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

9700/23 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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International Examinations

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) (i) **A** phospholipid **;** (1)
B protein **;** *ignore protein descriptions* **R** glycoprotein **R** lipoprotein (1) [2]

(ii) polar / hydrophilic, head / group **;**
attracted to / AW, water / aqueous environment **; A** water-loving
ref. hydrogen bonding (polar head to water) **;**

non-polar / hydrophobic / hydrocarbon / fatty acid, tails / chains / groups **;**
repelled by / away from, water / aqueous environment **;** AW **R** water-hating [max 3]

(b) C *any one of*
(channel) allows, ions / water / polar molecules / water-soluble molecules / hydrophilic molecules, to, pass through membrane / enter cell / leave cell **;**
R transport, without qualification e.g. across, through
facilitated diffusion **;**
active transport **;** (max 1)

D *any one relevant e.g.*
cellular recognition
cell identification
antigen
cell signalling
receptor
binding site
ref to hydrogen bonding with water / forms bond with water to stabilise membrane
cell adhesion (max 1) [2]

(c) 1764 **;;**

if correct working (588 × 3) is shown, but no answer or incorrect answer, award one mark [2]

[Total: 9]

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2 (a) *Mycobacterium tuberculosis* / *Mycobacterium bovis* **;** (1)

(infected person) coughs / sneezes / spits / exhales / breathes out / aerosol (infection) / droplet (infection) / moist air (containing the pathogen) **;**
(uninfected person) inhales / breathes in / inspires **;**
ignore ref. to cattle
treat ref. to virus etc as neutral (2) [3]

(b) 1 ref. patient does not complete course / takes inadequate dose / stops taking when feels better **;**
2 problems with continuing supply (of antibiotics) **;**
3 not all bacteria killed **;**
4 ref. mutation to become resistant **; R** immune
5 likelihood of resistance increases if only one antibiotic used **;**
6 ref. to changes in bacterium to enable resistance **;**
7 ref. to changes in host cell (membrane structure) **;**
8 AVP **;** e.g. repeated exposure to different drug regimes (because of mp. 1)
exposure to bacteria with different resistance [max 2]

(c) 1 ref. to, worldwide incidence of TB / TB found worldwide **;** AW
2 highest, incidence / AW, (sub-Saharan) Africa / LEDC / developing countries **;**
3 problem with, vaccine / BCG, qualified **;** e.g. doesn't work well, everywhere / in Africa / in Far East
doesn't work well for all ethnic groups
less efficient with age
ref. cold chain / needs to be kept cold
knowing when enough people vaccinated
ref. to cost
R vaccine doesn't work
4 difficult to identify infected people / ref. symptomless carriers / AW **;**
5 difficulty with, contact tracing / described **;**
6 difficult to diagnose / time to diagnose (can infect others) **;**
7 ref. to transmission from animals to humans **;**
8 weakened immune systems / link with HIV/AIDS / TB is opportunistic **;**
9 ref. social factor **;** e.g. overcrowded living conditions, poor diet, remote areas
10 coordination of, vaccine / treatment **;**
11 ref. to difficulty of administering, drugs / DOTS **;**
12 lack / availability, of trained personnel **;**
13 ref. to political problems **;** e.g. war , unstable regimes, refugees, migration
14 cost, qualified with additional relevant point **;**
15 AVP **;** e.g. ref. to countries (e.g. Russia) with large area / low population density,
16 AVP **;**ref. to quarantine problems, travel qualified, other social factor [max 5]

[Total: 10]

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3 (a) (i) glucose and fructose **;** *ignore monosaccharides* [1]

(ii) **1** active site, gives specificity **;** **A** specific active site
ignore ref to specific substrate
2 substrate binds with active site or enzyme-substrate / E-S, complex forms **;**
3 complementary (shape) / substrate fits into active site **;** **A** 'lock and key'
A matching shape
R 'same shape'
4 induced fit / described **;**
5 further detail of substrate and active site **;** e.g. binding by hydrogen bonding, e.g. transfer of electrons
6 lowers activation energy / described e.g. causes strain in substrate / AW **;** **A** Ea
7 breaks glycosidic bond **;**
8 glucose and fructose / products, no longer fit / AW **;** [max 4]

(iii) non-competitive (inhibition) **;**
irreversible (inhibition) **;** [max 1]

(b) (i) idea of, hydrolysis / product formation / further metabolism, lowering sucrose concentration (in, companion cells / sink cells) **;**
maintains, concentration / diffusion, gradient (between phloem sieve tubes and, companion cells / sink cells) **;**
to remove sucrose from the phloem (sieve tubes) **;**
AVP **;** e.g.ref. easier transport of, glucose / fructose, through membranes **;** [max 2]

(ii) ref. facilitated diffusion out / may be lost from cells **;**
products / glucose / fructose, are soluble / AW **;**
(so) will lower the water potential / water potential becomes more negative **;**
causes water to move into cells by osmosis **;** **A** osmotic, problems / stress
reactive / easily metabolised, qualified **;** e.g. so interferes with, other metabolic processes / cell chemistry **A** more reactive than starch [max 3]

[Total: 11]

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4 (a) **R** if mark points are in context of secondary response

sensitised / activated / AW, by (foreign) antigen / epitope **;** *accept once only*
correct ref. specificity **;** *accept once only*
production of memory cells **;** *accept once only*

T lymphocytes
(T-helper / Th) secrete, cytokines / lymphokines **;**
(T-helper / Th) stimulate, B cells to divide **; A** stimulate humoral response
(T-killer / Tk / T-cytotoxic / Tc) secrete, perforin / hydrogen peroxide / AW **;**
A toxins
R hormones
(T-killer / Tk / T-cytotoxic / Tc) kill / destroy / AW, non-self cells / pathogens / infected cells **;**
(T-surpressor / Ts) ref., surpresses / reduces, response (on recovery) **;**

B lymphocytes
formation of plasma cells **;**
antibody production **;** [max 4]

(b) no more antigen / AW **;**
(remaining) antibodies, removed from the blood / broken down (in the liver) **;**
R excreted
plasma cells, are short-lived / begin to die / are not replaced **;**
no more antibody produced **;**
AVP **;** e.g. detail of removal / macrophage engulfs, digested, peptide bonds broken [max 3]

(c) line drawn continuous with that provided **;**
and rising more steeply before day 55 **;** *should start to rise from day 40 / should rise more steeply initially /should not remain as a plateau from day 40*

reaches higher than primary response between day 45-55 and, peaks / plateaus **;**
must not go below the day 40 antibody concentration [3]

[Total: 10]

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5 (a) 1 thin (alveolar) walls / one cell thick / thin epithelium / squamous epithelium **;**
A pavement epithelium
R thin cell wall
R thin layer
2 short diffusion distance (between air and blood) **;**
3 elastin / elastic fibres **;**
4 stretch to increase surface area / increase surface area on inspiration / recoil to expel air **;**
5 ref. to maintaining, diffusion / concentration, gradient **;** *linked to marking points above*
6 large surface area for, diffusion / AW **;**
7 some cells secrete surfactant **;**
8 prevent collapse **;** [max 3]

(b) (i) (cigarette / tobacco) smoking **;**
infection **;**
inflammation / detail of inflammation **;**
(excessive) coughing **;** [max 1]

(ii) *max 1 for structure*
fewer alveoli **;** **A** alveolar walls broken down / fewer air sacs / alveoli burst / alveoli destroyed / reduced surface area **R** elastin broken down
or
fewer capillaries **;**

effect
less gas exchange / less uptake oxygen / less removal carbon dioxide **;** [2]

(c) *look for symptoms*

shortness of breath / breathlessness / AW **;** **A** breathing difficulty
wheezing (on inspiration) **;**
rapid breathing rate / hyperventilation / decreased ability to hold breath **;**
R heavy breathing
chest, tightness / pain **;**
cyanosis / bluish appearance to the skin / AW **;** **A** pale
fatigue / tiredness / lethargy / weakness / dizziness / reduced mobility / AW **;**
coughing / coughing up blood **;**
lots of / AW, mucus produced / much phlegm **;**
expanded / barrel, chest **;**
R refs to oxygen concentration of the blood
R small vital capacity [max 3]

[Total: 9]

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6 (a) (i) (for) chlorophyll (structure / synthesis) **;**
(for) ATP functioning **;**
(for) enzyme functioning / enzyme cofactor **;**
signalling ion / regulates carbon fixation **;**
(for) DNA / RNA, synthesis **;**
stabilises, DNA / RNA, structure **; A** required in translation
(matrix of) bone **;** [max 1]

(ii) mutualistic association / AW **; A** ref. to mycorrhiza
qualified**;** e.g. further detail of relationship, named nutrients

arrow from plant to fungi
ref. (some) fungi are, parasitic / pathogenic (on plants) **; A** pathogens
leakage (from plants) of assimilates **;**

arrow from fungi to plant
plants absorb nutrients, excreted by fungi / from decomposition by fungi **;** [2]

(b) (i) 5th / 6th **; A** top carnivore [1]

(ii) idea of little energy available, at / towards, top / end, of food chain **;**
too few organisms in level below **;**
expend much energy catching animals in trophic level below **;**
to obtain, a wider range of / varied, nutrients **;**
reduced competition **;** [max 2]

(c) (i) *community*
all, populations of all species / organisms, living in a particular area, at one time / AW **;** (1)

habitat
place / location / environment / AW, where, a population / an organism, lives **;**
A community (1) [2]

(ii) soil is source of nutrients for, plants / producers **;**
plants / producers, provide energy for ecosystems **;**
ref. recycling nutrients (by soil organisms) **;**
ref. to importance of, carbon / nitrogen, in, organic / complex molecules **;**
AVP **;** e.g. detail of nutrient cycling, maintains balance of nitrogen in air [max 3]

[Total: 11]

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