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**BIOLOGY**

**0610/41**

Paper 4 Theory (Extended)

**May/June 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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

**Mark schemes will use these abbreviations**

- ; separates marking points
- / alternatives
- **I** **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)	<p>1 (for) energy / energy source / respiration ;</p> <p>2 storage / stored ; (fat or vitamins or energy)</p> <p>3 insulation / reduce heat loss / maintains temperature / ref to myelin ;</p> <p>4 protection (against mechanical damage) / cushions organs / shock absorber ;</p> <p>5 AVP ;</p> <p>6 AVP ;</p>	3	<p>R 'produce energy'</p> <p>I homeostasis e.g. buoyancy making (some) hormones making (cell) membranes provide heat absorption of vitamins waterproofing</p>
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)	<p>(bile) emulsifies fats ;</p> <p>breaks down into / changed into smaller, globules / AW ;</p> <p>increases surface area (to volume ratio) ;</p> <p>for, enzyme(s) / lipase ;</p>	2	R molecules

Question	Answer	Marks	Guidance
1(d)	<p><i>fatty acids / glycerol / fats, enter / AW</i></p> <p><b>1</b> (micro)villi ;  <b>2</b> capillaries / blood vessels / blood / circulatory system ;  <b>3</b> lacteals / lymphatic capillary ;</p> <p><b>4</b> (travel via) lymph / in lymph vessels / in lymph(atic) system ;  <b>5</b> lymph empties into blood ;</p>	<b>3</b>	<p><b>MP5 A</b> tissue fluid / 'body fluid' for lymph  <b>A</b> lymphatic vessels empty into blood</p>
1(e)	<p><b>1</b> fat is deposited in (walls of) arteries ;  <b>2</b> <u>coronary arteries</u> ;  <b>3</b> arteries are blocked / blood flow is restricted in arteries ;  <b>4</b> less / no, blood flow to, heart muscle / cardiac muscle / wall of heart ;  <b>5</b> less / no, nutrients / glucose / oxygen, reaches heart, muscle / walls / cells ;  <b>6</b> AVP ;</p>	<b>3</b>	<p><b>I</b> veins / blood vessels  <b>A</b> narrows (lumen of) arteries</p> <p>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)	<ol style="list-style-type: none"> <li>1 drug treatment ;</li> <li>2 aspirin ;</li> <li>3 to, reduce risk of / prevent, blood clotting ;</li> <li>4 surgery / operation ;</li> <li>5 (coronary) by-pass ;</li> <li>6 described / a piece of blood vessel attached to carry blood around the blocked artery ;</li> <li>7 angioplasty ;</li> <li>8 described / tube <i>or</i> balloon inserted into artery and inflated to widen artery ;</li> <li>9 stent(s) ;</li> <li>10 tube / AW, to, hold arteries open / stop arteries collapsing ;</li> <li>11 to restore blood supply (to heart muscle) ;</li> <li>12 AVP ;</li> </ol>	<b>6</b>	<p><b>A</b> antiplatelets / warfarin  <b>I</b> 'thins the blood'</p>

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)	one mark per row <table border="1" data-bbox="362 751 1308 1294"> <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
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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 ;</p> <p>2 heroin diffuses into synapse ;</p> <p>3 heroin binds to receptors (for neurotransmitter) ;</p> <p>4 ref to, endorphin / enkephalin, receptors / neurotransmitter ;</p> <p>5 ref to heroin being complementary to receptor ;</p> <p>6 blocks neurotransmitter entering receptor site ;</p> <p>7 (or) stimulates receptor ;</p> <p>8 reduced / increased, pain perception ; as appropriate</p> <p>9 AVP ; morphine stimulates release of dopamine acts on relay neurone even when no impulse in neurone <b>B</b></p>	3	<p><b>A</b> competes for binds</p> <p><b>R</b> 'same shape' as receptor</p> <p><b>I</b> ref to summation</p> <p><b>A</b> antagonist</p> <p><b>A</b> agonist</p>
3(e)	<p>light ;</p> <p>temperature / heat / cold ;</p> <p>sound / vibration ;</p> <p>chemicals / taste / smell / pH ;</p> <p>pressure / touch ;</p> <p>position / gravity ;</p> <p>movement ;</p> <p>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)	<b>D</b> ;	1	
4(c)	<p>1 large surface area ;</p> <p>2 thin (surface) / one cell thick ;</p> <p>3 short <u>diffusion</u> distance ;</p> <p>4 good blood supply / many capillaries ;</p> <p>5 good ventilation / good movement of air <i>or</i> water / good oxygen supply ;</p> <p>6 permeable ;</p> <p>7 moist ;</p>	2	



Question	Answer	Marks	Guidance
5(a)(i)	Aloe ;	1	<b>R</b> <i>Aloe pillansii</i>
5(a)(ii)	<ol style="list-style-type: none"> <li>1 (isolated) group of individual plants / AW ;</li> <li>2 of, one / the same, species ;</li> <li>3 living in the same area ;</li> <li>4 at the same time ;</li> </ol>	3	
5(b)	<ol style="list-style-type: none"> <li>1 deforestation ;</li> <li>2 climate change / global warming ;</li> <li>3 change in land use / described ;</li> <li>4 desertification ;</li> <li>5 pollution ;</li> <li>6 plant hunters ;</li> <li>7 increase in (new / invasive), grazers / predators ;</li> <li>8 competition with, introduced species / alien species ;</li> <li>9 (new) disease / pests ;</li> <li>10 lack of pollinators ;</li> <li>11 AVP ;</li> </ol>	3	<p><b>A</b> habitat loss</p> <p><b>A</b> acid rain</p> <p>e.g. quiver trees are (very) slow growing damage to plants by, people / tourists</p>
5(c)	<ol style="list-style-type: none"> <li>1 high risk of extinction ;</li> <li>2 less chance of, reproduction / pollination AW ;</li> <li>3 high risk of genetic diseases ;</li> <li>4 less / little / no, (genetic) variation ;</li> <li>5 (small population so) more vulnerable to, pests / disease / catastrophe ;</li> <li>6 reduced number of <u>alleles</u> ;</li> <li>7 less likely to, adapt to / evolve to / cope with, (named) change in environment ;</li> <li>8 AVP ;</li> </ol>	3	<p><b>A</b> small gene pool <b>R</b> number of genes</p> <p><b>MP7</b> – e.g. new, disease / pest e.g. ref inbreeding ; <b>R</b> interbreeding</p>
5(d)(i)	44 (%) ;;	2	$4 / 9 \cdot 100 (= 44.4)$

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

Question	Answer	Marks	Guidance
6(a)	<ol style="list-style-type: none"> <li>1 variation (in radishes) is not a (confounding) factor ;</li> <li>2 any differences are due to non-genetic factors ;</li> <li>3 example of non-genetic factors – environment / mineral ions ;</li> <li>4 so it was possible to make comparisons ;</li> </ol>	<b>2</b>	<b>A</b> improves validity of investigation
6(b)	<ol style="list-style-type: none"> <li>1 humidity (of air) ;</li> <li>2 temperature ;</li> <li>3 light ;</li> <li>4 carbon dioxide ;</li> <li>5 pH (of nutrient solution(s)) ;</li> <li>6 rate of aeration / oxygen supply / oxygen ;</li> <li>7 depth of solution / volume of solution ;</li> <li>8 spacing / density (of radishes / plants) ;</li> <li>9 AVP ;</li> </ol>	<b>3</b>	<b>I</b> water supply / moisture <b>A</b> warmth  <b>I</b> gravity <b>R</b> ref. to soil  e.g. wind (speed) e.g. pests / diseases
6(c)	<ol style="list-style-type: none"> <li>1 less growth than the, control / complete medium / group 1 ;</li> <li>2 leaf / root, mass per plant is less than, control / group 1 ;</li> <li>3 comparative use of figures per plant, calculated / stated, from the table with units;</li> <li>4 (nitrate (ions) / nitrogen) required to make, amino acids / proteins ;</li> <li>5 any one use of proteins in plants ;</li> </ol>	<b>4</b>	<b>A</b> polypeptides
6(d)	<p><i>appearance max 1</i></p> <ol style="list-style-type: none"> <li>1 yellow(–green) leaves / chlorosis / stunted / short ;</li> </ol> <p><i>explanation for max 2</i></p> <ol style="list-style-type: none"> <li>2 magnesium is needed for chlorophyll ;</li> <li>3 chlorophyll, makes plants or chloroplasts green / is a green pigment ;</li> <li>4 cannot trap, enough / much, light for photosynthesis ;</li> <li>5 less / no, photosynthesis / sugar production ;</li> <li>6 less materials for, growth / making (new) cells ;</li> <li>7 less sugar for respiration ;</li> </ol>	<b>3</b>	<b>R</b> chloroplast

Question	Answer	Marks	Guidance
6(e)	<ol style="list-style-type: none"><li>1 less / no, DNA / RNA (is produced) ;</li><li>2 (new) DNA is needed for cells to divide (by mitosis) ; <b>ora</b></li><li>3 genes / chromosomes, are made of DNA ;</li><li>4 mitosis / cell division, is one way in which organisms grow ;</li><li>5 DNA / RNA, needed for protein synthesis ;</li><li>6 protein is needed for growth ;</li><li>7 AVP ;</li></ol>	<b>2</b>	e.g. energy supply in cells needs ATP