Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 2017**

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

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Question	Answer	Marks	Guidance
1(a)(i)	carbon dioxide / CO_2 / water / H_2O (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 **;** *idea that it* stores instructions for, making proteins / protein synthesis / making RNA **;** 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

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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 **;** *explanation* 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 mmol dm^{-3} at 15 minutes ± 0.2 mmol **A** produces ATP **R** produce / makes, energy'
2(c)(i)	**P** 12 (km h^{-1}) **and Q** 10 (km h^{-1}) **;**	**1**	*One mark only both must be right*
2(c)(ii)	*idea that* 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

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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**	

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Question	Answer	Marks	Guidance
3(b)	*population increases* 1 more births than deaths **;** 2 more sheep are imported **;** 3 more food needed for increasing human population **;** *4 idea that* more sheep needed for, export / economy of Tasmania **;** *population remains constant* *5 idea that* 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 *idea that* 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 *idea that* 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

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(a)</td><td>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 ;
idea that 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</td><td>4</td><td>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</td></tr>
<tr><td>4(b)(i)</td><td><table><tr><th>term</th><th>example in P. sativum</th></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></td><td>4</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
4(b)(ii)	*parental phenotype* purple flowers x white flowers purple flowers x white flowers *parental genotype* Bb x bb BB x bb **;** *genotypes of gametes* B b + b (b) B B + b (b) **;** *offspring genotypes* Bb bb Bb (Bb)**;** *offspring phenotypes* purple flowers, white flowers **;** purple flowers **;**	**5**	
4(c)(i)	*test cross 1* **GG** x **GG** / **GG** x **Gg** **A GG** on its own **R GG** x **gg ;** *test cross 2* **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)	*Helicobacter* **;**	**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 / HCl / mucus **;**	**1**	
5(d)	*active immunity* 1 exposure to antigen **; ora** 2 after, infection by pathogen / vaccination **;** 3 immune response occurs / antibodies produced **;** *passive immunity* 4 antibodies 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**	

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<tr><td>6(a)</td><td>
<table>
<tr><th>blood vessel</th><th>name of blood vessel</th><th>oxygenated / deoxygenated</th></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>
</td><td>4</td><td></td></tr>
<tr><td>6(b)(i)</td><td>chemical / substance, made by a gland ;
travels in the blood (plasma) ;
alters the activity of one or more specific target organs ;</td><td>2</td><td>I proteins R enzymes

A alters activity of / affects, target organ(s)
A controls</td></tr>
<tr><td>6(b)(ii)</td><td>1 controls blood, glucose / sugar, concentration / level ;
2 increased, uptake / respiration, of glucose ;
3 (simulates cells to) convert glucose to glycogen ;
4 idea that target organs are, muscle / liver ;
5 (so) decreases blood glucose concentration ;
6 ref to, negative feedback / homeostasis ;</td><td>3</td><td></td></tr>
<tr><td>6(c)</td><td>1 shunt vessels, constrict / close / AW ;
2 less blood flow through shunt vessels ;
3 arterioles, widen / dilate / relax ;
4 vasodilation (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) ;</td><td>3</td><td>

R if in context of capillaries / veins
A ‘blood vessels’</td></tr>
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