Cambridge Assessment International Education
Cambridge Pre-U Certificate

BIOLOGY **9790/01**

Paper 1 Structured **May/June 2019**

MARK SCHEME

Maximum Mark: 100

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 May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

PUBLISHED

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.

Question	Answer	Marks	Guidance
1	**B**	**1**	

Question	Answer	Marks	Guidance
2	**B**	**1**	

Question	Answer	Marks	Guidance
3	**D**	**1**	

Question	Answer	Marks	Guidance
4	**C**	**1**	

Question	Answer	Marks	Guidance
5	**D**	**1**	

Question	Answer	Marks	Guidance
6	**B**	**1**	

Question	Answer	Marks	Guidance
7	**B**	**1**	

Question	Answer	Marks	Guidance
8	**C**	**1**	

Question	Answer	Marks	Guidance
9	**D**	**1**	

Question	Answer	Marks	Guidance
10	**C**	**1**	

Question	Answer	Marks	Guidance
11	**C**	**1**	

Question	Answer	Marks	Guidance
12	**A**	**1**	

Question	Answer	Marks	Guidance
13	**A**	**1**	

Question	Answer	Marks	Guidance
14	**D**	**1**	

Question	Answer	Marks	Guidance
15	**D**	**1**	

Question	Answer	Marks	Guidance
16	**C**	**1**	

Question	Answer	Marks	Guidance
17	**A**	**1**	

Question	Answer	Marks	Guidance
18	**B**	**1**	

Question	Answer	Marks	Guidance
19	**C**	**1**	

Question	Answer	Marks	Guidance
20	**A, D, E**	**1**	

Question	Answer	Marks	Guidance
21(a)	*four in total with max. 3 for stating features (S). Outline (O) points should match S points.* **S1** small / green / inconspicuous , flower / petals / sepals ; **O1** access for / no obstruction to, wind / small flower saves energy ; **S2** feathery / branched, stigma ; **O2** large surface area / more chance of catching pollen ; **S3** stigma hangs outside flower ; **O3** more chance of catching pollen ; **S4** anthers, have long filaments / hang outside flower ; **O4** to catch the / exposed to, wind ; **S5** versatile anthers ; **O5** increases chance of pollen release ; **S6** large / long, anthers ; **O6** produce large quantity of pollen ; **S7** no leaves near flowers / flowers distinct from leaves ; **O7** allows good air flow ; **S8** long / thin, stem / stalk / pedicel ; **O8** so flower can move (with wind) ;	**4**	

Question	Answer	Marks	Guidance
21(b)	*five in total with max. four from mps 1–8* *or max. four from mps 9–14:* *comments on results* **1*** lower / less, seeds when, covered / bagged / self-pollinated / in group 1 **;** **2** calculation to quantify difference between, covered / group 1, and, uncovered / group 2 **;** **3** less, wind / movement / pollen release / pollen transfer, inside bag / in group 1 **;** **4** group 1 / bagged / covered, show self-pollination **;** **5** *B. inermis,* lower / lowest, when, covered / bagged / in group 1 **;** **6** *B. inermis*, does not self-pollinate / relies on cross-pollination **;** **7** AVP **;** **8** AVP **;** *advantages of self-pollination* **9** more reliable / increased chance of seed production **;** **10** maintains homozygosity / reduces genetic variation **;** **11** maintains, desirable features / specialisation, for habitat **;**	**5**	**7** e.g. little / less, seed produced in *B. inermis* when, uncovered / group 2 **OR** 0.3% seed production in *B. inermis* linked to bagging too late / pollen contaminating bag **8** e.g. calculated difference between 2 species (in either group) **OR** comparative comment **9** **ALLOW** increased chance of reproductive success **10** **ALLOW** maintains genotype

Question	Answer	Marks	Guidance
21(b)	**12** useful if plants are far apart / rare **;** **13** idea of, more resource efficient **;** **14** AVP **;**		 **14** e.g. unknown proportion of cross- and self-pollination in group 2 / uncovered / in wild genetic variation in ability to self-pollinate hermaphrodites have potential to, self-pollinate / self-fertilise
21(c)(i)	*max. 2 from labels (L) and max 2 from annotations (A):* **L1** variable / Fab / (fragment) antigen-binding, region / site **;** **A1** binds / specific, to (*Bromus*), pollen / allergen / antigen / epitope **;** **L2** hinge region / Cε2 **;** **A2** gives flexibility (when binding) **;** **L3** Fc / fragment crystallisable / constant / tail, region **;** **A3** binds to, Fc-receptors / mast cells **;**	**3**	*labels must be to correct region* **L1** **ALLOW** variant region **L2** **IGNORE** disulphide bonds / cysteine-cysteine bridges **L3** **ALLOW** invariant / non-variable, region
21(c)(ii)	**1** binds to, Fc region **;** **2** prevents, IgE binding to, Fc-receptors / mast cells **;** **3** binds to IgE **;** **4** prevents, allergen / antigen / epitope / pollen, binding **;**	**2**	 **2** **ALLOW** prevents mast cell activation

Question	Answer	Marks	Guidance
22(a)	*any four from:* **1** at, high pO_2 / lungs / over 8kPa, haemoglobin, loads / binds / has high affinity for / is saturated with, O_2 **;** **2** in, circulatory system / arteries, haemoglobin is, bound to / highly saturated with, O_2 **;** **3** at low pO_2 / tissues / below 4kPa, haemoglobin, unloads / dissociates from / has low affinity for, O_2 **;** **4** small decrease in pO_2 / from 6-2 kPa, gives large release of oxygen from haemoglobin **;** **5** at tissues, high CO_2 / low pH, increases, unloading / dissociation **;** **6** allosteric effects / cooperative binding, and oxygen, loading / unloading **;**	**4**	**1** **ALLOW** forms oxyhaemoglobin for 'Hb loads O_2' **2** **ALLOW** does not dissociate from for 'is bound to' **3** **ALLOW** oxyhaemoglobin dissociates for 'Hb unloads O_2' **4** **ALLOW ora**
22(b)	*lysosomes* cannot break down, old organelles / toxins / unwanted products / pathogens / *Plasmodium* **;** *smooth endoplasmic reticulum* cannot, synthesise / modify, lipids / steroids / cholesterol **or** must obtain, lipids / steroids / cholesterol, from outside cell **or** cannot repair cell (surface) membrane **;**	**2**	**IGNORE** substances **IGNORE** carbohydrates

Question	Answer	Marks	Guidance
22(c)(i)	*any two from:* **1** glycolysis / glucose converted to pyruvate **;** **2** anaerobic respiration **;** **3** net gain of 2ATP (per glucose) **;** **4** pyruvate, gains hydrogens / is reduced / forms lactate **;**	**2**	
22(c)(ii)	*any one from:* oxygen, in cell / bound to haemoglobin, is not used up **;** AVP **;**	**1**	e.g. avoids, oxidative stress / free radicals damaging cell **IGNORE** wasting, energy / resources, idea
22(d)	*any one from:* **1** rRNA in ribosomes lost **;** **2** no nucleus so no (new) mRNA produced **;** **3** existing mRNA, degraded / breaks down **;** **4** no point making mRNA as no ribosomes for translation **;**	**1**	
22(e)(i)	*any three from:* **1** abnormal cells have, high(er) Ψ / less negative Ψ / are hypotonic to, solution**;** **2** lose water, by osmosis / down water potential gradient **;** **3** normal cells, have same Ψ as / are isotonic to, solution **;** **4** so no <u>net</u> movement of water / AW **;** **5** erythrocytes vary in water potential **;** **6** image taken shortly after placing cells in glucose solution **;** **7** AVP **;**	**3**	**6** **ALLOW** not enough time to establish equilibrium **7** e.g. glucose diffuses into cells (at different rates) different (levels of) exposure to solution (due to packing), difference in number of aquaporins

Question	Answer	Marks	Guidance
22(e)(ii)	*any five from:* **G1** insulin / glucagon, binds to receptors on cell surface membrane **;** **G2** glucose, enters / exits, cell by, facilitated diffusion / GLUT 2 transporters / glucose channels **;** *blood glucose concentration too high / insulin* **H1** glucokinase phosphorylates glucose **;** **H2** more glucose diffuses in / steep diffusion gradient **;** **H3** more glucose respired / increases respiration of glucose **;** **H4** glucose converted to glycogen / glycogenesis / glycogen synthase activated **;** *blood glucose concentration too low / glucagon* **L1** glycogenolysis / glycogen breaks down to glucose / glycogen phosphorylase activated **;** **L2** gluconeogenesis / amino acids converted to glucose **;** **L3** glucose moves out of, liver (cell) / hepatocyte **;** **G3** blood glucose concentration, (therefore) increases / decreases (back to normal) **;** **G4** AVP **;**	**5**	**G1 ALLOW** plasma membrane / plasmalemma / surface of hepatocytes **G2 REJECT** insulin increasing number of, GLUT2 / glucose channels (in liver cell membrane) **G4** insulin / glucagon, trigger, signalling cascade / phosphorylation (cascade)

Question	Answer	Marks	Guidance
23(a)	changes, conformation / stability, of lamins **OR** breaks down / weakens, (nuclear), membrane / envelope **;**	**1**	
23(b)	breaks peptide bonds **;** in the interior of / within / not at ends of, polypeptide **;** hydrolysis / water used **;**	**3**	
23(c)(i)	to form, active site / (final) tertiary structure / 3D shape **;**	**1**	**ALLOW** securin acts as a chaperone protein
23(c)(ii)	covers / blocks, active / catalytic, site **;**	**1**	
23(d)	*any five from:* *metaphase to anaphase transition:* **1** separase action, can occur / no longer prevented **;** **2** separase breaks down cohesin **;** **3** sister chromatids, separated / pulled apart **;** **4** spindle fibres / microtubules, shorten / contract **;** *exit of cell from mitosis (max 4)* **5** no cyclin B to, bind to / form complex with, cdk1 **;** **6** decrease in / no, MPF **;** **7** condensins / lamins, dephosphorylated **;** **8** chromosomes de-condense **;** **9** nuclear envelope (re)-forms **;**	**5**	**1** **ALLOW** separase becomes active **7** **ALLOW** not activated / not phosphorylated, for 'dephosphorylated' **8** **ALLOW** chromosomes do not condense
23(e)	proteasome(s) cannot degrade, cyclin B / securin / cell cycle proteins (after they have performed function) **;**	**1**	**ALLOW** correct ref. to proteasome function

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>24(a)</td><td><table><tr><td>Kingdom</td><td>Animalia</td></tr><tr><td>Phylum</td><td>Chordata</td></tr><tr><td>Class</td><td>Mammalia</td></tr><tr><td>Order</td><td>Primate(s)</td></tr><tr><td>Family</td><td>Hominidae</td></tr><tr><td>Genus</td><td><u>H</u>omo</td></tr><tr><td>Species</td><td><u>s</u>apiens</td></tr></table></td><td>2</td><td>ALLOW chordates

ALLOW mammals

ALLOW hominids

REJECT homo

REJECT Sapiens

All correct = two marks
One or two incorrect = one mark</td></tr>
<tr><td>24(b)</td><td>any three from:

1 three fatty acids ;
2 (bound to) glycerol ;
3 (by) ester, bonds / linkages ;
4 fatty acids have, several / many, C=C / double bonds ;</td><td>3</td><td>ALLOW mps 1–4 from a labelled diagram</td></tr>
</table>

Question	Answer	Marks	Guidance
24(c)	*any four from:* **1** taxes are, innate / genetically pre-determined / instinctive **;** **2** negative (phototaxis) = young alevins (away from light / into gravel) **OR** positive (phototaxis) = older alevins (towards, light / surface) **;** **3** detail of / reason for, response to light **;** **4** negative (rheotaxis) = smolts (with current / to open ocean) **OR** positive (rheotaxis) = adults (against current / back to natal stream) **;** **5** (trigger to) migrate / return, to, natal stream / spawning ground, is, innate / instinctive / genetically-determined **;** **6** odour / olfactory, navigation / recognition, involves, (early) learning / imprinting / long-term memory **;** **7** AVP **;** **8** AVP **;**	**4**	**3** e.g. young alevins protected from, predators / currents **OR** older alevins, fill swim bladder **7** and **8** e.g. movement, towards / away from, gravel bed = geotaxis taking in air to fill swim bladder is innate movement of adult towards, food / feeding areas, is positive chemotaxis, innate behaviour of mature adults (not eating) resulting in death increases survival chances of population
24(d)	*any one from:* **1** low demand for oxygen as relatively inactive **;** **2** large surface area : volume ratio **;**	**1**	
24(e)	*any one from:* **1** dead fish, add nutrients / support food chain **;** **2** reduces, competition / predation **;** **3** AVP **;**	**1**	

Question	Answer	Marks	Guidance
24(f)(i)	two peaks either side of normal peak **;**	**1**	
24(f)(ii)	disruptive / diversifying (selection) **;**	**1**	**ALLOW** ECF of directional / stabilising, from **(i)**

Question	Answer	Marks	Guidance
24(g)(i)	*any two from:* **1** genetic diversity decreases **;** **2** loss of, alleles / heterozygosity / gene pools **;** **3** sub-populations / gene pools, different due to different, mutations / selection pressures **;**	**2**	
24(g)(ii)	*any five from:* **1** strategies, aim to, maintain biodiversity / prevent extinction **;** **2** and **3** for, social / ethical / medical / economic / environmental, reasons **; ;** *any two* **4** further detail **;** **5** and **6** two examples of conservation strategies **; ;** **7** criticism of strategies **;** **8** AVP **;**	**5**	**max. 4 if no reference to fish / salmon** **ALLOW** aesthetic **4** *either general or applied to coho salmon* e.g. for agriculture / food source / healthy diet / source of omega-3s / for leisure / fishing / important, in food web / as keystone species / as prey / in community **5** and **6 ALLOW** *general or applied to coho salmon* e.g. ban / restrict, hunting / fishing / control logging / human activities, near streams / prevent, pollution / disease spread / parasite spread / fish ladders over dams / remove obstacles in streams / re-stock streams / hatcheries / habitat, improvement / restoration / protection **7** e.g. effect on local human populations unknown / harmful, effect on other species **8** e.g. avoid / repair, habitat fragmentation ref. SLOSS debate

Question	Answer	Marks	Guidance
25(a)	*any three from:* *C4 plants* **1** Kranz anatomy **;** **2** ref. bundle sheath cells **;** **3** with chloroplasts **;** **4** mesophyll forms a ring (around bundle (sheath) **;**	**3**	*C3 plants*
25(b)	*any two from:* *light dependent stage / photophosphorylation:* **1** makes reduced NADP and ATP **;** *light independent stage / Calvin cycle:* **2** reduced NADP used to reduce GP to TP **;** **3** ATP used to, reduce GP to TP / regenerate RUBP **;**	**2**	**ALLOW NADPH** for reduced NADP throughout
25(c)	*any one from:* *phloem sieve tube elements* **1** presence of sieve plate **;** **2** (adjacent) companion cells, present / visible **;** *xylem vessel elements* **3** wall thick(er) **;** **4** umen, wide(r) / rounded **;** **5** empty / hollow / no cytoplasm **;** **6** lignin stains, red / with phloroglucinol **;**	**1**	**3** **ALLOW** ref. rings / helical thickening (in LS) **4** **ALLOW** xylem has a larger diameter

Question	Answer	Marks	Guidance
25(d)	*immobilised:* **1** enzyme can be, re-used / recycled **;** **2** less enzyme needs to be bought / cheaper to use same enzyme **;** **3** less downstream processing / do not need to separate enzyme and product **;** **4** is more stable at, high temperature / changed pH **;** **5** suitable for, continuous / mass, production **;** **6** longer shelf-life of enzyme **;**	**2**	allow general points or points linked to glucose isomerase **ALLOW** ora throughout for enzyme free in solution **3** **ALLOW** product is free of enzyme **5** **ALLOW** idea of scaling up production **6** **ALLOW** enzyme lasts longer

Question	Answer	Marks	Guidance
26(a)	*one mark from mps 1–3 and one mark from mps 4–6:* *monogamy* **1** male and female in pair have, same / overlapping, territory **;** **2** female territory does not overlap (with that of other females) **;** **3** territories supply enough food so small territories **;** *polygyny* **4** male has one territory that overlaps with two (or more) females / AW **;** **5** female territories overlap **;** **6** food more scarce so large territories **;**	**2**	

Question	Answer	Marks	Guidance
26(b)	*any two from:* **1** polyandry / polyandrous **;** **2** more chance of fertilisation **;** **3** nestlings fed by males for a greater proportion of time **;** **4** more food for young (as more birds provide for them) **;** **5** more protection, from predators / for young **;** **6** more chance of, reaching fledgling stage / surviving **OR** less chance of starving **;** **7** AVP **;**	**2**	**7** one brood may have more than one father increased genetic variability allows survival of some offspring if conditions unfavourable
26(c)	*any four from:* **1** sensory → (relay / intermediate) → motor **;** **2** receptor detects stimulus **;** **3** synapse **;** **4** spinal cord / non-conscious area of brain **;** **5** neuromuscular junction **;** **6** muscle contraction / gaping / cheeping / begging **;** **7** AVP **;**	**4**	**ALLOW** from labelled diagram **1** **ALLOW** effector for motor **2** **ALLOW** sight of, food / parent, for 'stimulus' **5** **ALLOW** neuromuscular synapse **7** e.g. ref. to neurotransmitters ref. to dorsal root (ganglion) / white and grey matter