Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2018**

MARK SCHEME

Maximum Mark: 60

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.

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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.

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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.

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point

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Question	Answer	Marks
1(a)	(nucleus of cell) **D** has two nucleoli v **E** has one nucleolus **;**	**1**
1(b)	**A** = (early / mid) prophase **;** **R** late **B** = (mid / late) prophase **;** **R** early **C** = anaphase **;**	**3**
1(c)	**I** name of stage *two from:* ref. to (daughter) chromosomes at poles **;** **A** (sister) chromatids at poles **R** chromatids move to poles **A** two separate groups of (daughter) chromosomes **A** two nuclei form (enclosing chromosomes) **I** there are two nuclei *in context of at each pole* nuclear envelope reassembles (around chromosomes) **;** **A** nuclear membranes reassemble nucleolus reappears / nucleoli reappear **;** (daughter) chromosomes, become diffuse / become long and thin / decondense / uncoil **;** **A** become chromatin **I** disappears spindle, disassembles / AW **;**	**2**

Question	Answer	Marks
2(a)	*too small to see* 35 µm is 0.035 mm (smaller than 0.05 mm) **or** 0.05 mm is 50 µm (larger than 35 µm) **;**	**1**
2(b)	*in context of light microscope* *two from:* 1 resolution / resolving power, poor / not high enough / AW **;** 2 ability to distinguish between two points not high enough / AW **;** 3 ref. to limit of resolution **;** e.g. organelles smaller than, 0.2 µm / 200 nm, not visible **A** organelles smaller than 200 nm (accept range 100–300 nm) 4 organelle too small to interfere with light waves **;** **A** wavelength of light too long **I** organelles are small	**2**
2(c)(i)	ester **;**	**1**

Question	Answer	Marks
2(c)(ii)	facilitated diffusion **;** *plus two from:* (diffusion) through (membrane), transport / channel / carrier, protein **;** **A** pore **I** transmembrane / integral, protein high to low concentration **or** down, concentration / diffusion, gradient **;** passive **;** **A** no, ATP / (metabolic) energy, required *if active transport incorrectly stated allow ecf* through (membrane), transport / carrier, protein **;** **R** channel protein low to high concentration / against a concentration gradient / requires ATP / requires (metabolic) energy **;**	**3**
2(c)(iii)	*four from:* 1 ref. to hormones, released into / arrive at adipocyte in, blood stream **;** **A** released by another, cell / tissue (elsewhere in the body) 2 hormone is, (chemical) signal / signalling molecule / messenger molecule **;** 3 (adipocyte is) target cell **;** **A** (adipose is) target tissue 4 (hormone) binds to / AW, receptor **;** *in context of* on cell surface membrane of adipocyte 5 ref.to receptor (shape) complementary to hormone **;** **A** specific receptor for hormone 6 (binding) triggers / stimulates, reactions within the cell **;** **A** cascade of reactions **I** binding causes a reaction to occur 7 cell signalling results in a response, qualified **;** e.g. triglyceride breakdown fatty acids (and glycerol) produced fatty acids leave, the cell / via transport protein	**4**

Question	Answer	Marks
2(d)	*any one valid suggestion:* *e.g.* do not have mitochondria / mitochondria required (to produce ATP) **;** do not have nucleus (so no mRNA produced) **;** no mRNA for enzyme synthesis **;** (required) enzymes not present **;** impermeable to fatty acids / AW **;** have lost / do not have, the required organelles **;**	**1**

Question	Answer	Marks
3(a)	*max 2 if only one section attempted* *three from:* *multilayered epidermis* reduces, cuticular transpiration / loss of water <u>vapour</u> through cuticle **;** increases distance for diffusion (of water vapour to cuticle) **;** ref. to protection from heat from sunlight and reduced evaporation (from spongy mesophyll cells) **;** *stomatal crypts* creates area of moist air / AW **;** **I** traps water minimises effect of, external air currents / wind **;** reduces / less steep, water potential gradient (between intercellular air space and external environment) **;** **A** water vapour potential gradient **A** diffusion gradient if referenced to water vapour ref. to only on lower surface / shaded, and reduced evaporation (from spongy mesophyll cells) **;** **A** lower temperature reduces rate of diffusion of water vapour (out via stomata)	**3**
3(b)	phloem sieve tube element(s) **;** **A** phloem sieve tube (cells) **A** sieve elements **I** companion / transfer, cells	**1**

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Question	Answer	Marks
3(c)	*allow named assimilates* *source* *in context of assimilates* site of synthesis **;** **A** described e.g. photosynthesis in leaf / storage compound breakdown in roots *sink* *in context of, via phloem / from source / from leaf* **I** nutrients / substances, unqualifed *if assimilates / named assimilate, not stated when explaining source* site where assimilates are stored **A** described e.g. roots for storage of starch **or** area where, growth occurs / assimilates are used for growth **A** described e.g. growth in developing buds / growth of immature leaf **or** area that receives, assimilates / AW **;** **A** area where sucrose unloaded **I** place that needs assimilates **I** place where assimilates are used, unless qualified	**2**
3(d)(i)	change in the, sequence / AW, of, bases / nucleotides (in, the DNA / the gene / *cyFBP*) **;**	**1**

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Question	Answer	Marks
3(d)(ii)	*one valid suggestion that prevents polypeptide synthesis or prevents synthesis of functional enzyme:* *e.g.* no mRNA produced **;** **A** transcription, does not / cannot, occur mRNA produced unable to attach to ribosome **;** **A** translation, does not / cannot, occur no start codon on mRNA **;** shortened polypeptide chain produced **;** **A** ref. to STOP codon premature chain termination mutation / nonsense mutation **;** polypeptide produced cannot fold to form, tertiary structure / active site **;** **R** changes shape of active site preventing function polypeptide produced cannot form quaternary structure of protein **;**	**1**
3(e)(i)	*accept cell for lymphocyte throughout* *four from:* 1 (primary) immune response **;** 2 cyFBPase / enzyme, is antigen **;** 3 formation of, APC / antigen-presenting cell **;** **A** antigens presented on surface of macrophages 4 antigen, recognition / binding (in context of B-, or T-lymphocytes) **;** 5 detail **;** e.g. clonal selection have receptors, complementary / specific, to, antigen / cyFBPase **A** immunoglobulin / antibody, as receptors for B-lymphocytes **A** surface molecules as receptors for T-lymphocytes 6 divide by mitosis / clonal expansion **;** 7 (specific) B-lymphocytes form plasma cells **;** 8 plasma cells, synthesise / secrete, specific antibody / antibody to cyFBPase **;** 9 T-helper / Th, lymphocyte, secretes, cytokine / interleukin **;** 10 stimulates, humoral / B-lymphocyte, response **;**	**4**
3(e)(ii)	no binding of (monoclonal) antibody to, antigen / cyFBPase / enzyme / AW **;**	**1**

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Question	Answer	Marks
3(f)	*two from:* (less cyFBPase / enzyme, so) less sucrose synthesised **;** **A** no enzyme to synthesise sucrose less sucrose transported (source to sink) **;** **A** less sucrose unloaded at sink **;** ref. to less glucose for synthesis of starch / AW (on context of sucrose hydrolysis) **;**	**2**

Question	Answer	Marks
4(a)	*answers must be in context of <u>oxygen</u>* *three from:* 1 <u>diffusion</u> 2 movement, down a, concentration / diffusion, gradient / from high(er) to low(er) concentration **;** **A** in terms of partial pressure 3 passive (process) **;** 4 through alveolar wall / across alveolar cells / across squamous epithelial cells (of alveolus) / across pavement cells (of alveolus) **;** **A** squamous cells 5 across, endothelium / endothelial cells / capillary wall **;** **A** squamous, epithelium / cells (in context of capillary wall) 6 ref. to diffusion / AW, through the phospholipid bilayer of cell surface membranes / between the phospholipids of the bilayer (of squamous or endothelial cells) **;**	**3**
4(b)(i)	65 / 66 / 67 (%)	**1**

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Question	Answer	Marks
4(b)(ii)	1 higher partial pressures in lungs / lower partial pressures in (respiring) tissues **;** **A** correct values / range of values, of kPa **A** in alveoli *advantages of differences (higher v lower partial pressure)* *only higher partial pressure or lower partial pressure explanation required to gain mark* 2 oxygen, binds to v released from, haemoglobin **or** oxyhaemoglobin, is formed v dissociates / AW **;** 3 (so) percentage saturation of haemoglobin (with oxygen) high v low **;** 4 affinity of haemoglobin for oxygen high v low **;** 5 data from Fig. 4.1 to support **;** 6 (body), cells / tissues, need oxygen for aerobic respiration **;**	**3**
4(c)	*idea of* abnormal, change in the body / condition, which produces, poor / ill-, health **or** absence of, good health / well-being **;** **A** disorder / illness further detail **;** e.g. having an adverse effect reduces the effectiveness of functions produces, (specific) signs / symptoms lack of social, physical and mental, well-being can be infectious or non-infectious AW	**2**

Question	Answer	Marks
4(d)	*five from:* 1 base substitution (in gene coding for, β-globin / polypeptide) **;** 2 different / altered, mRNA codon **;** 3 different tRNA brings a different amino acid (to ribosome) / leads to a change in one amino acid (in the polypeptide chain) **;** 4 altered, primary structure / sequence of amino acids (in β-globin) **;** 5 changed, tertiary / quaternary, structure **;** 6 haemoglobin / molecule, less soluble **;** 7 (haemoglobin) molecules, stick together / form fibres **;** 8 (haemoglobin) less able to bind oxygen / AW **;** *points above may be qualified* 9 details **; ;** + e.g. thymine / T, replaces, adenine / A 10 in sixth, codon / triplet **or** sixth amino acid in sequence is changed (non-template strand) GTG instead of GAG / GTA instead of GAA **or** (template strand) CAC instead of CTC / CAT instead of CTT mRNA codon is, GUG instead of GAG / GUA instead of GAA 11 (amino acid change is) valine instead of glutamic acid **;** 12 amino acid with non-polar side chain instead of polar side chain **;** 13 position of amino acid, is to the exterior / faces cytosol **;**	**5**

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Question	Answer	Marks
5(a)(i)	*three from:* 1 papain higher optimum temperature than ficin / ora **or** temperature is higher for papain for percentage of maximum activity of 100 **A** 100% activity / maximum activity / peak of activity **or** (100% of maximum activity) papain 60 °C v ficin 45 °C **;** 2 papain (overall) less steep increase / AW, (to peak) / ora **;** 3 papain steeper decline / AW (after peak) / ora **;** *for mp 2 and 3 allow ecf for a ref. to time, e.g. rapidly / slowly* 4 papain lower activity at all temperatures between 20 °C and, 54 °C / 55 °C **;** 5 papain higher activity at all temperatures above, 54 °C / 55 °C **;** 6 ref. to ficin more active over a greater range of temperatures **;** **A** ref. to activity at temperatures around 100% maximum 7 comparative, extracted / manipulated, data to support mp, 2–6 **;**	**3**
5(a)(ii)	ficin, as higher activity at 37 °C / body temperature **;**	**1**
5(b)	*one from:* (may be able to) obtain more product (per unit time) **;** **A** can use in a continuous system (may be) more, thermostable / tolerant to pH changes / AW **;** **A** idea that enzyme less likely to denature product, not / less, contaminated with enzyme **;** **A** less downstream processing longer shelf-life / AW **;** enzyme, easier to recover / can be reused **;** AVP **;** e.g. ficin may be, costly / difficult, to extract	**1**
5(c)(i)	extracellular (enzyme) **;**	**1**

Question	Answer	Marks
5(c)(ii)	*any one valid example:* e.g. collagen / elastin **;**	**1**

Question	Answer	Marks
6(a)	**A** HIV / AIDS, measles, smallpox **;** **B** cholera, tuberculosis **;** **C** cholera **;** **D** malaria **;**	**4**
6(b)	one mark for each correct column **; ;** nuclear envelope circular / (closed) loop / **A** ring of 80S mitochondria / chloroplasts **A** nucleus murein / peptidoglycan	**2**

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