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BIOLOGY

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Paper 4 Theory (Extended)

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MARK SCHEME

Maximum Mark: 80

Published

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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)	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)	<i>fatty acids / glycerol / fats, enter / AW</i> 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 ;	3	MP5 A tissue fluid / 'body fluid' for lymph A lymphatic vessels empty into blood
1(e)	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 ;	3	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

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 or 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)	one mark per row <table><tr><th>function</th><th>name of structure</th><th>letter from Fig. 2.1</th></tr><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></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)	1 heroin is converted into morphine ; 2 heroin diffuses into synapse ; 3 heroin binds to receptors (for neurotransmitter) ; 4 ref to, endorphin / enkephalin, 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	3	A competes for binds R 'same shape' as receptor I ref to summation A antagonist A agonist
3(e)	light ; temperature / heat / cold ; sound / vibration ; chemicals / taste / smell / pH ; pressure / touch ; position / gravity ; movement ; stretch (in muscle / tendons) ;	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)	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 <i>or</i> water / good oxygen supply ; 6 permeable ; 7 moist ;	2	

Question	Answer	Marks	Guidance
5(a)(i)	Aloe ;	1	R <i>Aloe pillansii</i>
5(a)(ii)	1 (isolated) group of individual plants / AW ; 2 of, one / the same, species ; 3 living in the same area ; 4 at the same time ;	3	
5(b)	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 ;	3	A habitat loss A acid rain e.g. quiver trees are (very) slow growing damage to plants by, people / tourists
5(c)	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 ;	3	A small gene pool R number of genes MP7 – e.g. new, disease / pest e.g. ref inbreeding ; R interbreeding
5(d)(i)	44 (%) ;;	2	$4 / 9 \cdot 100 (= 44.4)$

Question	Answer	Marks	Guidance
5(d)(ii)	1 decrease in population (at all sites) ; 2 D has highest mortality / B has the lowest mortality ; 3 site A has lost the most number of trees / site D has lost the lowest number of trees ; 4 use of data from last column to illustrate - minimum of two or 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 5 (in whole population) there is no (net) increase in number of trees ; 6 difficult to compare changes over time as numbers are for different sites ; 7 site A has most trees in original photograph / site C has the least trees in the original photo ; 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	3	A increase in mortality

Question	Answer	Marks	Guidance
6(a)	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 ;	2	A improves validity of investigation
6(b)	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 ;	3	I water supply / moisture A warmth I gravity R ref. to soil e.g. wind (speed) e.g. pests / diseases
6(c)	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 ;	4	A polypeptides
6(d)	<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 ;	3	R chloroplast

Question	Answer	Marks	Guidance
6(e)	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 ;	2	e.g. energy supply in cells needs ATP