Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/41**

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)	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** *for microvilli accept* – 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

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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)	*description* 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 **;** *explanation* 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 **;** oxygen debt **;** anaerobic 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

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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 a gene **;**	**1**	***A*** alternative form *of a gene*
3(c)(ii)	test cross **;**	**1**	
3(c)(iii)	*parental phenotypes* tall x dwarf *parental genotypes* **TT ;** x **tt ;** *gametes* **T T** x **t t ;** *offspring genotype* **Tt ;** *offspring phenotype* (100%) tall		**A** ecf from parental genotypes.
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

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Question	Answer	Marks	Guidance
4(a)(i)	stem (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**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(c)(i)</td><td>
<table>
<tr><td>letter from Fig. 4.1</td><td>name</td><td>description</td></tr>
<tr><td>E</td><td>mitochondrion / mitochondria ;</td><td>component of the cell that releases energy during aerobic respiration</td></tr>
<tr><td>H</td><td>neurotransmitters</td><td>chemicals that transmit signals from one neurone to the next neurone</td></tr>
<tr><td>J</td><td>synapse ;</td><td>the gap between two neurones</td></tr>
<tr><td>F/G</td><td>vesicle ;</td><td>the sac in which neurotransmitters are transported to the cell membrane</td></tr>
<tr><td>K</td><td>receptors ;</td><td>the molecules that the neurotransmitters bind to</td></tr>
<tr><td>M</td><td>nucleus ;</td><td>the structure that controls the activities in the cell</td></tr>
</table>
</td><td>5</td><td>one mark per correct row</td></tr>
<tr><td>4(c)(ii)</td><td>brain / spinal cord / central nervous system / CNS ;</td><td>1</td><td></td></tr>
<tr><td>4(d)</td><td>diffusion ;
from high concentration to low concentration / down a concentration gradient ;
direction described ;
AVP ;</td><td>3</td><td></td></tr>
<tr><td>4(e)</td><td>nerves faster / hormones slower ;
nerve impulses are a short lived response / ora ;</td><td>1</td><td></td></tr>
</table>

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

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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**	

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