UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2008 question paper

9700 BIOLOGY

9700/02 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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UNIVERSITY of CAMBRIDGE
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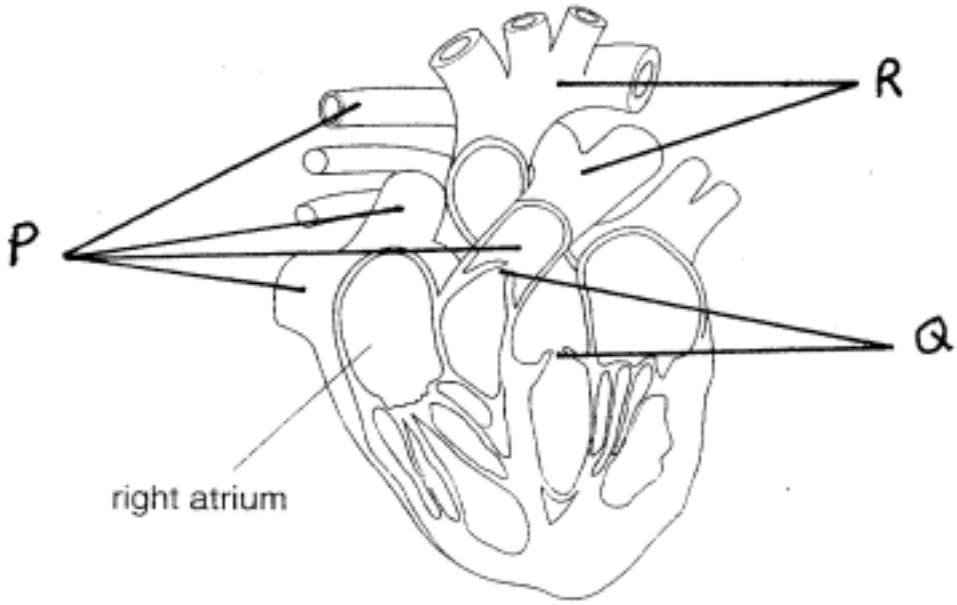
1 **(a)** *accept without label lines if not ambiguous e.g. if written correctly on diagram*
*only accept more than one line for each if **all** are correct*



[3]

(b) (both) atria pump blood to ventricles ;
same / short, distance ;

right ventricle pumps blood to lungs ;
short distance / at low(er) pressure / at approx 3.2 kPa / at approx 24 mmHg ; ora i.e. (left ventricle) greater distance / high(er) pressure / at approx 15.8 kPa / at approx 120 mmHg
less resistance, in lungs *or* pulmonary circulation / greater resistance in the systemic circulation ;
left ventricle pumps to, whole body / AW ;
correct ref. to (muscular) walls ; e.g. same (thickness) in atria
thicker / thinner, in ventricles
more / less, muscular, in ventricles
right ventricle pumps with lower / less, force ; **ora** [4 max]

(c) *accept once only for either nicotine or carbon monoxide*
damages lining of arteries ;
promotes, atheroma / atheromatous plaques / fatty plaques / arteriosclerosis / atherosclerosis ;

nicotine
increases heart rate ;
increases blood pressure ;
makes platelets 'sticky' ;
increases chance of blood clotting / promotes thrombosis ;
decreases flow of blood to, extremities / AW ;
constriction of blood vessels ; **R** contraction **R** capillaries (2 max)

carbon monoxide
combines with haemoglobin / forms carboxyhaemoglobin / higher affinity for haemoglobin (than oxygen); **R** absorbed, reacts with, bonds to
reduces oxygen carrying capacity (in context of, haemoglobin / blood) ;
promotes release of damaging free radicals / peroxides / super oxides / oxidising agents ;
causes platelets and neutrophils to stick together / platelets to stick to endothelium ;
hypoxia can damage heart muscle ; (2 max) [4 max]

[Total: 11]

2 **(a)** **A** – nuclear, membrane / envelope ; **R** nucleus (unqualified)
B – mitochondrion ; **A** crista(e)
C – (Golgi) vesicle / (small) vacuole ; **A** lysosome [3]

(b) (during), mitosis / meiosis / nuclear division ; ignore 'cell division' / phases
replicate, after / before, each division ; **A** at interphase
move / separate, to poles ;
assemble / organise, microtubules ;
centre for growth of / forms, spindle fibres / for formation of spindle / AW ;
modified centrioles found elsewhere such as in flagella / cilia ; [3 max]

(c) (EM has) greater / higher, resolution / resolving power ; **ora**
explanation of resolution as ability to differentiate between two points (close together) ;
width of membranes is 7 nm (±1) ;
(resolution of) LM is 200 nm (0.2 μm) and EM is 0.5 nm (0.0005 μm) ;
A 0.5 to 1 nm (0.001 μm)
ref to shorter wavelength ; **ora**
resolution is equal to half the wavelength ; [3 max]

(d) **(i)** general trend described linking temperature and percentage transmission ;
A negative correlation (with link) **R** inversely proportional
use of comparative figures (using data from both axes) to support trend ;
between 20 °C and 60 °C percentage transmission decreases, from 95% to 70% ;
between 60 °C and 70 °C, decrease is, significant / steep / from 70% to 19% ;
between 70 °C and 80 °C, decrease is, less steep / more steeply than initial temperature range / from 19% to 6% ; [3 max]

(ii) at (temperatures above) 60 °C, cell / vacuolar, membranes damaged / AW;
A tonoplast
(membrane) proteins, denatured / altered tertiary structure ;
increased fluidity (of membrane) / phospholipid bilayer more fluid ;
(so) diffusion / AW, of, betalain / pigment (out) ;
as temperature increases, rate of diffusion increases / diffusion occurs more quickly ;
[3 max]

[Total: 15]

3 (a)

Statement	Letter
an amino acid that is a major constituent of collagen	**J**
a component of RNA	**G ;**
a molecule polymerised to form glycogen	**D ;**
a molecule with a peptide bond	**H ;**
an important store of energy, insoluble in water	**K ;**
a molecule with hydrophilic and hydrophobic regions	**F ;**
an amino acid that forms disulfide (disulphide) bonds in proteins	**E ;**

[6]

(b) *Assume the answer is about DNA unless indicated otherwise. A comparison is not required. Information given below is for <u>either</u> DNA <u>or</u> collagen features.* ***A*** *ideas from either column. Do not penalise if points are not corresponding on one line / sentence as long as biologically correct. Only reject if biologically incorrect. If no attempt at 2 can* ***A*** *both marks from 1 if biologically correct.*

DNA	Collagen
4 (different) monomers ;	more than four (different) monomers
(monomers =) nucleotides / polynucleotides ;	(monomers =) amino acids / polypeptides
double helix ; **A** two strands	triple helix **A** three stands
right handed helix ;	left handed helix
loose helix ;	tightly coiled
sugar ;	no sugar
phosphate / phosphorus ;	no phosphate / phosphorus **A** sulfur (sulphur) present
base(s) ;	no base(s)
phosphodiester bonds ;	peptide bonds
antiparallel strands ;	strands not antiparallel

A sugar phosphate backbone for 2 marks if nothing written by 2. [2]

[Total: 8]

4 **(a)** volume of air breathed, in / out, with one breath ; **A** volume of air exchanged in one breath
ignore refs to at rest [1]

(b) (tidal volume and) vital capacity are measurements associated with, exercise / fitness ;
vital capacity is total volume of air that can be expired after maximum inspiration / vital capacity is sum of inspiratory reserve + tidal volume + expiratory reserve ;
differences between the groups (in tidal volume) could be due to larger, lung / vital, capacity ;
AVP ; [2 max]

(c) before / after recovery from, exercise ;

either
measure tidal volume, by breathing out into a bag ;
multiply by number of breaths per minute ; **A** total tidal volume in x minutes ÷ x

or
use a spirometer / described ;
ref to taking recordings from a trace / use of a, kymograph / datalogger ; [2 max]

(d) (bigger lungs so) more alveoli ; **A** greater surface area (of alveoli)
more, bronchioles / airways ; **R** more bronchi
wider, bronchioles / airways ;
larger number / higher density, of capillaries (around alveoli) ;
thinner wall / shorter distance, between air and blood / AW ; [2 max]

(e) partial pressure of oxygen is low ; **A** low concentration of oxygen / less oxygen
more haemoglobin (is required / produced / synthesised / available) ;
compensates for smaller volume of oxygen absorbed / compensates for lower saturation of haemoglobin / more oxygen can be carried (per unit of blood) ;
ref to, EPO / erythropoeitin ; [2 max]

[Total: 9]

5 (a) female *Anopheles* mosquito ;
either takes blood meal / AW, from infected person *or* parasites enter mosquito in blood meal from infected person ;

takes blood meal / AW, from uninfected person ;
parasite / pathogen / plasmodia, transferred in mosquito's, saliva / anticoagulant ;
ref. to transfusion malaria / congenital or mother-foetus malaria / needle sharing / needle stick injury for max 1 ; [3 max]

(b) (i) (protein is) antigen ;

following vaccination
(clonal) selection for, appropriate / corresponding / specific, B cell ;
clonal expansion / divide (by mitosis) (to form B cell clone) ;
memory cells ;

on infection by parasite
(B cells / plasma cells) secrete antibody ; **A** immunoglobulin / Ig
secondary response (qualified) / higher levels of antibody / rapid production of antibody ;
ref. to antigen-antibody specificity ;
antibody attaches to, surface protein / antigen, on parasite ;
prevents attachment to red blood cell ; **A** prevents entry into red blood cell [4 max]

(ii) genetic complexity of *Plasmodium* ; **A** ref to *Plasmodium*, being eukaryotic / having many genes
many antigens ;
many stages in life cycle (within human) ;
antigens change / antigenic variation, in different stages ;
Plasmodium / parasite, lives within cells ; **A** antigenic concealment
A only briefly free in the blood stream
antibodies cannot work against stages within cells ; [2 max]

(c) *use only one mark scheme as appropriate*

drug is either
competitive inhibitor / effect described in terms of competition ;
drug molecule has, same / similar / shape, as, substrate / surface protein ;
A complementary shape to active site
R same / similar, structure, as substrate
drug molecule fits into active site ;
blocks access to active site / prevents formation of ES complex ;

or
non-competitive inhibitor / described in terms of not competing ;
drug molecule fits into, another site (not the active site) / allosteric site ;
active site changes shape so cannot accept, substrate / surface protein ;
permanent (irreversible) / reversible ;

or
combines permanently with active site ;
e.g. by covalent bonding ;
blocks access to active site / prevents formation of ES complex ;
increasing, substrate / surface protein, has no effect ; [3 max]

[Total: 12]

6 (a) (i) *any **two** of the following for one mark*

amphipods
shrimps
Arctic cod
little auk ; [1]

(ii) some animals feed at different (trophic) levels / animals do not obtain all their food from one (trophic) level ; **A** correct reference to at least two consumer levels
animals may feed on different (trophic) levels at different, times / seasons ;
some food chains, do not start from primary producers / start from decomposing matter ;

named examples from food web ; [2]

(b) proportion of, phytoplankton / copepods, that is digested / some remains undigested ;
phytoplankton have cell walls ;
proportion that is absorbed after digestion ;
loss in, egestion / faeces ; } *in terms of energy loss or energy availability*
loss in, excretion ; } *in terms of energy loss or energy availability*
loss in, respiration / heat (by copepods) ; } *in terms of energy loss or energy availability*
energy losses in movement / AW ;
AVP ; e.g. denser phytoplankton means less energy loss in feeding [2 max]

[Total: 5]