UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 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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1 (a) **A** nucleus **;** **A** (eu)chromatin **R** nucleolus
B mitochondrion **;** **A** mitochondria
C (rough) endoplasmic reticulum **;** **A** (R)ER **R** smooth/S [3]

(b) (i) protein/polypeptide, synthesis/AW **;** **A** protein, transport/modification
A ecf if **C** is identified as Golgi or SERor ribosomes in **1 (a)** [1]

(ii) *ignore refs to magnification*
resolution/resolving power, low(er) **;** ora
200 nm compared to 0.5 nm **; A** resolution quoted in range 100-300 to 0.2-1.0 nm
ref. to visibility of structure **C ;** e.gs.
wavelength of light longer than size of, ribosomes/membrane
ribosomes/membrane, cannot be seen as less than 200nm diameter
ribosomes only 20–30 nm diameter **A** 15–20 nm
membranes 7–10 nm thick
small size linked to explanation of resolution [2 max]

(c) *any one relevant disadvantage e.g.*

only dead specimens can be viewed **;**
mounted in vacuum/pre-treatment, may distort delicate structures **; A** artefacts
expensive, qualified **;** e.g. to buy, maintain, increased cost electricity, costs associated with, time/training
requires, more electrical power **;**
requires stable, high voltage supplies/currents **;**
sensitive to external magnetic fields **;**
difficult to operate/requires technical training **;**
samples more difficult to prepare **; A** examples e.g. thin sections
lengthy preparation time **;**
monochrome/black and white only **;**
not portable/can only be used in specific locations (e.g. with voltage supplies) **;** [1 max]

(d) *allow +/- 1 mm in reading the line*
award two marks if correct answer is given

20 000/6 µm = (3333.3) **A** 19 000/6 = (3 166.7) **A** 21 000/6 = (3 500.0)

3 333 (x)**;;** **A** 3 167 (x) **A** 3 500n(x)

award one mark if answer is given to one or more decimal places or
award one mark if correctly measured and divided by 6 µm but incorrectly converted [2 max]

[Total: 9]

2 (a) semilunar valve **;** **A** pulmonary valve

prevents backflow (of blood) **;**
from the pulmonary artery/into the right ventricle **;**
or
ensures one-way flow of blood **;**
from the right ventricle/into the pulmonary artery **;** [3]

(b) (**Y**/wall of left ventricle) contains <u>more</u> (cardiac) muscle **;** ora
left ventricle/ventricle beside **Y**, pumps blood to, whole body / further **;** ora
at higher pressure with more force (than right) **;** ora
resistance to blood flow is greater in systemic circulation **;** ora [3 max]

(c) *any two of* SAN, AVN, Purkyne tissue/Bundle of His *in correct context* **;**

SAN/(primary) pacemaker, sends out, waves of excitation/impulses **;**
A electrical (im)pulses
R once only nervous impulse(s)/pulse(s)/signal(s)
R if brain stimulates SAN to send out impulses
spreads across atria **;**
atria contract/atrial systole **;**

fibrous ring/non-conducting tissue/insulating tissue **;**
prevents, it reaching the ventricles/ventricles contracting at the same time (as atria)**;**

atrio-ventricular node/AVN, acts as 'relay station'/sends wave of excitation to ventricles**;**
A in correct context – impulse reaches AVN and is passed on
(therefore) time delay to allow, atria to empty/atria to complete contraction/ventricles to fill//
atria and ventricles do not contract at the same time **;**
time ref. 0.1 – 0.2 seconds **;**

Purkyne tissue bundle of His, conducts, excitation/impulses, to base of, septum/ventricles **;**
A apex of heart
spreads upwards in ventricle (walls) **;**
(so) ventricles contract from base upwards/ventricles force blood up from base **;** [5 max]

[Total: 11]

3 **(a)** **(i)** primary ; **A** first
quarternary ; **A** fourth [2]

(ii) disulfide (bonds/bridges) ; [1]

(b) peptide bond broken ;
correct involvement of water ;
free –COOH/–COO^- and free –NH_2/–NH_3^+ shown ; [3]

[Total: 6]

4 **(a)** *any one correct description (1 mark) with explanation (1 mark) e.g.*

any named biological control method e.g *B. thuringiensis* ;
kills mosquito larvae ;

use of insecticides ;
kills (adult) mosquitoes ;

elimination of standing water ;
removes, mosquito breeding sites/egg-laying areas ;

use of oil on water ;
prevents maturation of/kills, mosquito larvae ; [2 max]

(b) (malarial) parasite/pathogen/*Plasmodium*, has many antigens ;
eukaryotic/many genes ;
many different stages of life cycle ;
ref. to more than one *Plasmodium* species/strain of each species ;
mutation changes antigens (over time)/antigenic shift/antigenic drift ;
parasite only vulnerable, at certain stages of life cycle/when free in plasma ;
antigenic concealment/described ;
AVP ; e.g. changes antigens which are expressed (through gene switching) [3 max]

(c) percentage of, parasites killed/growth inhibition, increases with drug concentration for both parasites ;
effect is greater on chloroquine-resistant parasites/AW ;
chloroquine-sensitive parasites not affected until 1 μmol dm^{-3} ;
further use of data from Fig. 4.1 to illustrate ;
further detail of difference in trend(s) ; **A** descriptive or figures [3 max]

(d) **(i)** (percentage) increase in malaria is high(er) in, countries in the, south/south and east **;**
ora **A** named countries **R** more malaria

ref. (percentage) increase correlates with countries where HIV incidence is higher **;**
penalise once if no ref to increase

data quote **;** [2 max]

(ii) HIV, infects/AW, T (helper)–lymphocytes/T-cells **;**
qualified ref. to immune system **;**
(HIV and) malaria may be contracted via blood transfusion **;**
ref. to reduced number of workers so malaria prevention not carried out **;** [2 max]

[Total: 12]

5 **(a)** conversion of/AW, nitrogen (gas)/N_2 **;** *in context of atmospheric nitrogen*
(to) ammonium (ions/compounds)/NH_4^+/amino acids **;**

further detail **;** e.g. nitrogenase (enzyme)/ref. conversion from unreactive (nitrogen) to reactive (compound)/reduction of nitrogen/ATP required/anaerobic conditions required for enzyme function [3]

(b) **(i)** ammonification/putrefaction/decomposition/decay **;** [1]

(ii) supplies, ammonia/ammonium ions, for, nitrifying bacteria/nitrification **;**
ammonia/ammonium ions, converted/oxidised/AW **;**
to nitrite **;**
to nitrate **;**
Nitrosomonas/*Nitrobacter* **;** *in correct context*
ref. nitrate useable form for plants ; [2 max]

(c) **(i)** to check that urea is not hydrolysed/broken down, without enzyme **;** ora
A there is no reaction without enzyme [1]

(ii) hydrolysis reduces, substrate/urea, concentration **;**
urea, hydrolysed/broken down, more quickly in Tube **A** than in Tube **B;**
A ref. to differences in reaction rates

*Tube **A*** enzyme can bind with substrate normally/ES complexes forming (at fast rate) **;**
ora *Tube **B***
shape of active site complementary to (shape of) substrate/AW **;**

*Tube **B*** (competitive) inhibitor, occupying/binding at/AW, active site **;**
ref. substrate unable to enter active site/AW **;**

correct data quote from either column to illustrate **;** [4 max]

[Total: 11]

6 (a) *1 mark each correct row*

	lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscle	
trachea	✓	✓		✓	;
bronchus	✓	✓	×	✓	;
bronchiole	✓	×	×		;
alveoli	×	×	✓	×	;

[4]

(b) good/circulating, blood supply **;**
good ventilation/breathing movements **;** [2]

(c) (i) stretch/expand/lengthen, on inspiration and, recoil/shorten, on expiration ;
A alternatives for inspiration and expiration
R contract and relax
(stretch) to increase, surface area/volume of air, for, diffusion/gas exchange **;**
(recoil) to help, expel air/force air out **;** ***ignore*** contract
prevent alveoli, bursting/breaking/AW **; R** collapsing [1 max]

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

(d) (cause) mutations **;**
uncontrollable, division/mitosis/cell replication/cell growth **;**
lack of contact inhibition/no apoptosis *or* described/(proto)oncogenes **;**

goblet cells secrete, excess/more/AW, mucus **;**
destroys/weakens/paralyses/AW, cilia **;**
development of scar tissue **;**
inflammation **;**
increased chance of infection/AW **;** [3 max]

[Total: 11]