



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY

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Paper 4 Theory (Extended)

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MARK SCHEME

Maximum Mark: 80

Published

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This document consists of **9** printed pages.

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)	L – atrioventricular valve ; M – septum ; O – semi-lunar valve ;	3	
1(a)(ii)	N/P ; J/K ; J ;	3	
1(b)(i)	1 blood from pulmonary vein /K, enters left atrium ; 2 atria contract ; 3 atrioventricular valve /L, <u>opens</u> due to pressure from blood ; 4 blood forced into left ventricle ; 5 ventricle contract ; 6 atrioventricular valves /L, shut to prevent blood entering atrium ; 7 semi-lunar valves /O, open ; 8 blood forced into, aorta /J ; 9 AVP;	5	
1(b)(ii)	left ventricle wall contains more muscle ; left ventricle pumps blood further ; left ventricle has to overcome more resistance ; left ventricle pumps blood at higher pressure ;	2	

Question	Answer	Marks	Guidance
2(a)	no nucleus ; cell wall ; loop of DNA ; AVP ;;	2	
2(b)(i)	overall increase in number of cases of MRSA ; largest increase, between 2004–2005 / exponential ; data quote including the number of cases and the year / data manipulation ;	2	
2(b)(ii)	1 correct ref to mutation of bacteria ; 2 <u>variation</u> in ability of bacteria to survive antibiotic treatment ; 3 bacteria with no / little resistance, die ; 4 bacteria with resistance, survive and breed ; 5 passing on resistant <u>allele</u> ; 6 ref to natural selection ; 7 AVP ; e.g. ref to strengthening of cell wall	4	
2(c)	more responsible use of antibiotics ; improved, detection / screening to avoid spread ; ref to improved cleanliness ; isolating infected patients ; development of new antibiotics / treatment ;	2	

Question	Answer	Marks	Guidance								
3(a)	<table border="1"> <tr> <td data-bbox="331 220 622 284">part of the eye</td> <td data-bbox="622 220 1391 284">function</td> </tr> <tr> <td data-bbox="331 284 622 347">rod cells</td> <td data-bbox="622 284 1391 347">night vision / detects low light ;</td> </tr> <tr> <td data-bbox="331 347 622 411">cone cells</td> <td data-bbox="622 347 1391 411">colour vision ;</td> </tr> <tr> <td data-bbox="331 411 622 480">sensory neurone</td> <td data-bbox="622 411 1391 480">transmits nerve impulses to brain ;</td> </tr> </table>	part of the eye	function	rod cells	night vision / detects low light ;	cone cells	colour vision ;	sensory neurone	transmits nerve impulses to brain ;	3	1 mark for each correct row
part of the eye	function										
rod cells	night vision / detects low light ;										
cone cells	colour vision ;										
sensory neurone	transmits nerve impulses to brain ;										
3(b)	<ol style="list-style-type: none"> 1 more rod cells than cone cells in the retina ; 2 ref to uneven distribution of rod cells either side of fovea ; 3 no rod cells and no cone cells at blind spot ; 4 optic nerve enters / leaves retina at blind spot ; 5 only cone cells at the fovea / no rod cells at the fovea ; 6 maximum number of cone cells are at the, fovea / 0 degrees ; 7 maximum number of rod cells at 20–21 degrees ; 8 data quote include units ; 9 AVP ; 10 AVP ; 	5									
3(c)	<p>more males affected than females / ora ; only females are carriers / males are affected or not ;</p>	2									
3(d)	<table border="1"> <tr> <td data-bbox="331 992 846 1027"><u>correct gametes :</u></td> <td data-bbox="846 992 1352 1027">$X^B, Y + X^b, X^b$;</td> </tr> <tr> <td data-bbox="331 1027 846 1062"><u>correct offspring genotypes :</u></td> <td data-bbox="846 1027 1352 1062">$X^B X^b, X^B X^b, X^b Y, X^b Y$;</td> </tr> <tr> <td data-bbox="331 1062 846 1098"><u>correct offspring phenotypes :</u></td> <td data-bbox="846 1062 1352 1098">carrier female, carrier female, colour-blind male, colour-blind male ;</td> </tr> <tr> <td data-bbox="331 1098 846 1133"><u>correct percentage :</u></td> <td data-bbox="846 1098 1352 1133">50 % ;</td> </tr> </table>	<u>correct gametes :</u>	$X^B, Y + X^b, X^b$;	<u>correct offspring genotypes :</u>	$X^B X^b, X^B X^b, X^b Y, X^b Y$;	<u>correct offspring phenotypes :</u>	carrier female, carrier female, colour-blind male, colour-blind male ;	<u>correct percentage :</u>	50 % ;	4	offspring phenotype must be linked to the correct offspring genotype
<u>correct gametes :</u>	$X^B, Y + X^b, X^b$;										
<u>correct offspring genotypes :</u>	$X^B X^b, X^B X^b, X^b Y, X^b Y$;										
<u>correct offspring phenotypes :</u>	carrier female, carrier female, colour-blind male, colour-blind male ;										
<u>correct percentage :</u>	50 % ;										

Question	Answer	Marks	Guidance
4(a)	carbon dioxide ; light energy ; chlorophyll ;	2	
4(b)	$(2 \div 13) \times 100$; 15(%) ;	2	
4(c)(i)	increased rate of transpiration ; greater concentration of water vapour inside the leaf than outside ; more water vapour diffuses out of the leaf ; through stomata ; more water is drawn up through xylem / transpiration pull ;	3	
4(c)(ii)	by osmosis ; the soil has a higher <u>water potential</u> than the root cells ; water moves from an area of higher water potential to lower water potential ; across a partially permeable membrane ; ref to root hair cell ;	3	A down a water potential gradient
4(d)	1 loss of habitat ; 2 population decrease / migration ; 3 extinction / endangerment, of species ; 4 loss of biodiversity ; 5 less food ; 6 disruption of, food chains / food webs ;	4	

Question	Answer	Marks	Guidance
5(a)(i)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$;;	2	
5(a)(ii)	liver ;	1	
5(b)	correct ref to active site ; enzyme must be complementary shape to, substrate / alcohol ; to make enzyme – substrate complex / to allow substrate to bind to enzyme ; ref to only fits one substrate / specific to one substrate ;	3	A 'lock and key'
5(c)(i)	increased <u>kinetic</u> energy ; molecules move faster ; increased frequency of collisions ; increased number of successful collisions ;	3	
5(c)(ii)	pH ;	1	
5(d)(i)	length of DNA ; that codes for a protein ;	2	
5(d)(ii)	mRNA passes through ribosomes ; ribosomes assemble amino acids into proteins ; order of amino acids is determined by the sequence of <u>bases</u> in mRNA ; AVP ;	2	

Question	Answer					Marks	Guidance
6(a)	enzyme	substrate	product/s	location of enzyme production		5	<p>A polypeptides for protein</p> <p>A peptides for protein</p>
(salivary) amylase	starch	maltose	salivary glands	;			
maltase	maltose	glucose	small intestinal wall	;			
<u>pepsin</u>	protein	amino acids	stomach (wall)	;			
<u>trypsin</u>	protein	amino acids	small intestinal (wall)	;			
lipase	fats	fatty acids and glycerol	pancreas/ small intestinal wall	;			
6(b)	<u>emulsification</u> ; increased surface area of fat globules ; faster, digestion / break down of fat by enzymes ; by lipase / to fatty acids <u>and</u> glycerol ; neutralises (stomach) acid ;					3	
6(c)	the movement of small food molecules and ions ; through the <u>wall</u> of the intestine ; into the blood ;					3	

Question	Answer	Marks	Guidance
6(d)	marasmus / kwashiorkor ;	1	
6(e)	reduces, calorie / energy intake ; reduces obesity ; reduces chances of CHD ; AVP ;;	3	