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

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.

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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)(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

Question	Answer	Marks	Guidance
2(a)	a length of DNA ; that codes for a protein ;	**2**	**I** characteristics / traits **A** polypeptide for protein
2(b)	**1** ribosomes make proteins ; **2** mRNA is copied, from gene / DNA ; **3** gene / DNA, remains in nucleus ; **4** mRNA moves, from nucleus to, cytoplasm / ribosome ; **5** mRNA 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

<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>

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

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, growth **;**	**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** emulsification **;** **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

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

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**	

<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>

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**	