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BIOLOGY

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Paper 4 Theory (Extended)

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MARK SCHEME

Maximum Mark: 80

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	A fungus / <i>Saccharomyces (cerevisiae)</i> / <i>S. cerevisiae</i>
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 <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)	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"> <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>	position on Fig. 3.1	result of electric activity	atrioventricular valves	semilunar valves	P	atria contract	open	closed ;	QRS	ventricles contract	closed	open ;	T	atria and ventricles relaxed	open	closed ;	3	one mark per row
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P	atria contract	open	closed ;																
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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 ; 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 ;	3																	
3(c)(iii)	deeper (breaths) / increased volume (of lung) ; faster (rate) ; AVP ;	2																	

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)	<i>description</i> 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 ;;; <i>explanation</i> 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>emulsification</u> ; 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	

Question	Answer	Marks	Guidance																											
6(a)(i)	cell membrane ; DNA ; ribosomes ; cytoplasm ;	2	A genes / genetic material / chromosome(s)																											
6(a)(ii)	<table><tr><td></td><td><i>white blood cell (S)</i></td><td><i>prokaryote (R)</i></td></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>		<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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8	antibodies	no antibodies ;																												
6(b)(i)	T = antigen ; U = <u>mitosis</u> ; 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 ₂ 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	