Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education (9–1)

BIOLOGY **0970/42**

Paper 4 Theory (Extended) **October/November 2018**

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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mark scheme abbreviations

- **;** separates marking points
- **/** alternative responses for the same marking point
- **R** reject the response
- **A** accept the response
- **I** ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- ( ) the word / phrase in brackets is not required but sets the context

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th></th><th>name of an organism from Fig.1.1</th></tr>
<tr><td>producer</td><td>algae / (phyto)plankton / clover / grass ;</td></tr>
<tr><td>secondary consumer</td><td>marsh rice rat / (stone) crab / mycid shrimp / blenny / (bald) eagle ;</td></tr>
<tr><td>an animal that feeds at two trophic levels</td><td>(bald) eagle / blenny / (spotted) sandpiper ;</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>1(b)</td><td>nitrification ;
(nitrifying) bacterium / bacteria ;</td><td>2</td><td>A oxidation</td></tr>
<tr><td>1(c)</td><td>root hairs ;
(by) active, transport / uptake ;
across (cell) membranes ;
against a concentration gradient / low to high concentration / AW ;
by proteins (molecules / pumps / carriers) ;
use of, energy / ATP ;
(also by) diffusion ;</td><td>3</td><td></td></tr>
<tr><td>1(d)</td><td>ribosome / (rough) endoplasmic reticulum ;</td><td>1</td><td></td></tr>
<tr><td>1(e)</td><td>nitrogen fixation ;</td><td>1</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
1(f)	little energy is transferred from one trophic level to the next /AW ; not enough energy, at the top of the pyramid / at higher trophic levels, to support a large number of organisms ; named example of energy loss ; heat / in respiration / in (named) metabolic processes / movement / excretion / urine / faeces not all organisms / parts of organisms (in one trophic level), are, eaten / digested ; AVP ;	3	

Question	Answer	Marks	Guidance
2(a)	a version of a gene ;	1	
2(b)	change in base (sequence of DNA) ; DNA / gene / base sequence, codes for, protein / enzyme ; *ref. to* mRNA ; different (sequence of) amino acids in, protein / polypeptide / enzyme ; (mutant / changed) enzyme / active site, has different, shape / structure ; (active site / enzyme) not complementary to substrate / enzyme-substrate complexes cannot form / substrate will not fit into *or* bind ;	3	
2(c)	the allele for dwarfism is, recessive / **t** ; both parents are heterozygous (so do not express the allele) ;	2	
2(d)(i)	*ref. to* asexual reproduction ; (plantlets / cells / offspring grow by) mitosis ; all cells / new plants, are genetically identical ; AVP ;	3	

Question	Answer	Marks	Guidance
2(d)(ii)	competition for resources as all individuals are close together ; increased risk of inheriting harmful, alleles / features / trait ; no / little, (genetic) variation ; no new adaptive features ; no evolution / no (natural) selection / no artificial selection / AW ; no / little, ability to respond to (named) environmental change ; all individuals are susceptible to the same, diseases / pests ; higher risk of extinction ;	3	

Question	Answer	Marks	Guidance
3(a)(i)	thick / strong, (cell) wall ; withstanding, tension / collapse / hydrostatic pressure / AW ; lignin (in walls) / walls are impermeable ; prevents collapse / waterproofing ; wide / AW ; transport large volumes of water ; no (cell) contents / empty / dead cells / like pipes / like tubes ; no / little resistance to flow of water / allows water to flow easily / lots of water / continuous columns of water / no obstruction ; no, cross walls / end walls ; no / little, resistance to flow of water / allows water to flow easily / lots of water / continuous columns of water / no obstruction ; (bordered) pits ; lateral transport / AW ;	2	

Question	Answer	Marks	Guidance
3(a)(ii)	evaporation from (cell walls) in mesophyll ; diffusion of water vapour through stomata ; reduction of, pressure / water potential, at top (of plant) resulting in water moving upwards ; continuous column of water (in the xylem) ; cohesion of water (molecules) ; **A** if described incorrectly cohesion described as, forces / attraction, between water molecules ; transpiration pull ; water enters *or* leaves xylem, by osmosis / down water potential gradient ; AVP ;	**4**	
3(a)(iii)	support / described ;	**1**	
3(b)	increase / decrease (in rate of transpiration) ; more / less, evaporation ; increase / decrease, rate of diffusion (of water vapour) ; *ref. to* (kinetic) energy of (molecules of) water ; stomatal pores become, wider / narrower ; guard cells become, turgid / flaccid ;	**3**	**A** stomata close

Question	Answer	Marks	Guidance
4(a)	chemical substance produced by a (endocrine) gland ; carried by the blood ; alters the activity of specific target organs / AW ;	**3**	
4(b)(i)	(**A**) 210 (mg 100 per cm^3) **and** (**B**) 88 (mg 100 per cm^3) ;	**1**	
4(b)(ii)	136 (%) ;;	**2**	
4(b)(iii)	increases / decreases, more steeply / faster ; increases to / has, a higher concentration ; reaches a peak / decreases, (much) later ; does not return to, starting concentration / original value / normal / AW ; any comparative use of figures with correct units ;	**2**	

Question	Answer	Marks	Guidance
4(b)(iv)	increase in glucose concentration detected (by pancreas) ; insulin is, secreted / released (into the blood) ; *role of* the pancreas in, detection / secretion of hormones ; insulin, stimulates / AW, liver / muscle ; increase, uptake / respiration, of glucose ; glucose is converted to glycogen ; activation / AW, of enzymes (in liver cells) ; (blood) glucose concentration, decreases / maintained ; *ref. to* homeostasis / negative feedback ;	**4**	
4(b)(v)	tiredness / lethargy / fatigue / described ; breathlessness ; dizziness / fainting / light-headedness / coma ; frequent urination / AW ; sticky / sweet, urine ; urinary tract infection / UTI ; recurrent thrush ; thirsty (all the time) / drinking lots of water ; dry mouth ; weight loss ; hunger / eating a lot of food ; sweet-smelling breath ; change(s) in behaviour ; e.g. irritability / confusion / mood swings nausea / vomiting ; blurred vision / blindness ; cuts / grazes / wounds, that do not heal ; AVP ;	**3**	

Question	Answer	Marks	Guidance
5(a)	***red blood cell:*** *feature:* red blood cells smaller than (named) white blood cell(s) / ora ; biconcave (disc / shape) / no nucleus ; *role:* contains haemoglobin / transports oxygen / transports carbon dioxide ; ***lymphocyte:*** *feature:* little cytoplasm / large(r) nucleus / nucleus fills most of the cell ; *role:* *ref. to* active immunity / responds to, antigen(s) or vaccine(s) / produce, antibodies or antitoxins / *ref. to* memory cells ; ***phagocyte:*** *feature:* lobed / irregular-shaped / C-shaped / AW, nucleus ; *role:* engulf pathogens / phagocytosis / AW ;	**6**	
5(b)(i)	fibrinogen ⟶ fibrin ;	**1**	
5(b)(ii)	prevent blood loss ; prevent entry of (named), pathogens / microbes ; *ref. to* wound healing / tissue repair ;	**2**	
5(c)(i)	(**P**) $\mathbf{X^HX^h}$; (**Q**) $\mathbf{X^hY}$; (**R**) $\mathbf{X^HY}$;	**3**	
5(c)(ii)	0.25 / 25% / 1 in 4 / ¼ ;	**1**	
5(c)(iii)	gene is located on, a sex chromosome / X or Y / X / Y ; characteristic is more common in, males / one sex (than the other) ;	**2**	

Question	Answer	Marks	Guidance
6(a)(i)	dry scaly skin ; leathery / soft-shelled, eggs ;	**2**	
6(a)(ii)	cellulose / cell wall ; chloroplast / chlorophyll ; starch grains ; (large / permanent / central) vacuole ;	**2**	
6(b)(i)	amylase ;	**1**	
6(b)(ii)	mouth ; small intestine ;	**2**	
6(c)	monitoring / AW, population(s) / individual(s) ; habitat, protection / restoration ; reducing / prevention, of pollution ; removal / AW, of alien species ; preventing colonisation by alien species ; hunting ban / prevent poaching ; government / legislation, to protect species ; create, exclusion zones / reserves (so not disturbed by people) ; specific, times when / areas where, hunting / AW, not allowed ; international agreements to limit trade ; removal to, zoos / botanical gardens / wildlife parks ; captive breeding / breeding programme (*in situ* or *ex situ*) ; seed banks / frozen zoos / cryopreservation / AW ; artificial insemination / IVF / use of surrogates / AW ; reintroduction programmes ; education / awareness ;	**5**	

Question	Answer	Marks	Guidance
6(d)	food ; drugs / medicines ; (named) fuel / biomass for energy ; timber / building materials / AW ; water ; ***ignore*** rain oxygen ; (named) mineral ; gene(s) ; clothing / fur ; AVP ;;;	**3**	