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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/42**

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

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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** *idea of* 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

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

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

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

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

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

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6(a)(i)</td><td>cell membrane ;
DNA ;
ribosomes ;
cytoplasm ;</td><td>2</td><td>A genes / genetic material / chromosome(s)</td></tr>
<tr><td>6(a)(ii)</td><td><table>
<tr><th></th><th>white blood cell (S)</th><th>prokaryote (R)</th></tr>
<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>
</table></td><td>3</td><td></td></tr>
<tr><td>6(b)(i)</td><td>T = antigen ;
U = mitosis ; I cell division
V = antibodies ;</td><td>3</td><td></td></tr>
<tr><td>6(c)(i)</td><td>phagocytosis ;</td><td>1</td><td>A endocytosis</td></tr>
<tr><td>6(c)(ii)</td><td>(phagocyte) engulfs pathogen ;
phagosome / vacuole, forms ;
(enzymes) digest / breakdown / destroy, pathogen ;
AVP ;</td><td>1</td><td>e.g. antigens presented on cell surface</td></tr>
</table>

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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 – *ref to* CO_2 is acidic – *ref to* lactic acid
6(e)	regular, brushing / mouthwash / flossing / wash / clean, teeth **;** avoid sugary foods / diet described **;** dental check-ups **;** fluoride, toothpaste / in water **;**	**2**	

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