

**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

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Mark schemes must be read in conjunction with the question papers and the report on the examination.

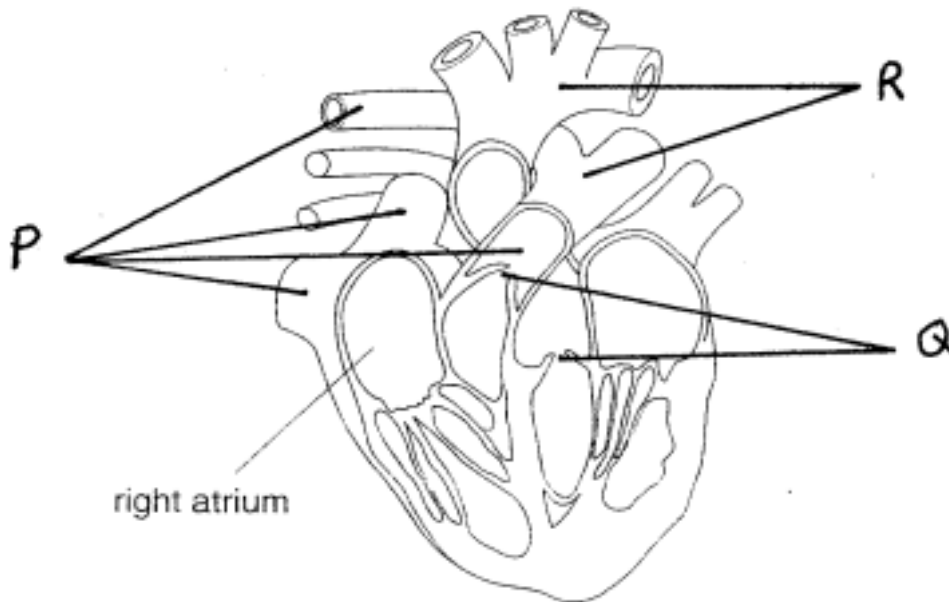
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- 1 (a) *accept without label lines if not ambiguous e.g. if written correctly on diagram only accept more than one line for each if **all** are correct*



[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]

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- (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]**

Page 4	Mark Scheme	Syllabus	Paper
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- 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 ( $\pm 1$ ) ;  
(resolution of) LM is 200 nm (0.2  $\mu\text{m}$ ) and EM is 0.5 nm (0.0005  $\mu\text{m}$ ) ;  
**A** 0.5 to 1 nm (0.001  $\mu\text{m}$ )  
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]

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3 (a)

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

[6]

(b) Assume the answer is about DNA unless indicated otherwise. A comparison is not required. Information given below is for either DNA or 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 ; <b>A</b> two strands	triple helix <b>A</b> three stands
right handed helix ;	left handed helix
loose helix ;	tightly coiled
sugar ;	no sugar
phosphate / phosphorus ;	no phosphate / phosphorus <b>A</b> 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]

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- 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 / erythropoietin ; [2 max]

**[Total: 9]**

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- 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]

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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 ;  
loss in, excretion ;  
loss in, respiration / heat (by copepods) ;  
energy losses in movement / AW ;  
AVP ; e.g. denser phytoplankton means less energy loss in feeding

} *in terms of energy  
loss or energy  
availability*

[2 max]

**[Total: 5]**