Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes will use these abbreviations

- **;** separates marking points
- / alternatives
- **I** **I**
- **R** reject
- **A** **A** (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)	**1** (for) energy / energy source / respiration **;** **2** storage / stored **;** (fat or vitamins or energy) **3** insulation / reduce heat loss / maintains temperature / ref to myelin **;** **4** protection (against mechanical damage) / cushions organs / shock absorber **;** **5** AVP **;** **6** AVP **;**	**3**	**R** 'produce energy' **I** homeostasis e.g. buoyancy making (some) hormones making (cell) membranes provide heat absorption of vitamins waterproofing
1(b)(i)	lipase **;**	**1**	
1(b)(ii)	fatty acids and glycerol **;**	**1**	
1(b)(iii)	bile **;**	**1**	
1(b)(iv)	gall bladder **;**	**1**	
1(c)	(bile) emulsifies fats **;** breaks down into / changed into smaller, globules / AW **;** increases surface area (to volume ratio) **;** for, enzyme(s) / lipase **;**	**2**	**R** molecules

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Question	Answer	Marks	Guidance
1(d)	*fatty acids / glycerol / fats, enter / AW* **1** (micro)villi **;** **2** capillaries / blood vessels / blood / circulatory system **;** **3** lacteals / lymphatic capillary **;** **4** (travel via) lymph / in lymph vessels / in lymph(atic) system **;** **5** lymph empties into blood **;**	**3**	**MP5 A** tissue fluid / 'body fluid' for lymph **A** lymphatic vessels empty into blood
1(e)	**1** fat is deposited in (walls of) arteries **;** **2** <u>coronary arteries</u> **;** **3** arteries are blocked / blood flow is restricted in arteries **;** **4** less / no, blood flow to, heart muscle / cardiac muscle / wall of heart **;** **5** less / no, nutrients / glucose / oxygen, reaches heart, muscle / walls / cells **;** **6** AVP **;**	**3**	**I** veins / blood vessels **A** narrows (lumen of) arteries e.g. to form, plaques / atheroma / atherosclerosis roughens the lining of arteries increases blood pressure promotes, blood clotting / thrombus / thrombosis heart muscle, cannot respire (aerobically) / respires anaerobically heart muscle, fatigues / tires / AW ref. to cholesterol heart muscle produces lactic acid

Question	Answer	Marks	Guidance
1(f)	**1** drug treatment **;** **2** aspirin **;** **3** to, reduce risk of / prevent, blood clotting **;** **4** surgery / operation **;** **5** (coronary) by-pass **;** **6** described / a piece of blood vessel attached to carry blood around the blocked artery **;** **7** angioplasty **;** **8** described / tube *or* balloon inserted into artery and inflated to widen artery **;** **9** stent(s) **;** **10** tube / AW, to, hold arteries open / stop arteries collapsing **;** **11** to restore blood supply (to heart muscle) **;** **12** AVP **;**	**6**	**A** antiplatelets / warfarin **I** 'thins the blood'

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2(a)</td><td>length of <u>DNA</u> ;

that codes for a protein ;</td><td>2</td><td></td></tr>
<tr><td>2(b)</td><td>1 antibodies lock on to antigens ;
2 ref to antigens are on pathogens ;
3 antibodies / antigens, are specific ;
4 antibodies (have shape) complementary to antigen ;
5 antibodies destroy pathogens (directly) ;
6 antibodies, mark / AW, pathogens for destruction by phagocytes / phagocytosis ;
7 AVP ;
8 AVP ;</td><td>4</td><td>R same shape
A description</td></tr>
<tr><td>2(c)</td><td>one mark per row

<table><tr><th>function</th><th>name of structure</th><th>letter from Fig. 2.1</th></tr><tr><td>absorption of amino acids to make antibodies</td><td>cell membrane</td><td>A</td></tr><tr><td>stores genetic information as DNA</td><td>nucleus</td><td>B ;</td></tr><tr><td>provides energy for making antibodies</td><td>mitochondrion</td><td>E ;</td></tr><tr><td>site of production of antibodies</td><td>ribosome / endoplasmic reticulum / ER</td><td>C / G ;</td></tr><tr><td>transport of antibody molecules for release into blood</td><td>vesicle(s) / vacuole</td><td>F ;</td></tr></table></td><td>4</td><td>A mitochondrion and E</td></tr>
</table>

Question	Answer	Marks	Guidance
2(d)	phagocyte **;** ingests / engulfs / digests / destroys, pathogens / bacteria / viruses **;** platelet(s) **;** release substances to promote / AW, blood clotting **;** epithelial cells **;** provide a barrier / AW **;** goblet cells **;** produce mucus **;** ciliated (epithelial) cells **;** move, mucus / pathogens, away from gas exchange surface / AW **;** acid-secreting cells (in stomach) **;** make <u>hydrochloric acid</u> (to kill bacteria / pathogens) **;**	**2**	**A** lachrymal (gland) cells ; secretes lysozyme ;
3(a)	any, chemical / substance, taken into / AW, the body **;** modifies / affects / changes / AW, (chemical) reactions / metabolism **;**	**2**	**I** behaviour
3(b)	**1** vesicles (containing neurotransmitter) move to the cell membrane **;** **2** vesicles fuse with cell membrane **;** **3** release of neurotransmitter **;** **4** (neurotransmitters/chemicals) diffuse across, synapse / synaptic cleft *or* gap **;** **5** neurotransmitter binds to, receptor / protein on cell surface **;** **6** neurotransmitter and receptor are complementary / AW **;** **7** results in an impulse in, relay / next, neurone **;**	**4**	**A** stimulates the, relay / next, neurone
3(c)	neurotransmitter released / vesicles, on one side of synapse **;** receptors / described, only found on the opposite side of synapse **;**	**2**	

Question	Answer	Marks	Guidance
3(d)	**1** heroin is converted into morphine **;** **2** heroin diffuses into synapse **;** **3** heroin binds to receptors (for neurotransmitter) **;** **4** ref to, endorphin / encephalin, receptors / neurotransmitter **;** **5** ref to heroin being complementary to receptor **;** **6** blocks neurotransmitter entering receptor site **;** **7** (or) stimulates receptor **;** **8** reduced / increased, pain perception **;** as appropriate **9** AVP **;** morphine stimulates release of dopamine acts on relay neurone even when no impulse in neurone **B**	**3**	**A** competes for binds **R** 'same shape' as receptor **I** ref to summation **A** antagonist **A** agonist
3(e)	light **;** temperature / heat / cold **;** sound / vibration **;** chemicals / taste / smell / pH **;** pressure / touch **;** position / gravity **;** movement **;** stretch (in muscle / tendons) **;**	**3**	

Question	Answer	Marks	Guidance
4(a)	blood travels through the heart once in a, circuit / cycle (of the body) / AW **;**	**1**	
4(b)	**D ;**	**1**	
4(c)	**1** large surface area **;** **2** thin (surface) / one cell thick **;** **3** short <u>diffusion</u> distance **;** **4** good blood supply / many capillaries **;** **5** good ventilation / good movement of air *or* water / good oxygen supply **;** **6** permeable **;** **7** moist **;**	**2**	

Question	Answer	Marks	Guidance
5(a)(i)	Aloe **;**	**1**	**R** *Aloe pillansii*
5(a)(ii)	**1** (isolated) group of individual plants / AW **;** **2** of, one / the same, species **;** **3** living in the same area **;** **4** at the same time **;**	**3**	
5(b)	**1** deforestation **;** **2** climate change / global warming **;** **3** change in land use / described **;** **4** desertification **;** **5** pollution **;** **6** plant hunters **;** **7** increase in (new / invasive), grazers / predators **;** **8** competition with, introduced species / alien species **;** **9** (new) disease / pests **;** **10** lack of pollinators **;** **11** AVP **;**	**3**	**A** habitat loss **A** acid rain e.g. quiver trees are (very) slow growing damage to plants by, people / tourists
5(c)	**1** high risk of extinction **;** **2** less chance of, reproduction / pollination AW **;** **3** high risk of genetic diseases **;** **4** less / little / no, (genetic) variation **;** **5** (small population so) more vulnerable to, pests / disease / catastrophe **;** **6** reduced number of <u>alleles</u> **;** **7** less likely to, adapt to / evolve to / cope with, (named) change in environment **;** **8** AVP **;**	**3**	**A** small gene pool **R** number of genes **MP7** – e.g. new, disease / pest e.g. ref inbreeding **; R** interbreeding
5(d)(i)	44 (%) **;;**	**2**	4 / 9 × 100 (= 44.4)

Question	Answer	Marks	Guidance
5(d)(ii)	**1** decrease in population (at all sites) **;** **2** **D** has highest mortality / **B** has the lowest mortality **;** **3** site **A** has lost the most number of trees / site **D** has lost the lowest number of trees **;** **4** use of data from last column to illustrate - minimum of two *or* loss of trees from at least two sites or one site between two years **;** comparative data quote **A** 12 to 4 / **B** 9 to 5 / **C** 5 to 3 / **D** 6 to 5 **5** (in whole population) there is no (net) increase in number of trees **;** **6** difficult to compare changes over time as numbers are for different sites **;** **7** site **A** has most trees in original photograph / site **C** has the least trees in the original photo **;** **8** in 2004, **B** and **D** had the most trees / site **C** had the least trees **;** **A** more dead tree stumps in site **A** / least dead tree stumps in **D**	**3**	**A** increase in mortality

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Question	Answer	Marks	Guidance
6(a)	**1** variation (in radishes) is not a (confounding) factor **;** **2** any differences are due to non-genetic factors **;** **3** example of non-genetic factors – environment / mineral ions **;** **4** so it was possible to make comparisons **;**	**2**	**A** improves validity of investigation
6(b)	**1** hhumidity (of air) **;** **2** temperature **;** **3** llight **;** **4** carbon dioxide **;** **5** pH (of nutrient solution(s)) **;** **6** rate of aeration / oxygen supply / oxygen **;** **7** depth of solution / volume of solution **;** **8** spacing / density (of radishes / plants) **;** **9** AVP **;**	**3**	**I** water supply / moisture **A** warmth **I** gravity **R** ref. to soil e.g. wind (speed) e.g. pests / diseases
6(c)	**1** less growth than the, control / complete medium / group 1 **;** **2** leaf / root, mass per plant is less than, control / group 1 **;** **3** comparative use of figures per plant, calculated / stated, from the table with units**;** **4** (nitrate (ions) / nitrogen) required to make, amino acids / proteins **;** **5** any one use of proteins in plants **;**	**4**	**A** polypeptides
6(d)	*appearance max 1* **1** yallow(–green) leaves / chlorosis / stunted / short **;** *explanation for max 2* **2** magnesium is needed for chlorophyll **;** **3** chlorophyll, makes plants *or* chloroplasts green / is a green pigment **;** **4** cannot trap, enough / much, light for photosynthesis **;** **5** less / no, photosynthesis / sugar production **;** **6** less materials for, growth / making (new) cells **;** **7** less sugar for respiration **;**	**3**	**R** chloroplast

Question	Answer	Marks	Guidance
6(e)	**1** less / no, DNA / RNA (is produced) **;** **2** (new) DNA is needed for cells to divide (by mitosis) **; ora** **3** genes / chromosomes, are made of DNA **;** **4** mitosis / cell division, is one way in which organisms grow **;** **5** DNA / RNA, needed for protein synthesis **;** **6** protein is needed for growth **;** **7** AVP **;**	**2**	e.g. energy supply in cells needs ATP

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