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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 **11** 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)	carbon dioxide / CO ₂ / water / H ₂ O (vapour) ; (respiring / all) cells / tissues / mitochondria / named tissue(s) / named organ(s) ;	2	R alveoli / lungs
1(a)(ii)	urea ; toxic / poisonous / harmful / waste / AW ;	2	A ammonia / ammonium / creatin(ine) / uric acid / urine
1(b)(i)	glomerulus ;	1	A ball / knot / AW, of capillaries A Bowman's capsule / basement membrane
1(b)(ii)	red (blood) cells / erythrocytes ; phagocytes ; lymphocytes ; named plasma proteins ;; platelets ;	2	e.g. albumen / fibrinogen / insulin / glucagon / thrombin / antibodies / clotting factors
1(c)(i)	microvilli – E ; nucleus – A ; mitochondrion – C ;	3	
1(c)(ii)	stores / contains, chromosomes / genes / alleles / genetic information / DNA ; controls the (activity / reactions of the) cell ; controls how cells, develop / divide / reproduce / grow ; <i>idea that it stores instructions for, making proteins / protein synthesis / making RNA ;</i> AVP ;	1	I 'controls movement of cell' I giving instructions unqualified A 'codes for protein' e.g. making ribosome(s)
1(c)(iii)	small intestine / duodenum / ileum ;	1	A villi / jejunum / tongue / liver / egg cell / white blood cells / ear / nose

Question	Answer	Marks	Guidance
1(c)(iv)	(microvilli give a) large surface area ; for diffusion / described as movement down a concentration gradient ; lots of, mitochondria / C ; C / mitochondria, are the site of (aerobic) respiration ; C / mitochondria, provide energy / make ATP ; energy / ATP, is needed for active transport ; (active transport needed for) movement against concentration gradient ; ref to carrier proteins (in cell membrane) ; AVP ;	4	mp2 is linked to mp1 R 'produces energy' e.g. substances pass to blood to maintain concentration gradient

Question	Answer	Marks	Guidance
2(a)	prevents contamination / transmission, of (named) pathogen / toxin ; prevents, infection / spreading of disease / illness ; ora	2	
2(b)	1 low (concentration) of lactic acid in blood at, rest / the start / before ; 2 lactic acid (concentration) increases, steeply / quickly / AW, during exercise ; 3 reaches a peak / increases and decreases ; 4 decreases steeply, then gradually after exercise ; 5 any use of figures ; <i>explanation</i> 6 oxygen, demand increases / does not reach muscles fast enough / AW ; 7 <u>anaerobic respiration</u> ; 8 provides / releases, energy ; 9 anaerobic respiration produces lactic acid ; 10 lactic acid diffuses from muscles into the blood ; 11 lactic acid is, broken down / respired / oxidised / converted to glucose / AW ; 12 in the liver ; 13 ref. to <u>oxygen debt</u> ;	6	e.g. peak at $13.2 \text{ mmol dm}^{-3}$ at 15 minutes $\pm 0.2 \text{ mmol}$ A produces ATP R produce / makes, energy'
2(c)(i)	P $12 \text{ (km h}^{-1}\text{)}$ and Q $10 \text{ (km h}^{-1}\text{)}$;	1	<i>One mark only both must be right</i>
2(c)(ii)	<i>idea that</i> trained athlete / P, has a higher level of (aerobic) fitness (than Q) ; difference in, gender / age / height / mass / lung capacity / lung mass / stroke volume / muscle type ; AVP ;	1	A P, is fitter than Q / has trained more than Q e.g. ref to genetics but not different genes

Question	Answer	Marks	Guidance
2(c)(iii)	1 increase in demand for energy ; 2 increase in (aerobic) respiration ; 3 increase in demand for oxygen ; 4 increase in carbon dioxide (concentration) ; 5 decrease in pH / increase in acid, in the blood ; 6 detected by the, brain / chemoreceptors ; 7 (brain stimulates) an increase in breathing rate / faster breathing ; 8 (brain stimulates) an increase in depth of breathing / AW ; 9 ref to negative feedback in correct context ;	4	A 'needs' more energy e.g. rate of breathing remains high until carbon dioxide concentration returns to, normal / set point

Question	Answer	Marks	Guidance
3(a)	1 (immediate / steep) increase in numbers / no lag phase ; 2 exponential / log, phase ; 3 decelerating phase / described as increase slowing down ; 4 stationary phase / plateau / levels off / remains constant ; 5 levels, at 1.6 to 1.65 million / from between 1850 and 1875 ;	3	

Question	Answer	Marks	Guidance
3(b)	<i>population increases</i> 1 more births than deaths ; 2 more sheep are imported ; 3 more food needed for increasing human population ; 4 <i>idea that</i> more sheep needed for, export / economy of Tasmania ; <i>population remains constant</i> 5 <i>idea that</i> population reaches, carrying capacity / described ; 6 number of births = number of deaths / culling for meat / AW ; 7 any ref to <u>limiting factor(s)</u> in correct context in either increase or plateau ; 8 any example of a limiting factor ; resources food supply water supply space / area of land for grazing / AW disease predators competitors	3	e.g. maximum that the land can support I drought / floods / any other natural disaster
3(c)	1 <i>idea that</i> farmer, chooses / selects (animals that are best adapted to conditions) ; 2 appropriate named feature(s) ; 3 selected animals bred together / (cross) breed them ; 4 select the offspring that show the features required ; 5 repeat, the selection and breeding / the process ; 6 <i>idea that</i> imports (male) sheep with desired features to mate with flock ; 7 uses artificial insemination ;	4	
3(d)	providing for the needs of (the increasing) humans (population) ; without harm to the (natural) environment / ecosystem(s) / habitat / biodiversity ;	2	A examples of development, e.g. roads / houses / cities / urbanisation / AW

Question	Answer	Marks	Guidance												
4(a)	little / less / AW / no, variation / (genetic) diversity ; ref to becoming homozygous ; less chance of, surviving / adapting / evolving, to, changing conditions / new environments / (new) disease ; risk of <u>extinction</u> ; increase chance of genetic disease ; adapted variety spreads / AW ; only one plant needed / no mate required ; R if ‘asexual reproduction’ is given greater chance of pollination / ensures pollination occurs ; <i>idea that</i> reproduction / fertilisation, successful if no other plants (of same species) nearby ; less wastage of pollen ; not dependent on (named) agent of pollination ; AVP ; no hybrid vigour / smaller gene pool	4	A fewer <u>alleles</u> I ref to gene(s) R cloning / uniform(ity) A increased risk of abnormalities / genetic ‘weakness’ / AW A gametes I no wastage												
4(b)(i)	<table><tr><td>term</td><td>example in <i>P. sativum</i></td></tr><tr><td>dominant trait</td><td>purple flowers</td></tr><tr><td>recessive allele</td><td>b ;</td></tr><tr><td>phenotype</td><td>(flower) colour / purple (flowers) / white (flowers) ;</td></tr><tr><td>homozygous genotype</td><td>BB and / or bb ;</td></tr><tr><td>heterozygous genotype</td><td>Bb ;</td></tr></table>	term	example in <i>P. sativum</i>	dominant trait	purple flowers	recessive allele	b ;	phenotype	(flower) colour / purple (flowers) / white (flowers) ;	homozygous genotype	BB and / or bb ;	heterozygous genotype	Bb ;	4	
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Question	Answer	Marks	Guidance
4(b)(ii)	<i>parental phenotype</i> purple flowers x white flowers purple flowers x white flowers <i>parental genotype</i> Bb x bb BB x bb ; <i>genotypes of gametes</i> B b + b (b) B B + b (b) ; <i>offspring genotypes</i> Bb bb Bb (Bb); <i>offspring phenotypes</i> purple flowers, white flowers ; purple flowers ;	5	
4(c)(i)	<i>test cross 1</i> GG x GG / GG x Gg A GG on its own R GG x gg ; <i>test cross 2</i> Gg x Gg ;	2	A Gg on its own
4(c)(ii)	white plants are, homozygous recessive / gg ; (white plants / no chlorophyll) cannot, photosynthesise / produce own food ; (therefore white plants) do not grow into mature plants / do not produce flowers / die before reproducing / AW ;	2	I cannot survive unqualified

Question	Answer	Marks	Guidance
5(a)	<i>Helicobacter</i> ;	1	
5(b)	circular DNA / chromosome ; plasmid(s) ; cell membrane ; cell wall (not made of cellulose) ; cytoplasm ; capsule ; (small) ribosomes ; flagella ; AVP ;	2	A naked, DNA / chromosome I cilia e.g. pili
5(c)(i)	antibiotic(s) ;	1	
5(c)(ii)	(stomach / hydrochloric / gastric) acid / HC// mucus ;	1	
5(d)	<i>active immunity</i> 1 exposure to <u>antigen</u> ; ora 2 after, infection by pathogen / vaccination ; 3 immune response occurs / antibodies produced ; <i>passive immunity</i> 4 <u>antibodies</u> acquired from another individual ; 5 e.g. by breast milk / injection of antibodies ; 6 active is, permanent / long-term (immunity) ; ora 7 ref to memory cells, in active / not in passive ; 8 response is slow on first exposure in active ; ora	4	

Question	Answer	Marks	Guidance																		
6(a)	<table><tr><td>blood vessel</td><td>name of blood vessel</td><td>oxygenated / deoxygenated</td></tr><tr><td>A</td><td>hepatic portal vein</td><td>deoxygenated ;</td></tr><tr><td>B</td><td>(inferior) vena cava</td><td>deoxygenated ;</td></tr><tr><td>C</td><td>pulmonary vein</td><td>oxygenated ;</td></tr><tr><td>D</td><td>aorta</td><td>oxygenated ;</td></tr><tr><td>E</td><td>femoral artery</td><td>oxygenated ;</td></tr></table>	blood vessel	name of blood vessel	oxygenated / deoxygenated	A	hepatic portal vein	deoxygenated ;	B	(inferior) vena cava	deoxygenated ;	C	pulmonary vein	oxygenated ;	D	aorta	oxygenated ;	E	femoral artery	oxygenated ;	4	
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6(b)(i)	chemical / substance, made by a gland ; travels in the blood (plasma) ; alters the activity of one or more specific target organs ;	2	I proteins R enzymes A alters activity of / affects, target organ(s) A controls																		
6(b)(ii)	1 controls blood, glucose / sugar, concentration / level ; 2 increased, uptake / respiration, of glucose ; 3 (stimulates cells to) convert glucose to <u>glycogen</u> ; 4 <i>idea that</i> target organs are, muscle / liver ; 5 (so) decreases blood glucose concentration ; 6 ref to, negative feedback / homeostasis ;	3																			
6(c)	1 shunt vessels, constrict / close / AW ; 2 less blood flow through shunt vessels ; 3 arterioles, widen / dilate / relax ; 4 <u>vasodilation</u> (in context of arteries and arterioles) ; 5 more blood flow (through capillaries) near the surface of the skin / AW ; 6 (more) heat loss from blood (by radiation) ;	3	R if in context of capillaries / veins A ‘blood vessels’																		