UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/23 Paper 2 (AS Structured Questions), maximum raw mark 60

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.

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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 excepted)
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

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1 (a) (i) metaphase **;** [1]

(ii) chromosomes / (sister) chromatids, line up at the, equator / equatorial plate / metaphase plate **;** **A** move to **I** middle / centre
centromeres attached to, spindle / spindle fibres **;**
A (spindle) microtubules **A** kinetochore
centrioles, reach / located at / AW, poles **;** **R** ends
ref. spindle fully formed **;** **A** spindle fibres extend from poles / AW
R ref. to nuclear envelope absent (in anaphase also) [max 3]

(b) replacement of cells **;**
repair of tissue **;** **R** repair of cells
growth / increase in cell numbers **;**
asexual reproduction / vegetative propagation **;** **R** cloning
maintains / same, number of chromosomes **;** **A** two sets of chromosomes / diploid / 2n
genetically identical to parents **;**
A produces daughter cells that are genetically identical **A** ref. clone(s)
ref to rejection / self vs non-self **;** [max 3]

(c) ref. coordination of growth / limiting growth **;**
ref. minimising exposure to mutations / alterations to DNA (during replication) / AW **;**
prevent tumour formation **;** **A** prevent, cancer / uncontrollable growth
effect of, tumour / cancer **;** e.g. compress other organs / invades other tissues or organs
AVP **;** e.g. example of timing of cell cycle linked to cell function / idea of producing cells when required [max 2]

[Total: 9]

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2 **(a)** *one mark per complete correct row*

DNA	RNA	
two, polynucleotides / chains / strands **A** double	single, polynucleotide / strand / chain	;
(double) helix	not a helix / straight chain **;**	;
deoxyribose	ribose *differences between pentoses / sugar may be described in terms of OH on C_2*	;
<u>thymine</u> / no uracil	uracil / no <u>thymine</u>	;
hydrogen bonding (between all bases)	hydrogen bonds between some bases **A** no hydrogen bonds	;
ratio of A+G to C+T = 1 / AW	ratio of A+G to C+T varies	;
longer	shorter	;
one type	more than one type / three types / mRNA + tRNA + rRNA	;

[max 3]

(b) *(GCG)* CGC **;**
(ACA) UGU **;** [2]

(c) 714 **;; A** 717 / 720
if, no / incorrect, answer given, award one mark for correct working [2]

(d) 1 (tRNA) carries amino acid to ribosome **;**
2 ref. to specificity of amino acid carried **; A** role in ensuring correct primary structure
3 ref. anticodon (on tRNA): codon (on mRNA) binding **;**
4 ref. complementary / base pairing **; A** A-U, C-G
5 ref to tRNA binding sites within ribosome **;**
6 two tRNAs bound to, mRNA / ribosome, at same time **;**
7 amino acids held close to each other / AW **;**
8 (for) <u>peptide</u> bond formation **;**
9 (tRNA) can be reused / binds another amino acid **;** [max 4]

[Total: 11]

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3 (a) (i) active, transport / uptake **;** [1]
carrier / transport, protein **; A** pump protein **R** channel protein
ref. (protein) changing shape / conformational change **;**
ref to specificity **;**
ATP / energy, required **;** [max 2]

(ii) ATP / ADP / DNA / RNA / nucleic acid / NADP / phospholipid **;**
A nucleotide / named nucleotide / nucleoside **A** phospholipid bilayer [1]

(b) (i) W in the central X-shaped region **;** [1]

(ii) osmosis *in correct context* **;** e.g. through, cell surface / partially permeable, membrane or into, cytoplasm / cell
diffusion, into / through, cell walls **;**

from (region of), high(er) / less negative, water potential, to (region of), low(er) / more negative, water potential *or* down a water potential gradient **;**

transpiration pull **;** [max 2]

(iii) through cortex / via cortical cells **;**

apoplast pathway
(by) via cell walls (of adjacent cells) **; R** *if named as* symplast pathway **;**
symplast pathway
via cytoplasm and plasmodesmata **; R** *if named as* apoplast pathway
ref. vacuolar pathway **;**

ref. apoplast to symplast / pathway described, at endodermis **;**
(via) passage cells **;**
ref to, suberised / Casparian, strip **;** *in correct context* [max 4]

[Total: 11]

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4 (a) (i) red blood cells / erythrocytes / red blood corpuscles **;** [1]

(ii) *myoglobin* 78% **A** 77% } **;**
haemoglobin 21% } *must have both correct for 1 mark* [1]

(iii) myoglobin has higher affinity for oxygen / myoglobin binds oxygen while haemoglobin releases oxygen **;** ora
(myoglobin) acts as a store of oxygen **;**
myoglobin will only release oxygen, at (very) low oxygen partial pressures / AW when oxygen demand (in muscles) exceeds supply **; A** during exercise
AVP **;** e.g. myoglobin has, one / fewer haem groups, so no cooperative binding effects
e.g. allows aerobic respiration to continue (in muscle) [max 2]

(b) (i) fetal haemoglobin has higher oxygen affinity (than adult / maternal haemoglobin) / AW **;**
(higher oxygen affinity) over all ppO_2 / use of data at more than one ppO_2 (from Fig. 4.1) **;**

oxygen uptake from, adult / maternal, blood / AW **;**
or
gas exchange taking place between fetal and, adult / maternal, blood **;**

ref. to fetal reliance on mother to supply oxygen / mother only source of oxygen for fetus **;** [2]

(ii) at lower ppO_2 both, unload / AW, oxygen **;**
sufficient / more, adult haemoglobin present or adult haemoglobin provides sufficient oxygen / AW **;**
ref. to compensating by producing additional red blood cells **;**
AVP **;** e.g. ref. to similarity of position of both curves [max 1]

(c) (all) to the right of given curve, same overall shape as adult haemoglobin curve **;**
to the right of given curve, begins at 0.2 kPa, ends at 97% **;**
A *within range of* 0–0.4kPa and 95–99% [2]

[Total: 9]

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5 **(a)** (phloem) sieve plate **;** [1]

(b) **(i)** sucrose / amino acids / named amino acid / AVP **;** **R** sugar [1]

(ii) *source* – leaf / named photosynthetic part **;**
sink – roots / seeds / fruits / petals / bud / named non-photosynthetic part **;** [2]

(c) *accept, assimilate / named assimilate, throughout*
allow ecf from ***(b)(i)***

1 H^+ / protons, (move) out of companion cells by, active transport / AW **;**
R diffuse by active transport
2 H^+ / protons, diffuse (back) in with / cotransport sucrose, into companion cells **;**
A description of (facilitated) diffusion
R active transport
ref. to companion cell required only once for mps 1 and 2
3 via, cotransporter / cotransporter described **;**
4 sucrose, diffuses / AW, into (phloem) sieve, tube / element, via plasmodesmata **;**
5 (entry of sucrose into sieve tube so) water potential lowers **;**
6 water enters by osmosis **;**
7 (hydrostatic) pressure builds up **;** **A** pressure difference created
8 unloading at, sink / named sink, gives a difference in pressure (between source and sink) **;** AW
9 (so) mass flow **;** *term to be used in context* [max 5]

(d) *any one relevant e.g.*
obtain, sucrose / amino acids / other named assimilate **;** **R** nutrients unqualified
pressure forces, sap / AW, into aphid **;** [max 1]

[Total: 10]

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6 (a) (i) denitrification **;** [1]

(ii) nitrate required for, amino acid / protein / nucleic acid, production in plants **;**
A other relevant named N-containing biochemicals
nitrogen (gas) not useable form for (most) plants **;**

removal of nitrate
slows / AW, growth of plants **; A** reduces crop yield **A** plants need nitrates for growth
decreases fertility of soil / fertilisers need to be added to soil **;** [2]

(b) (i) nitrification **;** [1]

(ii) *P. stutzeri* / bacteria, can be (added to the water and) used to, remove nitrate / carry out denitrification **;**
detail **;** e.g. use of filter bed
ref. to leave for sufficient time to remove nitrates
nitrogen escapes to air [2]

(c) 1 air / oxygen, will not get into soil **;**
2 lack of oxygen reduces uptake of ions by plants / AW **;**
3 ref. saprobiotic bacteria and fungi / nitrifying bacteria / (some) nitrogen fixing bacteria, are aerobic **;**
4 ref. reduced populations (of bacteria in mp 2) **;**
5 example of effect on nitrogen cycle **;;**
6 e.g. slower rate / AW, of decomposition / decay
nitrogen fixation cannot occur (as rapidly)
nitrification cannot occur / nitrate will not be produced / less nitrate produced
(more) denitrification will occur
7 crops / plants, will use up remaining nitrate **;**
8 ref. leaching of, nitrates / other nutrients, for growth or (only) low levels of nitrates / other nutrients, for growth remain in soil **; A** ref. leaching reducing soil fertility
9 AVP **;** e.g. named example of another nutrient, with role
will take time to, recover nitrate levels / resume nitrogen fixation **;**
fertilisers (previously) applied washed away **;** [max 4]

[Total: 10]

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