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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 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)	1 goblet cells labelled P ; 2 shaped described / produces mucus ; 3 lacteal / lymph vessel / lymphatic vessel, labelled Q ; 4 description / transports fatty acids / fats; 5 capillaries / blood vessel, labelled R ; 6 thin / one cell thick, walls / carries products of digestion ; 7 microvilli / epithelia labelled S ; 8 <i>for microvilli accept</i> – large surface area / thin, for diffusion / absorption ;	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)	<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 ; <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 ;	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																				
3(a)	scent ; nectar ; 'honey' guides ; colourful petals ; large petals ; pollen (as source of food) ;	3	I sticky pollen / stigma I stigma / anther, inside flower A mimicry																				
3(b)	pollen lands on stigma ; pollen tube grows ; through style ; to ovary ; (pollen nucleus / male gamete) enters ovule ; through micropyle ; pollen and ovule / egg, nuclei fuse ;	5																					
3(c)(i)	a version / type, of <u>a gene</u> ;	1	A alternative form of <u>a gene</u>																				
3(c)(ii)	test cross ;	1																					
3(c)(iii)	<table border="0"> <tr> <td><i>parental phenotypes</i></td><td>tall</td><td>x</td><td>dwarf</td></tr> <tr> <td><i>parental genotypes</i></td><td>TT ;</td><td>x</td><td>tt ;</td></tr> <tr> <td><i>gametes</i></td><td>T T</td><td>x</td><td>t t ;</td></tr> <tr> <td><i>offspring genotype</i></td><td colspan="3">Tt ;</td></tr> <tr> <td><i>offspring phenotype</i></td><td colspan="3">(100%) tall</td></tr> </table>	<i>parental phenotypes</i>	tall	x	dwarf	<i>parental genotypes</i>	TT ;	x	tt ;	<i>gametes</i>	T T	x	t t ;	<i>offspring genotype</i>	Tt ;			<i>offspring phenotype</i>	(100%) tall				A ecf from parental genotypes.
<i>parental phenotypes</i>	tall	x	dwarf																				
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<i>offspring genotype</i>	Tt ;																						
<i>offspring phenotype</i>	(100%) tall																						
3(c)(iv)	tt ; so that no dominant allele is present / all alleles are recessive / AW ; recessive alleles only expressed if no dominant allele present ;	2	A homozygous recessive																				

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)	$200 \div 0.0001$ $2\,000\,000 \div 2 \cdot 10^6$;	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	