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**BIOLOGY**

**0610/43**

Paper 4 Theory (Extended)

**October/November 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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This document consists of **10** printed pages.

**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 <sub>2</sub> ; water (vapour) ;	1								
1(b)	<ol style="list-style-type: none"> <li>1 <b>B</b> are cilia ;</li> <li>2 <b>C</b> is mucus ;</li> <li>3 <b>C / D</b>, are goblet cells ;</li> <li>4 <b>E</b> is cartilage ;</li> <li>5 <b>B</b> / cilia, waft / beat, mucus / <b>C</b> (up / out of, the airway) ;</li> <li>6 <b>C / D</b> / goblet cells, secrete, mucus / <b>C</b> ;</li> <li>7 <b>C</b> / mucus, traps, particles / pathogens ;</li> <li>8 <b>B / C / D</b> / AW, prevent infections ;</li> <li>9 <b>E</b> / cartilage, keeps the, airway / trachea, open ;</li> </ol>	6	<p>max 2 marks for labels</p> <p><b>A</b> prevent collapse</p>							
1(c)(i)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 12.5%;"><b>U</b></td> <td style="width: 12.5%;"><b>P</b> ;</td> <td style="width: 12.5%;"><b>T</b></td> <td style="width: 12.5%;"><b>S</b></td> <td style="width: 12.5%;"><b>Q</b></td> <td style="width: 12.5%;"><b>R</b> ;</td> <td style="width: 12.5%;"><b>V</b></td> </tr> </table>	<b>U</b>	<b>P</b> ;	<b>T</b>	<b>S</b>	<b>Q</b>	<b>R</b> ;	<b>V</b>	2	
<b>U</b>	<b>P</b> ;	<b>T</b>	<b>S</b>	<b>Q</b>	<b>R</b> ;	<b>V</b>				
1(c)(ii)	<ol style="list-style-type: none"> <li>1 for, gas exchange / diffusion / movement of CO<sub>2</sub> <u>and</u> O<sub>2</sub> ;</li> <li>2 short distance (for diffusion / gas exchange) ;</li> <li>3 fast (gas exchange / diffusion) ;</li> </ol>	2								
1(d)	<ol style="list-style-type: none"> <li>1 haemoglobin is, abnormal / rigid / AW ;</li> <li>2 abnormal haemoglobin carries less oxygen (than normal haemoglobin) ; <b>ora</b></li> <li>3 <u>red</u> blood cells are, sickle shaped / AW ;</li> <li>4 (sickle cells) stick together / clot (in blood vessels) ;</li> <li>5 fewer red blood cells ;</li> </ol>	3	<p><b>A</b> abnormal haemoglobin does not carry O<sub>2</sub></p> <p><b>A</b> not biconcave</p> <p><b>A</b> blocked vessels / stuck / more red blood cells broken down</p>							

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

Question	Answer	Marks	Guidance
2(d)	<ol style="list-style-type: none"> <li>1 reduced, salt / (saturated) fats / cholesterol ;</li> <li>2 stop smoking ;</li> <li>3 reduce stress ;</li> <li>4 AVP ; e.g. / medication qualified / control diabetes / reduced alcohol / reduce blood pressure</li> </ol>	<b>1</b>	

Question	Answer	Marks	Guidance
3(a)(i)	DNA ;	<b>1</b>	<b>A</b> correct elements I RNA
3(a)(ii)	<p><i>parental phenotypes</i> resistant x not disease-resistant</p> <p><i>parental genotypes</i> Rr ; x rr ;</p> <p><i>gametes</i> R r x r (r) ;</p> <p><i>offspring genotype</i> Rr and rr ;</p> <p><i>offspring phenotype</i> resistant and not resistant / AW ;</p>	<b>5</b>	<b>ecf</b> 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 ;	<b>2</b>	<b>A</b> homozygous dominant = no r allele / <u>only</u> R <b>A</b> 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	<b>1</b>	<b>A</b> artificial pollination
3(b)(iii)	human choice (rather than environmental pressures) / AW ; less, diversity / variation ; faster change ; AVP ; e.g. mating is not random	<b>2</b>	<b>A</b> named features for human use <b>A</b> reduced fitness (of species)

Question	Answer	Marks	Guidance
4(a)(i)	(species) <b>M</b> ;	<b>1</b>	
4(a)(ii)	(species <b>L</b> ) because most stable ;	<b>1</b>	
4(a)(iii)	300(%) ;;	<b>2</b>	<i>If no answer or wrong answer award one mark for working: <math>(2000-500) / 500 \cdot 100</math></i>
4(b)	increased, predation ; disease ; lack of food ; migration ; (named) relevant pollution ;; (named) relevant environmental change ;;  introduction of <u>new</u> species ;	<b>2</b>	<b>I</b> competition unqualified <b>A</b> new predators  <b>A</b> 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 ; <b>ora</b> nets more specific to target species / prevents by-catch ;	<b>1</b>	

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

Question	Answer	Marks	Guidance
4(d)	<p>1 guillemots / gulls / squid / seals, <u>reduce</u> in numbers ;</p> <p>2 guillemots / gulls, become extinct ; <b>Accept</b> ref to alternative food sources for any other named species</p> <p>3 because their food / energy, source has reduced / (intraspecific) competition for their food increases ;</p> <p>4 zooplankton, might increase / stay same / decrease <u>and</u> valid explanation ;</p> <p>5 phytoplankton decrease because zooplankton increase ; 6</p>	4	<p>mp4 <i>examples of valid explanations:</i></p> <p>increase leads to less cod predation</p> <p>decrease leads to more squid predation</p> <p>stay same leads to balance squid and cod predation</p>
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	<p><b>A</b> respiration using oxygen</p> <p><b>A</b> provide energy</p> <p><b>R</b> produce / generate, energy</p>
5(a)(ii)	different composition of cell wall ; no, chlorophyll / chloroplasts / heterotrophic ; extracellular digestion / saprophytic / decomposer / AW ; hyphae / mycelium ; no (central) vacuole ; AVP ;	2	<p><b>A</b> not, autotrophic / photosynthetic / AW</p> <p><b>A</b> enzymes secreted from cells to digest food</p> <p><b>I</b> spores</p> <p>e.g. multinucleate / reproduction by budding</p>



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	<b>A</b> bioreactors <b>A</b> bubble air through e.g. ammonia / amino acids / protein  e.g. described maintenance of culture / penicillin produced, when sugar source decreases / in stationary phase <b>A</b> fermentation conditions such as stirring / use of water jacket / controlling temp / pH etc.
5(c)(ii)	bacteria are made of cells ; <b>ora</b>	1	<b>A</b> 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	<b>A</b> physical barriers / dead layer of cells for skin e.g. skin / hairs in nose / ear wax <b>A</b> mucus as mechanical or chemical e.g. mucus / stomach acid / vaginal acid / tears / lysozymes <b>A</b> scab

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

Question	Answer	Marks	Guidance
6(a)(ii)	sweat glands ; blood vessels ; hair erector muscles ;	1	
6(a)(iii)	<u>negative feedback</u> ;	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	<b>A</b> vasoconstriction <b>A</b> 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	<b>A</b> less air trapped
6(c)(i)	quick(er) (response) ; long-term response is not required ;	1	
6(c)(ii)	insulin ; <u>glucagon</u> ; ADH ; AVP ;	2	