

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**

**9700/22**

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) *plant cell because presence of*  
 cell wall ; **A** cellulose cell wall **R** incorrect cell wall materials  
 plasmodesma ; **A** plasmodesmata  
 tonoplast ; **A** vacuolar membrane  
 large/central, vacuole ; **ignore** permanent [2 max]

(b)

name of organelle	diagram of organelle(s) as seen under the electron microscope (not to scale)	one function of organelle	cell type(s) in which organelle is located
	<i>all 3 for one mark</i>  oval/circular shape <u>and</u> two membranes close together <u>and</u> inner membrane infolded as two or more cristae ;	<u>aerobic</u> respiration/ATP, production/synthesis ;  <b>A</b> oxidative phosphorylation <b>A</b> ref. $\beta$ oxidation fats <b>A</b> ref. urea/ornithine cycle  <b>R</b> any answer that refers to synthesis/production, of energy	
centrioles ; <b>A</b> centriole <b>A</b> centrosome			animal ;
	<i>both for one mark</i>  two membranes <u>and</u> ribosomes on external surface ; <b>R</b> if ribosomes are excessively large		animal and plant/both ;
		processing/modification/AW/ packaging, of, proteins/ molecules ; <b>A</b> description of modification e.g. glycosylation <b>A</b> production of, <u>secretory/ Golgi, vesicles</u> <b>A</b> production of lysosomes <b>R</b> protein synthesis	
chloroplast ;			

[8]

[Total: 10]

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2 (a) (i) right, atrium/auricle **and** left ventricle ; *correctly labelled*  
*left hand side box                  right hand side box* [1]

(ii) *right atrium has* (ora for left atrium)

lower, concentration/partial pressure/AW, of, oxygen ; **R** no oxygen

**A** (right) deoxygenated blood (versus oxygenated blood)

**A** higher saturation of haemoglobin with oxygen

higher concentration/AW of, hydrogen carbonate ions/carbon dioxide ;

**A** more carbaminohaemoglobin

higher concentration of water molecules/high(er) water potential/less negative water potential ;

higher concentration/AW, of glucose ; [2 max]

(b) *reject if more than one letter for each disease*

*pulmonary stenosis* = **G** ;

*coarctation of the aorta* = **D** ;

*ventricular septal defect* = **F** ; [3]

(c) *accept ora where relevant*

*suggest*

1 blood flows from aorta to pulmonary artery ;

2 increased volume of / more, blood to lungs ;

**A** blood to lungs at higher pressure

3 oxygenated and deoxygenated mix ;

4 oxygenated blood / blood from aorta, to lungs ;

*explain (why blood flows from aorta to pulmonary artery)*

5 left ventricle thicker wall (than right ventricle) ;

6 (so) contraction generates greater force (than right ventricle)/AW ;

7 higher pressure in aorta (than pulmonary artery) ; [3 max]

**[Total: 9]**

3 (a) 53 % ;; 2 marks for correct answer

*max 1 mark for correct calculation but, no/incorrect, answer  
or not to nearest whole number*

$$72.4 - 33.9 = 38.5$$

$$(38.5 / 72.4) \times 100 = 53.18 / 53.2$$

[2]

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(b) **R** greater wealth unless linked to points below  
*any two valid reasons e.g. accept answers written as ora*

- 1 more educated population ; *in context of health*
- 2 better/greater access to, health care/AW ;
- 3 higher level of preventive medicine ; e.g. immunisation programmes
- 4 better diet ; **A** ref. to less malnourished  
**A** ref. to access to food supplies
- 5 greater access to, therapeutic medicines/drugs ; **A** antibiotics
- 6 better/less overcrowded, housing/living conditions ;
- 7 better, sanitation/sewage treatment ;
- 8 greater access to uncontaminated drinking water ;  
**R** clean water unqualified
- 9 fewer, fatal diseases/AW ;
- 10 ref. to effects of, civil war/war ;
- 11 ref. to natural disaster ;

[2 max]

(c) (i) rank of % positive (of countries) is different to rank of difference in decrease in life expectancy ;  
data quote to support ; e.g. Kenya 6th highest % positive but 3rd highest decrease in life expectancy  
S. Africa 4th highest % positive but 6th highest decrease in life expectancy  
countries with, similar/same, decrease (in life expectancy) have different % positive ;  
data quote to support ; e.g.  
Malawi 17.8 years decrease, 16%, cf South Africa 17.5 years, 19.9%  
Kenya 20.1 years, 14%, cf Zambia 20.1 years, 20% ;

*with ref. to decrease in life expectancy and % positive*

Kenya, does not fit general trend/AW ;

South Africa, does not fit general trend/AW ;

data quote to support ; e.g.

Kenya larger decrease than, Malawi/South Africa, but lower % positive

Kenya 20.1 years decrease but only 14.0 %, compared to, Malawi 17.8 with 16.0%/  
South Africa 17.5 with 19.9 % ;

[2 max]

(ii) *any two relevant factors e.g.*

- 1 anti HIV drug therapy/AW ;
- 2 ref. to treatment of AIDS-related diseases ;
- 3 ref. to education to prevent, transmission/spread ;
- 4 use/provide free, condoms/femidoms ; **A** dental dams
- 5 avoid promiscuity ; **A** one sexual partner
- 6 HIV mothers avoid breast feeding ;
- 7 heat treat/screen, blood (for transfusion) ;
- 8 needle-exchange schemes/AW ; **A** ref. to sterile syringes
- 9 use of sterile equipment, qualified e.g. in surgery/tattooing/piercing ;
- 10 testing for HIV status/contact tracing ;
- 11 ref. to vaccine development ;

[2 max]

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- (d) 1 primary/immune, response ;  
2 ref. specificity; *in correct context*  
3 (HIV/virus) antigens ;  
4 antigen presentation/antigen presenting cell/APC/described ;  
5 clonal selection/described ; e.g. recognition of/binding to, antigen by, B-lymphocyte  
6 sensitisation/activation/described ; e.g. cell growth or cellular changes  
7 clonal proliferation/formation of clone/mitosis/cell division/AW ;  
8 B-lymphocytes/B-cells/plasma cells, synthesise/produce/secrete/release, antibody ;  
9 T(helper)-lymphocyte response described ; e.g. cytokine production  
ignore ref. to T killer cells [5 max]

[Total: 13]

- 4 (a) (i) (describes the) sequence of amino acids (in a polypeptide chain) ; **A** order/arrangement [1]

- (ii) H<sub>2</sub>O/water, released ;  
(correct) bond formation between (lysine) carboxyl group and (valine) amino group ;  
dipeptide (of lysine and valine) and formed with correct structural formula ; [3]

- (b) (i) *secondary*

- 1 regular order/pattern, based on H-bonds ;  
2 between CO– group of one amino acid and NH– group of another ;  
3 alpha-helix and  $\beta$ -pleated sheet ;

*tertiary to max 4*

- 1 folding coiling ;  
2 interactions between, R groups side chains ;  
3 two correctly named bonds ; e.g. hydrogen bonds, disulfide, bonds/bridges, ionic bonds, hydrophobic interactions  
4 further description of bonds ; e.g. *disulfide* between cysteine (S–H) groups  
*hydrogen* between polar groups (NH– and CO–)  
*ionic* between ionised amine and carboxylic acid groups  
*hydrophobic interactions* between non-polar side chains  
5 ref. active site, specific/precise, shape ;  
6 ref. globular/AW, shape ; **A** spherical/ball  
7 ref. amino acids with, hydrophilic/polar, R groups facing to outside ; ora [5 max]

- (ii) enables (protein to) function/AW ; **A** enables antimicrobial action/AW  
**A** biological catalyst, qualified  
provides active site ;  
qualified ref. to specificity ; [1 max]

- (c) altered, (mRNA) codon(s)/triplet(s) ; **A** named type of mutation  
changed/AW, amino acid(s) ;  
ref. to effects of stop codon ; e.g. shortened polypeptide chain  
different, primary structure/described ;  
**A** ref. to differences in, transcription/translation  
ref. to different properties of, R group/side chain (of normal v replaced amino acid) ;  
altered tertiary structure/AW ; **A** different R group interactions  
**A** change/loss of, active site  
idea of globular to fibrous change/hydrophilic R groups no longer to outside ; [3 max]

[Total: 13]

5 (a) one mark for each correct row ; ; ; ;

	cartilage	ciliated epithelium	elastic fibres	goblet cells	smooth muscle
A	✓		✓		✓
B	✓	✓		✓	✓
C	x	✓	✓		
D		x	✓	x	

[4]

(b) goblet cells to max 3

synthesise/produce/secrete/release, mucus ;

mucus, sticky/AW ;

(mucus) traps/AW, pathogens/AW , dust/particles/AW, pollen ;

**A** named organism types/microorganisms

**R** cilia traps

increased secretion when, inflamed / infection ;

qualified ref. to role of mucus ; e.g.

increases distance (e.g. of pathogen) to reach (epithelial) cells

acts as barrier/prevents, entry/attachment to, cells

prevent, infections/pathogens reaching alveoli *allow once only in either section*

*cilia to max 3*

waft/move/AW, mucus ;

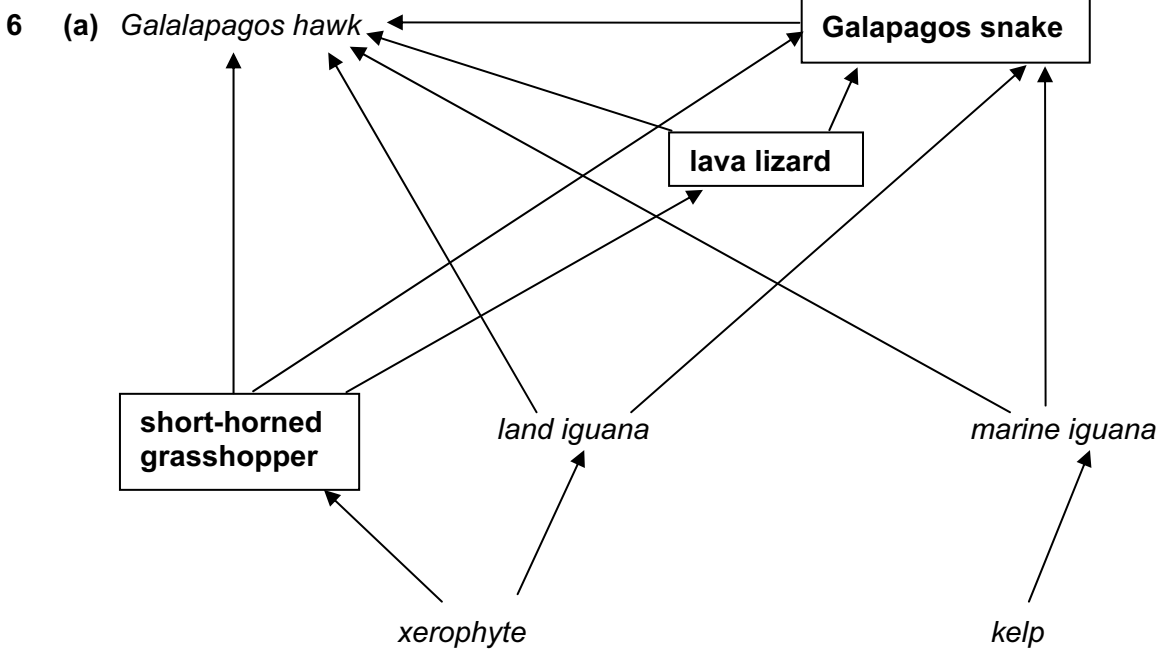
synchronous/metachronal, rhythm ; AW

movement towards back of throat for, swallowing/coughing out ;

qualified ref. to role of cilia in health ; e.g. ref. to, normal air flow/ventilation/keeping airways clear

[4 max]

[Total: 8]



animals in correct boxes ;  
 all five animals to hawk ;  
 all animals except hawk to snake ;

(only) short-horned grasshopper to lava lizard  
 xerophyte to short-horned grasshopper and land iguana } ;  
 kelp to marine iguana

*max 3 if all correct but one arrow head missing*  
*max 2 if arrow heads, mixed in incorrect direction/missing* [4]

(b) kelp and xerophytes ; *allow ecf for next two mps if only one organism*  
 both, photosynthetic/autotrophic/fix carbon/AW ; **A** both have chlorophyll  
 both are, at the start of the food web/at the first trophic level/the source of energy to rest of  
 food web/AW ; [3]

[Total: 7]