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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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_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

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

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)	*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>

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**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<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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