sense of smell ;	2	A eye has no cones
2(c)(i)	block added to the top of the pyramid that is 4 small squares wide ; labelled carnivores ;	2	
2(c)(ii)	(detritivores) eat (mainly), plants / producers ; (detritivores) feed, at second trophic level / as primary consumers ; detritivores are eaten by, third trophic level / secondary consumers ;	1	
2(c)(iii)	little energy is transferred from one trophic level to the next ; ora not all of the organisms are, eaten / digested / absorbed ; named example of energy loss ; <i>idea that</i> not enough energy to support higher trophic levels ;	2	

Question	Answer	Marks	Guidance
2(c)(iv)	<p><i>idea that</i> in a pyramid of numbers one large individual is shown in the same way as one very tiny individual ; ora biomass indicates how much food there is, available / left ; biomass is an indicator of the energy available ; pyramid of biomass is pyramid shaped whereas a pyramid of numbers is not always ; ora AVP ;</p>	3	

Question	Answer	Marks	Guidance
3(a)(i)	label line and X pointing to any part of the ‘star’ in the centre of the root section ;	1	
3(a)(ii)	composed of (group of) cells with similar structures ; working together to perform shared functions ;	2	
3(b)	<u>xylem</u> supplies water ; air spaces ; large (internal) surface area ; water evaporates from surface of mesophyll cells ; guard cells, open / close, stomata ; water vapour, diffuses / moves, out through stomata ;	3	

Question	Answer	Marks	Guidance
4(a)(i)	sensory neurone / (temperature / thermo-) receptor (neurone) ;	1	
4(a)(ii)	Q venule ; S arteriole ; T capillary ;	3	
4(a)(iii)	fat / fatty tissue ;	1	

Question	Answer	Marks	Guidance
4(b)(i)	blood flow remains constant and then increases / AW ; blood flow remains at, 4 / 5% ; increase in blood flow from 25 (± 2) °C ; to, maximum / 100%, at 41 °C ;	3	
4(b)(ii)	detection by, sensory neurone / receptor (in skin) ; brain / hypothalamus, as control centre / AW ; <u>impulses</u> in, motor / effector, neurones ; <u>muscles</u> in, shunt vessels contract / arterioles relax ; so shunt vessels, constrict / close ; arterioles dilate / <u>vasodilation</u> ; increased / more, blood flow, into capillaries / near surface (of skin) ;	3	A brain / hypothalamus, detecting temperature
4(b)(iii)	46 (%) ;	1	
4(b)(iv)	<u>diffusion</u> ; down concentration gradient / high to low concentration ; active transport ; through epidermis ; between / into / through, cells ; across cell membranes ; AVP ;	3	
4(c)	(so that) enzymes do not denature / enzymes remain active / maintains optimum temperature for enzymes ; <i>idea of</i> maintaining a constant rate of, reactions / metabolism / respiration ; avoids damage to other named (type of) protein ; avoids damage to cell membranes ; avoids, heatstroke / hyperthermia / overheating / dehydration / freezing / chills / becoming too cold / hypothermia ; at high temperature sperm production, reduced / harmed ; AVP ;	4	e.g. (permits) colonisation of different parts of the world / different climates active in, both day and night / different seasons

Question	Answer	Marks	Guidance
4(d)	hormones are chemicals / hormonal coordination is only chemical ; transported in the, blood / circulatory system ; (effects are) <u>slower</u> (than nerves) ; ora (effects are) <u>longer</u> lasting ; ora each hormone may have more than one target, organ / tissue / cells ; ora	3	

Question	Answer	Marks	Guidance								
5(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	2	one mark for correct symbols one mark for correct balancing								
5(b)	150(%) ;;	2	one mark for correct working if answer wrong								
5(c)	demand for, energy / oxygen, increases ; (rate of) respiration increases ; limited supply of oxygen to <u>muscle</u> (tissue) ; <i>idea that</i> heart / pulse / breathing, rate not increased enough ; muscles respire <u>anaerobically</u> ; lactic acid is produced ;	3									
5(d)	horses continue to breathe, at high rate / deeper ; continue with a high, heart / pulse, rate ; to provide, enough / AW, oxygen (to ‘pay-off’ the debt) ; lactic acid, moves / diffuses / AW, (from muscle) into blood ; lactic acid transported to the liver ; (in the liver) lactic acid is, broken down / oxidised / respired (aerobically) ;	4									
6(a)(i)	<table border="1"> <tr> <td>process / event</td> <td>letter from Fig. 6.1</td> </tr> <tr> <td>meiosis</td> <td>R ;</td> </tr> <tr> <td>fertilisation</td> <td>S ;</td> </tr> <tr> <td>implantation</td> <td>V ;</td> </tr> </table>	process / event	letter from Fig. 6.1	meiosis	R ;	fertilisation	S ;	implantation	V ;	3	
process / event	letter from Fig. 6.1										
meiosis	R ;										
fertilisation	S ;										
implantation	V ;										

Question	Answer	Marks	Guidance
6(a)(ii)	oviduct ;	1	
6(b)(i)	image size ÷ actual size ;	1	
6(b)(ii)	55 (μm) ;	1	
6(c)	haploid / n / one set of chromosomes / half the diploid number / 23 chromosomes ; (produced by) meiosis ; so number of chromosomes, remains the same / does not double at fertilisation ;	2	A so diploid number restored at fertilisation / so zygote is diploid
6(d)	<i>flagellum</i> (flagellum) propels the sperm ; to, oviduct / site of fertilisation / egg (cell) / ovum ; <i>mitochondria</i> <u>aerobic respiration</u> ; provides / releases / supplies, energy / ATP ; <i>acrosome</i> (contains / has / releases) enzyme(s) ; (enzymes) digest / break down / dissolve, jelly coat / protein layer ; so sperm nucleus can enter the egg cell / so sperm and egg membranes can fuse together ;	6	A flagellum allows sperm to swim R 'produces energy'
6(e)	<i>idea that</i> sex is determined by X and Y chromosomes / males are XY and females are XX ; egg cells have X chromosome / females can only provide X chromosome ; sperm cells have X <u>or</u> Y chromosome / only the males can provide X <u>or</u> Y chromosome / only males can provide the Y chromosome ;	2	

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2017

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	D	1
2	A	1
3	C	1
4	B	1
5	C	1
6	B	1
7	D	1
8	B	1
9	D	1
10	C	1
11	D	1
12	B	1
13	A	1
14	B	1
15	B	1
16	B	1
17	B	1
18	A	1
19	A	1
20	C	1
21	A	1
22	D	1
23	A	1
24	A	1
25	A	1
26	D	1
27	C	1
28	A	1

Question	Answer	Marks
29	C	1
30	B	1
31	C	1
32	C	1
33	D	1
34	B	1
35	D	1
36	D	1
37	D	1
38	D	1
39	A	1
40	C	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2017

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes will use these abbreviations

- ; separates marking points
- / alternatives
- **I** ignore
- **R** reject
- **A** accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- AVP any valid point
- **ecf** credit a correct statement / calculation that follows a previous wrong response
- **ora** or reverse argument
- () the word / phrase in brackets is not required, but sets the context
- underline actual word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

Question	Answer	Marks	Guidance
1(a)(i)	absorption (of digested food / water) / movement of (small) molecules (from small intestine) into blood ;	1	
1(b)	<p>1 goblet cells labelled P ; 2 shaped described / produces mucus ;</p> <p>3 lacteal / lymph vessel / lymphatic vessel, labelled Q ; 4 description / transports fatty acids / fats;</p> <p>5 capillaries / blood vessel, labelled R ; 6 thin / one cell thick, walls / carries products of digestion ;</p> <p>7 microvilli / epithelia labelled S ; 8 <i>for microvilli accept</i> – large surface area / thin, for diffusion / absorption ;</p>	4	
1(c)(i)	watery faeces / AW ; dehydration / described ; loss of, salts / ions / electrolytes ; cramps / stomach pain ; death ;	2	A water not absorbed from faeces I nutrients
1(c)(ii)	oral rehydration therapy ;	1	A antibiotics
1(d)(i)	(blood) plasma ;	1	
1(d)(ii)	assimilation ;	1	
1(d)(iii)	protein ; named proteins ;;	2	A (poly)peptides e.g. (named) enzymes, antibodies, insulin, fibrinogen, haemoglobin, glucagon I hormones

Question	Answer	Marks	Guidance
2(a)	watch chest / abdomen, rise and fall / use a spirometer ; ref. to time / in one minute ;	2	
2(b)	exercise will increase breathing rate ; after exercise the breathing rate, will start decreasing / levels off ;	2	
2(c)	<p><i>description</i> carbon dioxide constant / at 4.7% , before exercise ; carbon dioxide highest / higher, at 6.0% / (immediately) after exercise ; decreases; falls below resting level / AW ; comparative data quote ;</p> <p><i>explanation</i> removal of excess carbon dioxide ; more energy used during exercise means higher rates of respiration ; aerobic respiration releases carbon dioxide ; oxygen not supplied fast enough (from lung / heart) / more oxygen required by muscles ; <u>oxygen debt</u> ; <u>anaerobic</u> respiration (in muscles) ; (produces) lactic acid / lactate; lactic acid is, broken down / respired / converted to glucose / converted to carbon dioxide ;</p>	6	A 4.6%.
2(d)(i)	safety risk (not to over exercise) ; CHD could change the expected result (for healthy people) ; she does not show (named) risk factor ;	1	A suitable suggestion related to CHD I 'danger' unqualified
2(d)(ii)	prevents blocked arteries / prevents thrombus formation ; lowers blood pressure ; lowers cholesterol / lowers fats / reduces risk of atheroma ; weight loss / using fats / avoids obesity ; lowers stress ; (heart) muscle stronger / lower (resting) pulse ;	3	A increased stroke volume

Question	Answer	Marks	Guidance
4(a)(i)	<u>stem</u> (cells) ;	1	
4(a)(ii)	nucleus / nucleolus / nuclear membrane ; cell membrane ; cytoplasm ; ribosomes ; mitochondria ; endoplasmic reticulum / ER ; vesicle / vacuole ; AVP ;	2	R large permanent vacuole A Golgi apparatus, lysosome, centrioles
4(a)(iii)	(transmit impulses) from one (distant) part of the body to another / AW; so (impulse) is fast / AW ;	1	
4(b)(i)	motor (neurones) ;	1	
4(b)(ii)	muscle ; gland ;	1	

Question	Answer			Marks	Guidance
4(c)(i)	letter from Fig. 4.1	name	description	5	one mark per correct row
	E	mitochondrion / mitochondria ;	component of the cell that releases energy during aerobic respiration		
	H	neurotransmitters	chemicals that transmit signals from one neurone to the next neurone		
	J	synapse ;	the gap between two neurones		
	F/G	vesicle ;	the sac in which neurotransmitters are transported to the cell membrane		
	K	receptors ;	the molecules that the neurotransmitters bind to		
	M	nucleus ;	the structure that controls the activities in the cell		
4(c)(ii)	brain / spinal cord / central nervous system / CNS ;			1	
4(d)	diffusion ; from high concentration to low concentration / down a concentration gradient ; direction described ; AVP ;			3	
4(e)	nerves faster / hormones slower ; nerve impulses are a short lived response / ora ;			1	

Question	Answer	Marks	Guidance
5(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow ;$ $6H_2O + 6CO_2 ;$	2	max one mark if not balanced
5(b)(i)	sugar beet ; (one of three crops that) falls with appropriate temperature range / ora ; sugar beet / corn requirement for rainfall, is in the range ; wheat requires more rainfall ; corn / wheat, has a lower productivity / energy yield ; appropriate use of data ;	3	wheat and corn also grow in suitable temp.(ecf) A sugar beet has a higher energy yield than wheat (or corn).
5(b)(ii)	stunted / reduced / no, growth / yield ; used to make amino acids / proteins ; amino acids converted to proteins ; named molecule containing nitrogen ;	3	e.g. DNA, enzymes, chlorophyll
5(b)(iii)	$200 \div 0.0001$ $2\ 000\ 000 \div 2 \times 10^6 ;$	1	
5(b)(iv)	less land required ; crops can be used as food (rather than fuel) ; less habitat destruction / less deforestation ; less disruption to food chains / greater diversity maintained ; comparison of algae yield with any crop from Table 5.1, with units ; AVP ;	3	
5(c)	development that provides for the needs of an (increasing) human (population) ; without harming the natural environment / ecosystems / habitat ;	2	

Question	Answer	Marks	Guidance
6(a)(i)	genetic material ; protein coat ; parasitic / pathogenic ; only reproduce in a host / do not show (other) features of living organisms / AW ; very small ; they are not cellular / absence of named organelle; AVP ; cannot be killed / cannot be treated, with antibiotics.	2	A DNA / RNA A virus are non-living.
6(a)(ii)	active immunity ; harmless / dead / weakened / attenuated pathogen / microorganisms ; injected / ingested ; ref. to antigens ; (antigen) triggers antibody production ; by lymphocytes ; memory cells (are produced) ; rapid response to reinfection ; long-term immunity ; prevention of spread person to person e.g. no host for pathogen / herd ref to programmes of mass vaccination ; AVP ;	5	.
6(b)	shape / size / AW ; genetic material (sequence / type) ; host species / type of disease it causes ; AVP ;	1	

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

May/June 2017

MARK SCHEME

Maximum Mark: 40

Published

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1	B	1
2	C	1
3	C	1
4	B	1
5	C	1
6	B	1
7	D	1
8	A	1
9	B	1
10	B	1
11	D	1
12	C	1
13	C	1
14	B	1
15	B	1
16	A	1
17	D	1
18	D	1
19	C	1
20	B	1
21	A	1
22	A	1
23	C	1
24	C	1
25	D	1
26	B	1
27	D	1
28	B	1

Question	Answer	Marks
29	D	1
30	C	1
31	A	1
32	D	1
33	A	1
34	D	1
35	B	1
36	B	1
37	B	1
38	C	1
39	B	1
40	A	1

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2017

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of 12 printed pages.

Mark schemes will use these abbreviations

- ; separates marking points
- / alternatives
- I
- R reject
- A A (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- AVP any valid point
- ecf credit a correct statement / calculation that follows a previous wrong response
- ora or reverse argument
- () the word / phrase in brackets is not required, but sets the context
- underline actual word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

Question	Answer	Marks	Guidance
1(a)	1 (for) energy / energy source / respiration ; 2 storage / stored ; (fat or vitamins or energy) 3 insulation / reduce heat loss / maintains temperature / ref to myelin ; 4 protection (against mechanical damage) / cushions organs / shock absorber ; 5 AVP ; 6 AVP ;	3	R 'produce energy' I homeostasis e.g. buoyancy making (some) hormones making (cell) membranes provide heat absorption of vitamins waterproofing
1(b)(i)	lipase ;	1	
1(b)(ii)	fatty acids <u>and</u> glycerol ;	1	
1(b)(iii)	bile ;	1	
1(b)(iv)	gall bladder ;	1	
1(c)	(bile) emulsifies fats ; breaks down into / changed into smaller, globules / AW ; increases surface area (to volume ratio) ; for, enzyme(s) / lipase ;	2	R molecules

Question	Answer	Marks	Guidance
1(d)	<p>fatty acids / glycerol / fats, enter / AW</p> <p>1 (micro)villi ; 2 capillaries / blood vessels / blood / circulatory system ; 3 lacteals / lymphatic capillary ; 4 (travel via) lymph / in lymph vessels / in lymph(atic) system ; 5 lymph empties into blood ;</p>	3	<p>MP5 A tissue fluid / 'body fluid' for lymph A lymphatic vessels empty into blood</p>
1(e)	<p>1 fat is deposited in (walls of) arteries ; 2 <u>coronary arteries</u> ; 3 arteries are blocked / blood flow is restricted in arteries ; 4 less / no, blood flow to, heart muscle / cardiac muscle / wall of heart ; 5 less / no, nutrients / glucose / oxygen, reaches heart, muscle / walls / cells ; 6 AVP ;</p>	3	<p>I veins / blood vessels A narrows (lumen of) arteries e.g. to form, plaques / atheroma / atherosclerosis roughens the lining of arteries increases blood pressure promotes, blood clotting / thrombus / thrombosis heart muscle, cannot respire (aerobically) / respire anaerobically heart muscle, fatigues / tires / AW ref. to cholesterol heart muscle produces lactic acid</p>

Question	Answer	Marks	Guidance
1(f)	1 drug treatment ; 2 aspirin ; 3 to, reduce risk of / prevent, blood clotting ; 4 surgery / operation ; 5 (coronary) by-pass ; 6 described / a piece of blood vessel attached to carry blood around the blocked artery ; 7 angioplasty ; 8 described / tube <i>or</i> balloon inserted into artery and inflated to widen artery ; 9 stent(s) ; 10 tube / AW, to, hold arteries open / stop arteries collapsing ; 11 to restore blood supply (to heart muscle) ; 12 AVP ;	6	A antiplatelets / warfarin I ‘thins the blood’

Question	Answer	Marks	Guidance																		
2(a)	length of <u>DNA</u> ; that codes for a protein ;	2																			
2(b)	1 antibodies lock on to antigens ; 2 ref to antigens are on pathogens ; 3 antibodies / antigens, are specific ; 4 antibodies (have shape) complementary to antigen ; 5 antibodies destroy pathogens (directly) ; 6 antibodies, mark / AW, pathogens for destruction by phagocytes / phagocytosis ; 7 AVP ; 8 AVP ;	4	R same shape A description																		
2(c)	<p>one mark per row</p> <table border="1"> <thead> <tr> <th>function</th> <th>name of structure</th> <th>letter from Fig. 2.1</th> </tr> </thead> <tbody> <tr> <td>absorption of amino acids to make antibodies</td> <td>cell membrane</td> <td>A</td> </tr> <tr> <td>stores genetic information as DNA</td> <td>nucleus</td> <td>B ;</td> </tr> <tr> <td>provides energy for making antibodies</td> <td>mitochondrion</td> <td>E ;</td> </tr> <tr> <td>site of production of antibodies</td> <td>ribosome / endoplasmic reticulum / ER</td> <td>C / G ;</td> </tr> <tr> <td>transport of antibody molecules for release into blood</td> <td>vesicle(s) / vacuole</td> <td>F ;</td> </tr> </tbody> </table>	function	name of structure	letter from Fig. 2.1	absorption of amino acids to make antibodies	cell membrane	A	stores genetic information as DNA	nucleus	B ;	provides energy for making antibodies	mitochondrion	E ;	site of production of antibodies	ribosome / endoplasmic reticulum / ER	C / G ;	transport of antibody molecules for release into blood	vesicle(s) / vacuole	F ;	4	A mitochondrion and E
function	name of structure	letter from Fig. 2.1																			
absorption of amino acids to make antibodies	cell membrane	A																			
stores genetic information as DNA	nucleus	B ;																			
provides energy for making antibodies	mitochondrion	E ;																			
site of production of antibodies	ribosome / endoplasmic reticulum / ER	C / G ;																			
transport of antibody molecules for release into blood	vesicle(s) / vacuole	F ;																			

Question	Answer	Marks	Guidance
2(d)	phagocyte ; ingests / engulfs / digests / destroys, pathogens / bacteria / viruses ; platelet(s) ; release substances to promote / AW, blood clotting ; epithelial cells ; provide a barrier / AW ; goblet cells ; produce mucus ; ciliated (epithelial) cells ; move, mucus / pathogens, away from gas exchange surface / AW ; acid-secreting cells (in stomach) ; make <u>hydrochloric acid</u> (to kill bacteria / pathogens) ;	2	A lachrymal (gland) cells ; secretes lysozyme ;
3(a)	any, chemical / substance, taken into / AW, the body ; modifies / affects / changes / AW, (chemical) reactions / metabolism ;	2	I behaviour
3(b)	1 vesicles (containing neurotransmitter) move to the cell membrane ; 2 vesicles fuse with cell membrane ; 3 release of neurotransmitter ; 4 (neurotransmitters/chemicals) diffuse across, synapse / synaptic cleft or gap ; 5 neurotransmitter binds to, receptor / protein on cell surface ; 6 neurotransmitter and receptor are complementary / AW ; 7 results in an impulse in, relay / next, neurone ;	4	A stimulates the, relay / next, neurone
3(c)	neurotransmitter released / vesicles, on one side of synapse ; receptors / described, only found on the opposite side of synapse ;	2	

Question	Answer	Marks	Guidance
3(d)	<p>1 heroin is converted into morphine ; 2 heroin diffuses into synapse ; 3 heroin binds to receptors (for neurotransmitter) ; 4 ref to, endorphin / encephalin, receptors / neurotransmitter ; 5 ref to heroin being complementary to receptor ; 6 blocks neurotransmitter entering receptor site ; 7 (or) stimulates receptor ; 8 reduced / increased, pain perception ; as appropriate 9 AVP ; morphine stimulates release of dopamine acts on relay neurone even when no impulse in neurone B</p>	3	<p>A competes for binds</p> <p>R 'same shape' as receptor</p> <p>I ref to summation</p> <p>A antagonist</p> <p>A agonist</p>
3(e)	<p>light ; temperature / heat / cold ; sound / vibration ; chemicals / taste / smell / pH ; pressure / touch ; position / gravity ; movement ; stretch (in muscle / tendons) ;</p>	3	

Question	Answer	Marks	Guidance
4(a)	blood travels through the heart once in a circuit / cycle (of the body) / AW ;	1	
4(b)	D ;	1	
4(c)	<p>1 large surface area ; 2 thin (surface) / one cell thick ; 3 short <u>diffusion</u> distance ; 4 good blood supply / many capillaries ; 5 good ventilation / good movement of air or water / good oxygen supply ; 6 permeable ; 7 moist ;</p>	2	

Question	Answer	Marks	Guidance
5(a)(i)	Aloe ;	1	R <i>Aloe pillansii</i>
5(a)(ii)	<p>1 (isolated) group of individual plants / AW ; 2 of, one / the same, species ; 3 living in the same area ; 4 at the same time ;</p>	3	
5(b)	<p>1 deforestation ; 2 climate change / global warming ; 3 change in land use / described ; 4 desertification ; 5 pollution ; 6 plant hunters ; 7 increase in (new / invasive), grazers / predators ; 8 competition with, introduced species / alien species ; 9 (new) disease / pests ; 10 lack of pollinators ; 11 AVP ;</p>	3	<p>A habitat loss A acid rain e.g. quiver trees are (very) slow growing damage to plants by, people / tourists</p>
5(c)	<p>1 high risk of extinction ; 2 less chance of, reproduction / pollination AW ; 3 high risk of genetic diseases ; 4 less / little / no, (genetic) variation ; 5 (small population so) more vulnerable to, pests / disease / catastrophe ; 6 reduced number of <u>alleles</u> ; 7 less likely to, adapt to / evolve to / cope with, (named) change in environment ; 8 AVP ;</p>	3	<p>A small gene pool R number of genes MP7 – e.g. new, disease / pest e.g. ref inbreeding ; R interbreeding</p>
5(d)(i)	44 (%) ;;	2	$4 / 9 \times 100 (= 44.4)$

Question	Answer	Marks	Guidance
5(d)(ii)	<p>1 decrease in population (at all sites) ;</p> <p>2 D has highest mortality / B has the lowest mortality ;</p> <p>3 site A has lost the most number of trees / site D has lost the lowest number of trees ;</p> <p>4 use of data from last column to illustrate - minimum of two <i>or</i> loss of trees from at least two sites or one site between two years ; comparative data quote A 12 to 4 / B 9 to 5 / C 5 to 3 / D 6 to 5</p> <p>5 (in whole population) there is no (net) increase in number of trees ;</p> <p>6 difficult to compare changes over time as numbers are for different sites ;</p> <p>7 site A has most trees in original photograph / site C has the least trees in the original photo ;</p> <p>8 in 2004, B and D had the most trees / site C had the least trees ; A more dead tree stumps in site A / least dead tree stumps in D</p>	3	A increase in mortality

Question	Answer	Marks	Guidance
6(a)	<p>1 variation (in radishes) is not a (confounding) factor ; 2 any differences are due to non-genetic factors ; 3 example of non-genetic factors – environment / mineral ions ; 4 so it was possible to make comparisons ;</p>	2	A improves validity of investigation
6(b)	<p>1 humidity (of air) ; 2 temperature ; 3 light ; 4 carbon dioxide ; 5 pH (of nutrient solution(s)) ; 6 rate of aeration / oxygen supply / oxygen ; 7 depth of solution / volume of solution ; 8 spacing / density (of radishes / plants) ; 9 AVP ;</p>	3	I water supply / moisture A warmth I gravity R ref. to soil e.g. wind (speed) e.g. pests / diseases
6(c)	<p>1 less growth than the, control / complete medium / group 1 ; 2 leaf / root, mass per plant is less than, control / group 1 ; 3 comparative use of figures per plant, calculated / stated, from the table with units; 4 (nitrate (ions) / nitrogen) required to make, amino acids / proteins ; 5 any one use of proteins in plants ;</p>	4	A polypeptides
6(d)	<p><i>appearance max 1</i> 1 yellow(-green) leaves / chlorosis / stunted / short ; <i>explanation for max 2</i> 2 magnesium is needed for chlorophyll ; 3 chlorophyll, makes plants or chloroplasts green / is a green pigment ; 4 cannot trap, enough / much, light for photosynthesis ; 5 less / no, photosynthesis / sugar production ; 6 less materials for, growth / making (new) cells ; 7 less sugar for respiration ;</p>	3	R chloroplast

Question	Answer	Marks	Guidance
6(e)	<p>1 less / no, DNA / RNA (is produced) ; 2 (new) DNA is needed for cells to divide (by mitosis) ; ora 3 genes / chromosomes, are made of DNA ; 4 mitosis / cell division, is one way in which organisms grow ; 5 DNA / RNA, needed for protein synthesis ; 6 protein is needed for growth ; 7 AVP ;</p>	2	e.g. energy supply in cells needs ATP

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

October/November 2016

MARK SCHEME

Maximum Mark: 40

Published

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	21

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	D	21	D
2	B	22	A
3	D	23	B
4	B	24	D
5	A	25	B
<hr/>			
6	C	26	B
7	B	27	A
8	A	28	C
9	C	29	B
10	B	30	D
<hr/>			
11	C	31	A
12	A	32	C
13	C	33	D
14	C	34	C
15	A	35	C
<hr/>			
16	B	36	B
17	A	37	C
18	B	38	D
19	B	39	A
20	C	40	A

BIOLOGY

0610/41

Paper 4 Theory (Extended)

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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Page 2	Mark Scheme Cambridge IGCSE – October/November 2016	Syllabus 0610	Paper 41
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Abbreviations used in the Mark Scheme:

- ; separates marking points
- / alternatives
- I ignore
- R reject
- A accept (for answers correctly cued by the question, or guidance for examiners)
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Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
1(a)(i)	(antibiotics) kill / damage / destroy / eliminate, pathogens / bacteria / fungi; Bacteria / fungi / pathogen can cause illness / disease / infections; (antibiotics), prevent growth / reproduction of, bacteria / fungi / pathogen; AVP ref. to how antibiotics kill bacteria; e.g. ref. to cell wall / production of proteins / inhibition metabolism;	2	I virus
1(a)(ii)	1 all (bacteria / pathogens) need to be killed / destroyed; 2 any remaining (bacteria) will reproduce / multiply; 3 illness / disease would continue; 4 ref to problem of antibiotic resistance; 5 antibiotics no longer effective; 6 new antibiotics have to be developed;	3	A prevents growth I virus I any reference to immunity
1(b)	fungus / mould;	1	A <i>Penicillium (notatum)</i>
1(c)(i)	steam; autoclave / high temperature <u>and</u> high pressure; UV / gamma, radiation / X rays; bleach; AVP; e.g. sterilise nutrients / air supply / items, entering fermenter	2	A any reference to sterilizing substances that are <u>added</u> to the fermenter.

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer			Mark	Guidance																					
1(c)(ii)	<table border="1"> <thead> <tr> <th>letter from Fig. 1.1</th> <th>name</th> <th>function</th> </tr> </thead> <tbody> <tr> <td>P</td> <td>water jacket</td> <td>Maintain / control, temperature;</td> </tr> <tr> <td>S</td> <td>paddles / stirrers / mixers / vanes</td> <td>mixes / stirs / maintains a suspension / stops solids settling / keeps nutrients moving / gives uniform mixture;</td> </tr> <tr> <td>Q</td> <td>nutrient inlet</td> <td>supplies glucose / ammonia / amino acids / nutrients for growth / nutrients for respiration / energy;</td> </tr> <tr> <td>R</td> <td>Probe / sensor / data logger</td> <td>monitors, temperature / pH;</td> </tr> <tr> <td>U</td> <td>air supply</td> <td>supplies oxygen for respiration;</td> </tr> <tr> <td>T</td> <td>outlet</td> <td>allows collection of the liquid containing penicillin after fermentation</td> </tr> </tbody> </table>	letter from Fig. 1.1	name	function	P	water jacket	Maintain / control, temperature;	S	paddles / stirrers / mixers / vanes	mixes / stirs / maintains a suspension / stops solids settling / keeps nutrients moving / gives uniform mixture;	Q	nutrient inlet	supplies glucose / ammonia / amino acids / nutrients for growth / nutrients for respiration / energy;	R	Probe / sensor / data logger	monitors, temperature / pH;	U	air supply	supplies oxygen for respiration;	T	outlet	allows collection of the liquid containing penicillin after fermentation			5	one mark for each correct row
letter from Fig. 1.1	name	function																								
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Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
1(d)	penicillin is, separated/extracted/filtered/centrifuged/evaporated/ purified/crystallised/precipitated/dried/impurities removed;	1	A downstream processing
		Total: 14	

Question	Answer	Mark	Guidance
2(a)	group/number, of organisms/AW, from one species; living in same, area/place/environment/time, together;	2	
2(b)	1 mode is/majority/most fish are, between 12.1 and 16.0 cm long; 2 range/body length, varies up to 24 cm/varies 0 to 24 cm; 3 very few fish are less than 4 cm; 4 no fish longer than 24 cm; 5 normal distribution/bell-shaped curve/similar number of fish longer and shorter than the mean; AW 6 Data quote of range with units and thousands of fish; 7 AVP ref to actual range may be shorter than 0– 24 cm;	3	A mean
2(c)(i)	$4 + 8 + 10 + 6 + 4 + 2 \text{ (thousand)}$; $= 34 \text{ thousand (fish)}$;	2	

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
2(c)(ii)	quotas/licences/permits/limits; fines for overfishing/taxes; only adult fish caught/young fish returned; (laws to) restrict net size; no fishing, zones/seasons; encourage, fish farms/nurseries/hatcheries/captive breeding; international fishing agreements/treaties; reduce, pollution/silting (of rivers)/avoidance of environmental factors detrimental to fish; education; restocking/add more, fish than removed / AW;	4	A 'regulation of fishing' A 'eutrophication' if linked to the death of fish.
2(d)(i)	genetics/inherited (genes); environmental factors ; any two named environmental factors; (natural) selection;	2	examples of named environmental factors: nutrition/pollution/temperature/predation/disease/fishing
2(d)(ii)	bar chart;	1	
		Total: 14	

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
3(a)(i)	amino acids;	1	
3(a)(ii)	stomach;	1	
3(b)(i)	ref. to surface area; affecting enzyme / enzyme activity; allows comparison; make experiment valid; controlled variable;	2	
3(b)(ii)	water-bath / in a beaker of water / incubator; insulate test-tube; allow solutions to equilibrate to temperature (before experiment); use a thermometer to check the temperature (is constant);	2	
3(c)	(pH) 8 ± 1 ;	1	

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
3(d)	<p>enzymes are protein; enzymes can be reused/are unchanged in the reaction; enzymes are specific; (enzymes are)catalysts / speeds up reaction; lowers the energy needed for the reaction; successful collisions / enzyme-substrate complex / ESC; active site; (enzyme and substrate) fit together; complementary shape; (digestive enzymes perform) chemical digestion /hydrolysis / catabolic reactions; break down, large / insoluble, molecules into, small / soluble, molecules; amylase converts starch to sugars / maltose; lipase converts lipid / fats, to fatty acids and glycerol; maltase converts maltose to simple sugars / glucose; ref to pH; ref to denaturation;</p>	6	
		Total: 13	

Question	Answer	Mark	Guidance
4(a)(i)	pancreas;	1	
4(a)(ii)	<p>recognize a specific, pathogen / antigen; lock on antigens / antibody-antigen complex; agglutination / clumping; destruction by, phagocytes / white blood cells / lymphocytes; AVP; e.g. neutralise / inhibit toxins;</p>	2	A bacteria/fungus/virus/parasite

Page 9	Mark Scheme	Syllabus	Paper
Cambridge IGCSE – October/November 2016			0610

Question	Answer	Mark	Guidance
4(b)(i)	lack of sun(light)/ dark skin AW; lack of fish (oils)/ egg (yolk)/ liver; unbalanced diet; kidney / liver / digestive, disease;	1	
4(b)(ii)	muscle cramps; soft/bent, bones /rickets; stunted growth; prone to infections; fatigue; reduced ability to absorb calcium (ions);	2	
4(c)	lack of vitamin D leads to more cases of type 1 diabetes in mice / ora; there is no difference in cases / same number of cases (wrt normal mice) until after 50 days; at 100 days there are more cases (in vitamin D mice); (vitamin D mice) levels off before normal mice /levels off after 150 days; comparative data use ;e.g. 20% more cases at day 200 or at 250 days normal mice is 46% , deficient mice is 65%;	3	

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
4(d)	frequent urination; thirst / AW; hunger; fatigue; weight loss; itchy skin; wounds heal slowly / more susceptible to infection; blurred vision / AW; vomiting; glucose in urine; high blood, glucose/sugar;	4	A nausea A hyperglycaemia.
4(e)	insulin; by injection/insulin pump; regular blood sugar tests; regular meals; AVP; exercise / restrict carbohydrate content of diet	3	
		Total: 16	

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
5(a)	root hair (cells); long and thin; thin cell wall; large surface area; for absorption; (water by) osmosis ; (ion/nutrients by) active transport; against the concentration gradient; protein (pumps) in membrane; require energy/ATP; ref. to many mitochondria;	5	
5(b)(i)	(positive) gravitropism;	1	A geotropism R negative gravitropism
5(b)(ii)	auxin;	1	

Page 12	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
5(b)(iii)	<p>in space/AW; because no gravity;</p> <p>in a clinostat/AW; gravity constantly changing/AW;</p> <p>remove root tip; no auxin source;</p> <p>lateral roots; searching for, water/nutrients/hydrotropic;</p> <p>light source below, plant/root; roots grow away from light/negatively phototropic;</p> <p>anaerobic mud/mangrove swamp/pneumatophores; need oxygen (for respiration); ORA</p> <p>roots attaching plant to solid objects for support eg walls/other host plants; material is too hard for root to grow through (takes line of least resistance);</p> <p>AVP; e.g. epiphytes/parasitic plants</p>	2	paired marking points
		Total: 9	

Page 13	Mark Scheme Cambridge IGCSE – October/November 2016	Syllabus 0610	Paper 41
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Question	Answer	Mark	Guidance
6(a)(i)	T, C, A, G;	2	all correct = 2 marks 2 or 3 correct = 1 mark
6(a)(ii)	double helix;	1	
6(b)	<i>species C with species D: 4; species G with species H: 3;</i>	2	
6(c)	species A and species D	1	
6(d)	<pre> graph TD Root --- A Root --- B A --- C A --- D C --- E B --- F B --- G F --- H </pre>	3	4 correct = 3 marks 2 or 3 correct = 2 marks 1 correct = 1 marks
6(e)(i)	<u>genetic engineering</u> ;	1	

Page 14	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0610	41

Question	Answer	Mark	Guidance
6(e)(ii)	drought/salt/pollution/metal/frost/stress/cold, resistant; increased, yield/productivity; extend range where crops can be grown; herbicide resistance; increased yield/productivity; pesticide resistance; increased yield/productivity; crop plants produce own insecticides; less insecticide used; increased yield; vitamin/nutrient, enrichment/ β carotene (Golden rice); increased nutritional value; pathogen resistant/Bt; increased productivity/less pesticide use; antigens/vaccines/pharmaceuticals; e.g. insulin cheap production of medicines; flavour/texture/ripening; Improved customer satisfaction/shelf life;	4	linked marking points 2+2 R bacteria (as not a crop plant) A ‘more profit’ once.
		Total: 14	

BIOLOGY

0610/21

Paper 2 Multiple Choice (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 40

Published

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Page 2	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0610	Paper 21
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<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	C	21	D
2	C	22	D
3	C	23	C
4	B	24	B
5	B	25	D
<hr/>			
6	B	26	B
7	B	27	B
8	B	28	B
9	C	29	C
10	A	30	B
<hr/>			
11	C	31	B
12	B	32	A
13	D	33	B
14	A	34	D
15	C	35	C
<hr/>			
16	B	36	B
17	A	37	D
18	A	38	B
19	A	39	A
20	D	40	A

BIOLOGY

0610/41

Paper 4 Theory (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of **10** printed pages.

Page 2	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0610	Paper 41
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Abbreviations used in the Mark Scheme:

- ; separates marking points
- / alternatives
- **I** ignore
- **R** reject
- **A** accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- AVP any valid point
- ecf credit a correct statement/calculation that follows a previous wrong response
- ora or reverse argument
- () the word/phrase in brackets is not required, but sets the context
- underline actual word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer			Mark	Guidance
1 (a)	function	letter on Fig. 1.1	name	[6]	<p>A 'AV valve' R right atrioventricular valve</p>
	structure that separates oxygenated and deoxygenated blood	F	septum ;		
	structure that prevents backflow of blood from ventricle to atrium	D	bicuspid / mitral / atrioventricular, <u>valve</u> ;		
	blood vessel that carries oxygenated blood	A	aorta		
	blood vessel that carries deoxygenated blood	B	pulmonary artery		
		H	vena cava ;		
	structure that prevents backflow of blood from pulmonary artery to right ventricle	K	semilunar <u>valve</u> ;		
	chamber of the heart that contains oxygenated blood	C E	left atrium left ventricle ;		
	chamber of the heart that pumps deoxygenated blood	J G	right atrium right ventricle ;		
(b) (i)	pulse rate increases and remains constant ; immediate/sudden/stEEP/rapid/AW, increase in pulse rate ; increases from 44–48 <u>bpm</u> to 164–170 <u>bpm</u> ; maximum/ 164–170 <u>bpm</u> , at, 4 <u>min</u> (utes)/2 <u>min</u> (utes) after race starts ;			[max 3]	<i>units must be used</i> R exponential increases by 120–126 bpm/by 3.5 to 4 times or approx. 4

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance
(ii)	adrenaline stimulates increase in, heart/pulse, rate ; increase in blood, carbon dioxide (concentration)/acidity, detected ; nerves stimulate heart to beat faster ; ref to muscle contraction/AW ; muscles require more energy/muscles are doing more work ; (rate of aerobic) respiration increases ; increase demand for, oxygen/glucose ; ref to removal of, carbon dioxide/lactic acid/heat ; more, blood/carbon dioxide, to <u>lungs</u> (per unit time) ; more, blood/oxygen/glucose, to <u>muscles</u> ; AVP ; e.g. ref to ATP/vasodilation in muscles	[max 4]	A decrease in pH 'more'/'increases', is only needed once R 'produce energy' once only
		[Total: 13]	
2 (a)	central (nervous system) ; peripheral (nervous system) ; spinal cord ;	[3]	R spine
(b) (i)	sensory neurone ;	[1]	A afferent neurone R sensory nerve
(ii)	simple reflex/reflex ;	[1]	A reflex arc
(iii)	slower/takes more time ; needs thought/uses (higher centres of) the brain/conscious control ; learnt/not inherited/not innate/needs training/AW ; not automatic ; response is not always the same to the stimulus ;	[max 2]	

Page 5	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0610	Paper 41
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Question	Answer	Mark	Guidance
(c) (i)	<i>either</i> pot P – (uniform) light AND pot Q – no light/dark/covered (up) ; <i>or</i> pot P – (uniform) with/plus, magnesium AND pot Q – no magnesium ;	[1]	A pot P has all nutrients
(ii)	positive ; (photo)tropism/(photo)tropic ;	[2]	R (photo)trophic/geotropic/gravitropic
(iii)	<i>idea that</i> leaves/seedlings/plants/chloroplasts, get more light ; more (<i>light</i>) <u>energy</u> , absorbed/trapped/AW ; more photosynthesis ; more, growth/biomass/glucose/starch/AW ;	[max 2]	'more' is only required once
(iv)	(auxins) made/produced, in (shoot), tip/apex ; pass/move/diffuse/spread (down the stem) ; auxins collect in the side, in the dark/away from light ; greater (cell) elongation on side in the dark ; AVP ; e.g. absorption of water (by osmosis)/stretching of cell walls/ phototropin(s)/plants detect or sense light/ref to turgor pressure	[max 4]	I 'found, in/on' A 'dark/shaded, side' I comments about roots
		[Total: 16]	
3 (a)	<i>gene</i> a length of DNA that codes for a protein ; <i>gene mutation</i> a change in <u>base</u> sequence of DNA ;	[2]	R chromosome/molecule of/genome
(b) (i)	1 Bb ; 2 bb ; 3 Bb ;	[3]	

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance															
(ii)	(Bb x bb) B , b + b , (b) ; offspring genotypes Bb and bb ; A heterozygous and homozygous recessive offspring phenotypes normal/carrier and acatalasia ;	[3]	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="2"></td> <td colspan="2">male gametes</td> </tr> <tr> <td colspan="2"></td> <td>B</td> <td>b</td> </tr> <tr> <td rowspan="2">female gametes</td> <td>b</td> <td>Bb</td> <td>bb</td> </tr> <tr> <td>(b)</td> <td>(Bb)</td> <td>(bb)</td> </tr> </table>			male gametes				B	b	female gametes	b	Bb	bb	(b)	(Bb)	(bb)
		male gametes																
		B	b															
female gametes	b	Bb	bb															
	(b)	(Bb)	(bb)															
(iii)	test (cross) ;	[1]																
		[Total: 9]																
4 (a)	carbon dioxide/CO ₂ ; (aerobic) respiration ; (simple) diffusion ;	[3]	A excretion gas exchange															
(b)	water enters by osmosis ; down a water potential gradient/high(er) to low(er) water potential ; through partially permeable membrane ; needs to remove water to prevent bursting ;	[max 3]	R water concentration A semi-/selectively/differentially															
(c)	as concentration of sea water increases the removal of water decreases ; as concentration of sea water increases the water potential gradient decreases ; therefore less water enters at higher concentrations of sea water ; less excess water ;	[max 3]	A 0% to 12%															

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance
(d)	cell walls, inelastic/do not stretch/rigid/inflexible/keep shape of cell ; cells, are turgid/have high turgor pressure ; resist any increase in, volume/pressure ; these cells do not absorb excess water ; the cells will not burst ;	[max 3]	I strong/tough/don't break A (very) little water enters
		[Total: 12]	
5 (a) (i)	vertical axis – numbers/population ; horizontal axis – time/years ; curve showing exponential increase/log phase ;	[3]	I lag phase/curve starting at origin
(ii)	<i>idea that 'birth' / reproduction / breeding, rate is greater than death rate ; no limiting factors ; no/little, competition ; plenty, of food/nutrients/space/mates/oxygen/resources ; no/few, predators ; no/few, parasites/pathogens/disease ; AVP ; e.g. no/little, pollution/waste products/toxins</i>	[max 4]	I definitions of exponential growth
(b)	<i>between 1950 and 2012 mass of fish caught increased and levels off ; 17 to 90 million tonnes/increase = 73 million tonnes ; fluctuations/increases and decreases/described ; e.g. around 1970/any time after 1990 ; maximum catch, 94 million tonnes/in 1996 ; steep increase between, 1950–1970/1973–1989 ;</i>	[max 3]	<i>units must be used at least once A 16 to 18/increase of 72 to 74 mp4 cannot be awarded without mp3</i>

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance
(c)	<p><i>answers can refer to seas, lakes and/or rivers</i></p> <p>international, agreements/treaties ;</p> <p>quotas/permits/licenses ;</p> <p>fines/sanctions, for, overfishing/illegal/unauthorised, fishing ; fishery protection vessels/wardens/patrols/AW ;</p> <p>restrictions on times when fishing can occur ;</p> <p>exclusion zones/nursery zones/‘no take’ zones/reserves ;</p> <p>total ban for some species ;</p> <p>regulations on method of fishing ; e.g. mesh size of nets/ban nets/use of lines instead/size of fishing vessel/‘fishing effort’</p> <p>education/raise awareness/any example ;</p> <p>monitoring fish stocks ;</p> <p>captive breeding (of wild fish) ; re-stocking (of wild stocks) ;</p> <p>encourage farmed fish ; e.g. provide subsidies</p> <p>AVP ; e.g. tax on wild fish/increase the cost of wild fish</p>	[max 6]	<p>A set maximum mass/number/amount/quantity A ‘ban unauthorised fishing’</p> <p>A consequences other than fines</p> <p>A not in breeding season</p> <p>A descriptions or examples</p> <p>A named examples</p> <p>I ban on all wild fish</p>

Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance
(d)	<p><i>definition of sustainable resource</i></p> <p>renewable/self-renewing/regenerates/described ; e.g. produced as rapidly as it is removed</p> <p>resource, does not/will not, run out/become exhausted ;</p> <p>replanting/reseeding/regrowing ;</p> <p>AVP ; e.g. pollarding/coppicing/leaving mature trees</p>	[max 3]	I reused/recycled
		[Total: 19]	
6 (a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$;;	[2]	one mark for the correct chemical formulae one mark for balancing the equation correctly R word equation
(b)	<p>as <u>wavelength</u> increases, rate (of photosynthesis) decreases and increases ;</p> <p>high rates in, blue and violet and red/400–475 nm and 675 nm ; low(est) rate in, green and yellow/550–600 nm ;</p> <p><i>either</i> maximum rate = 0.9 cm^3, at 675 nm/red <i>or</i> minimum rate = 0.2 cm^3, at 550 nm/green ;</p>	[max 3]	units must be used once in the answer A volume of gas for rate
(c)	divide the volumes by, five (minutes)/time ;	[1]	

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0610	41

Question	Answer	Mark	Guidance
(d) (i)	to keep the <u>light intensity</u> the same ;	[1]	R temperature I ‘fair test’ A ‘control light intensity’ / ‘light intensity is a control(led) variable’
(ii)	to provide carbon dioxide/so carbon dioxide is not a limiting factor/ so the only limiting factor is wavelength ;	[1]	
(e)	for, respiration/energy ; converted to sucrose ; used to make, nectar/fruits ; used to make, cellulose/lignin ; used in cell walls ; used to make, starch/oils/fats ; storage ; used to make, amino acids ; used to make, chlorophyll ;	[max 3]	I protein synthesis/growth/active transport R produces energy I ‘makes food’, but A ‘stores food’ for 1 mark
		[Total: 11]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0610 BIOLOGY

0610/21

Paper 2 (Core), maximum raw mark 80

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Page 2	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0610	Paper 21
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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- R reject
- ignore mark as if this material was not present
- A accept (a less than ideal answer which should be marked correct)
- AW alternative wording (accept other ways of expressing the same idea)
- underline words underlined (or grammatical variants of them) must be present
- max indicates the maximum number of marks that can be awarded
- mark independently the second mark may be given even if the first mark is wrong
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- AVP any valid point

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

Question	Answer	Marks	Additional Guidance
1	E <i>E. robustus</i> ; B <i>A. marsupialis</i> ; A <i>D. bicornis</i> ; C <i>M. rufus</i> ; D <i>H. sapiens</i> ;	max [4]	4 or 5 correct = 4 marks 3 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark
		[Total: 4]	
2 (a)	constant/maintenance/AW ; <u>internal</u> environment/AW ;	[2]	
(b) (i)	F : hair ; G : (temperature) receptors/AW ; H : <u>sweat gland</u> ;	[3]	
(ii)	3 ;	[1]	
(c) (i)	arterioles dilate ; more blood flows, to the (skin) surface / through the (surface)capillaries ; (more) heat is taken to the surface / blood carries heat ; heat (energy) is lost (from the skin) ;	max [3]	A more, conduction / convection / radiation

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

(ii)	1. sweat/water on skin surface ; 2. water is evaporated ; 3. (body) heat/energy used (in evaporation) ; 4. heat, from body/carried by blood ; 5. blood temperature decreases ; 6. correct reference to heat loss by conduction / convection / radiation ;		idea of “more” must be expressed at some point A water vapour is lost max [3]
(iii)	shivering or description ; vasoconstriction/AW ; hairs stand on end ; increased rate of respiration ;	max [2]	
(d)	brain ; hypothalamus ;	max [1]	ignore CNS
		[Total: 15]	

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

3	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="padding: 5px;">allele</td><td style="padding: 5px;">a thread of DNA, made up of a string of genes</td></tr> <tr> <td style="padding: 5px;">chromosome</td><td style="padding: 5px;">a length of DNA that codes for a specific protein</td></tr> <tr> <td style="padding: 5px;">diploid</td><td style="padding: 5px;">an alternative form of a gene</td></tr> <tr> <td style="padding: 5px;">gene</td><td style="padding: 5px;">containing two sets of chromosomes</td></tr> <tr> <td style="padding: 5px;">haploid</td><td style="padding: 5px;">transmission of genetic information from generation to generation</td></tr> <tr> <td style="padding: 5px;">inheritance</td><td style="padding: 5px;">the physical features of an organism due to both its genotype and its environment</td></tr> <tr> <td></td><td style="padding: 5px;">containing a single set of unpaired chromosomes</td></tr> </tbody> </table>	allele	a thread of DNA, made up of a string of genes	chromosome	a length of DNA that codes for a specific protein	diploid	an alternative form of a gene	gene	containing two sets of chromosomes	haploid	transmission of genetic information from generation to generation	inheritance	the physical features of an organism due to both its genotype and its environment		containing a single set of unpaired chromosomes	<p>1 mark for each correct linkage</p> <p>[5]</p>
allele	a thread of DNA, made up of a string of genes															
chromosome	a length of DNA that codes for a specific protein															
diploid	an alternative form of a gene															
gene	containing two sets of chromosomes															
haploid	transmission of genetic information from generation to generation															
inheritance	the physical features of an organism due to both its genotype and its environment															
	containing a single set of unpaired chromosomes															
		[Total: 5]														

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

4 (a)	<p><i>growth:</i></p> <ol style="list-style-type: none"> 1. (seedling) increase in size / (dry) mass / AW ; 2. permanent (increase in size) ; 3. larger / more cells ; <p><i>development:</i></p> <ol style="list-style-type: none"> 4. cells become specialised ; 5. increase in complexity ; 6. ref. to formation of new (named) structures ; 	max [4]	A leaves / shoot / roots / stem															
(b)	oxygen / O ₂ ; water / H ₂ O ; (suitable) temperature / warmth ;	[3]	in any order															
		[Total: 7]																
5 (a)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 33%;"></td><td style="width: 33%;"></td><td style="width: 33%;"></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td>E ;</td><td>testis ;</td></tr> <tr><td></td><td>F ;</td><td>penis ;</td></tr> <tr><td></td><td>D ;</td><td>urethra ;</td></tr> </table>								E ;	testis ;		F ;	penis ;		D ;	urethra ;	[6]	
	E ;	testis ;																
	F ;	penis ;																
	D ;	urethra ;																

Page 7	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0610	Paper 21
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(b) (i)	centre of X anywhere on the sperm duct ;	[1]	
(ii)	to prevent sperm passing down the sperm duct ;	[1]	
	[Total: 8]		
6 (a)	renal artery ; renal vein ;	[2]	either order
(b)	(excess) water ; (named) ions / salts ; hormones ; vitamins ;	max [1]	ignore named elements ignore glucose / protein / fats
(c) (i)	liver ;	[1]	
(ii)	too many/excess, amino acids/protein ; idea of: inability to store/removal of (excess, amino acids or protein)/AW ; need to be broken down ;	max [2]	A deaminated A ref to remaining carbohydrates as an energy source
(iii)	in plasma / blood ;	max [1]	
	[Total: 7]		
7 (a) (i)	(carbon compounds in) plants ;	[1]	
(ii)	feeding/eating/nutrition/digestion/AW ;	[1]	ignore herbivore R carnivore
(iii)	arrow drawn in opposite direction to E/from CO ₂ in air to box H ;	[1]	A arrow if unlabelled as long as only 1 arrow drawn
(iv)	death ;	[1]	ignore decay/decomposition/rotting

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

(b) (i)	A ; E ;	[2]	either order A F
(ii)	glucose + oxygen ; → carbon dioxide + water ;	[2]	R if energy given on LHS ignore if energy given on RHS If chemical equation is given it must be correct and balanced = 2 mark / 1 mark per “side” ignore mixed chemical and word equation
(iii)	releases energy ; example of use of energy(in cells or organisms) ;	[2]	e.g. growth / synthesis / active transport / movement / reproduction /
		[Total: 10]	
8 (a)	1. (food)consists of, large/complex/insoluble, molecules ; 2. (food) needs to be broken down ; 3. by, mechanical / chemical, processes ; 4. to, small / simple / soluble, molecules ; 5. (small / simple / soluble, molecules) for absorption/ ora ;	max [3]	ignore convert

Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

(b)	J liver ; K stomach ; L large intestine/colon ; M small intestine/ileum ;	[4]	
(c) (i)	<u>950</u> (per cm ²) ;	[1]	
(ii)	Q has, most / more, villi (per cm ²) ; has large(st) surface (area) ; villi is where absorption takes place / AW ; by diffusion ; data processing mark ;	max [3]	A active transport
		[Total: 11]	
9 (a)	evaporation of water ; (from) mesophyll (cells / tissue) ; water vapour loss ; by diffusion ; through stomata ;	max [3]	must be in correct context

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

(b)	<p>add water ; to restore turgor to cells / AW ;</p> <p>put in the dark / put in shade / AW ; stomata close so, less water loss / less transpiration ;</p> <p>lower temperature ; reduces KE of water molecules ;</p> <p>protect from draughts / wind / method of ; to reduce diffusion gradient ;</p> <p>increase humidity / method of ; to reduce diffusion gradient ;</p>	max [4]	<p>reason must match the change mark change and explanation together</p> <p>ignore ref to photosynthesis</p>
		[Total: 7]	
10 (a)	<p>A: log / exponential (phase) ;</p> <p>B: stationary (phase) ;</p>	[2]	<p>ignore descriptions</p>
(b) (i)	<p><i>difference:</i> no stationary phase or exponential / log, phase has continued / AW ;</p> <p><i>explanation:</i> development of farming / improved food supplies / AW ;</p> <p>ref. to sanitation / hygiene / AW ;</p> <p>ref. to medical treatments / care ;</p> <p>use of technology / AW ;</p> <p>AVP ;</p>	max [3]	

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	21

(ii) <i>lack of (named) resource leading to:</i>	<ul style="list-style-type: none"> • idea of conflict / war / social unrest / riots • starvation food shortages / • people encouraged to have small families / • spread of disease or overcrowding / • unequal distribution of resources / • poverty / • migration / • AVP; 	max [1]	ignore education unqualified ignore over population e.g. less employment/ pollution
		[Total: 6]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0610 BIOLOGY

0610/31

Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0610	Paper 31
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- AVP any valid point

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer		Marks	Additional Guidance
1 (a) (i)	reptiles ;		[1]	
(ii)	go to 2		[3]	<p>5/6 right = 3 3/4 right = 2 1/2 right = 1 0 right = 0</p>
	go to 3			
	go to 4			
	<i>Chalcides minutus</i>	B		
	go to 5			
	go to 6			
	<i>Brookesia perarmata</i>	G		
	<i>Calumma parsonii</i>	C		
	<i>Amblyrhynchus cristatus</i>	A		
	<i>Cyclura lewisi</i>	E		
	<i>Abronia graminea</i>	F		
	<i>Varanus komodoensis</i>	D		

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer	Marks	Additional Guidance
(b)	encourages biodiversity ; ora prevents extinction ; encourages <u>genetic</u> diversity (within each species) ; maintain food, webs/chains ; food for predators ; increasing research/source of medicine ; AVP ;; e.g. maintain habitats for other organisms/ethical/moral/aesthetic reasons/tourism	max [3]	A species diversity A an example of feeding
(c) (i)	reduced genetic diversity ; identical offspring ; negative traits passed on ; more competition for local resources ; less chance of survival in a varying environment ; one disease could wipe out total population ; AVP ; e.g. less chance of evolving	max [2]	A no genetic diversity A unfavourable / bad traits.
(ii)	offspring may not be as well adapted to environment ; slower process/takes longer (than asexual reproduction) ; requires partner/ two parents ; less energy efficient/ requires more energy/ many eggs is wasteful ; AVP ;	max [2]	A description e.g. good characteristics are not always passed on.
(d) (i)	reduction division/chromosome number is halved/one set of chromosomes ; diploid to haploid ; for production of gametes ; daughter cells are not genetically identical/genetically different ;	[2]	to each other or parent

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer	Marks	Additional Guidance
(ii)	for adaption to, new / changed environment ; causes (genetic) variation ; competition for survival ; best suited reproduce ; allows natural selection ; allows evolution ; AVP ;	max [3]	ignore mutations unqualified.
		[Total: 16]	
2 (a) (i)	<i>award two marks if the answer is correct – 12 if there is no answer or it is incorrect, award one mark for correct working</i> 6 s – 1 s = 5 seconds for 1 breath ; 60 / 5 = 12 (breaths per minute) ;	max [2]	Alternative: 4 s – 9 s = 5 s for 1 breath Allow 10 s for 2 breaths for working mark.
(ii)	slower breathing rate before match ; ora deeper breathing during match ; ora during the match breaths are different from each other ; ora pressure (in lungs) increases during the match ;	max [3]	
(b)	<u>external</u> intercostal muscles contract ; <u>internal</u> intercostal muscles relax ; lifts ribs, upwards / outwards ; diaphragm contracts ; diaphragm, flattens / drops ; volume of, thorax / lungs / chest, increases ; pressure in, thorax / lungs / chest, decreases ; air flows in down a pressure gradient / description ;	max [4]	Note: internal and external must be stated
(c) (i)	(CO ₂) is metabolic / AW, waste ; (CO ₂) is toxic ;	max [1]	ignore – from body (in question stem)

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer	Marks	Additional Guidance								
(ii)	(blood) plasma ;	[1]									
(iii)	pH decreases/becomes acidic ;	[1]									
(d)	more, (aerobic) respiration ; steeper concentration gradient ;	[2]	A description of gradient.								
		[Total: 14]									
3 (a)	<table border="1"> <tr> <td>name of part</td> <td>letter from Fig. 3.1</td> </tr> <tr> <td>hair</td> <td>R ;</td> </tr> <tr> <td>blood vessel/arteriole/small artery</td> <td>S ;</td> </tr> <tr> <td>sweat gland</td> <td>U ;</td> </tr> </table>	name of part	letter from Fig. 3.1	hair	R ;	blood vessel/arteriole/small artery	S ;	sweat gland	U ;	[3]	1 mark per correct row R artery, capillary
name of part	letter from Fig. 3.1										
hair	R ;										
blood vessel/arteriole/small artery	S ;										
sweat gland	U ;										
(b)	(involuntary responses are) automatic/no conscious decision/does not involve thought/decision making/innate/reflex ; (higher centres of) brain not involved ; faster/immediate/rapid ; response always the same/response specific to stimulus ; may involve glands ; they are protective/linked to survival/AW ; AVP ;	max [3]	A reverse argument written in favour of voluntary responses if this is clearly stated								

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer	Marks	Additional Guidance
(c)	(change in) temperature/hot / cold is stimulus ; temperature receptors (in skin) / V ; (electric) impulse ; travels through sensory neurone ; to brain ; relay/connector/intermediate neurone ; motor neurone ; to effector ; example of effector (arteriole/erector, muscle) ;	max [4]	R messages points need to be in the correct sequence A 'muscle' unqualified.
(d)	change in temperature, is detected/acts as a stimulus ; to keep temperature, constant / at 37 °C / within limits / near set point / at the norm/AW ; corrective/opposite, action by the body ; return to normal temperature ; correct ref to homeostasis ;	max [3]	
		[Total: 13]	
4 (a)	(group of) cells with similar structure(s) working together to perform a function ;	[1]	
(b) (i)	(spongy) mesophyll ;	[1]	ignore palisade
(ii)	diffusion ;	[1]	
(c)	no chloroplasts/chlorophyll in (root hair cells) ; ora root hair cells are not column shaped ; ora (root hair cells) have long protrusion / extension / larger surface area ; ora	max [2]	R root hair cells have hairs

Page 8	Mark Scheme	Syllabus	Paper
Cambridge IGCSE – October/November 2015			0610

Question	Answer	Marks	Additional Guidance
(d)	<p>1 water moves from root cells, into xylem ; 2 cohesion / adhesion AW, of water molecules ; 3 (this) pulls on/creates tension (in water column in xylem) ; 4 Water moves up/through, the xylem ; 5 mass flow of water (in xylem)/transpiration stream ; 6 water moves into leaf by osmosis (from xylem) ; 7 loss of water from leaf (cells) lowers water potential ; A ref to water potential gradient 8 evaporation, from surfaces of (mesophyll) cells/into air spaces (in leaf) ;</p>	max [4]	<p>ignore method of movement across the root A ‘stick together’, ref to polar</p> <p>ignore ‘water concentration’</p> <p>R ‘through stomata’</p>
(e) (i)	more leaf hairs on lower surface ; leaf hairs appear larger on upper surface ;	max [1]	
(ii)	(increased humidity at lower surface) will reduce transpiration rate ; causes lower water demand / less water loss / reduces chances of wilting ; reduced, concentration gradient (water vapour) / water potential gradient ; creates a boundary layer/AW ;	max [2]	less water loss by transpiration = 2 marks.
		[Total:12]	
5 (a)	<i>method of pollination:</i> wind ; <i>explanation to max 2:</i> Feathery/AW, stigma ; long, filament ; large, anthers/stamens ; anthers/stamens, hang outside flower ; anthers loosely attached (to filament) ; light pollen ; no petals ;	[1] + [2] max [3]	A ‘only bracts’

Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Answer	Marks	Additional Guidance
(b)	cross (pollination) ;	[1]	
(c)	pollen tube ; delivers male gamete / pollen nucleus / male nucleus to ovule ; AW	[2]	A female gamete/egg/female nucleus/ovum.
(d)	<i>idea that tip of pollen tube opens/AW ; gametes / sex cells / ova and pollen nuclei fuse / join / combine ; formation of zygote ; diploid ;</i>	max [2]	A male nucleus for pollen nucleus ignore pollen unqualified ignore meet/mix
(e) (i)	ovule ;	[1]	
(ii)	ovary (wall) ;	[1]	
(iii)	colonise new areas ; reduce (intraspecific) competition ; reduce inbreeding ; ora	max [1]	
(f)	stored food / food reserves (in seed) broken down ; named enzyme plus substrate ; product plus use ; enzymes required in process of respiration ;	max [2]	
		[Total:13]	

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance
6 (a) (i)	<i>award two marks if the answer is correct – 49 if there is no answer or it is incorrect, award one mark for correct working $(207+65+4+410+38+527=1251)$ $(1251 / 2558) \times 100$; 49 (%) ;;</i>	[2]	ignore 48.9 %
(ii)	(awareness / education) to use less paper ; alternatives to using paper ;	max [1]	
(iii)	green kitchen waste ; glass ;	max [1]	
(b)	paper collection / sorting / sent to recycling centre ; shredding ; pulping ; requires water / soaking ; deinking / described ; requires bleach ; rolling / pressing / flattened ; AVP ;	max [4]	process must be in the correct sequence A ‘made thin’
(c)	global warming ; increase in rate of photosynthesis ; causes increase in plant growth / crop yield / vegetation ; any two qualified examples of environment effects of global warming e.g. flooding, extreme weather conditions, qualified habitat change, reduced biodiversity ;; AVP ; e.g. disruption to migration routes	max [4]	R holes in ozone, acid rain, polar ice caps melting.
		[Total:12]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0610 BIOLOGY

0610/21

Paper 2 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Page 2	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- R reject
- ignore mark as if this material was not present
- A accept (a less than ideal answer which should be marked correct)
- AW alternative wording (accept other ways of expressing the same idea)
- underline words underlined (or grammatical variants of them) must be present
- max indicates the maximum number of marks that can be awarded
- mark independently the second mark may be given even if the first mark is wrong
- ecf credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- ora or reverse argument
- AVP any valid point

Page 3	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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question number	mark scheme			marks	guidance												
1	<table border="1"> <tr> <td>difference</td> <td>monocotyledons</td> <td>eudicotyledons</td> </tr> <tr> <td>number of cotyledons in the seed</td> <td>1</td> <td>2</td> </tr> <tr> <td>pattern of leaf veins</td> <td>parallel/AW ;</td> <td>branched/network/AW ;</td> </tr> <tr> <td>number of petals present</td> <td>3 / multiples of (up to 60) ;</td> <td>4 or 5 / multiples of (up to 60) ;</td> </tr> </table>			difference	monocotyledons	eudicotyledons	number of cotyledons in the seed	1	2	pattern of leaf veins	parallel/AW ;	branched/network/AW ;	number of petals present	3 / multiples of (up to 60) ;	4 or 5 / multiples of (up to 60) ;	[4]	
difference	monocotyledons	eudicotyledons															
number of cotyledons in the seed	1	2															
pattern of leaf veins	parallel/AW ;	branched/network/AW ;															
number of petals present	3 / multiples of (up to 60) ;	4 or 5 / multiples of (up to 60) ;															
				[Total: 4]													
2 (a) (i)	<p>bacteria (in mouth) ;</p> <p>(bacteria) change or respire sugar/named sugar (in food) ;</p> <p>(sugar) to acid/lactic acid ;</p> <p>acid dissolves/attacks, enamel/teeth/dentine/top layer/AW ;</p> <p><u>anaerobic respiration</u> ;</p>			max [4]													

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	21

2 (a) (ii)	<p><i>brushing</i>: dislodges, plaque/bacteria/food (particles)/ sugars (from mouth) ;</p> <p><i>rinsing</i>: removes, plaque/bacteria/food (particles)/ sugars (from mouth) ;</p> <p><i>not eating sweet foods between meals</i>: bacteria have, less sugar/food (to respire/use) bacteria respire less/less acid produced ;</p>	[3]	<p>A <u>antiseptic</u> mouth-wash kills/inhibits bacteria</p>
2 (b) (i)	<p><i>incisors</i>: chop/cut/bite/AW ;</p> <p><i>canines</i>: pierce/tear/grip/AW ;</p> <p><i>premolars and molars</i>: grind/crush/chew/AW ;</p>	[3]	<p>R chew</p> <p>A canines chop/cut/bite food</p> <p>A increases surface area of the food/breaks up large chunks/AW</p>
2 (b) (ii)	<p>moves food (between teeth)/AW ;</p> <p>mixes food with saliva/amylase ;</p> <p>helps form a bolus ;</p>	max [1]	

Page 5	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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2 (c)	food small enough (to be swallowed) or a ; increases surface area ; for more rapid enzyme action/digestion ; food mixed with, enzyme/amylase ; food mixed with saliva/mucus (to make swallowing easier) ; prepares stomach for receiving food / AW ;	max [2] [Total: 13]	A makes food softer
3 (a)	bronchiole ; larynx ; trachea ;	[3]	one mark for each labelled line in the correct position.
3 (b)	large surface area (per volume) ; thin/small diffusion distance ; moist/wet/liquid film ; (alveolar) wall permeable ; well ventilated/diffusion gradient maintained ; well supplied with capillaries / diffusion gradient maintained ;	max [3]	A answers in context applying to animals other than mammals.
3 (c) (i)	<u>82.95</u> (dm ³ /min) ;	[1]	

Page 6	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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3 (c) (ii)	breaths more rapid /AW ; breaths deeper / heavier /AW ;	[2]	A diaphragm/external intercostal muscles, contract more rapidly/frequently
3 (c) (iii)	more oxygen needed ; more (cell) respiration carried out ; more energy is required ; more muscle contraction ;	max [1] [Total: 10]	

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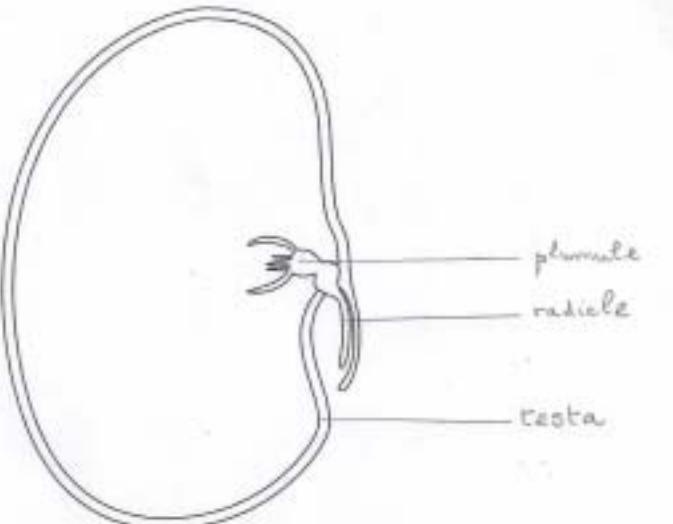
4 (a)	<p>desertification/AW ; soil erosion/landslides/land unstable/AW ; (rapid run-off leads to) local flooding ; rivers silt up ;</p> <p>less transpiration ; (dry air) so less rainfall ; climate change/changed weather patterns/disruption of water cycle ;</p> <p>carbon dioxide added to atmosphere by burning trees / AW ;</p> <p>less photosynthesis so less carbon dioxide removed from atmosphere / more carbon dioxide remains ;</p> <p>more carbon dioxide leads to, global warming/greenhouse effect/sea levels rising ;</p> <p>lack of food/shortage of shelter/homes/nesting sites/loss of habitat ;</p> <p>organisms die/extinction of species/loss of bio-diversity/food chains disrupted/nutrient cycles disrupted/reference to migration ;</p>	max [4]	ignore references to ozone layer/acid rain
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Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	21

4 (b)	<p><i>air:</i> carbon dioxide / carbon monoxide / oxides of sulfur / methane / oxides of nitrogen / CFCs / oxides of lead / ozone / smoke / dust / AVP ;</p> <p><i>land:</i> sewage / pesticides / herbicides / insecticides (or examples) / fertilisers / nuclear waste / chemical waste / land-fill / litter or rubbish / oil spillage / heavy metals / AVP ;</p> <p><i>water:</i> fertilisers / pesticides / herbicides / insecticides / human excrement / nuclear waste / reproductive hormones / antibiotics / chemical waste / industrial waste / litter or rubbish / chlorine / oil spillage / AVP ;</p>	<p>max 3</p> <p>[Total: 7]</p>	<p>6 correct =3 4-5 correct =2 1-3 correct =1</p> <p>ignore car fumes / car exhaust / forms of radiation</p> <p>A specific examples in place of litter e.g. plastic bottles</p> <p>ignore waste unqualified</p> <p>note that any one pollutant can be given credit in one category only</p>
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Page 9	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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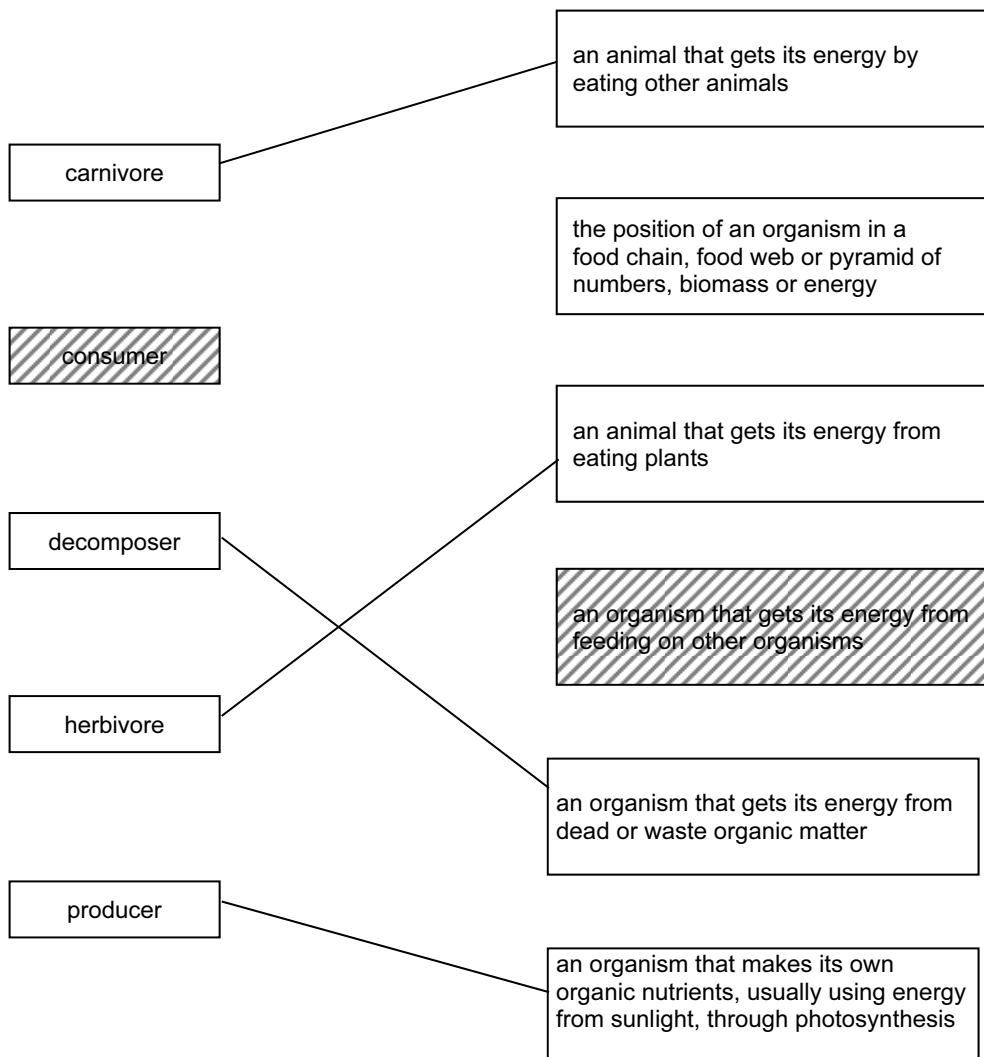
5 (a)	<p><i>mutation</i>: a change/error ; in a, gene/chromosome/DNA ;</p> <p><i>heterozygous</i>: having, two different alleles/a dominant allele and a recessive allele ; of a particular gene ;</p> <p><i>recessive allele</i>: alternative form of a gene ; only expressed, in absence of the dominant (allele)/if homozygous ;</p>	[6]	<p>A not pure breeding ignore symbols alone e.g. Hh</p> <p>ignore symbols alone</p>
5 (b)	(sun-cream) absorbs/blocks/stops Sun's rays ; prevents ionising radiation/harmful Sun's rays from reaching skin/cells/body ; reference to cancer/melanoma/mutation ;	max [1]	<p>R repels / reflects radiation</p> <p>ignore ref to tanning / sunburn</p>
5 (c) (i)	1: aa ; 2: Aa ; 3: aa ; 9: Aa ;	[4]	A if recessive allele is given first (e.g. aA)
5 (c) (ii)	couple R	[1]	A individuals 6 and 7
5 (c) (iii)	if it was recessive all their offspring would have shown the condition ; but individual 11/AW is normal, so must be dominant/AW ;	[2] [Total: 14]	

6 (a)	plumule ; radicle ; testa ;  [3]		
6 (b)	cotyledon ;	[1]	ignore endosperm
6 (c)	colonise new areas/more space (for plant to grow) ; reduce competition (for resources/named resource) ;	max [1] [Total: 5]	

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	21

7 (a) (i)	<p>finch (in a box) above level of tree and grass ;</p> <p><u>arrowed</u> line from tree to finch ; R if no arrow head/arrow head in wrong direction/extra incoming line</p> <p>two <u>arrowed</u> lines from finch to hawk and eagle ; R if no arrow heads/arrow heads in wrong direction/extra outgoing line</p>	[3]	
7 (a) (ii)	<p>increase in hawks ; as not eaten (by eagles/no predators/AW) ;</p> <p>increase in hawks ; decrease in, everything eaten by the hawk/decrease in finch/crow ;</p> <p>decrease in crows/finches ; as more hawks to eat them ;</p> <p>increase in finches ; as fewer eagles to eat them ;</p> <p>increase in aphids and locusts ; as fewer crows to eat them ;</p> <p>any logical suggestion ; with reason ;</p>	max [4]	

7 (b)



award 1 mark for each correct line

R any box on the left with more than 1 line coming from it

[4]

[Total: 11]

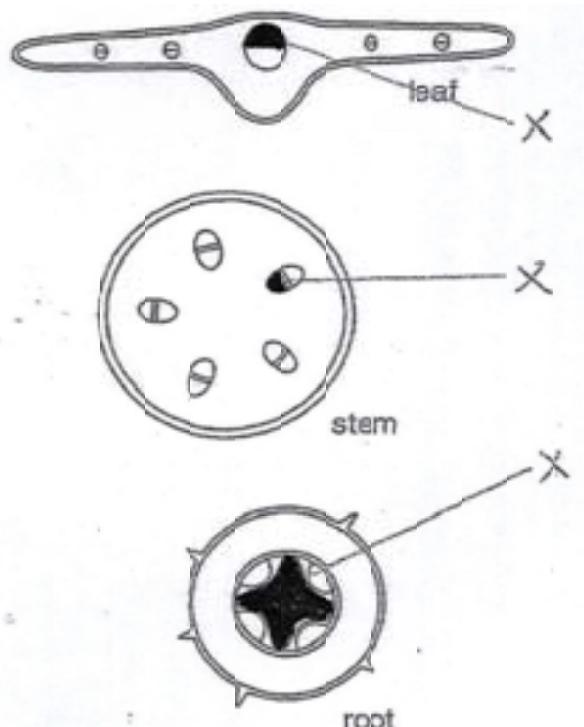
Page 13	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 21
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8 (a)	protein ; acts as a (biological) catalyst ; speeds up/ alters rate of (chemical) reaction or is not altered/used up by reaction ;	max [2]	ignore specific processes/specific enzymes												
8 (b)	<i>L</i> : pH 2 ; <i>M</i> : pH 8 ;	[2]	A 1.9 – 2.1 for <i>L</i> A pH 7.8 – 8.2 for <i>M</i>												
8 (c)	<table border="1"> <thead> <tr> <th><i>name of enzyme</i></th> <th><i>substrate</i></th> <th><i>one end-product</i></th> </tr> </thead> <tbody> <tr> <td><i>amylase</i></td> <td>starch ;</td> <td>maltose/glucose ;</td> </tr> <tr> <td><i>lipase</i></td> <td>fat ;</td> <td>glycerol/fatty acids ;</td> </tr> <tr> <td><i>protease</i></td> <td>protein ;</td> <td>amino acids ;</td> </tr> </tbody> </table>	<i>name of enzyme</i>	<i>substrate</i>	<i>one end-product</i>	<i>amylase</i>	starch ;	maltose/glucose ;	<i>lipase</i>	fat ;	glycerol/fatty acids ;	<i>protease</i>	protein ;	amino acids ;	[6] [Total: 10]	
<i>name of enzyme</i>	<i>substrate</i>	<i>one end-product</i>													
<i>amylase</i>	starch ;	maltose/glucose ;													
<i>lipase</i>	fat ;	glycerol/fatty acids ;													
<i>protease</i>	protein ;	amino acids ;													

Page 14	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	21

9 (a)	<p>movement of sugars/named sugar/amino acids ; in phloem ; from region of production/leaves/source ; to region of utilisation/storage/growth ; energy required/AW ;</p>	max [3]	<p>A water and sugars/water and amino acids R starch</p>
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9 (b)

*correctly labelled:**xylem in leaf ;**xylem in stem ;**xylem in root ;*

[3]

[Total: 6]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0610 BIOLOGY

0610/31

Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **R** reject
- **ignore** mark as if this material was not present
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- underline words underlined (or grammatical variants of them) must be present
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- mark independently the second mark may be given even if the first mark is wrong
- ecf credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- **ora** or reverse argument
- AVP any valid point

Page 3	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers	Marks	Additional Guidance
1 (a)	E A B D C	[max 3]	all 5 correct = 3 marks 3/4 correct = 2 marks 1/2 correct = 1 mark
(b)	soft body ; not segmented ; mantle ; visceral mass ; (muscular) foot ; ignore feet/legs produce slime/have slimy body ; A mucus radula/rasping tongue/AW ; hydrostatic skeleton ;	[max 2]	
		[Total: 5]	
2 (a) (i)	maintain constant temperature/prevent heat from the lamp heating the water/absorbs heat from the lamp/heat shield ; (thermometer) to measure/check/monitor/record, water ; prevent temperature (change), influencing/affecting, the results/rate of photosynthesis ; temperature is a, control(led)/standardised, variable ;	[max 2]	1 mark for ‘controlling’ 1 mark for ‘measuring’
(ii)	maintain constant light intensity ; (light meter) to measure/check/monitor/record, the light intensity ;		1 mark for ‘controlling’ 1 mark for ‘measuring’

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance
	<p>prevent light intensity (change) influencing / affecting the, results / rate of photosynthesis ;</p> <p>make sure the lamp is always, in the same place / at right distance ;</p> <p>light, intensity / level, is dependent on distance ;</p> <p>light intensity is, a controlled / standardised, variable ;</p>	[max 2]	<p>A (ruler) to measure the distance between lamp and plant</p>
(b) (i)	<p>rate / photosynthesis / bubbles:</p> <p>increases as carbon dioxide concentration increases and then, levels off AW ;</p> <p>increases to 0.40 % ; A rate remains constant above 0.40%</p> <p>little / slow, increase up to 0.1 % ; ora</p> <p>one data quote with CO₂ concentration and rate with units ;</p>	[max 3]	<p>units must be used at least once anywhere in the answer to award marking points that require them</p> <p>A bpm for bubbles per minute</p>
(ii)	carbon dioxide / CO ₂ , concentration / % / level / availability ;	[1]	R ‘amount of carbon dioxide’
(iii)	<p>ref to <u>limiting factor</u> in suitable context ;</p> <p>carbon dioxide (concentration), is no longer limiting / AW ;</p> <p>light, intensity / level, could be limiting / AW ;</p> <p>reference to light providing <u>energy</u> for photosynthesis ;</p> <p>temperature could be limiting / AW ;</p> <p>reference to temperature influencing the activity of enzymes ;</p>	[max 4]	

Page 5	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers	Marks	Additional Guidance
	chloroplast / chlorophyll / number of leaves / size of plant, could be limiting factor ;		
(c)	<p>measure <u>volume</u> (of oxygen/gas) ;</p> <p>use, inverted test-tube / measuring cylinder / syringe (barrel) ;</p> <p>reference to, graduations/markings ; A ‘take readings from...’ / ‘record results...’</p> <p>filled with water ;</p> <p>gas collects at the top and pushes out the water / downward displacement of water;</p> <p>gas syringe ;</p> <p>attached by (delivery) tube to, flask / AW ;</p> <p>oxygen sensor ;</p> <p>data logger for any other suitable electronic method ;</p> <p>reference to equilibration / described ;</p> <p>reference to time period ; A rate = volume divided by time</p>	[max 3]	
(d) (i)	<p>use / combustion / burning, of fossil fuels ;</p> <p>reason for increased demand for energy ;</p> <p>carbon dioxide from, volcanic activity / volcanoes ;</p>	[max 2]	<p>A named fossil fuel(s)</p> <p>A named example, e.g. increased use of cars / heating / air-conditioning</p>

Page 6	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers	Marks	Additional Guidance
	deforestation ; burning of, forests/trees ;		
(ii)	carbon dioxide is a <u>greenhouse gas</u> ; (enhanced) <u>greenhouse effect</u> (in context of carbon dioxide) ; heat/infra-red/long wavelength radiation, radiated/emitted, from / absorbed/trapped/AW, by, carbon dioxide/greenhouse gases ; travels/AW, back to the surface ; heat cannot, leave (from the atmosphere)/pass into outer space ;	[max 4]	R ‘ozone causes greenhouse effect’ A reflected as an alternative to radiated ignore UV light/visible light/(solar) radiation
		[Total: 21]	
3 (a)	either KMJ ; ON ; or KMO ; JN ;	[2]	
(b) (i)	release of an, egg/ovum/oocyte ; either from, follicle/ovary ; or into, oviduct/fallopian tube ;	[2]	A ‘follicle and egg’
(ii)	<u>zygote</u> ;	[1]	
(c)	zygote/fertilised egg, divides ; mitosis/cell division ;	[max 5]	ignore embryo forming after implantation

Page 7	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers	Marks	Additional Guidance
	<p>forms, an embryo ; A blastocyst/blastula (hollow) ball/collection/group/AW, of cells ;</p> <p>goes/moves, down oviduct/down fallopian tube/towards uterus ;</p> <p>detail, e.g. ciliary action/peristalsis/muscle contraction ;</p> <p>implants/AW, into, lining of the uterus/endometrium/wall of uterus ;</p> <p>growth/development, of <u>placenta</u> ;</p> <p>follicle becomes, yellow body/corpus luteum/remains of follicle/AW ;</p> <p>yellow body/corpus luteum/ovary/AW, secretes/releases/produces <u>progesterone</u> ;</p> <p>progesterone maintains, endometrium/lining of uterus/wall of uterus/AW ;</p> <p>progesterone, prevents menstruation ;</p> <p>inhibition of FSH (secretion/release) ;</p> <p>prevents, production of more eggs/production of follicles ;</p>		A ‘embeds/sinks in’ R ‘zygote implants’ A any suitable description of yellow body
(d)	corpus luteum/yellow body/ovary ; placenta ;	[2]	
(e) (i)	(named) drug, injected/taken, early in menstrual cycle ; inhibits action of oestrogen ;	[max 3]	e.g. FSH/clomiphene/clomid

Page 8	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers	Marks	Additional Guidance
	<p>stimulates, production/release, of FSH ;</p> <p>makes sure that FSH concentration is high enough ;</p> <p>to stimulate production/development/maturation of, follicles/eggs/ova/oocytes ;</p> <p>more eggs are released ;</p> <p>LH stimulates, ovulation/release of eggs ;</p>		
(ii)	<p><i>idea that</i> stress is associated with difficulty having children ;</p> <p>stated problem with multiple births ;</p> <p>problems with unused embryos (when used with IVF) ;</p> <p>issues with elderly parent(s) ;</p> <p>religious objections to use of fertility drugs ;</p> <p>any reference to cost of the treatment ;</p> <p>increases populations/any negative effect of population increase ;</p> <p>can be used to increase populations/any positive effect of population increase ; e.g. in countries with falling birth rates</p>	[max 2]	<p>ignore ‘interfering with a natural process’</p>
		[Total: 17]	

Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance												
4 (a)	<table border="1"> <tr> <td>function</td> <td>letter from Fig. 4.1</td> <td>name</td> </tr> <tr> <td>resists the turgor pressure of the cell</td> <td>A</td> <td>cell wall ;</td> </tr> <tr> <td>controls the activities of the cell</td> <td>C</td> <td>nucleus ;</td> </tr> <tr> <td>site of the chemical reactions of the cell including synthesis of proteins</td> <td>D</td> <td>cytoplasm ;</td> </tr> </table>	function	letter from Fig. 4.1	name	resists the turgor pressure of the cell	A	cell wall ;	controls the activities of the cell	C	nucleus ;	site of the chemical reactions of the cell including synthesis of proteins	D	cytoplasm ;	[3]	D – ignore ribosome / mitochondria
function	letter from Fig. 4.1	name													
resists the turgor pressure of the cell	A	cell wall ;													
controls the activities of the cell	C	nucleus ;													
site of the chemical reactions of the cell including synthesis of proteins	D	cytoplasm ;													
(b) (i)	<p>cytoplasm/vacuole, decreases in, size/volume ;</p> <p>(some) cell membrane/cytoplasm, pulls away/AW, from cell wall ;</p> <p><u>plasmolysis</u>/cells are <u>plasmolysed</u> ;</p> <p>cells, are flaccid/not turgid/lose turgor ;</p> <p>cell walls no longer, pushed outward/withstand pressure ;</p>	[max 3]	A ‘cell shrinks’ ignore implodes/shrivels up												
(ii)	<p>salt solution has a lower <u>water potential</u> than the cell ; ora</p> <p>water moves out of the cells, by <u>osmosis</u> ;</p> <p>down a water potential gradient/from a high(er) water potential to a low(er) water potential ;</p> <p>through a partially permeable membrane ;</p>	[max 3]	ignore ‘water concentration’												

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance																		
		[Total: 9]																			
5 (a)	<i>idea that</i> blood travels through the heart twice during one complete circuit (of the body) ; <i>or</i> pulmonary circulation / to the lungs and systemic circulation / described ;	[1]	A ‘one cycle/one full circulation’																		
(b)	<table border="1"> <thead> <tr> <th>organ</th> <th colspan="2">blood vessel</th> </tr> <tr> <th></th> <th>delivers blood</th> <th>takes blood away</th> </tr> </thead> <tbody> <tr> <td>heart</td> <td>1 vena cava / coronary artery ; 2 pulmonary vein</td> <td>1 aorta 2 pulmonary artery ;</td> </tr> <tr> <td>lungs</td> <td>pulmonary artery</td> <td>pulmonary vein ;</td> </tr> <tr> <td>liver</td> <td>1 hepatic artery 2 hepatic portal vein ;</td> <td>hepatic vein</td> </tr> <tr> <td>kidney</td> <td>renal artery</td> <td>renal vein</td> </tr> </tbody> </table>	organ	blood vessel			delivers blood	takes blood away	heart	1 vena cava / coronary artery ; 2 pulmonary vein	1 aorta 2 pulmonary artery ;	lungs	pulmonary artery	pulmonary vein ;	liver	1 hepatic artery 2 hepatic portal vein ;	hepatic vein	kidney	renal artery	renal vein	[5]	
organ	blood vessel																				
	delivers blood	takes blood away																			
heart	1 vena cava / coronary artery ; 2 pulmonary vein	1 aorta 2 pulmonary artery ;																			
lungs	pulmonary artery	pulmonary vein ;																			
liver	1 hepatic artery 2 hepatic portal vein ;	hepatic vein																			
kidney	renal artery	renal vein																			
(c) (i)	high pressure would, burst/damage, capillaries/AW ; capillaries/capillary walls, are, thin/fragile/weak/delicate/narrow ; wall/lining, (of capillary) is one <u>cell</u> thick ;	[max 2]	A ‘capillaries cannot withstand pressure’ R thin / thick, ‘cell wall’																		

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance
(ii)	contraction of muscles (in the legs)/ movement of legs ; pushing/squeezing, blood ; (semi-lunar) valves, ensure blood flows towards heart/prevents backflow ; negative pressure in the, chest/thorax/right atrium/atria/heart ; <i>idea of residual pressure from the heart</i> ;	[max 3]	R ‘muscles in the, veins/wall of veins’ A ‘one way flow’
5 (d)	thick wall ; withstands/AW, (blood) pressure ; muscular (tissue) ; (vaso)constriction/ (vaso)dilation/resisting rupture/withstands pressure ; elastic (tissue) ; stretches to allow blood surge/AW or recoils to maintain (blood) pressure/smooths out blood flow ; folded/crinkly, endothelium/lining ; allows artery to stretch/allow larger volume of blood to flow/AW ; small lumen ; maintains (blood) pressure ; fibrous (tissue) ;	[max 3]	R ‘thick cell wall’ A resist rupture R increase

Page 12	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0610	31

Question	Expected Answers	Marks	Additional Guidance
	maintains shape / prevents bursting ;		
		[Total: 14]	
6 (a) (i)	willow (tree) and/or aquatic plants → moose → wolf arrows point from food to feeder ; organisms are in the correct order in the food chain ;	[2]	ignore the Sun at the start of the food chain
(ii)	<i>the three organisms can be in any order in the table</i> willow tree / aquatic plants / shoots / plants – producer / 1 st / 1 ; moose – primary consumer / 2 nd / 2 ; wolf – secondary consumer / 3 rd / 3 ;	[3]	ignore autotroph ignore herbivore ignore carnivore / top consumer
(iii)	competition ; food supply / food for moose / food for wolves ; water ; shelter / 'nest' sites / space / territory ; mates ; competition with other types of predators ; disease / parasites ; hunting / poaching ; pollution ; rate of reproduction ; habitat, loss / destruction ; AVP ;	[max 2]	A intraspecific competition A numbers of other competitors A interspecific competition R predation / new predator

Page 13	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0610	Paper 31
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Question	Expected Answers			Marks	Additional Guidance
6 (b) (i)	<i>two marks for the correct answer if no answer or incorrect answer, one mark for correct working</i>				
	<i>answer for two marks</i>	1.3 ;; A 1.30	1.4 ;; A 1.42		
	<i>working for one mark</i>	<p><i>either</i> $\frac{56\,000}{4\,320\,000} \quad (\times 100)$ <i>or</i> A 1.296 / 1.2963, etc.</p> <p>ignore 1.29</p>	<p><i>either</i> $4\,320\,000 - 380\,000 = 3\,940\,000$ <i>or</i> $= \frac{56\,000}{3\,940\,000} \quad (\times 100)$ <i>or</i> A 1.421 / 1.4213, etc.</p>	[2]	

6 (b) (ii)	<p><i>this question can be answered in terms of energy flow (left column) or predator-prey relationships (right column)</i></p> <p>energy is lost, between/within, trophic levels/along food chain ; A from moose to wolf</p> <p>energy lost, in respiration/as heat/in metabolism ;</p> <p>use of figure with units from Table 6.2 to illustrate/ 1.3% / 1.4% ; A ecf from (b)(i)</p> <p>energy used in maintaining body temperature ;</p> <p>moose/wolf, is an, endotherm/homeotherm ;</p> <p>energy lost in movement ;</p> <p>energy used in muscle contraction ;</p> <p>energy in food, not eaten/egested/passed out in faeces ;</p> <p>energy lost in, excretion/urine ;</p> <p>wolves not very successful at catching prey ;</p> <p>more energy available for moose (than for wolf) ;</p> <p>no other source of food for wolves but, moose ;</p> <p>AVP ; e.g. some/AW, energy is not used for growth</p>	<p>low numbers of wolves ; A wolves die</p> <p>little predation ;</p> <p>more moose, reach reproductive age/have offspring ;</p> <p>numbers of moose increase ;</p> <p>more food for wolves ;</p> <p>more wolves, reach reproductive age/have offspring ;</p> <p>numbers of wolves increases ;</p> <p>more predation ;</p> <p>greater competition between wolves ;</p> <p><i>idea that wolf population reaches carrying capacity/ reaches maximum for resources available ;</i></p> <p>A not enough energy available for more than 50 wolves</p> <p>[max 5]</p>
		<p>[Total: 14]</p>

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0610 BIOLOGY

0610/21

Paper 2 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- R reject
- I ignore (mark as if this material was not present)
- A accept (a less than ideal answer which should be marked correct)
- AW alternative wording
- underline words underlined must be present
- max indicates the maximum number of marks that can be awarded
- mark independently the second mark may be given even if the first mark is wrong
- A, S, P, L Axes, Size, Plots and Line for graphs
- O, S, D, L Outline, Size, Detail and Label for drawings
- (n)ecf (no) error carried forward
- () the word / phrase in brackets is not required, but sets the context or reverse argument.
- ora
- AVP any valid point

Page 3	Mark Scheme Cambridge IGCSE – October/November 2014	Syllabus 0610	Paper 21
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Question	Answer	Marks	Additional Guidance										
1 (a)	<table border="1"> <tr> <td>characteristic of life</td> <td>definition</td> </tr> <tr> <td>nutrition</td> <td>obtaining nutrients for energy, growth and repair (by eating small animals)</td> </tr> <tr> <td>excretion;</td> <td>removal from an organism of toxic materials, the waste products of metabolism or substances in excess of requirements</td> </tr> <tr> <td>reproduction</td> <td>processes which make more if the same organism / AW;</td> </tr> <tr> <td>growth;</td> <td>a permanent increase in size and dry mass</td> </tr> </table>	characteristic of life	definition	nutrition	obtaining nutrients for energy, growth and repair (by eating small animals)	excretion;	removal from an organism of toxic materials, the waste products of metabolism or substances in excess of requirements	reproduction	processes which make more if the same organism / AW;	growth;	a permanent increase in size and dry mass	3	I egestion
characteristic of life	definition												
nutrition	obtaining nutrients for energy, growth and repair (by eating small animals)												
excretion;	removal from an organism of toxic materials, the waste products of metabolism or substances in excess of requirements												
reproduction	processes which make more if the same organism / AW;												
growth;	a permanent increase in size and dry mass												
(b)	(reptiles) do not have gills or fins / have legs / have lungs / can live on land / lay shelled eggs / cannot live under water / AVP;	1	A the opposite for fish if fish clearly stated										
		[Total: 4]											
2 (a)	A cuticle; B palisade / palisade mesophyll; C xylem;	3	A vascular bundle (as bracket also contains a sheath cell)										

(b) (i)	<p>May</p> <p>comparison: there is more carbohydrate in the leaves than in the new potatoes / 4 times as much or 3 a.u. more;</p> <p>explanation: potatoes have not grown yet / leaves are photosynthesising / starch being used for growth;</p> <p>September</p> <p>comparison: there is more carbohydrate in the new potatoes than in the leaves / 5 times as much or 4 a.u. more;</p> <p>explanation: potatoes are large or fully developed / carbohydrate or glucose or sugar has been sent to new potatoes for storage (as starch) / leaves photosynthesising less or are dying AW;</p>	4	<p>must manipulate data for either May or September results, otherwise max 3</p> <p>I starch not stored during May</p> <p>I reference to starch transport and storage of glucose</p>
(ii)	starch;	1	A amylose / amylopectin
(iii)	<p>respiration / to release energy;</p> <p>movement; one example of movement e.g. running or active transport;</p> <p>growth / repair / cell division;</p> <p>synthesis of other chemicals; one named example of synthesis e.g. cellulose or nectar;</p> <p>nutrient for a consumer;</p>	max 2	
		[Total: 10]	

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	21

3 (a)	0.16;; but $(0.18 + 0.15 + 0.15 + 0.16 + 0.16) / 5$;	2	allow 1 mark for the correct formula / figures if answer incorrect
(b) (i)	receptor / sensor; effector;	2	A sense organ or named sense organ A muscle or gland or named examples A if receptor and effector of a specific reflex given e.g. retina and iris
(ii)	protection of eye surface / cornea (from dust / injury / AVP); protection of retina from bright light; maintaining eye surface moist with tears AW;	max 1	
(c) (i)	any substance taken into the body; that modifies chemical reactions in the body / alters the metabolism;	2	
(ii)	(heroin is a depressant so could) slow down the transmission of impulses / AW; or increase reaction time;	1	

<p>(iii) addiction, withdrawal symptoms, risk of overdosing, risk of death, infection from shared needles, damage to veins, risk of HIV, risk of hepatitis C, criminal behaviour, theft, imprisonment, loss of inhibitions, aggression, violence, more prone to accidents, poor judgement of behaviour, euphoria, mental health problems, social problems, family breakdown, loss of job, loss of home, poor ability to work, emotional problems / AW (e.g. lack of self-esteem), physical health problems, heart attacks, liver damage, brain or neurone damage, respiratory failure, strokes,</p>	<p>max 3</p>	<p>A more than one from each category</p>
<p>(d) destroy / kill / inhibit <u>bacteria</u>;</p>	<p>1</p>	
	<p>[Total: 12]</p>	
<p>4 (a) (i) Y in sperm and X in egg;</p>	<p>1</p>	<p>both correct for 1 mark</p>
<p>(ii) zygote;</p>	<p>1</p>	
<p>(b) male is XY and female is XX; idea of random assortment (at meiosis); sperm / male gametes are X or Y and eggs / female gametes are all X; idea of equal chance of an X or Y sperm fertilising an egg / random fertilisation;;</p>	<p>max 3</p>	<p>A information given in Punnett square</p>

(c) (i)	alleles must be identical / the same;	1													
(ii)	sex / gender; blood group;	2													
		[Total: 8]													
5 (a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th style="background-color: #cccccc;">function of part</th> <th style="background-color: #cccccc;">letter labelling part</th> </tr> <tr> <td>protection of the flower when in bud</td> <td>G;</td> </tr> <tr> <td>place where pollen is produced</td> <td>C;</td> </tr> <tr> <td>site of fertilisation</td> <td>F;</td> </tr> <tr> <td>a suitable landing site for pollen</td> <td>B;</td> </tr> <tr> <td>attracts insects</td> <td>A / C;</td> </tr> </table>	function of part	letter labelling part	protection of the flower when in bud	G;	place where pollen is produced	C;	site of fertilisation	F;	a suitable landing site for pollen	B;	attracts insects	A / C;	5	
function of part	letter labelling part														
protection of the flower when in bud	G;														
place where pollen is produced	C;														
site of fertilisation	F;														
a suitable landing site for pollen	B;														
attracts insects	A / C;														
(b) (i)	phenotype genotype; gametes; genotype phenotype;	3	both needed and in correct order both needed and in correct order												
(ii)	1:1 / equal / 50% : 50% / $\frac{1}{2}$: $\frac{1}{2}$ / 3 : 3 etc.;	1	A 50% alone												
		[Total: 9]													
6 (a) (i)	B;	1	A liver												
(ii)	gall bladder;	1	A C												

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(iii)	(bile is) necessary to emulsify fats / AW; (emulsification) needed to increase surface area; for the action of lipase;	max 2	A break down into small droplets but I breakdown unqualified
(b) (i)	stomach; small intestine / ileum;	2	
(ii)	no amylase present / protease cannot digest starch; pH too low / too acidic;	2	A amylase from the mouth is denatured by stomach acid
(c) (i)	water is removed / reabsorbed (into bloodstream);	1	
(ii)	fibre / roughage;	1	A any named high fibre food
(iii)	constipation; diverticulitis; colon / bowel cancer;	max 1	A cancer unqualified
		[Total: 11]	
7 (a) (i)	algae / pond weed;	1	
(ii)	algae → water flea / gnat larvae → ; (diving beetle) → trout → kingfisher;	2	both needed for 1 mark in each case A use of fish and bird
(b)	to kill insects; to stop insects eating crops; to increase yield of crops;	max 1	I reference to killing aquatic insects
(c) (i)	gnats (larvae) / diving beetles killed by / get insecticide, in their body; trout eat gnats; insecticides persistent / non-biodegradable;	2	I water fleas
(ii)	(less predation on trout) so numbers increase:	1	

Page 9	Mark Scheme	Syllabus	Paper
Cambridge IGCSE – October/November 2014			0610 21

(d)	eutrophication; fertilisers increase growth of algae / aquatic plants; animals eating algae / plants are unable to restrict this growth; algae / plants cover water surface and reduce light to lower layers; algae / plants die; decomposers / bacteria feed on dead plants; decomposers / bacteria (respirate) and remove oxygen from the water; fish die as there is insufficient oxygen;	max 4	A alternative wording throughout mark points independently (in any order)
[Total: 11]			
8 (a) (i)	bacteria / fungi / saprophytes / saprotrophs / decomposers;	1	I named organisms e.g. mushrooms
(ii)	temperature / AW; availability of water / AW; pH (of soil); oxygen concentration;	max 2	A number of decomposers present I sunlight / wind
(b) (i)	1025;; but $3050 - (125 + 1900)$;	2	A 1 mark for correct formula / figures if answer incorrect
(ii)	maintaining body temperature; movement / e.g. of movement (muscle contraction / active transport); growth / repair of tissues / cell division; synthesis of chemicals / e.g. given;	max 2	
(c)	global warming / reference to greenhouse effect / causes climate change;	1	I pollution

(d)	desertification; species extinction / loss of biodiversity / loss of habitat; soil erosion; flooding; silting of rivers / lakes; increase carbon dioxide levels; climate change / global warming; disruption of water cycle; AVP;		max 2											
			[Total: 10]											
9 (a)	<table border="1"> <thead> <tr> <th>function</th> <th>label letter</th> </tr> </thead> <tbody> <tr> <td>transport oxygen</td> <td>D</td> </tr> <tr> <td>removes bacteria from the blood</td> <td>B</td> </tr> <tr> <td>involved in blood clotting</td> <td>A</td> </tr> <tr> <td>transports urea</td> <td>C</td> </tr> </tbody> </table>	function	label letter	transport oxygen	D	removes bacteria from the blood	B	involved in blood clotting	A	transports urea	C	3	4 correct = 3 2 or 3 correct = 2 1 correct = 1	
function	label letter													
transport oxygen	D													
removes bacteria from the blood	B													
involved in blood clotting	A													
transports urea	C													
(b)	capillary / hepatic vein / pulmonary artery / vena cava;	1												
(c)	calcium / phosphorus;	1	A magnesium / calcium phosphate / magnesium phosphate / strontium A chemical symbols											
		[Total: 5]												

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0610 BIOLOGY

0610/31

Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme Cambridge IGCSE – October/November 2014	Syllabus 0610	Paper 31
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Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	31

Question	Answer	Marks	Additional Guidance
1 (a)	nucleus: 1 controls (activities in) the cell/AW; 2 contains, chromosomes/genes/alleles/genetic information/DNA; 3 controls how cells, develop/divide/reproduce/grow; 4 cell membrane: 5 forms a barrier/separates a cell from surroundings; 6 allows/controls, movement of (named) substance(s), across/in/out; keeps contents of cell inside/keeps cytoplasm intact/AW;	max 4	I ‘brain’ of cell/‘tells cell what to do’ MP1 A ref to making proteins A makes ribosomes e.g. O ₂ /CO ₂ /nutrients I ref to shape/‘covers cell’/protects cell
(b)	a group of cells, same type/do the same function;	1	cells are in the same place = group
(c)	1 mucus traps, particles/any example; 2 mucus protects lining; 3 (cilia) beat/create wave motion/wafting; 4 move, mucus/fluid away; 5 reduce risk of/stop, (named) pathogens entering lungs;	max 3	e.g. dust/bacteria/spores/virus I ‘collects’ particles
		[Total: 8]	
2 (a)	the allele that is expressed (if it is present)/AW; always seen in the phenotype; masks (effect of) recessive allele;	max 1	I ‘powerful’ defines the phenotype defines characteristic(s)
(b) (i)	<i>Parent genotype:</i> Ff , Ff; <i>Parent phenotype:</i> (with) flecks × (with) flecks; <i>Gametes:</i> F , f, F , f; Working shown to derive genotype; <i>Offspring genotype:</i> FF , Ff , ff; linked to correct phenotype	5	ECF on incorrect key usage ECF from each line A Punnett square/criss-cross lines

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	31

Question	Answer			Marks	Additional Guidance																		
(ii)	ff × ff; parents may be implied as first part of the question asks for parental genotype both parents must have a recessive <u>allele</u> / (if ff × ff) no dominant or F <u>allele</u> , in either parent / (if ff × ff) both parents must be homozygous, recessive / without flecks no parent must be homozygous dominant / presence of (even) one dominant allele in parents could result in flecks;			2	A Ff × Ff and Ff × ff ECF on incorrect key usage from (i) A gene for allele																		
				[Total: 8]																			
3 (a)	<table border="1"> <thead> <tr> <th>substance</th> <th>direction of movement</th> <th>reason</th> </tr> </thead> <tbody> <tr> <td>amino acids</td> <td>to fetus/from mother</td> <td>make proteins/translation/growth / make cells/AW;</td> </tr> <tr> <td>carbon dioxide</td> <td>from fetus</td> <td>waste gas from respiration</td> </tr> <tr> <td>glucose</td> <td>to fetus/from mother</td> <td>(release) energy/respiration/stored as glycogen;</td> </tr> <tr> <td>oxygen</td> <td>to fetus/from mother</td> <td>(gas for) respiration;</td> </tr> <tr> <td>urea</td> <td>from fetus/to mother</td> <td>excretion/metabolic waste;</td> </tr> </tbody> </table>			substance	direction of movement	reason	amino acids	to fetus/from mother	make proteins/translation/growth / make cells/AW;	carbon dioxide	from fetus	waste gas from respiration	glucose	to fetus/from mother	(release) energy/respiration/stored as glycogen;	oxygen	to fetus/from mother	(gas for) respiration;	urea	from fetus/to mother	excretion/metabolic waste;	4	one mark per row A nitrogenous waste
substance	direction of movement	reason																					
amino acids	to fetus/from mother	make proteins/translation/growth / make cells/AW;																					
carbon dioxide	from fetus	waste gas from respiration																					
glucose	to fetus/from mother	(release) energy/respiration/stored as glycogen;																					
oxygen	to fetus/from mother	(gas for) respiration;																					
urea	from fetus/to mother	excretion/metabolic waste;																					

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	31

Question	Answer	Marks	Additional Guidance
(b)	iron: for red blood cells/haemoglobin/to transport oxygen/prevent anemia; vitamin D: absorption of calcium; growth/formation/strengthening, of bones/teeth; preventing rickets;	max 2	max 1 from vitamin D
(c) (i)	lymphocytes/white blood cells/leucocytes;	1	I white cells unqualified
(ii)	provides (passive) <u>immunity</u> ; protects against, infection/illness/disease/pathogen(s)/AW; reference to disease(s) mother has had; immune system of babies not yet developed; any one function of antibodies;	max 3	functions of antibodies: <ul style="list-style-type: none"> • stop pathogens spreading (in the body) • stop pathogens entering cells • stop pathogens dividing/reproducing/increasing in number • cause pathogens to, clump/agglutinate • immobilise bacteria • kill bacteria • make it easier for phagocytes to ingest pathogens • neutralise toxin(s)/make toxins harmless
(iii)	bonding/AW, with mother; it's free/'cheap'; sterile/no risk of infection; body temperature; no preparation/easily available; provides, best/complete/most suitable/balanced/AW, nutrients/food; composition/quantity, of breast milk changes to match development; easier to digest/reduced risk of colic; reduce risk of allergies; contraceptive effect; AVP;	max 4	AVPs: no additives protects against, <u>breast cancer/ovarian cancer</u> children less likely to develop diabetes helps the mother's body to return to 'normal', e.g. weight loss/restores uterus
		[Total: 14]	

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	31

Question	Answer	Marks	Additional Guidance
4 (a) (i)	xylem;	1	
(ii)	<p>thick/lignified, cell walls; for support;</p> <p>lignin; cell walls are waterproof/no water leaks out;</p> <p>long/hollow/no cytoplasm/no organelles/no end walls; water passes through easily/low resistance (to flow);</p> <p>pits; for lateral movement;</p> <p>AVP;;</p>	max 2	<p>one feature linked to a reason max 1 for feature</p>
(b)	<p>1 transpiration/transpiration pull; 2 creates a tension/negative pressure; 3 water potential gradient; 4 osmosis into leaf cells; 5 continuous column of water; 6 cohesion of water molecules/described; 7 adhesion of water to, cell wall/xylem; 8 water evaporates, into airspaces (in mesophyll); 9 water (vapour), diffuses/passes, out through stomata; 10 root pressure;</p>	max 4	<p>I water into roots I water concentration</p> <p>A evaporates</p>

Page 7	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks	Additional Guidance
(c) (i)	<p>1 two peaks; 2 at 10h, and 14/15h; 3 no water conduction before 4h; 4 slow/gradual, increase from 4h to 6h/7h; 5 maximum water conduction rate of 2.4 dm^3 per hour; 6 steep increase in rate of water conduction at 7h/7.5h; 7 decrease in rate of water conduction after 14.5 – 15h; 8 any other data quote;</p>	max 3	<p>Correct units (dm^3 per hour) for water conduction must be stated at least once. If no units at all, only penalise once.</p> <p>A at 15h</p>
(ii)	add the volume (of water conducted) for each hour / calculate area under curve/AW;	1	A half hour
(iii)	<p>possible reasons: different rates of transpiration; different numbers of leaves/different surface areas; different rates of evaporation;</p> <p>factors affecting transpiration: (sun)light/shade; temperature/heat; humidity; wind speed;</p> <p>different species; different diameters of xylem/AW; any feature of leaf structure; e.g. thickness of cuticle / stomatal density/hairs length of roots; different ages; AVP;</p>	max 3	

Page 8	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks	Additional Guidance
(d)	<p>abiotic: increase in carbon dioxide, concentration/production; decrease in oxygen, concentration/production; increased soil erosion; reduced soil fertility; less soil water/faster flow of water from the land; increased, flooding/landslides; disrupts water cycle; greater exposure/AW;</p> <p>biotic: habitat/ecosystem, loss; disruption to, food chain/food webs; less biodiversity; extinction described; seeds germinate/seedlings grow/regeneration;</p> <p>AVP;</p>	max 4	<p>I global warming/greenhouse effect A less decomposition I desertification A silting of rivers</p> <p>A ‘loss of/no, food’ A ‘species die out’/local extinction</p> <p>examples of AVP: organisms exposed to greater, grazing/ predation</p>
		[Total: 18]	
5 (a)	<p>cell wall, peptidoglycan/murein; no nucleus/no nuclear membrane/have nucleoid; loop of DNA; no mitochondria; no chloroplasts; no vacuoles; smaller ribosomes; have pili; have capsule; small/1–2 µm; A correct reference to size</p>	max 2	<p>A plasmids;</p>

Page 9	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks	Additional Guidance
(b) (i)	lag (phase); log/exponential (phase); stationary/plateau (phase); death (phase);	4	
(ii)	no longer reproducing/death rate greater than or equal to ‘birth’ rate; ref to <u>limiting</u> factor(s); no/less, (named) nutrients; no/less, space; no/less, oxygen; build-up of (named) waste; waste is toxic; idea that pH could change to be unsuitable;	max 2	A reached carrying capacity A lactose/sugar/glucose/salts/minerals e.g. carbon dioxide/lactic acid
(c)	increase in, size/length/mass/volume/AW; increase in <u>dry</u> mass; increase in <u>cell</u> number; ref to permanent;	max 2	note: increase in dry mass = 2 marks A ref to cell division/mitosis/reproduction of cells/tissues R reproduction unqualified I development
(d)	asexual (reproduction) / binary fission;	max 1	R mitosis

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0610	31

Question	Answer	Marks	Additional Guidance
(e)	advantages: longer shelf-life/stop foods going off; stop/reduce, growth of (unwanted) bacteria/fungi/microbes; prevent food poisoning; improve/give, taste/flavor; give colour/improve appearance; give texture; emulsify/stabilise, food components; disadvantages: hyperactivity (in children); allergies; vomiting/nausea/headache; asthma; possible link with cancer; AVP;	max 4	advantages to max 3 A reproduction/multiplication/AW disadvantages to max 3
		[Total: 15]	
6 (a)	<u>lock and key</u> mechanism; substrate fits into enzyme; (shape of) substrate is complementary to, enzyme/active site; ref to active site; substrate breaks/product(s) forms/product(s) leaves enzyme; enzyme, free for next reaction/not used up/remains unchanged; AVP;	max 3	e.g. lowers activation energy
(b)	(cellulose) <u>cell wall</u> ;	1	

Page 11	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks	Additional Guidance
(c) (i)	protease activity, similar/AW, on both sites; all enzyme activity is, greater/better/faster, in site A ; cellulase activity on site A greater than protease activity on site A ; cellulase activity, higher on site A , than site B /ORA; cellulase and protease activity on site B similar; use of data with units to support any of these marking points;	max 3	do not award data quote unqualified
(ii)	pH/water content, no effect on protease activity; cellulase more active, at higher pH/less acidic environment; cellulase more active, at lower soil moisture; ref to <u>optimum</u> pH of, protease/cellulase/enzymes; low pH may denature cellulase; idea of different leaf composition; size of leaves/surface area/species of leaf; different stage of decomposition;	max 3	
(d)	1 ref to, decomposers/bacteria/fungi; 2 proteins are broken down to amino acids; 3 by proteases; 4 amino acids converted to, ammonia/ammonium (ions); 5 deamination; 6 ammonia/ammonium ions, converted to nitrite ions; 7 nitrites converted to nitrate ions; 8 nitrification/oxidation/nitrifying bacteria; 9 nitrate ions absorbed by plants;	max 4	protease is linked to MP2 ammonia to nitrate = 1 A nitrites A nitrates ammonia to nitrite and then to nitrate = 2 A nitrates
(e) (i)	<u>nitrogen fixation</u> ;	1	

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Question	Answer	Marks	Additional Guidance
(ii)	root nodules (on legumes); free living bacteria; <u>nitrogen-fixing bacteria</u> ; nitrogen, converted to, ammonium/ammonia/amino acids;	max 2	lightning nitrate(s) nitrification/nitrifying bacteria
		[Total: 17]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0610 BIOLOGY

0610/21

Paper 2 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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	Answer	Marks	Guidance for Examiners												
1	A (<i>M.</i>) ermine ; B (<i>V.</i>) vulpes ; C (<i>O.</i>) cuniculus ; D (<i>M.</i>) vison ; E (<i>M.</i>) leucurus ;	max [4]	5 correct = 4 3 or 4 correct = 3 2 correct = 2 1 correct = 1												
		[Total: 4]													
2 (a) (i)	<u>buffalo</u> ;	[1]													
(ii)	<u>300</u> ;	[1]													
(iii)	<u>elephant</u> ;	[1]													
(iv)	4 ;	[2]													
(b)	(idea of) the smaller the mass/weight/size of a mammal the higher/faster/smaller is its heart rate (or vice versa)/ORA ;	[1]													
(c)	<table border="1"> <thead> <tr> <th>label</th> <th>component name</th> <th>function of component</th> </tr> </thead> <tbody> <tr> <td>F</td> <td>red (blood) cell ;</td> <td>transports oxygen/O₂ ;</td> </tr> <tr> <td>G</td> <td>white (blood) cell ;</td> <td>antibody formation/phagocytosis/kills bacteria or pathogens/AW;</td> </tr> <tr> <td>H</td> <td>plasma ;</td> <td>transport of blood cells/soluble nutrients/hormones/urea/carbon dioxide/plasma proteins/heat;</td> </tr> </tbody> </table>	label	component name	function of component	F	red (blood) cell ;	transports oxygen/O ₂ ;	G	white (blood) cell ;	antibody formation/phagocytosis/kills bacteria or pathogens/AW;	H	plasma ;	transport of blood cells/soluble nutrients/hormones/urea/carbon dioxide/plasma proteins/heat;	[6]	function must match component, but if component is incorrectly named, and the function given for it is a correct one, allow 1 mark
label	component name	function of component													
F	red (blood) cell ;	transports oxygen/O ₂ ;													
G	white (blood) cell ;	antibody formation/phagocytosis/kills bacteria or pathogens/AW;													
H	plasma ;	transport of blood cells/soluble nutrients/hormones/urea/carbon dioxide/plasma proteins/heat;													

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(d)	label line to aorta ; label line to hepatic portal vein ;	[2]	
(e)	more muscle contraction/muscle activity (in exercise) ; more energy required ; more respiration (occurs) ; more oxygen/oxygenated blood/glucose/sugar needed (by muscle cells) ; more carbon dioxide/heat produced ; (and so) more blood pumped round body/blood pumped round body faster;	max [3]	"more" (AW such as "increased") must be mentioned at least once in the account – if not, max = 2
		[Total: 17]	
3 (a)	tick ; cross/blank tick ; cross/blank tick ; cross/blank	[3]	
(b)	condom/sheath/femidom ; virus/HIV contained in sperm/semen/body fluids ; (thin rubber bag catches sperm/semen/fluids) virus cannot get into contact with partner/AW ;	[1] [2]	

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(c) (i)	no intercourse/AW around ovulation time/fertile time/day 12 – 17/fertile period/ORA ; detected by change in female body temperature/changes in vaginal mucus/dates if menstruation is regular ;	[2]	
(ii)	religious or moral reasons/lack of money/lack of availability of other methods/lack of medical advice/AVP ;	[1]	
		[Total: 9]	
4 (a)	A = respiration/excretion/decay/decomposition/rotting/AW ; B = photosynthesis ; C = feeding/nutrition/eating ; D = respiration/excretion decay/decomposition/rotting/AW ;	[4]	
(b) (i)	glucose/fat/protein/amino acid/starch/AVP ;	[1]	
(ii)	glucose/fat/protein/amino acid/glycogen/AVP ;	[1]	

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(c)	<p>(body) rotted/decayed/decomposed/action of decomposers/AW ; bacteria/fungi/saprophytes/saprotrophs/microbes ; carry out respiration on/gain energy from/use body as food/AW/equation for respiration (words or symbols) ; as result of respiration (carbon dioxide released) as waste product/excreted ;</p> <p>OR</p> <p>body eaten by carnivores ; digested/absorbed ; (carnivore) cells carry out respiration/respiration equation ; as a result of respiration (carbon dioxide) released as waste/excreted ;</p> <p>OR</p> <p>body decomposed/rotted/AW ; (the) nutrients absorbed from soil by plants/AW ; plants respire using (this) nutrients/respiration equation ; as a result of respiration (carbon dioxide released) as waste/excreted ;</p>		max [3]
(d)	<p>deforestation/AW ; respiration ; burning (fossil) fuels/named example ; driving vehicles/AW/generating electricity/factories/ industrialisation/AW ;</p>	[2]	
	[Total: 11]		

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5 (a)	cuticle	waterproofs the leaf ;	[4]	5 correct = 4 3 or 4 correct = 3 2 correct = 2 1 correct = 1
	stoma	allows gaseous exchange with surroundings ;		
	palisade cell	produces glucose ;		
	phloem tissue	transports sucrose out of the leaf ;		
	spongy mesophyll	allows diffusion of gases within the leaf ;		
(b)	transport of minerals/ions/named mineral or ion (into the leaf) ; support/AW ;		[2]	R – nitrogen
(c)	starch/sucrose ;		[1]	
(d)	evaporation of water ; from the surfaces of mesophyll (leaf) cells ; (followed by) loss of water vapour ; out of stomata/stoma ;		[2]	
		[Total: 9]		

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6 (a)	<u>P</u> ; <u>M</u> ; <u>L</u> ;	[3]	
(b)	<p><i>colon</i>: absorption of water ; AVP (e.g. absorption of Vitamin K produced by intestinal flora) ;</p> <p><i>pancreas</i>: secretion / production of / AW enzymes / amylase / protease / lipase ; production of alkaline secretions to neutralise stomach acid ;</p> <p>accept secretion of insulin / glucagon ;</p> <p><i>stomach</i>: storage of food ; digestion / chemical digestion / mechanical digestion / AW ; production of (gastric) protease / digestion of proteins ; sterilisation of food (by hydrochloric acid) ;</p>	max [1] max [1] max [1]	
(c) (i)	line labelled X ending on the liver / "X" on liver ;	[1]	
(ii)	emulsification / breaks down / break up large fat globules to smaller ones / AW ;	[1]	
(iii)	increases surface area (of fat globules) ; enzyme / lipase (can digest it more rapidly) ;	[2]	

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(d)	diffusion/description of ; active transport/description of ; digested food/named example passes into blood/capillary/villi ; surface area increased by villi/AW ;	max [3]	R – reference to cilia
		[Total: 13]	
7 (a)	direction of energy transfer/flow/movement (through the food web) ;	[1]	
(b)	grass ; bird/snake/lizard ; <u>2</u> ; <u>4</u> ;	[4]	
(c)	hawk ; snake ;	max [1]	
		[Total: 6]	

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8 (a) (i)	meiosis ;	[1]	I – words that are a cross between meiosis and mitosis (e.g. meiotosis or any word containing a “t”)
(ii)	(gametes) are haploid/n/contain 1 set of chromosomes/contain half the number of chromosomes/ORA ;	[1]	I – numbers of chromosomes
(b)	male = X Y (or vice versa) ; female = X X ;	[2]	R – if both answers identical use judgement if letters appear indeterminate
(c) (i)	(two or more) alternative/different forms of a gene/AW ;	[1]	I – (different) type/copy/sort/kind
(ii)	Bb × Bb ; B and b × B and b ; BB + Bb + Bb + bb (any order so long as correct re “lines”) ; black + black + black + white (or different order to match genotypes) ; 3 black : 1 white ;	[5]	allow ecf if a mistake is made, but each line must correspond to the previous one at each stage
(d)	Bb ;	[1]	accept bB
		[Total: 11]	
		[Paper Total 80]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
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MARK SCHEME for the May/June 2014 series

0610 BIOLOGY

0610/31 Paper 31 (Extended Theory), maximum raw mark 80

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	Answer			Marks	Guidance for Examiners
1 (a)	pollutant	source	effect on the environment	[5]	
	heavy metals, e.g. lead and mercury	factories/industries/mining / exhaust from transport/chemical plants/sewage (sludge) ;			
	phosphate	fertiliser/detergents / sewage ;			
	sulfur dioxide	(combustion of) coal/oil/factories/power stations/chemical plants/exhaust from transport ;			
	ionising radiation	nuclear fall-out/radioactive waste/nuclear industries/nuclear power plants/uranium/plutonium/X-rays ;	mutations/cancers ; A changes genes/changes DNA		

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(b)	<p>1 growth of algae / algal bloom ; 2 light blocked (by algae) ; 3 reduced / no, photosynthesis ; 4 (so) algae / (fixed) water plants, die ; 5 less / no, oxygen released by plants ; 6 algae / plants, fed on / decayed / decomposed, by bacteria ; 7 bacteria, multiply / increase / grow / divide ; 8 (aerobic) respiration ; 9 low levels of oxygen cause, death / suffocation / migration, of, (named) fish / animals / invertebrates / (aquatic) creatures / organisms / consumers ;</p>		max [5]
(c)	<p>1 add lime(stone) / calcium carbonate / CaCO_3 / alkali, to, lakes / rivers / soils ; 2 use less fossil fuels ; ignore stop using fossil fuels 3 use low sulfur fuels ; A stop using sulfur fuels 4 desulfurisation of, coal / oil ; 5 flue gas desulfurisation / ‘use (wet) scrubbers’ / neutralise waste gases with lime ; 6 catalytic converters / use electric cars ; 7 <i>idea of international treaty for reducing emissions</i> ;</p>		max [2]
2 (a)	<p><i>full marks may be possible from a fully annotated genetic diagram</i> females are XX, males are XY ; female gametes are X, male gametes are X or Y ; ref to random fusion of gametes / shown in a Punnett square or alternative ; 1:1 / 50:50 / described, shown / stated ;</p>	[4]	

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(b)	ref to, identify/separate, sperm with X (chromosome) ; semen/sperm, inserted/injected, into, uterus/oviduct ; at/around time of, ovulation/AW ;	max [2]	
(c)	1 formula milk is, similar/closer in composition, to human milk ; 2 any nutrient with similar quantities in formula and human milk ; 3 <i>idea that</i> human milk meets requirements of human babies ; <i>comparisons with cow's milk</i> 4 formula supplies less protein which is harder to digest ; 5 formula supplies more iron, for haemoglobin formation/to prevent anaemia ; 6 formula supplies more vitamin D for, absorption of calcium/formation of bone/for strong bones/prevention of rickets ; 7 formula supplies more vitamin A, for immune system/retina/rods/vision in dim light/prevention of night blindness ; 8 use of comparative figures <u>with correct units</u> ;	max [4]	
(d)	biological/made by cells ; catalyst/speeds up the rate of a reaction ; made of protein ;	max [2]	

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(e)	<p>tubes 1 and 3 – the effect of pH</p> <p>1 lysozyme is active in, 1 / pH 4.0 / acid ;</p> <p>2 <u>cell walls</u>, broken down / digested / destroyed in tube 1 ;</p> <p>3 no (bacterial) growth in tube 1 ;</p> <p>tubes 1 and 4 – the effect of type of bacteria</p> <p>4 lysozyme, destroys / AW, bacteria, A / in tube 1 ;</p> <p>5 lysozyme does not, destroy / AW, bacteria, B / in tube 4 ;</p> <p>6 ref to specificity to bacteria A / bacteria B is resistant ;</p> <p>7 ignore bacteria are immune</p> <p>idea that nothing in (cell wall of) bacteria B for lysozyme to digest ;</p> <p>tubes 1 and 2 – the effect of boiling</p> <p>8 lysozyme denatured (by boiling) ;</p> <p>9 lysozyme not, active ;</p> <p>10 idea that tube 2 is a control to show that lysozyme is responsible for no growth in tube 1 ;</p>	max [6]	
(f)	<p>1 gives (passive) <u>immunity</u> ;</p> <p>2 defends against, infection / illness / disease / pathogens / AW ;</p> <p>3 ref to diseases that the mother has had ;</p> <p>4 any one function of antibodies ;</p>	max [2]	

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3 (a) (i)	eaten/absorbed, a (sugary/high carbohydrate) meal/AW ; (secretion/effect, of) adrenaline ; (secretion/effect, of) <u>glucagon</u> ; dehydration/loss of water ;	max [1]	
(ii)	used in <u>respiration</u> ; (named) exercise/physical activity ; hungry/fasting/starvation ; (secretion/effect, of) insulin ;	max [1]	
(iii)	liver ; muscle ; kidney ; testes ;	max [2]	
(b)	1 pancreas/islets of Langerhans, detects increase in glucose concentration ; 2 (pancreas/islets) secretes/produces, insulin ; 3 transported in, blood/plasma ; 4 liver/muscle/cells, convert glucose to <u>glycogen</u> ; 5 ref to, enzymes (converting glucose to <u>glycogen</u>) ; 6 <u>homeostasis/negative feedback</u> ;	max [3]	
(c)	water, diffuses out of (red blood cells) ; through, partially permeable membrane ; by osmosis ; down water potential gradient/from high water potential to low water potential ; (red cells) decrease in volume/shrink/crenated/AW ;	max [3]	

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4 (a)	(chemical) <u>reactions</u> that breakdown, (named) nutrient(s) ; to, release / transfer, energy ; inside cells ;	max [2]	R produces / creates / AW, energy
(b)	biceps contracts ; pulls on forearm / radius ; ref to the tendon ; bends / flexes, the arm ; triceps relaxes ;	max [3]	
(c) (i)	increase in muscle contraction ; increase in demand for, energy / ATP ; increase in rate of respiration ; <u>aerobic</u> respiration ; heart beats faster / breathes faster or breathes deeper ;	max [4]	<i>For MP1, 2 and 3 'more' / increase must be given at least once</i>
(ii)	line decreases immediately at 20 min ; line reaches $0.2 \text{ dm}^3 \text{ min}^{-1}$ at 30 min ;	[2]	
(iii)	1 <u>oxygen debt</u> ; 2 (during exercise) oxygen not supplied fast enough (from lung/heart) ; 3 to muscles ; 4 <u>anaerobic</u> respiration occurred during exercise ; 5 lactic acid produced ; 6 builds up in muscle/not carried away fast enough in blood ; 7 extra oxygen required after exercise ; 8 lactic acid is, broken down/respired/oxidised/converted to glucose ;	max [4]	

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5 (a) (i)	Caenorhabditis ;	[1]	
(ii)	thread-like bodies / filamentous / filament-like ; unsegmented body ; hydrostatic skeleton ; body, tapers / is pointed, at, one / both, ends ; through gut / mouth and anus ; relatively large pharynx / sucking mouthparts ;	max [2]	
(b)	prevents accumulation of dead matter / removes (organic) waste ; recycles nutrients / named nutrient(s) ; releases (carbon as) carbon dioxide ; (carbon dioxide) for photosynthesis ; decreases particle size of food for decomposers ; ref to energy flow in, food chain / food web / ecosystem ;	max [3]	R energy cycling / recycling
(c) (i)	gametes from same individual ; self-fertilisation / described ; only new source of variation is mutation ; variation produced by meiosis ;	max [2]	
(ii)	6 ;	[1]	

Page 9	Mark Scheme IGCSE – May/June 2014	Syllabus 0610	Paper 31
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(iii)	<p>P meiosis</p> <p>reduction division / chromosome number is halved ;</p> <p>prevents doubling of chromosome number, with each generation / when gametes fuse together / at fertilisation ;</p> <p>ref to haploid (cells / gametes / sex cells) ; gamete / sex cell, production ;</p> <p>Q mitosis</p> <p>growth is taking place ; producing (genetically) identical cells ; more diploid cells ;</p>		producing haploid gametes = 2 max [3]
(d)	in chromosomes ; in the nucleus ; in mitochondria ;	max [2]	A in plasmids ;

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6 (a)	1.8 / 1.83 / 1.825, mm ;	[1]	
(b)	nitrogen fixation ; convert nitrogen into, ammonia/NH ₃ /ammonium ions/NH ₄ ⁺ ; convert ammonia to amino acids ;	max [2]	
(c) (i)	photosynthesis ; carbon dioxide + water/CO ₂ + H ₂ O ; use of, <u>light</u> (energy)/ <u>sunlight</u> ;	max [2]	
(ii)	translocation/mass flow ; phloem ; as sucrose ; from, source/leaf ; then from phloem to root nodule by diffusion ;	max [2]	
(d)	active, transport/uptake ; use of, energy/ATP (from respiration) ; use of, proteins/carrier molecules, in membrane ;	max [2]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0610 BIOLOGY

0610/21

Paper 2 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Mark schemes will use these abbreviations

- ; separates marking points
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- **R** reject
- **A** accept (for answers correctly cued by the question)
- **I** ignore as irrelevant or inadequate
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- **ORA** or reverse argument
- **OWTTE** or words to that effect
- underline actual word given must be used by candidate (grammatical variants excepted)
- () the word / phrase in brackets is not required but sets the context
- **D, L, T, Q** quality of: drawing / labelling / table / detail as indicated
- maxindicates the maximum number of marks

Page 3	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 21
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	Answer	Marks	Guidance for Examiners
1 (a)	<p>insects; 3 pairs of / six legs / 3 regions to body / wings;</p> <p>arachnids; 4 pairs of / eight legs;</p> <p>myriapods; 1 or two pairs of identical legs on each segment;</p> <p>Any two pairs – 2 marks each</p>	[max 4]	<p>A – head, thorax, abdomen named</p> <p>I – Refs to individual organisms but if in an arthropod group allow correct feature for the group</p>
(b)	<p>1 to be out of sight; to avoid predators / less likely to be eaten;</p> <p>2 it is damper; to avoid drying out / keep gills moist;</p> <p>3 it is cooler; avoids drying out;</p> <p>4 to be out of the sun; avoids UV light;</p> <p>5 is herbivore / eats plants / source of food; (feeds on) decaying vegetation;</p> <p>Any two pairs – 2 marks each</p>	[max 4]	<p>A – desiccation</p> <p>A – temperature changes less A – metabolism more constant</p> <p>A – rotting</p>
		[Total: 8]	

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	21

2	<table border="1"> <tr> <td>substance</td><td>how inspired air is different from expired air</td></tr> <tr> <td>carbon dioxide</td><td>less in inspired air;</td></tr> <tr> <td>dust particles</td><td>more in inspired air;</td></tr> <tr> <td>oxygen</td><td>more in inspired air;</td></tr> <tr> <td>water vapour</td><td>less in inspired air;</td></tr> </table>	substance	how inspired air is different from expired air	carbon dioxide	less in inspired air;	dust particles	more in inspired air;	oxygen	more in inspired air;	water vapour	less in inspired air;	[4]	A – ORA if specify reverse comparison No credit for absolutes for oxygen, carbon dioxide, water vapour
substance	how inspired air is different from expired air												
carbon dioxide	less in inspired air;												
dust particles	more in inspired air;												
oxygen	more in inspired air;												
water vapour	less in inspired air;												
		[Total: 4]											
3 (a)	<p><i>label A</i> plasma; transports / carries food materials;</p> <p><i>label B</i> white blood cell; engulfs bacteria / pathogens / produces antibodies;</p> <p><i>label C</i> red blood cell; transports / carries oxygen;</p>	[6]	A – transports carbon dioxide, urea, hormones, blood cells, named food materials A – leucocytes, phagocytes, lymphocytes										
(b)	platelets; help to form clots / prevent bleeding;	[2]	A – plaquettes										
		[Total: 8]											

Page 5	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 21
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4 (a) (i)	three bars plotted correctly;	[1]	
(ii)	working - add totals; deduct from 100;	[max 2]	$17 + 7 + 17 = 41$ $100 - 41 = 59\%$ Correct answer but no working shown = 2 marks
(iii)	prostate (cancer);	[1]	
(b) (i)	1 exercise (regularly); 2 reduce / stop smoking; 3 reduce (animal / saturated) fat / cholesterol in diet; 4 lose weight / avoid obesity; 5 reduce salt intake; 6 reduce alcohol intake; 7 avoid stress situations; 8 correct ref to medication;	[max 3]	I – refs to balanced diet
(ii)	drinking a lot of alcohol / binge drinking / drug abuse;	[1]	A – heroin use
		[Total: 8]	

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	21

5 (a) (i)	1 (emmer) has smaller ears (than modern wheat); 2 (emmer) grains are smaller (than modern wheat); 3 (emmer) has fewer grains per ear (than modern wheat); 4 (emmer) grains have an awn (but not modern wheat);	[max 2]	Assume answer refers to emmer unless specifically stated otherwise A – description of awn as bristle, hair etc.
(ii)	(artificial) selection / selective breeding;	[1]	
(b)	wind (pollination); has exposed anthers / stamens / OWTTE; has feathery / exposed stigma / OWTTE;	[3]	
(c) (i)	(aerobic) respiration;	[1]	R – anaerobic A – oxidation
(ii)	oxygen;	[1]	
(iii)	carbon dioxide;	[1]	
(iv)	1 high temperature kills grains / embryo; 2 high temperature denatures enzymes; 3 lack of oxygen kills grains / embryo; 4 accumulation of carbon dioxide kills / poisons grains / embryo; 5 high temperature kills bacteria / fungi (so no decay); 6 lack of water (prevents germination / decay);	[max 3]	A – ref to 80 °C A – lack of air
		[Total: 12]	

Page 7	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	21

6	DNA; genes; alleles; haploid; chromosomes; gametes;	[6]	
		[Total: 6]	

Page 8	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 21
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7 (a) (i)	combustion – E; photosynthesis – C; respiration – A / B / D;	[3]	
(ii)	1 it could cause a rise in world temperatures / global warming; 2 heat energy becomes trapped; 3 causing ice caps to melt; 4 sea levels to rise; 5 flooding (of low lying land); 6 could cause climate change / alter rainfall; 7 affects agriculture / have to grow different crops; 8 affects ecosystems / distribution of plants / animals; 9 affects water supply;	[max 3]	1 A – greenhouse effect 3 A – glaciers, poles 6 A – extreme weather conditions
(b) (i)	four organisms in suitable sequence; joined by arrows in correct direction;	[2]	grass, gazelle, ticks, oxpecker bird grass → gazelle → ticks → oxpecker bird
(ii)	the flow of energy (between organisms);		
(iii)	1 the energy in the food chain is lost; 2 as heat; 3 it cannot be reused (by living organisms); 4 carbon (dioxide) can be reused (in photosynthesis);	[max 3]	A – energy cannot be reused / not returned to start of chain again
		[Total: 12]	

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8 (a)	female – XX; male – XY;	[2]	
(b)	parent female male parent XX XY chromosomes gametes X X X Y; offspring XX XY XX XY; chromosomes offspring female male female male;		NO MARK for parent chromosomes Gametes ECF from parent chromosomes. Continue marking in logical sequence
		[3]	[Total: 5]

Page 10	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	21

9 (a)	1 enzymes are proteins; 2 act as (biological) catalysts; 3 speed up / alter the speed of chemical reactions; 4 not changed by the reaction;	[max 2]	4 A – can be used over and over again
(b)	1 Benedict's reagent / solution; 2 ref to crushing food to be tested 3 heat food / material with reagent; 4 to at least 70 °C; 5 if colour changes from blue to red reducing sugar present;	[max 3]	4 A – boiling 5 A – green, yellow, orange
(c) (i)	8.6 +/– 0.2;	[1]	
(ii)	1 increasing the pH increase lactase / enzyme activity (up to a peak); 2 (beyond peak) as pH rises further the lactase activity decreases; 3 no activity below pH 4 / above pH 13 / only active between pH 4 and 13;	[3]	
(d)	1 break food up into small pieces (that can be swallowed); 2 increase surface area of food particles; 3 for enzyme activity;	[max 2]	1 I – molecules 3 A – named digestive enzyme
		[Total: 11]	

Page 11	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 21
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10 (a) (i)	in palisade cells / in chloroplasts;	[1]	A – chlorophyll / (upper / spongy) mesophyll
(ii)	(water +) carbon dioxide; (oxygen +) sugar / glucose;	[2]	mark is for carbon dioxide mark is for sugar / glucose A – starch
(b)	1 water enters root hairs (cells); 2 by osmosis; 3 through partially permeable cell membrane; 4 from high (water) concentration to low concentration / down (water) concentration gradient;	[max 3]	2 A – by diffusion
		[Total: 6]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0610 BIOLOGY

0610/31 Paper 31 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	31

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- **AVP** alternative valid point
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Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0610	31

	Answers					Marks	Guidance for Examiners
1 (a)	group of vertebrates	scaly skin	external ear (pinna)	feathers	mammary glands	[4]	
	birds	✓	✗	✓	✗		
	bony fish	✓	✗	✗	✗ ;		
	amphibians	✗	✗	✗	✗ ;		
	reptiles	✓	✗	✗	✗ ;		
	mammals	✗	✓	✗	✓ ;		
(b)	<ul style="list-style-type: none"> • either fruit is soft or seeds, are hard / thick / have a hard / thick / protective covering or testa ; • no enzymes to digest, testa / seed coat / seed ; 					[2]	I refs to teeth

Page 4	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
(c)	<p>1 wind (dispersal) ; 2 ‘hairs’ / wing(s), on seed / fruit, to aid dispersal ;</p> <p>3 self– (dispersal) ; 4 explosive, pods / fruits ;</p> <p>5 water (dispersal) ; 6 float / buoyant ;</p>	[max 2]	<p>A parachute / light I fur</p> <p>I pollination</p>
(d)	oxygen ; warmth / warm temperature ; water ;	[max 2]	A suitable quoted warm temp, 15–30 °C I humidity
(e)	<p>1 (cassowaries are large birds) so need large, territory / habitat / feeding area / lots of space ; 2 cannot fly so cannot move easily from one area to another ; 3 need many trees to produce enough fruit ; 4 cassowaries are dependent on many (tree) species ; 5 need suitable nesting areas ;</p>	[max 3]	
	[Total: 13]		

Page 5	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
2 (a) (i)	provides, sufficient energy / energy for needs ; provides, molecules / materials, for metabolism / equivalent ; provides, nutrients / named nutrients i.e. CPFVM H ₂ O fibre ; in correct / right, quantities / proportions / amounts ;	[max 3]	A substances fibre – accept roughage and non-starch polysaccharide. A minimum of any three named nutrients A contains (all the) food, groups / types / classes R ‘substances’ A adequate / sufficient R ‘equal’
(ii)	age ; sex / gender ; activity / exercise; pregnancy / lactation ; growth / body building ; ambient temperature / climate / weather ; disease / medical condition / illness ; allergy / food intolerance ; size / body mass / build ;	[max 3]	A weight I height
(b) (i)	horizontal line at 180 mg per 100 cm ³ ;	[1]	A tolerance of half-square up or down
(ii)	60 to 300 minutes <i>Units essential</i>	[1]	A 240 minutes / 4 hours
(iii)	increases after time when glucose is ingested, decreases, but stays below or touches 180 / line from b(i) throughout ;	[1]	
(c)	insulin secreted / produced / released ; by pancreas ; glucose absorbed (by liver / muscles) ; stored as / converted to , glycogen ;	[max 3]	
		[Total:12]	

Page 6	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
3 (a) (i)	amylase ;	[1]	
(ii)	pH is a factor that influences / affects enzyme activity / AW; to give the optimum pH ; extreme pH could denature enzyme / AW ;	[max 1]	ORA
(b)	<i>idea that protease</i> , would break down, enzymes / enzyme 2 ;	[1]	
(c)	stable at high temperatures / does not denature at 60 °C / optimum temperature near 60 °C ;	[1]	I bears / tolerates hot temperatures I heat resistant I ref to denatures > 60 °C
(d)	1 (bacteria grown in) fermenters ; 2 (bacteria provided with) substrate / food (substances) / glucose / minerals / whey / waste substances / nutrients / culture medium / AW ; 3 oxygen / aerobic conditions ; A air bubbled through 4 (bacteria) grow / reproduce / increase in number ; 5 enzymes, secreted / released / AW ; 6 enzymes separated from, bacteria / mixture ; A ref to filtration 7 AVP ; e.g. conditions – 26 °C / pH 5–6	[max 3]	A extracted by crushing bacteria
(e)	extracts more juice / speeds up juice extraction ; pectin converted to sugars ; so juice is sweeter ; cell wall material is removed from juice / pectin digested to soluble product(s) ; so the juice is clearer ; AVP; humans don't produce pectinase i.e. humans can digest the juice.	[max 3]	I easier.....
	[Total:10]		

Page 7	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers		Marks	Guidance for Examiners
4 (a)	<p>1 (red blood cells) get stuck in capillaries / do not flow smoothly / capillaries blocked;</p> <p>2 reduce , supply of, oxygen / nutrients (to tissues / cells / muscles) ;</p> <p>3 reduce , removal of, carbon dioxide / wastes, (from tissues / cells / muscles) ;</p> <p>4 ref to respiration (in tissues) ;</p> <p>5 cause sickle cell crises ;</p> <p>6 pain ;</p> <p>7 increased chance of, thrombosis / blood clotting ;</p> <p>8 death of tissues / cells ;</p> <p>9 AVP ;</p>	[max 4]	<p>ignore less haemoglobin</p> <p>A carries <u>less</u> oxygen / nutrients...</p> <p>A carries <u>less</u> carbon dioxide...</p>	
(b) (i)	allele(s) ;	[1]		
(ii)	H^A , H^S + H^A , H^S ; $(H^A H^A$, $H^A H^S$, $H^A H^S$) <u>$H^S H^S$</u> ;	[2]	<p>Could be in Punnett square</p> <p>A just A and S</p> <p>A just S and S</p>	
(iii)	0.25 / 25% / $\frac{1}{4}$ / 1 in 4 ;	[1]	I ratios	

Page 8	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
(c) (i)	<p>1 malaria, is severe disease / may be fatal ; 2 <i>idea that it is the selective agent / ref to natural selection</i> ; 3 $H^A H^A$ / homozygous dominant, susceptible to malaria ; 4 $H^A H^S$ / heterozygous, resistant ; A $H^S H^S$ resistant ; 5 $H^A H^S$ survive / $H^A H^A$ more likely to die before have children ; 6 $H^A H^S$ have children and pass on, the allele / H^S ; 7 (if $H^A H^S$ x $H^A H^S$) 1 in 4 chance of, $H^S H^S$ / homozygous recessive ; 8 2 in 4 / $\frac{1}{2}$, have advantage of resistance to malaria ; 9 AVP ; e.g. ref to malarial parasite / 10 AVP ; e.g. ref to transmission of malaria</p>	[max 4]	<p>A sickle cell trait / carrier for $H^S H^A$ throughout the answer R immune</p>
(ii)	<p>1 malaria not very serious / not a severe strain of malaria ; 2 people have other genetic protection from malaria ; 3 malaria has only recently spread to these areas / no malaria before; 4 mutation not occurred in populations of these areas ; 5 people with mutation / have sickle cell allele , have not migrated here ; 6 (majority of) population in Australia has not lived there for long ; 7 came from areas where no malaria, is / was, present ; 8 AVP ; 9 AVP ;</p>	[max 2]	<p>E.g. Thalassemia A mutation described I gene, for allele</p>
	[Total:14]		

Page 9	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
5 (a)	<p>1 eye, light ; 2 ear, sound / noise ; 3 ear, gravity / acceleration / movement ; 4 tongue, taste / chemicals / flavours in food ; 5 nose, smell / chemicals in the air / odours ; 6 skin, touch / pressure ; 7 skin, temperature ; 8 skin, pain ;</p>	[max 3]	
(b) (i)	response / reaction , to stimulus ; occurs without having to, think / use the brain / make decision ;	[2]	I reflex A not conscious of action until it has happened
(ii)	<p>1 receptor(s) / sensory cells / nerve ending , detects heat / stimulus ; 2 (nervous / electrical) impulses ; 3 generated by (skin) receptor ; 4 travels to spinal cord along sensory neurone(s) ; 5 within spinal nerve ; 6 synapse ; 7 relay / connector / inter–, neurone ; 8 motor neurone to effector / biceps / muscle ; 9 <u>biceps</u> contracts ;</p>	[max 5]	R messages, signals R spinal cord
(iii)	fast ; automatic ; protective / defensive / avoid injury ; removes (part of) body from source of danger ;	[2]	
(c)	hormones / chemical messengers ; secreted into the blood / which travels in blood ; stimulate target , cells / tissues / organs ;	[max 2]	A endocrines I endocrine system
	[Total:14]		

Page 10	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers	Marks	Guidance for Examiners
6 (a) (i)	amino acid / protein / RNA / DNA / AW;	[1]	A named protein, both plant and animal
(ii)	secondary (consumer) / carnivore / predator ;	[1]	R third / tertiary
(iii)	excretion ;	[1]	
(iv)	nitrification ;	[1]	A oxidation
(b)	<p>1 <i>idea that</i> (fixed) nitrogen is in limited supply ;</p> <p>2 <i>idea that</i> if not recycled is not available for plants to absorb ;</p> <p>3 needed for many biological compounds ;</p> <p>4 (required by organisms to make) amino acids / proteins / DNA / chlorophyll ;</p> <p>5 for growth / for repair / for enzymes / for genes / AW ;</p>	[max 3]	
(c)	<p>1 not ideal habitat / not well adapted to habitat / conditions not favourable ;</p> <p>2 any suitable reason ; e.g. too dry / wrong soil / wrong pH / wider leaves / larger leaf surface (area)</p> <p>3 (seedlings) eaten by impala / herbivores ;</p> <p>4 much tastier than grass / better nutritional content ;</p> <p>5 competition with grasses ;</p> <p>6 for any resource ; e.g. light / nutrients / minerals / water</p> <p>7 slow growing ;</p> <p>9 AVP ; e.g. few seeds produced, lack of suitable pollinators, lack of suitable / required symbiont, soil contains plenty of nitrate (so no advantage to being a nitrogen fixer, because of much animal dung) / poor seed dispersal</p> <p>8 Connection...lightning and nitrogen in soil ;</p>	[max 3]	<p>I competition with self</p> <p>A lack of light / minerals / water</p>

Page 11	Mark Scheme IGCSE – October/November 2013	Syllabus 0610	Paper 31
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	Answers		Marks	Guidance for Examiners
(d)	<p>1 general idea of energy loss (in food chain) ; 2 cheetahs are at a higher trophic level (than impala) / impala are the primary consumers / prey ; 3 each cheetah eats many impala; 4 large population of cheetahs cannot be sustained / number of impala controls or determines the number of cheetahs ; 5 hunted / poached (for skins) ; 6 killed by local people as they feed on animals ; 7 reference to balanced ecosystem / food chain / food web; 8 cheetahs do not eat, all impalas / all parts of an impala 'lose energy', in respiration / as heat to environment ; 9 and in movement / excretion / egestion / reproduction ; 10 offspring killed / die (while growing) by other predators / their prey AVP ;</p>		[max 4]	
(e)	<p>1 <i>idea of</i> interdependence ; 2 if one species is lost others may become extinct ; 3 rely indirectly on plants ; 4 impala eat a variety of plants ; 5 cheetahs eat a variety of other prey animals ; 6 <i>idea of</i> conserving habitats ; 7 to ensure species continue for future generations to, enjoy / use ; 8 biodiversity reference;</p>		[max 3]	<p>A idea of knock-on effect / AW</p> <p>A tourism</p>
	[Total:17]			

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0610 BIOLOGY

0610/21 Paper 2 (Core Theory), maximum raw mark 80

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Page 2	Mark Scheme IGCSE – May/June 2013	Syllabus 0610	Paper 21
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Page 3	Mark Scheme IGCSE – May/June 2013	Syllabus 0610	Paper 21
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	Answer	Marks	Guidance for Examiners
1 (a)	1 intake of nutrients / organic substances / mineral ions; 2 for respiration / growth / tissue repair / metabolic activity;	[2]	A – obtain, ingest, absorb, named nutrient, food A – using light to form organic substances / food I – photosynthesis
(b)	1 the release energy; 2 by the breakdown / oxidation of glucose / sugar;	[2]	A – reaction of oxygen with glucose / sugar
		[Total: 4]	

Page 4	Mark Scheme IGCSE – May/June 2013	Syllabus 0610	Paper 21
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2 (a)	<table border="1"> <tr> <td></td><td><i>alcohol</i></td><td><i>heroin</i></td></tr> <tr> <td><i>addiction</i></td><td>YES</td><td>YES;</td></tr> <tr> <td><i>depressant</i></td><td>YES</td><td>YES;</td></tr> <tr> <td><i>can cause liver damage when used in excess</i></td><td>YES;</td><td>YES</td></tr> </table>		<i>alcohol</i>	<i>heroin</i>	<i>addiction</i>	YES	YES;	<i>depressant</i>	YES	YES;	<i>can cause liver damage when used in excess</i>	YES;	YES	[3]	<p>1 mark for each correctly completed row.</p> <p>A – ticks (YES) and crosses (N)</p>
	<i>alcohol</i>	<i>heroin</i>													
<i>addiction</i>	YES	YES;													
<i>depressant</i>	YES	YES;													
<i>can cause liver damage when used in excess</i>	YES;	YES													
(b) (i)	reduces the carriage of oxygen (by red blood cells) / OWTTE;	[1]	A – blocks haemoglobin from carrying oxygen, reduces fetal growth / weight												
(ii)	causes addiction / paralyses cilia / raises blood pressure;	[1]	A – increases heart rate, (risk of) thrombosis												
(iii)	can lead to lung cancer / persistent coughing / bronchitis / emphysema / damages cilia;	[1]	A – tongue, mouth, trachea, stomach, liver cancers												
		[Total: 6]													

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3 (a)	(i) C / I; (ii) C; (iii) B / C / F; (iv) G; (v) B;	[1] [1] [1] [1] [1]	Throughout (i) to (v) accept correct names. R – H
(b)	1 (lipase digests) fats / oils / lipid; 2 into fatty acids; 3 and glycerol; 4 changes large / insoluble to small / soluble molecules; 5 catalyst / speeds up / catalyses (breakdown of fats);	[3]	Any three – 1 mark each
(c) (i)	calcium;	[1]	A – phosphates / fluorides / phosphorus I – fluorine, symbols
(ii)	R – enamel / crown; S – dentine; T – pulp (cavity);	[3]	A – named components of pulp e.g. nerves, capillaries

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(iii)	<p>1 bacteria (in mouth); 2 use sugars / glucose; 3 release (lactic) acid; 4 this erodes enamel; 5 allows entry of bacteria to dentine / live tissue; 6 ref to poor dental hygiene;</p>	max [3]	<p>A – ref to acid in foods A – breakdown / destroy / corrodes / dissolves Any three – 1 mark each.</p>
		[Total:15]	

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4 (a)	A – petal; B – anther / stamen; C – sepal; D – ovule / ovary / carpel;	[4]	A – corolla A – calyx I – stigma / style
(b) (i)	transfer of pollen / OWTTE; from male part of plant / anther to female part of plant / stigma;	[2]	A – male gamete I – refs to mechanism
(ii)	1 having a scent / smell; 2 having a nectary / nectar; 3 having nectary guides / lines on petals; 4 being large / obvious / having a particular shape; 5 being brightly coloured; 6 anthers / stigma enclosed by petals / OWTTE; 7 having sticky / adhesive pollen;	[4]	A – honey R – wind-pollinated features Any four – 1 mark each
(c)	<i>more pollen</i> the pollen is blown everywhere / randomly distributed / pollen wasted; <i>light pollen</i> easily carried by wind / can be carried further;	[2]	A – higher chance of pollination
		[Total:12]	

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5 (a) (i)	<p>1 better medical facilities / drugs / treatments / fewer infant mortalities / longer life span;</p> <p>2 better hygiene conditions such as improved sewage / refuse disposal / water supply;</p> <p>3 better nutrition / healthier foods / more food consumed;</p> <p>4 improved availability of food by better food preservation / storage / less risk of starvation;</p> <p>5 improved agricultural processes / use of fertilisers / pesticides / crop and animal selection makes more food available;</p> <p>6 improved transfer of food (worldwide);</p>	[3]	Any three – 1 mark each.
(ii)	<p>1 increased demand for oil / energy / gas / electricity / fuel;</p> <p>2 increased demand for raw materials / minerals;</p> <p>3 increased demand for food;</p> <p>4 increased demand for water;</p> <p>5 leads to overcrowding;</p> <p>6 more risk of major / epidemic disease outbreaks;</p> <p>7 greater risk of conflict;</p> <p>8 increased amounts of waste for disposal;</p> <p>9 increased risk of environmental damage / pollution;</p> <p>10 increased demand for jobs / employment;</p>	[3]	<p>A – increased demand for resources (In lieu of both MPs 1 and 2)</p> <p>A – ref to competition is equiv to increased demand . ORA applies to these MPs</p> <p>A - refs to reduced living space</p> <p>Any three – 1 mark each.</p>

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(b) (i)	1 radiation (from fall out) affects / alters DNA / causes mutations; 2 can cause cancers / radiation sickness; 3 much fallout has a long radioactive half-life / breaks down very slowly; 4 can enter food chains / description of food chain / bioaccumulation	[2]	Any two – 1 mark each.
(ii)	1 contain pathogens / bacteria / disease causing organisms; 2 leads to disease outbreaks / named disease; 3 can lead to eutrophication of waterways / anaerobic conditions / description; 4 fish / other aquatic organisms may die; 5 has a visual impact / unacceptable smell;	[3]	A – migrate, numbers decrease Any three – 1 mark each
		[Total:11]	

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6 (a)	it is an animal / predator that eats other animals; to obtain the energy / raw materials / food it needs;	[2]	A – meat, flesh
(b)	insects;	[1]	
(c)	<p>column of four boxes, each larger than the one above; each labelled as per food chain / labelled by trophic levels;</p>	[2]	A – birds A – tree A – triangle shape with 4 sections
(d)	photosynthesis; 1 (sun)light is source of energy / is used; 1 absorbed / trapped by chloroplasts / chlorophyll; 3 to react together carbon dioxide and water; 4 to form glucose / sugar; 5 oxygen is also formed / waste product;	[1] max [3]	MPs 1, 3, 4, 5 may be gained from a word equation. I – starch, carbohydrate Any three – 1 mark each.
		[Total: 9]	

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7 (a)	<i>allele</i> is (any two or more) alternative forms of a gene; <i>gene</i> is a length of DNA (that codes for a protein) / part of a chromosome;	[2]	A – piece, segment, part of, thread
(b) (i)	child 5 cannot taste PTC and must have inherited this from parents; allele for not tasting PTC present in parents but is not apparent in both / either parents' phenotype; as parents can taste PTC the allele for tasting must be dominant to the other allele;	[3]	Some points may be gained by annotation of diagram. Accept other letters apart from T,t child (5) cannot taste but parents can; child (5) has double recessive / child tt; received from both / each parent; parents must be heterozygous; parent phenotype shown is taster – thus allele must be dominant; Any 3 – 1 mark each
(ii)	2 – Tt; 5 – tt;	[2]	
(iii)	TT and Tt;	[1]	NB - both genotypes needed for 1 mark.
		[Total: 8]	

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8 (a)	F – aorta; G – renal vein; H – pulmonary artery;	[3]	
(b)	1 entering leg muscle has higher concentration of oxygen; 2 has lower concentration of carbon dioxide; 3 has more glucose; 4 has lower temperature; 5 has lower lactic acid concentration; 6 has higher (blood) pressure;	[2]	Assume responses refer to blood entering muscle unless reversed is stated. Need comparative A – ORA for blood leaving muscle A – more, less for refs to concentration Any two – 1 mark each.
(c)	1 this allows a lower pressure circulation to the lungs; 2 less likely to damage delicate tissues; 3 higher pressure circulation to rest of body; 4 with greater distance to travel; 5 allows only deoxygenated blood to go to lungs / only oxygenated blood to rest of body / bloods do not mix;	[3]	A – capillaries, alveoli Any three – 1 mark each.
		[Total: 8]	

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9 (a)	(excretion is the) removal from an organism / body; of toxic materials / metabolic waste / substances in excess;	[2]	Only award MP1 if clearly distinct from egestion
(b)	lungs; carbon dioxide and water; kidney; urea and (mineral) salts / water; skin / sweat gland; water and (mineral) salts; liver; bile pigments and cholesterol;	[4]	One mark for organ and one mark for <u>two</u> excretory substances A – urea A – bilirubin, biliverdin Any two pairs – 2 marks each.
(c)	oxygen; carbon dioxide; water;	[1]	Any one – 1 mark.
		[Total: 7]	

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0610 BIOLOGY

0610/31

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Mark schemes will use these abbreviations

- ; separates marking points
- / alternatives
- **R** reject
- **A** accept (for answers correctly cued by the question)
- **I** ignore as irrelevant
- **ecf** error carried forward
- **AW** alternative wording (where responses vary more than usual)
- **AVP** alternative valid point
- **ORA** or reverse argument
- underline actual word given must be used by candidate (grammatical variants excepted)
- () the word / phrase in brackets is not required but sets the context
- **D, L, T, Q** quality of: drawing / labelling / table / detail as indicated
- max indicates the maximum number of marks

Page 3	Mark Scheme IGCSE – May/June 2013	Syllabus 0610	Paper 31
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	Answer	Marks	Guidance for Examiners														
1 (a)	<table border="1"> <tr> <td>structure</td> <td>letter from Fig. 1.1</td> </tr> <tr> <td>left lung</td> <td>D</td> </tr> <tr> <td>bronchus</td> <td>J</td> </tr> <tr> <td>diaphragm</td> <td>E</td> </tr> <tr> <td>intercostal muscle</td> <td>H</td> </tr> <tr> <td>rib</td> <td>C</td> </tr> <tr> <td>trachea</td> <td>B</td> </tr> </table>	structure	letter from Fig. 1.1	left lung	D	bronchus	J	diaphragm	E	intercostal muscle	H	rib	C	trachea	B	[5]	<p><i>Only one letter per box; if more than one letter no mark</i></p> <p><i>If letter crossed out but not rewritten mark it</i></p> <p>JEHCB</p>
structure	letter from Fig. 1.1																
left lung	D																
bronchus	J																
diaphragm	E																
intercostal muscle	H																
rib	C																
trachea	B																
(b) (i)	3750 ; no mark for working alone	[1]	<i>if the answer is not in the table look for it in the space for working</i>														
(ii)	number of breaths (per minute) / different rate of breathing ; exhaled breath has a higher temperature ;	[max 1]	A faster, slower, change in frequency ignore depth (as in the table) / heavier														
(iii)	water vapour / H ₂ O / any named rare or inert gas or pollutant ;	[1]	<i>names, correct symbols or formulae for any of the following: H₂, Ar, He, Xe, Ne, Rn, Kr, SO₂, O₃, CO, NO₂, N₂O, CH₄, NH₃, I₂</i>														

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	Answer	Marks	Guidance for Examiners
(iv)	<p>1 <i>in breathed out air</i> 2 after exercise less oxygen <u>and</u> more carbon dioxide / ora ; use of data <u>with %</u> to quantify (for either oxygen or carbon dioxide) ; <i>explanation in terms of the following increasing</i> 3 more oxygen, absorbed / is needed / used up ; 4 more carbon dioxide, produced ; 5 more gas exchange ; 6 more <u>respiration</u> ; R more anaerobic respiration 7 more energy required ; 8 repaying / AW, oxygen debt ;</p>	[max 3]	MP2 oxygen – 17.2 to 15.3% / 1.9% carbon dioxide – 3.6 to 5.5% / 1.9% R inhaled R exhaled R produce energy
2 (a) (i)	L = (primary) producer(s) ; N = secondary consumer(s) ;	[2]	ignore (green) plant ignore carnivore
(ii)	energy, of / at, each trophic level ; A shows that energy, decreases / is lost (at each trophic level) e.g. 'L has more energy than M'	[1]	R biomass / numbers R 'production of energy' ignore energy passed on – shown by the arrows not the boxes
(iii)	<p>1 <i>idea that</i> 2 no, energy left ; 3 use figures from Fig. 2.1 to show that all energy to O is already little / not enough, energy available from eating, tertiary consumers / O / AW ; 4 loss of (90%) energy, at / between, each trophic level / AW ; 5 would be very small population of predators of O ; 6 (population of) predators of O unlikely to survive ; 7 AVP ; e.g. <i>idea that</i> difficult to be a predator of O because O is likely to be 'large and fierce'</p>	[max 3]	<p>A 'needing to eat a lot to get enough energy'</p> <p>MP4 <i>no need to use the term trophic level if idea is implied</i></p>

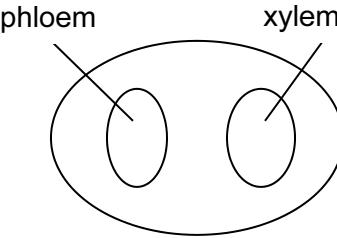
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	Answer	Marks	Guidance for Examiners															
(iv)	<p>1 loss of energy (from, each / all, trophic level(s)) ; 2 (by) <u>respiration</u> ; 3 (to the) environment / atmosphere / surroundings ; 4 as, heat / thermal energy ;</p>	[max 2]	<i>accept once only</i>															
(b)	<p><i>M is the herbivore</i></p> <p>1 more (biomass of / energy in), producers / L ; 2 as fewer / no, herbivores / primary consumers / predators (to eat L) / M ; 3 fewer / extinction of, carnivores / secondary consumers / N ; 4 fewer / extinction of, tertiary consumers / O ; 5 as less, food / energy ; 6 more competition ;</p>	[max 3]	<i>ignore</i> any changes to decomposers / recycling <i>A</i> the argument that more primary consumers will migrate into the ecosystem <i>ignore</i> predators / organisms unqualified															
3 (a)	<table border="1"> <tbody> <tr> <td>function</td> <td>name of organ</td> <td>letter from Fig. 3.1</td> </tr> <tr> <td>production of gametes</td> <td>ovary</td> <td>T ;</td> </tr> <tr> <td>site of implantation</td> <td>uterus</td> <td>X ;</td> </tr> <tr> <td>site of fertilisation</td> <td>oviduct / fallopian tube</td> <td>R ;</td> </tr> <tr> <td>dilates during birth</td> <td>cervix</td> <td>V</td> </tr> </tbody> </table>	function	name of organ	letter from Fig. 3.1	production of gametes	ovary	T ;	site of implantation	uterus	X ;	site of fertilisation	oviduct / fallopian tube	R ;	dilates during birth	cervix	V	[3]	<i>ignore</i> lining / endometrium – <i>not an organ</i> <i>R</i> uterus wall <i>R</i> ‘egg, canal / tube’
function	name of organ	letter from Fig. 3.1																
production of gametes	ovary	T ;																
site of implantation	uterus	X ;																
site of fertilisation	oviduct / fallopian tube	R ;																
dilates during birth	cervix	V																
(b) (i)	ovary / ovaries ; ignore T	[1]	R follicle – <i>not an organ</i>															
(ii)	makes (Graafian) follicle, form / develop / mature / be produced ; causes, secretion / release / production, of oestrogen ;	[max 1]	A egg / ovum / gamete for follicle R ovulation / described															

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	Answer	Marks	Guidance for Examiners
(c) (i)	<p>award the following to max 3</p> <p>increase from, day 1 / first day, to day 11 ; A peaks at day 11 / increases over first 10/11 days</p> <p>decreases from day 11 to day 15 ;</p> <p>increases to day 20 / peaks (again) at day 20 ;</p> <p>decreases to, day 27 / last day ;</p>		<p>award max 2 for data quotes including changes in concentration over stated number of days - units must be used at least once in the answer</p> <p>155 / 156 (arbitrary) units on day 11 ;</p> <p>54 / 55 (arbitrary) units on day 15 ;</p> <p>136 (arbitrary) units on day 20 ;</p> <p>40 (arbitrary) units on day 27 ;</p> <p>[max 4]</p>
(ii)	<p>release of, egg / egg cell / ovum / oocyte / female gamete ;</p> <p>either from, ovary / follicle</p> <p>or</p> <p>into fallopian tube / oviduct ;</p>	[2]	R ovule
(d)	<p>1 sperm cell digests way through, jelly coat / AW ;</p> <p>2 uses enzymes (from acrosome) ;</p> <p>3 sperm, attaches to / fuses with, egg / AW ; A fusion of gametes</p> <p>4 whole sperm cell enters egg / head of sperm enters egg ;</p> <p>5 (egg membrane changes so that) no other sperm can enter ;</p> <p>6 haploid / 23 chromosomes ;</p> <p>7 nuclei, fuse / join ; A ref to chromosomes ‘coming together’</p> <p>8 diploid / 46 chromosomes ;</p> <p>9 zygote ;</p>	[max 3]	<p>ignore egg wall / cell wall</p> <p>ignore events after fertilisation</p>

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	Answer		Marks	Guidance for Examiners
(e) (i)	length / molecule / thread / strand, of DNA (and proteins) ; made of (string of), genes / alleles ; A contains genes		[max 2]	R pair of genes
(ii)	46 ; A 23 pairs		[1]	
4 (a)			[2]	<p>1 mark for drawing and 1 mark for labelling <i>drawing must represent correct position of xylem and phloem as shown in Fig. 4.1</i></p> <p><i>if cells are drawn, these must be in the correct positions for xylem and phloem as in the photograph</i></p>
(b)	<u>sucrose</u> ;		[1]	ignore sugar / non-reducing sugar A phonetic spellings
(c)	<p>1 during growing season / when photosynthesising / when food is made ; 2 (substances are) transported (down), to the roots or to (named) 3 transported (up) to the, growing points / flowers / fruits / seeds / new leaves / AW ; 4 (time of year) when no photosynthesis / when food is not made ; 5 (substances are transported upwards) from, roots / storage organ / seed ; 6 (substances transported) from <u>source</u> to <u>sink</u> ;</p>		[max 4]	<p>A when there is plenty of light</p> <p>A move for are transported MP3 A transported up for either time of year once only</p> <p><i>source may be a storage organ or a leaf depending on the time of year</i></p>

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	Answer	Marks	Guidance for Examiners
(d)	<p>1 evaporation of water, from (surfaces of) mesophyll ; 2 movement / diffusion / loss of, water vapour ; 3 from, leaves ; A (named) aerial / upper, parts ; 4 through / from, stomata / cuticle ;</p>	[max 3]	
(e)	<p>1 evaporation / transpiration, causes movement of water ; 2 in xylem ; 3 reduces pressure at the top of the plant / ref to a water potential 4 transpiration pull ; 5 maintained by <u>cohesion</u> between water molecules ; 6 maintains a continuous column of water / AW ; 7 adhesion of water / AW, to walls of xylem ;</p>	[max 4]	ignore capillarity (except if discussing events at interface between water and air in mesophyll in leaf)
5 (a) (i)	<p>1 without enzymes reactions, occur too slowly / not at all ; A enzymes speed up reactions 2 reduce, activation energy / energy needed for a reaction ; 3 reactions take place at lower temperatures ; 4 enzymes are catalysts ;</p>	[max 3]	MP1 A some aspect of metabolism as an alternative to reactions, e.g. digestion
(ii)	lipase – pancreas ; protease – stomach / pancreas ; amylase – salivary gland / pancreas ;	[3]	organs have to be different if the answer for lipase is incorrect A pancreas for either protease or amylase but not both
(b) (i)	control ; R control(led) variable to show differences in, colour / pH / fat, due to, enzyme / lipase ; to use for comparing, colours / pH ;	[max 2]	A to show what happens without, enzyme / lipase, and bile salts
(ii)	acid pH / below pH 5 / lowers the pH / becomes acidic ; fat has been, digested / broken down ; fatty acids (and glycerol) ;	[3]	R ref to lipase / bile salts being acidic

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	Answer	Marks	Guidance for Examiners															
(iii)	<p>1 ref to specific, pH / colour in, B / C ; i.e. B is blue / 8-10 / alkaline i.e. C is yellow / 4-5 / slightly acid</p> <p>ignore bile salts / lipase is alkaline in B</p> <p>B no, (chemical) digestion / breakdown (of fat) ; no fatty acids ; no lipase ;</p> <p>C some, (chemical) digestion / breakdown (of fat) ; fat not <u>emulsified</u> ; so slower reaction (than A) ; fewer fatty acids produced ;</p> <p><i>award for B / C</i> 9 bile salts <u>emulsify</u> fats ; 10 ref to increasing surface area of fat (globules / AW) ; 11 bile salts are not enzymes ;</p>	[max 4]	<table border="1"> <tr> <td>test-tube</td> <td>contents</td> <td>colour of pH indicator after 5 minutes at 40 °C</td> </tr> <tr> <td>A</td> <td>milk, alkaline solution, lipase and bile salts</td> <td>orange</td> </tr> <tr> <td>B</td> <td>milk, alkaline solution, bile salts and water</td> <td>blue</td> </tr> <tr> <td>C</td> <td>milk, alkaline solution, lipase and water</td> <td>yellow</td> </tr> <tr> <td>D</td> <td>milk, alkaline solution and water</td> <td>blue</td> </tr> </table>	test-tube	contents	colour of pH indicator after 5 minutes at 40 °C	A	milk, alkaline solution, lipase and bile salts	orange	B	milk, alkaline solution, bile salts and water	blue	C	milk, alkaline solution, lipase and water	yellow	D	milk, alkaline solution and water	blue
test-tube	contents	colour of pH indicator after 5 minutes at 40 °C																
A	milk, alkaline solution, lipase and bile salts	orange																
B	milk, alkaline solution, bile salts and water	blue																
C	milk, alkaline solution, lipase and water	yellow																
D	milk, alkaline solution and water	blue																
6 (a)	<p>1 cell wall ; 2 plasmid ; 3 flagella ; 4 capsule ; 5 loop of DNA / circular chromosome / no chromosome(s) ; 6 no nucleus ; 7 no, organelles / named organelle ; 8 AVP ; e.g. smaller ribosomes</p>	[max 2]	<p>R size</p> <p>A fimbriae / pili</p> <p>ignore ‘thread of DNA’ unqualified</p> <p><i>some of these structures are not in all bacteria, but are often shown in diagrams of bacteria</i></p>															
(b) (i)	A – lag ; B – exponential / log ;	[2]	<i>please look carefully at spelling of lag and log</i>															

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	Answer		Marks	Guidance for Examiners
(ii)	<p>1 D – ‘birth’ = death ;</p> <p>2 E – death > ‘birth’ ; <i>for either D or E</i></p> <p>3 less / no, food / nutrients ;</p> <p>4 less / no, oxygen ;</p> <p>5 accumulation of, wastes / toxins ;</p> <p>6 limiting factor(s) <i>used in appropriate context</i> ;</p> <p>7 carrying capacity / described ;</p>		[max 3]	<p>A rate of growth / reproduction for birth</p> <p>A limit / limits in context</p>
(c) (i)	jointed, legs / limbs / appendages ; exoskeleton ;		[max 1]	
(ii)	<i>either</i>	<i>or</i>		
	<p>1 <i>idea that</i> bottom of sea, predators / prey, unable to see ;</p> <p>2 camouflage not needed (ref to, avoiding predators / (therefore) no need to make pigment ;</p> <p>3 less energy needed (to make pigment) ;</p> <p>5 mutation / change in gene <i>or</i> DNA ;</p> <p>6 so no pigment made (allow only if MP5 is given) ;</p> <p>7 white crabs / albino crabs, survive and reproduce ;</p> <p>8 pass on their, gene(s) / allele(s) (for no pigment) ;</p> <p>9 ref to (natural) <u>selection</u> in context ; R if artificial</p>	<p>1 bottom of the sea is covered in white, sand / rock ;</p> <p>2 dark coloured crabs, are conspicuous / easily seen, by predators / more likely to be predated ;</p> <p>3 no need to make pigment ;</p> <p>4 less energy needed (to make pigment) ;</p> <p>5 mutation / change in gene / DNA ;</p> <p>6 so no pigment made (allow only if MP5 is given) ;</p> <p>7 white crabs / albino crabs, survive and reproduce ;</p> <p>8 pass on their, gene(s) / allele(s) (for no pigment) ;</p> <p>9 ref to (natural) <u>selection</u> in context ; R if artificial</p>	[max 4]	