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

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 will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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** **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

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

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** coronary arteries **;** **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

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