



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**BIOLOGY**

**0610/42**

Paper 4 Theory (Extended)

**May/June 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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This document consists of **11** printed pages.

**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)(i)	yeast ;	1	<b>A</b> fungus / <i>Saccharomyces (cerevisiae)</i> / <i>S. cerevisiae</i>
1(a)(ii)	respiration / fermentation ;	1	
1(b)(i)	<b>1</b> drought ; <b>2</b> flooding / tsunami / monsoon / hurricane / cyclone ; <b>3</b> earthquake ; <b>4</b> volcanic eruption ; <b>5</b> (named) disease ; <b>6</b> AVP ;	2	<b>MP 1 I</b> desertification <b>I</b> tornado / landslide (too localised) / acid rain (not natural) / loss of soil fertility (usually not natural) <b>I</b> fire e.g. potato blight / foot and mouth disease e.g. (locust / rat) plagues
1(b)(ii)	<b>1</b> increased demand for food ; <b>2</b> unequal (global) distribution of food ; <b>3</b> war / poverty ; <b>4</b> limited land for farming / increased urbanisation / AW ; <b>5</b> cash crops ; <b>6</b> poor farming practice ; <b>7</b> pollution (linked to crop failure) ; <b>8</b> AVP ;	3	<b>A</b> (food) spoilage / wastage <b>A</b> government policies / sanctions  <b>A</b> biofuels / tobacco (crops) e.g. loss soil fertility / erosion / eutrophication e.g. acid rain burning crops e.g. overfishing
1(c)	<b>1</b> outbreaks / spreading, of diseases / pests / plagues ; <b>2</b> endangered / extinction, of species ; <b>3</b> disruption to food chains / described ; <b>4</b> loss in (variety) of, habitat / places where organisms live / described ; <b>5</b> loss of nutrients / disrupted nutrient cycling ; disrupted (soil) fertility <b>6</b> decreased in (soil) water / desertification ; <b>7</b> soil erosion / described ; <b>8</b> increased (described) pollution ; <b>9</b> deforestation ; <b>10</b> efficient food production so less land required ; <b>11</b> AVP ;	4	<b>A</b> loss of (bio)diversity   <b>A</b> landslides / reduced soil volume   e.g. targeted use of pesticides / AW

Question	Answer	Marks	Guidance
2(a)	a length of DNA ; that codes for a <u>protein</u> ;	2	I characteristics / traits A polypeptide for protein
2(b)	1 ribosomes make proteins ; 2 <u>mRNA</u> is copied, from gene / DNA ; 3 gene / DNA, remains in nucleus ; 4 <u>mRNA</u> moves, from nucleus to, cytoplasm / ribosome ; 5 <u>mRNA</u> passes through ribosome / AW ; 6 ribosome assembles amino acids (into a protein) / AW ; 7 (protein synthesis) uses energy ; 8 order of amino acids determined by base sequence of, mRNA / DNA / gene ;	4	A protein synthesis at, ribosomes / (rough) ER
2(c)(i)(i)	active transport ;	1	
2(c)(ii)	1 protein uses, energy / ATP (from respiration) ; 2 <i>idea of</i> protein interaction with ions ; 3 (to) change shape of protein ; 4 ions move through the protein ; 5 against concentration gradient / lower concentration to high concentration (across a membrane) ; 6 AVP ;	3	e.g. ref to selective / specific shape
2(d)	1 plasma proteins ; 2 haemoglobin ; 3 (named) enzymes ; 4 antibodies ; 5 fibrinogen ; 6 (named) hormone ;	2	A fibrin A insulin / glucagon / ADH / oxytocin

Question	Answer	Marks	Guidance																
3(a)	(motor / effector) neuron(e) / nerve (cell) ;	1	R relay / sensory / SAN / pacemaker																
3(b)(i)	<table border="1"> <thead> <tr> <th>position on Fig. 3.1</th> <th>result of electric activity</th> <th>atrioventricular valves</th> <th>semilunar valves</th> </tr> </thead> <tbody> <tr> <td><b>P</b></td> <td>atria contract</td> <td>open</td> <td>closed ;</td> </tr> <tr> <td><b>QRS</b></td> <td>ventricles contract</td> <td>closed</td> <td>open ;</td> </tr> <tr> <td><b>T</b></td> <td>atria and ventricles relaxed</td> <td>open</td> <td>closed ;</td> </tr> </tbody> </table>	position on Fig. 3.1	result of electric activity	atrioventricular valves	semilunar valves	<b>P</b>	atria contract	open	closed ;	<b>QRS</b>	ventricles contract	closed	open ;	<b>T</b>	atria and ventricles relaxed	open	closed ;	3	one mark per row
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3(b)(ii)	to prevent backflow / AW ; ensures one-way flow of blood (through the heart) ;	1	I pressure changes																
3(c)(i)	43 ;; OR 48 ;;	2	one mark for correct working if value incorrect																
3(c)(ii)	1 increased electrical activity during exercise ; <b>ora</b> 2 comparative data before ; 3 no / small, difference in, height of peak / amplitude ; 4 waves closer together during exercise / S–T interval is shorter ;	3																	
3(c)(iii)	deeper (breaths) / increased volume (of lung) ; faster (rate) ; AVP ;	2																	

Question	Answer	Marks	Guidance
4(a)	<b>1</b> all, nutrients / components ; <b>2</b> nutrients in correct, proportions / amounts ; <b>3</b> at least three named 'components' ; <b>4</b> to maintain health ; <b>5</b> appropriate energy requirements / AW ; <b>6</b> different requirements according to, age / sex / lifestyle / pregnancy ;	<b>3</b>	<b>A</b> prevent (named) deficiencies
4(b)	<b>1</b> lack of growth / low body weight / weight loss ; <b>2</b> (described) effect on, hair / skin / nails ; <b>3</b> diarrhoea / vomiting ; <b>4</b> fatigue ; <b>5</b> muscle wasting ; <b>6</b> (more) prone to, infections / disease ;	<b>3</b>	<b>A</b> dehydration <b>A</b> irritable / dizzy / weak / AW <b>A</b> muscle weakness <b>A</b> wounds heal slowly

Question	Answer	Marks	Guidance
4(c)	<p><i>description</i></p> <p><b>1</b> marasmus child lower mass than healthy child, initially / AW ;  <b>2</b> initial (rapid) increase in mass of child with marasmus ;  <b>3</b> then trend almost follows increase of healthy children ;  <b>4</b> later / AW, marasmus child is similar to / heavier than, healthy child ;  <b>5</b> comparative data in children's mass with units stated at least once ;  <b>6&amp;7&amp;8</b> comparative data of milk with units stated at least once ;;;</p> <p><i>explanation</i></p> <p><b>9</b> protein required for, new cells / muscle / repair ;  <b>10</b> carbohydrates / fats, required for, energy / respiration ;  <b>11</b> fats required for, insulation / cell membranes / protecting organs / neurones ;  <b>12</b> treatment for marasmus / AW, has more, (named) nutrients / energy ;  <b>13</b> marasmus child encouraged to drink as much as possible ;  <b>14</b> nutrients are required (for children) for, <u>growth</u> ;</p>	<b>6</b>	<p><b>MP 4 A</b> masses of both children crossover / are the same at 16.6 months  <b>MP 4 A</b> any stated time after 16.5 months</p>
4(d)	<p><b>1</b> <u>emulsification</u> ;  <b>2</b> increased surface area of fats ;  <b>3</b> for lipase ;  <b>4</b> neutralises (stomach) acid / chyme / provide suitable pH (for lipase) ;  <b>5</b> speeds up digestion (of fats) ;</p>	<b>3</b>	<p><b>A</b> description</p> <p><b>A</b> makes chyme alkaline / AW</p>

Question	Answer	Marks	Guidance
5(a)	<p>1 lake / river, pH decreases / acidification ; AW</p> <p>2 aluminium ions become mobile ;</p> <p>3 nutrients / named example(s), leached ;</p> <p>4 shells damaged ;</p> <p>5 fish / frogs, fail to reproduce ;</p> <p>6 (aquatic) plants, die / become damaged / AW (from acid) ;</p> <p>7 disrupts food chains / described ;</p> <p>8 loss of (bio)diversity / endangered / extinct, species ;</p> <p>9 acid / low pH / aluminium ions, toxic to / kills / AW, aquatic animals ;</p> <p>10 fish produce mucus which blocks gills ;</p> <p>11 AVP ;</p>	5	<p><b>ecf</b> on 'higher pH'</p> <p><b>MP 3</b> e.g. potassium / calcium / unqualified ions</p> <p><b>MP 6 / 9 A</b> kills aquatic organisms = 1 mark</p> <p><b>MP 6 I</b> plant death via eutrophication</p> <p><b>MP 9 I</b> low oxygen causes fish death</p> <p>e.g. denatured enzymes / described loss of habitat in context</p>
5(b)(i)	(acid rain often caused by) sulfur dioxide / sulfuric / sulfurous acid ; chlorine / hydrochloric acid, does not cause acid rain ;	1	<b>I</b> sulfur unqualified
5(b)(ii)	pH, meter / paper / probe / sensor / AW ; (pH) indicator ;	1	<b>I</b> data logger unqualified <b>A</b> named indicator
5(b)(iii)	warmth ; oxygen ; water / moisture ; AVP ;	2	<b>A</b> heat / temperature  <b>A</b> humidity e.g. conditions that break dormancy of pine seeds: low pH, cold, light qualified, stratification described



Question	Answer	Marks	Guidance
5(c)(i)	(aerobic) respiration / fermentation / metabolic reactions ; heat / energy, is released ;	<b>2</b>	<b>MP 1 A</b> (named metabolic reaction) e.g. hydrolysis / enzyme activity <b>A</b> exothermic reaction / heat produced <b>I</b> produce energy unqualified
5(c)(ii)	denatures enzymes ;	<b>1</b>	
5(c)(iii)	germination / temperature, increased as, pH increased / acidity decreased ; <b>ora</b> no / little, effect / AW, at less than pH 4 ; <b>ora</b> comparative data quote between pH and temperature with units stated at least once ;	<b>2</b>	<b>I</b> ref to pH 7.0 as optimum
5(d)	(Petri dish) <b>2</b> / pH 3.5 ;	<b>1</b>	

Question	Answer	Marks	Guidance																											
6(a)(i)	cell membrane ; DNA ; ribosomes ; cytoplasm ;	2	A genes / genetic material / chromosome(s)																											
6(a)(ii)	<table border="1"> <thead> <tr> <th></th> <th><i>white blood cell (S)</i></th> <th><i>prokaryote (R)</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>no cell wall</td> <td>cell wall ;</td> </tr> <tr> <td>2</td> <td>(named) organelles</td> <td>no (membrane-bound) organelles ;</td> </tr> <tr> <td>3</td> <td>nucleus</td> <td>nucleoid / no nucleus ;</td> </tr> <tr> <td>4</td> <td>linear, chromosomes / DNA</td> <td>loop of DNA / circular / naked, chromosome ;</td> </tr> <tr> <td>5</td> <td>large ribosomes</td> <td>small ribosomes ;</td> </tr> <tr> <td>6</td> <td>no plasmids (in cytoplasm)</td> <td>plasmids (in cytoplasm) ;</td> </tr> <tr> <td>7</td> <td>large</td> <td>small ;</td> </tr> <tr> <td>8</td> <td>antibodies</td> <td>no antibodies ;</td> </tr> </tbody> </table>		<i>white blood cell (S)</i>	<i>prokaryote (R)</i>	1	no cell wall	cell wall ;	2	(named) organelles	no (membrane-bound) organelles ;	3	nucleus	nucleoid / no nucleus ;	4	linear, chromosomes / DNA	loop of DNA / circular / naked, chromosome ;	5	large ribosomes	small ribosomes ;	6	no plasmids (in cytoplasm)	plasmids (in cytoplasm) ;	7	large	small ;	8	antibodies	no antibodies ;	3	
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6(b)(i)	T = antigen ; U = mitosis ; I cell division V = antibodies ;	3																												
6(c)(i)	<u>phagocytosis</u> ;	1	A endocytosis																											
6(c)(ii)	(phagocyte) engulfs pathogen ; phagosome / vacuole, forms ; (enzymes) digest / breakdown / destroy, pathogen ; AVP ;	1	e.g. antigens presented on cell surface																											

Question	Answer	Marks	Guidance
6(d)(i)	incisors ;	1	
6(d)(ii)	bacteria use sugar / AW (on teeth as a food source) ; bacteria respire ; acid is produced ; AVP ;	2	e.g. plaque / tartar, forms – <i>ref to</i> CO <sub>2</sub> is acidic – <i>ref to</i> lactic acid
6(e)	regular, brushing / mouthwash / flossing / wash / clean, teeth ; avoid sugary foods / diet described ; dental check-ups ; fluoride, toothpaste / in water ;	2	