UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/21 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 guidance on the mark scheme)
AW	alternative wording (where responses may vary more than usual)
underline	actual word given must be used by the candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument

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1 **(a)** community **;**
niche **; A** role
second trophic level / first level consumers / primary consumer level **;**
A *other appropriate terms* [3]

(b) *loss (of energy-containing food in producers or in grazers) in*
indigestible parts / not being absorbed / faeces / egestion **;;**
one mark for producer, one mark for grazer

excretion (in, grazers / herbivores / primary consumers) **;**
respiration (in, grazers / herbivores / primary consumers) **;**
loss of energy in movement / AW (in, grazers / herbivores / primary consumers)**;**
AVP **;** e.g. heat energy [max 2]

[Total: 5]

2 **(a)**

structure	trachea	bronchus	bronchiole	alveolus
ciliated epithelium	✓	✓	✓	×
goblet cells	✓	✓	✓ / ×	×
cartilage	✓	✓	×	×
smooth muscle	✓	✓	✓	×

one mark each row [4]

(b) **(i)** athlete takes a deep breath and then breathes out as much air as possible / AW **;**
suitable method to record this, e.g. spirometer / breathing out into a bell jar of water **;** [2]

(ii) 0.5 dm^3 / 500 cm^3 **;** [1]

(c) reduced supply of blood to, heart / cardiac, <u>muscle</u> **;**
reduced supply of glucose (to cardiac muscle) **; R** no
reduced supply of oxygen (to cardiac muscle) **; R** no
less aerobic respiration / (more) anaerobic respiration (of cardiac muscle) **;**
build up of, lactate / carbon dioxide **;**
ref. limited cardiac output **;**
AVP **;** e.g. ref. to consequences to (muscles of) body with reduced blood supply, ref. to pain caused by angina **R** heart attack / AW [3]

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(d) damages, lining of arteries / endothelium **;** *accept once*
speeds up (atheromatous / fibrous) plaque development **;** *accept once*
increases chance of blood clotting / promotes thrombosis **;** *accept once*

nicotine
increases heart rate / AW **;**
increases blood pressure **;**
makes platelets 'sticky' **;**
decreases blood flow to, extremities / AW **;**
constriction of blood vessels **;** (max 2)

carbon monoxide
combines with haemoglobin / forms carboxyhaemoglobin / higher affinity for haemoglobin (than oxygen) **;**
reduces oxygen-carrying capacity / AW (in context of, haemoglobin / blood) **;**
promotes release of damaging free radicals / peroxides / superoxides / oxidising agents **;**
causes, platelets and neutrophils to stick together / platelets to stick to endothelium **;**
ref. hypoxia damage to cardiovascular system **;** (max 2) [max 3]

[Total: 13]

3 (a) *accept ora*
penalise once if refs. in context of rates e.g. faster
no cells remaining, correct concentration value given (accept up to 0.26%) **;**
100% / AW, cells remaining, ref. from 0.86%–0.9% / AW **;**
steep increase in percentage cells remaining between 0.5–0.8% **;** **A** to 0.7% *if next marking point included*
steepest increase between 0.7–0.8% **;**
comparative data quote to support ref. to increase **;** [max 3]

(b) *max 5 if no mention of water potential anywhere in the answer*
correct use of term osmosis linked to water potential (in context of high to low) **;**

0% and 0.7%
(net) water in (to red cells) **;**
0%, all cells burst / (haemo)lysis of all cells **;**
0.7%, some cells burst **;** ora
} general ref. to bursting at either concentration **;**
cell membrane cannot withstand pressure **;**
(0.7%) (remaining) cells swollen / cell volume increases **;**
0.7% water potential gradient not as steep as in, water / 0% **;**

1.5%
(net) loss of water from cells **;**
cells, shrink / AW *or* cell volume decreases **;** **A** descriptions relative to biconcave disc shape [max 6]

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(c) 4, oxygen molecules / O_2, per (molecule of) haemoglobin **;**
(forms) oxyhaemoglobin (in lungs) **; A** marking points 1 and 2 as equation
ref. oxygen remains bound until blood in area of low pO_2 / high pCO_2 / high(er) temperature **; A** in area of respiring tissues (max 3)
carbon dioxide combines with haemoglobin **;**
terminal, amine / amino, group of haemoglobin **; A** $–NH_2$
carbamino-haemoglobin **; R** carboxyhaemoglobin
ref. to hydrogen ions from carbonic acid **;**
ref. carbon dioxide remains bound until blood in area of low pCO_2 / high pO_2 **;** [max 4]

(d) (i) 19.7 / 20 (%) **;;**

allow 1 mark if incorrect answer but correct working shown
7.3 – 6.1 / 6.1 × 100 / 1.2 / 6.1 × 100 [2]

(ii) partial pressure / AW, of oxygen is, low / lower than at sea level **;**
haemoglobin less well saturated **;**
more red blood cells / more haemoglobin **;**
compensates for, smaller volume of oxygen absorbed (per red blood cell) / lower saturation of haemoglobin **;**
A ref. to tissues receiving sufficient oxygen
AVP **;** e.g. ref to erythropoietin (EPO) [max 3]

[Total: 18]

4 (a) (i) Vibrio cholerae **;** [1]

(ii) active transport / described as movement against concentration gradient **;**
A facilitated diffusion / described [1]

(iii) (bacteria) leave infected person in faeces / AW **;**
(bacteria) enter water supply / AW **; A** idea of contaminated, food / utensils
(bacteria) ingested by uninfected person **;** [3]

(b) *must be in context of B-lymphocytes / B-cells / plasma cells*
max 3 if T-cells

*secondary response **A** ora*
presence of memory cells / AW (giving larger numbers) **;**
ref. increased chance of, encountering antigen / antigen presentation / clonal selection **;**
ref. larger numbers cells following, clonal expansion / AW (cf primary response) **;**
(so) shorter duration for onset of antibody production **;**
(so) higher antibody concentration **;**

secondary response antibody production (by plasma cells) lasts longer **;**
AVP **;** e.g. faster rate, plasma cell / antibody, production, ref. longer-life of cells involved in secondary response [max 4]

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(c) **1** poor sanitation / no treatment of faecal waste / AW **;**
2 contamination of (drinking) water supply **;**
3 poverty, qualified / poor living conditions
4 poor hygiene **;**
5 poor / lack of, (health) education about transmission **;**
6 ref to natural disasters **;** e.g. assistance / aid / medical help / AW, cannot arrive in time
7 ref. refugees / displaced people **;**
8 lack of, water purification equipment / bottled water / AW **;**
9 no rehydration therapy available (at time when needed) **;**
10 no (effective) vaccine **;**
11 further detail **;** (bacteria live in gut, where immune system is not effective)
12 AVP **;** e.g. contamination of vegetable plots with faecal waste, ref. to different strains [max 4]

[Total: 13]

5 **(a)** **(i)** β glucose **;** [1]

(ii) glycosidic **;** [1]

(b) many hydrogen bonds within the molecule **;**
idea of parallel chains / AW **;**
hydrogen bonds between cellulose molecules **;**
to form microfibrils **;**
held together by more hydrogen bonds to form fibres **;** [2 max]

(c)

function	letter from Fig. 5.1
organelle that contains DNA	H
structure that transports cell wall material to the cell surface membrane	A
site of transcription	H
site of ribosome synthesis	J
site of photosynthesis	D

[4]

(d) polypeptide / protein, in (cisternae of) RER **;**
to Golgi (apparatus / AW) **;**
modification / glycosylation / packaging **;**
vesicle(s) formed / transport in vesicle **;** **A** vacuole
membrane of vesicle fuses with cell surface membrane **;**
exocytosis / described **;** [max 3]

[Total: 11]

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