

**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

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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Page 2	Mark Scheme	Syllabus	Paper
	GCE A/AS LEVEL – October/November 2007	9700	02

**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<sup>2+</sup> / 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]

Page 3	Mark Scheme	Syllabus	Paper
	GCE A/AS LEVEL – October/November 2007	9700	02

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

(ii) partial pressure of oxygen in tissues 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 cell walls ;  
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 more mucus ;

**A** excess [3 max]

[Total: 9]

Page 4	Mark Scheme	Syllabus	Paper
	GCE A/AS LEVEL – October/November 2007	9700	02

- 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]

<b>Page 5</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL – October/November 2007</b>	<b>9700</b>	<b>02</b>

- (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]**