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**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2007 question paper

## 9700 BIOLOGY

**9700/02** Paper 2 (Theory 1), maximum raw mark 60

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UNIVERSITY of CAMBRIDGE
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**A** = accept
**R** = reject
AW = alternative wording
*ora* = or reverse argument
AVP = additional valid point

**1** **(a)** no membrane-bound organelles / no named organelle(s) ;
murein / peptidoglycan, in cell wall ;
smaller / 70s / 18nm, ribosomes ;
no nucleus / no nucleolus / no nuclear envelope ;
loop of DNA / circular DNA / no chromosomes / naked DNA / no histones ;
mesosome ;
plasmid ;
capsule ; **A** slime / mucilage, around cell wall ; [3 max]

**(b)** **(i)** growth ;
repair ;
regeneration ;
replacement / renewal ;
asexual / vegetative, reproduction / propagation ; **[3 max]**

**(ii)** *idea that* identical / sister chromatids, separate (in anaphase) ;

*identical because*
semi-conservative replication ;
base pairing / A – T and C – G ;
idea that each, strand / polynucleotide, of DNA acts as a template ;
two double helices produced are identical ;
cells have same, genotype / alleles / DNA / number and kind / set of chromosomes ;
no valid aspect of meiosis ; [3 max]

**[Total: 9]**

**2** **(a)** **(i)** haem / prosthetic group ; **A** porphyrin

site of attachment of / binds with / carries / combines with / joins with / takes up / transports, oxygen ;
**R** absorbs / reacts with / stores
(oxygen binds to) iron ion / $Fe^{2+}$ / FeII (in haem) ;
**A** atom, of iron / ferum [3]

**(ii)** *tertiary*
(each) polypeptide / protein, with complex 3D shape ;
folding of secondary structure / folded alpha helices ;
polypeptide / protein, coiled / folded / curled up / compact ;
*1 max*
*quaternary*
more than one polypeptide / AW ; [2]

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**(b) (i)** 58 ;
100 ; [2]

**(ii)** partial pressure of oxygen in <u>tissues</u> is low ; **A** concentration
percentage saturation decreases sharply ;
**A** appropriate ref to 'steepest part of the curve'
small decrease in partial pressure of oxygen / 6 to 2 kPa, causes very large change in % saturation with oxygen ;
78–80 to 22–24% saturated ; **A** appropriate figure(s)
this = range of partial pressures of oxygen in (respiring) tissues ;
(oxy)haemoglobin, dissociates / 'gives up its oxygen', at low partial pressures of oxygen ;
ref to, distortion of haemoglobin molecule and ability to release oxygen / allosteric effect / cooperative binding ; [4 max]

**(c)** *accept curve drawn on Fig. 2.3*
same shape as existing curve – begins at origin, ends at 95%–100% ;
to the **right** of existing curve ; [2]

**[Total: 13]**

**3 (a) (i)** tube-like / tubular / hollow / empty / no obstructions / no cell contents, so little resistance, easy movement ;
**R** mass flow, continuous column
wide / large diameter / large lumen, so large volume / amounts of water can be transported ;
thickening of the walls, to prevent collapse (under tension) ; **[2 max]**

**(ii)** evaporation of water inside, leaf / within mesophyll ;
ref to mesophyll <u>cell walls</u> ;
lowers water potential ;
water moves down water potential gradient ;
cohesion between water molecules /AW ;
adhesion of water molecules to vessel walls / AW;
water pulled up under tension / transpiration pull ;
transpiration, stream / column ; **A** continuous column
(water moves up xylem) from high to low hydrostatic pressure ; [4 max]

**(b)** nicotine,
increases heart rate / raises blood pressure / constriction of blood vessels /
increases stickiness of platelets (so cause clots ) /
decrease in blood flow to, hands / feet / fingers / extremities /
is addictive / damages, endothelium / lining of blood vessels ;

carbon monoxide,
combines with haemoglobin to form carboxyhaemoglobin / reduces amount of oxygen that can be transported in the blood ;

carcinogens / named carcinogen (e.g. benzpyrene / phenol), cause mutations / AW ;

tar,
inhibits / weakens action of / destroys / paralyses, cilia / stimulates, goblet cells /
mucous glands, to secrete <u>more</u> mucus ;
**A** excess [3 max]

**[Total: 9]**

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**4** **(a)** sino-atrial node / sinu-atrial node / sinoatrial node / SAN ; [1]

**(b)** myogenic, explained (e.g. contracts and relaxes without stimulation) ;
SAN / pacemaker, sends out, waves of excitation / impulses ;
spreads across atria (and causes atria to contract) ;
fibrous ring / non-conducting tissue / insulating tissue, prevents it reaching the ventricles ;
time delay to allow, atria to empty / ventricles to fill *or* time ref. (0.1–0.2 seconds) ;
atrio-ventricular node / AVN, acts as 'relay station' ;
relays impulse to Purkyne tissue / bundle of His ;
Purkyne tissue conducts impulse to, base / apex of heart / septum / ventricles; [4 max]

**(c)** 60 / 0.8 ;
75 ; [2]

**(d)** lower / less, resistance (within pulmonary tissue) ; *ora*
lower / less force needed ; *ora*
short distance / only has to pump blood to lungs ; *ora* ;
because RV wall is, thinner / less muscular ; *ora* [2 max]

**[Total: 9]**

**5** **(a)** **(i)** *Mycobacterium, tuberculosis / bovis* ;
**A** *M. tuberculosis / M. bovis* [1]

**(ii)** (infected person) coughs / sneezes / spitting / sputum / breathes out ;
aerosol / droplets / moist air, inhaled / breathed in by (uninfected) person ; [2]

**(b)** make fair / valid comparison ; **A** easier to, compare /
interpret total populations of regions are different ;
calculate, incidence / prevalence (rates) ;
so can see where impact (of TB) is greatest ; [2 max]

**(c)** disease of, poverty / the poor ;
people, living / sleeping, in close proximity / overcrowded conditions ;
HIV / AIDS / malnutrition, weakens immune system / AW ;
TB is opportunistic disease / described ; e.g. easily infects / increased susceptibility to TB
HIV infection rates are highest in, Africa / S-E Asia ;

control regimes / vaccination programmes for TB are better in, some countries /
regions, than others ; *ora*
ref to (WHO) DOTS scheme ;
ref to availability / combination of / length of treatment / resistance, re antibiotics / drugs ;

use of comparative data to support a statement ;
**A** either quote figures or calculation, e.g. percentage

AVP ; e.g. general ref to provision of health services
ref to HIV and, T cells / lymphocytes
ref to, cost / complexity, of providing treatments
ref to lack of, knowledge / education [3 max]

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**(d)** vaccine (BCG) is not effective ;
does not always give lasting protection / effectiveness decreases with years unless exposure to TB ;
no worldwide vaccination programme (as there was for smallpox) ;
endemic all over the world ;
many, carriers / symptomless people ;
bacteria remain in the body for a long time ;
intracellular parasite / lives in lung cells ;
AVP ; e.g. lack of protein in diet means it is difficult to produce antibodies /
difficult to produce herd immunity / some ref to antigenic variation / bacteria can live in animals
[3 max]

**[Total: 11]**

**6 (a)** *definition of ecosystem*

community (of organisms) ;
physical / abiotic, factors / environment ;
ref to interaction between organisms ;
ref to interaction between organisms and physical environment ;
ref to 'self-contained' / delimited by some physical feature ;
use of named example to illustrate one above point ; [3 max]

**(b)** these (fierce) animals are, at the top of food chain / last in food chain ;
secondary / tertiary, consumer / top carnivores ;
ref to energy loss along food chains / energy lost between trophic levels /
insufficient energy transfer ;
further detail, e.g. little energy trapped by (primary) producers / only 10% transfer /
loss in, respiration / decomposition ;
large animals, require much energy / find it difficult to obtain sufficient energy ;
need large habitat to provide sufficient food ;
ref to fierce and maintaining territories ;
AVP ; e.g. hunting / competition [3 max]

**(c)** (legumes have) *Rhizobium* ;
in their root nodules ;
carry out nitrogen fixation ;
(legumes) not dependent on nitrate ions from soil ;
nitrogen / ammonium / nitrate, required for making, amino acids / proteins ;
ref to growth / reproduction ;
AVP ; e.g. have mycorrhiza [3 max]

**[Total: 9]**

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