Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/43**

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.

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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

Question	Answer	Marks	Guidance
1(a)	carbon dioxide / CO_2 **;** water (vapour) **;**	**1**	
1(b)	**1** **B** are cilia **;** **2** **C** is mucus **;** **3** **C / D**, are goblet cells **;** **4** **E** is cartilage **;** **5** **B** / cilia, waft / beat, mucus / **C** (up / out of, the airway) **;** **6** **C** / **D** / goblet cells, secrete, mucus / **C** **;** **7** **C** / mucus, traps, particles / pathogens **;** **8** **B** / **C** / **D** / AW, prevent infections **;** **9** **E** / cartilage, keeps the, airway / trachea, open **;**	**6**	max 2 marks for labels **A** prevent collapse
1(c)(i)	**U** | **P ;** | **T** | **S** | **Q** | **R ;** | **V**	**2**	
1(c)(ii)	**1** for, gas exchange / diffusion / movement of CO_2 and O_2 **;** **2** short distance (for diffusion / gas exchange) **;** **3** fast (gas exchange / diffusion) **;**	**2**	
1(d)	**1** haemoglobin is, abnormal / rigid / AW **;** **2** abnormal haemoglobin carries less oxygen (than normal haemoglobin) **; ora** **3** red blood cells are, sickle shaped / AW **;** **4** (sickle cells) stick together / clot (in blood vessels) **;** **5** fewer red blood cells **;**	**3**	**A** abnormal haemoglobin does not carry O_2 **A** not biconcave **A** blocked vessels / stuck / more red blood cells broken down

Question	Answer	Marks	Guidance
2(a)(i)	**1** exercise will increase heart rate (from resting rate) ; **2** after exercise heart rate will, remain high / start decreasing ; **OR** **3** there is no effect of exercise on heart rate ; is the null hypothesis ;	**2**	**A** before exercise heart rate will be lower
2(a)(ii)	**1** fingers on, wrist / neck / artery ; **2** number beats over a period of time / bpm ; **3** use a heart rate monitor / AW ; **4** contact of sensor with skin ;	**2**	
2(b)	**1** lack of, blood supply / oxygen / glucose to heart, wall / muscle / tissues / cells ; **2** less / no, (aerobic) respiration / described ; **3** (heart) tissue / cells, die ; **4** heart (muscle) cannot contract ;	**2**	**A** more anaerobic
2(c)	*description* **1** no difference between groups at 0 months ; **2** HRR in **A** increases and **B** increases and then decreases ; **3** (at) 3 months, little difference between groups / group **B** higher ; **4** (at) 6 months / at end, group **A** higher HRR (than group **B**) ; **5** comparative data quote with units ; *explanation* **6** (regular) exercise improves, HRR / fitness ; **7** exercise, strengthens heart muscle / increases, stroke volume / cardiac output ; **8** *idea that* anaerobic respiration / oxygen debt reduces HRR ; **ora** **9** given plan has better long term effect / without given plan better short term effect ; **10** patients may stick to given plan better (than their plan) ; **ora** **11** without a given plan patients probably started with a higher intensity plan ; **ora** **12** given plan may be better designed (to improve HRR long term) ; **ora**	**6**	**A** fitness or HR for HRR throughout **A** both groups increase HRR overall

Question	Answer	Marks	Guidance
2(d)	**1** reduced, salt / (saturated) fats / cholesterol ; **2** stop smoking ; **3** reduce stress ; **4** AVP ; e.g. / medication qualified / control diabetes / reduced alcohol / reduce blood pressure	**1**	

Question	Answer	Marks	Guidance
3(a)(i)	DNA ;	**1**	**A** correct elements **I** RNA
3(a)(ii)	*parental phenotypes* resistant x not disease-resistant *parental genotypes* Rr ; x rr ; *gametes* R r x r (r) ; *offspring genotype* Rr and rr ; *offspring phenotype* resistant and not resistant / AW ;	**5**	**ecf** from previous line above throughout
3(b)(i)	heterozygous, plant / parent, carry the not-resistant / r, allele ; some offspring would be, not-resistant / rr / homozygous recessive ; using heterozygotes results in profit loss / AW ;	**2**	**A** homozygous dominant = no r allele / only R **A** therefore all offspring are disease-resistant
3(b)(ii)	paint pollen onto selected trees / AW ; isolate plants / cover flowers, of unselected trees ; identify not disease resistant trees ; AVP ; remove not-resistant trees	**1**	**A** artificial pollination
3(b)(iii)	human choice (rather than environmental pressures) / AW ; less, diversity / variation ; faster change ; AVP ; e.g. mating is not random	**2**	**A** named features for human use **A** reduced fitness (of species)

Question	Answer	Marks	Guidance
4(a)(i)	(species) **M ;**	**1**	
4(a)(ii)	(species **L**) because most stable **;**	**1**	
4(a)(iii)	300(%) **;;**	**2**	*If no answer or wrong answer award one mark for working:* (2000–500) / 500 × 100
4(b)	increased, predation **;** disease **;** lack of food **;** migration **;** (named) relevant pollution **;;** (named) relevant environmental change **;;** introduction of new species **;**	**2**	**I** competition unqualified **A** new predators **A** competition for food e.g. eutrophication / rubbish / acid rain e.g. habitat loss / el Niño / global warming / climate change / hurricane / tsunami
4(c)(i)	(larger holes) allow, more / small / immature, fish through **; ora** nets more specific to target species / prevents by-catch **;**	**1**	

Question	Answer	Marks	Guidance
4(c)(ii)	**1** education / awareness **;** **Accept** commercials / advertising / tax consumer **2** reduced demand (to eat from unsustainable fish stocks) / public pressure / campaigning **;** **3** steps taken by fisherman voluntarily / AW **;** **4** (legal) quotas / treaties / licenses / laws / restricted catch weight **;** **5** ensuring sustainable population size / recovery of, endangered / specific, species **;** **6** no-catch zones / nursery zones / protected areas / MPAs **; ora** **7** overflow of target species / increase in population outside zone / breeding recovery **;** **8** limited fishing season **;** **9** stock recovery / optimises breeding seasons **;** **10** fines**;** **11** discourage / punish, poor practice **;** **12** restocking / captive breeding and release **;** **13** increases gene pool / number of young / reproductively-viable, fish **;** **14** fish farming **;** **15** alternative source of fish **;**	**4**	*max 3 for methods only* *explanations must be linked to correct method* e.g. use of better fishing methods MPA = marine protected areas **A** patrols / policing

Question	Answer	Marks	Guidance
4(d)	**1** guillemots / gulls / squid / seals, reduce in numbers **;** **2** guillemots / gulls, become extinct **; Accept** ref to alternative food sources for any other named species **3** because their food / energy, source has reduced / (intraspecific) competition for their food increases **;** **4** zooplankton, might increase / stay same / decrease and valid explanation **;** **5** phytoplankton decrease because zooplankton increase **; 6**	**4**	mp4 *examples of valid explanations:* increase leads to less cod predation decrease leads to more squid predation stay same leads to balance squid and cod predation
4(e)	development providing the needs of increasing human population **;** without harming the, environment **;**	**2**	

Question	Answer	Marks	Guidance
5(a)(i)	respiration **;** aerobic (respiration) **;** release energy / make ATP **;**	**2**	**A** respiration using oxygen **A** provide energy **R** produce / generate, energy
5(a)(ii)	different composition of cell wall **;** no, chlorophyll / chloroplasts / heterotrophic **;** extracellular digestion / saprophytic / decomposer / AW **;** hyphae / mycelium **;** no (central) vacuole **;** AVP **;**	**2**	**A** not, autotrophic / photosynthetic / AW **A** enzymes secreted from cells to digest food **I** spores e.g. multinucleate / reproduction by budding

Question	Answer	Marks	Guidance
5(b)	respiration / fermentation ; carbon dioxide released ; (bubbles / carbon dioxide) causes, dough / bread, to rise ; (yeast produces) enzymes ; enzymes / amylase, digest starch ; AVP ;	**3**	e.g. yeast, are not toxic / does not produce toxins / reproduce rapidly / can be stored dry / are single celled / cheap
5(c)(i)	(fungus) grown / put, in fermenters ; aerobic conditions / AW ; (provide) sugars / nitrogen source / nutrients ; purification / filtration, of product / penicillin ; batch culture / AW ; sterile conditions ; AVP ;	**3**	**A** bioreactors **A** bubble air through e.g. ammonia / amino acids / protein e.g. described maintenance of culture / penicillin produced, when sugar source decreases / in stationary phase **A** fermentation conditions such as stirring / use of water jacket / controlling temp / pH etc.
5(c)(ii)	bacteria are made of cells ; **ora**	**1**	**A** viruses are not alive / do not have a cell wall
5(d)	mechanical barriers ; example of mechanical barriers ;; chemical barriers ; example of chemical barriers ;; blood clotting ;	**max 3**	**A** physical barriers / dead layer of cells for skin e.g. skin / hairs in nose / ear wax **A** mucus as mechanical or chemical e.g. mucus / stomach acid / vaginal acid / tears / lysozymes **A** scab

Question	Answer	Marks	Guidance
6(a)(i)	**X** – sensory; **Y** – motor / effector ;	**2**	

Question	Answer	Marks	Guidance
6(a)(ii)	sweat glands ; blood vessels ; hair erector muscles ;	**1**	
6(a)(iii)	negative feedback ;	**1**	
6(b)(i)	shunt vessels, constrict / close / AW ; more / redirect, blood flow to skin (capillaries) ; heat from blood, lost / radiates ; vasodilation (of arterioles) ;	**3**	**A** vasoconstriction **A** heat loss from blood vessels
6(b)(ii)	sweat, secreted / made (by sweat glands) ; evaporative (cooling) ; hair erector muscles relax ; (hairs lie flat) so that less (air) insulation / allows more air movement (across skin) ;	**3**	 **A** less air trapped
6(c)(i)	quick(er) (response) ; long-term response is not required ;	**1**	
6(c)(ii)	insulin ; glucagon ; ADH ; AVP ;	**2**	