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**BIOLOGY**

**0610/42**

Paper 4 Theory (Extended)

**March 2017**

MARK SCHEME

Maximum Mark: 80

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**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.

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.

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**Mark schemes will use these abbreviations**

;	separates marking points
/	alternatives
<b>I</b>	ignore
<b>R</b>	reject
<b>A</b>	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
<b>ora</b>	or reverse argument
( )	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	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)	<b>L</b> – atrioventricular valve ; <b>M</b> – septum ; <b>O</b> – semi-lunar valve ;	<b>3</b>	
1(a)(ii)	<b>N/P</b> ; <b>J/K</b> ; <b>J</b> ;	<b>3</b>	
1(b)(i)	<b>1</b> blood from pulmonary vein /K, enters left atrium ; <b>2</b> atria contract ; <b>3</b> atrioventricular valve /L, <u>opens</u> due to pressure from blood ; <b>4</b> blood forced into left ventricle ; <b>5</b> ventricle contract ; <b>6</b> atrioventricular valves /L, shut to prevent blood entering atrium ; <b>7</b> semi-lunar valves /O, open ; <b>8</b> blood forced into, aorta /J ; <b>9</b> AVP;	<b>5</b>	
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 ;	<b>2</b>	

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 1386 284">function</td> </tr> <tr> <td data-bbox="331 284 622 347">rod cells</td> <td data-bbox="622 284 1386 347">night vision / detects low light ;</td> </tr> <tr> <td data-bbox="331 347 622 411">cone cells</td> <td data-bbox="622 347 1386 411">colour vision ;</td> </tr> <tr> <td data-bbox="331 411 622 480">sensory neurone</td> <td data-bbox="622 411 1386 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"> <li>1 more rod cells than cone cells in the retina ;</li> <li>2 ref to uneven distribution of rod cells either side of fovea ;</li> <li>3 no rod cells and no cone cells at blind spot ;</li> <li>4 optic nerve enters / leaves retina at blind spot ;</li> <li>5 only cone cells at the fovea / no rod cells at the fovea ;</li> <li>6 maximum number of cone cells are at the, fovea / 0 degrees ;</li> <li>7 maximum number of rod cells at 20–21 degrees ;</li> <li>8 data quote include units ;</li> <li>9 AVP ;</li> <li>10 AVP ;</li> </ol>	5									
3(c)	<p>more males affected than females / <b>ora</b> ;  only females are carriers / males are affected or not ;</p>	2									
3(d)	<table border="1"> <tr> <td data-bbox="331 992 846 1024"><u>correct gametes :</u></td> <td data-bbox="846 992 1352 1024"><math>X^B, Y + X^b, X^b</math> ;</td> </tr> <tr> <td data-bbox="331 1024 846 1056"><u>correct offspring genotypes :</u></td> <td data-bbox="846 1024 1352 1056"><math>X^B X^b, X^B X^b, X^b Y, X^b Y</math> ;</td> </tr> <tr> <td data-bbox="331 1056 846 1088"><u>correct offspring phenotypes :</u></td> <td data-bbox="846 1056 1352 1088">carrier female, carrier female, colour-blind male, colour-blind male ;</td> </tr> <tr> <td data-bbox="331 1088 846 1120"><u>correct percentage :</u></td> <td data-bbox="846 1088 1352 1120">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	<b>A</b> down a water potential gradient
4(d)	<b>1</b> loss of habitat ; <b>2</b> population decrease / migration ; <b>3</b> extinction / endangerment, of species ; <b>4</b> loss of biodiversity ; <b>5</b> less food ; <b>6</b> 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	



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