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.

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

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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
	all 3 for one mark oval/circular shape and two membranes close together and inner membrane infolded as two or more cristae ;	aerobic respiration/ATP, production/synthesis ; **A** oxidative phosphorylation **A** ref. β oxidation fats **A** ref. urea/ornithine cycle **R** *any answer that refers to* synthesis/production, of energy	
centrioles ; **A** centriole **A** centrosome			animal ;
	both for one mark two membranes and ribosomes on external surface ; **R** *if ribosomes are excessively large*		animal and plant/both ;
		processing/modification/AW/ packaging, of, proteins/ molecules ; **A** description of modification e.g. glycosylation **A** production of, secretory/ Golgi, vesicles **A** production of lysosomes **R** protein synthesis	
chloroplast ;			

[8]

[Total: 10]

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

(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 <u>from</u> aorta <u>to</u> 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) x 100 = 53.18 / 53.2 [2]

(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 <u>decrease</u> 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, <u>decrease</u> (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 <u>decrease</u> 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 <u>decrease</u> than, Malawi/South Africa, but lower % positive
Kenya 20.1 years <u>decrease</u> 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]

(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_2O/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 β-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 musc
A	✓		✓		✓
B	✓	✓		✓	✓
C	×	✓	✓		
D		×	✓	×	

[4]

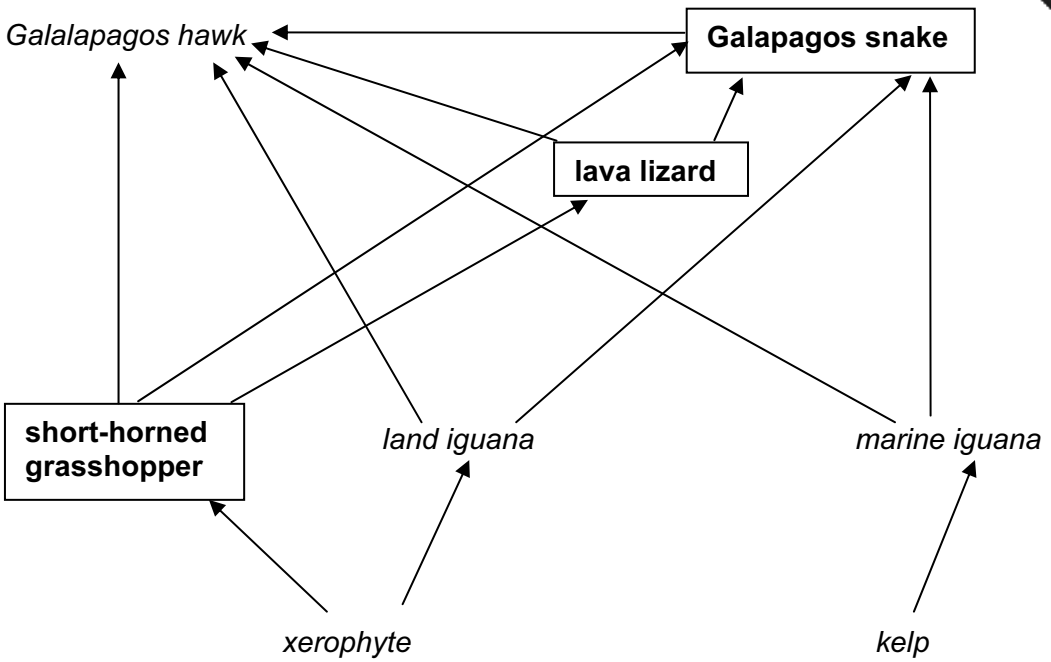
(b) *goblet cells to max 3*
synthesise/produce/secrete/release, mucus **;**
mucus, sticky/AW **;**
(mucus) traps/AW, pathogens/AW , dust/particles/AW, pollen **;**
A named organism types/microorganisms
R cilia traps
increased secretion when, inflamed / infection **;**

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]

6 **(a)**



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]