UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/22 Paper 2 (AS Structured Questions), maximum raw mark 60

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UNIVERSITY of CAMBRIDGE
International Examinations

Mark Scheme abbreviations:

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question or guidance on the mark scheme
AW	alternative wording (where responses may vary more than usual)
underline	actual word given must be used by the candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument

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1 (a) (i) transcription <u>first</u> process and exocytosis <u>final</u> process **;**
correct order for remaining three processes (3, 4, 2) **;** [2]
accept words and mixture of words and letters

(ii)
F ;
A / **D**
A ;
C
D ;

events	order of events	cell location (letter)	
exocytosis	**5**	**F**	cell membrane **;**
protein modification	**3**	**A / D** **A+D**	Golgi and/or RER ,
secretory vesicle formation	**4**	**A**	Golgi **;**
transcription	**1**	**C**	nucleus ,
translation	**2**	**D**	RER **;**

[3]

(b) 1 vesicle / vacuole, moves towards, cell, surface / membrane **;**
A plasma membrane **R** if lysosome
2 fusion / described, of vesicle with membrane **; R** attach / bind / combine
3 ref. to (fluid nature of) phospholipids **;**
4 contents / AW, secreted / released / exported / removed / emptied / excreted **;**
A waste material / digested material
5 active process / energy-requiring / ATP used / AW **;**
R 'active transport' **R** endocytosis [max 3]

(c) (i) AUG **;** [1]

(ii) 1 secondary structure / α-helix / β-(pleated) sheet **;**
2 tertiary structure / description / folding / complex 3D shape **;**
3 formation of named bond(s) **; R** if peptide bond in list
4 quaternary structure / description (e.g. assembly of polypeptides) **;**
5 glycosylation / formation of glycoproteins / addition of carbohydrate(s) *or* sugar(s) **;**
R hydrocarbon chain
6 addition of, non-protein portion(s) / prosthetic group(s) / named example **;**
A haem / iron / Fe / copper / Cu / magnesium / Mg / AW
7 removal of some amino acids **; R** one amino acid
8 polypeptide(s) cut into two or more pieces **;**
9 AVP **;** e.g. ref. to exposure to water molecules and folding
R ref. to amino acids coded for by stop codons [max 2]

[Total: 11]

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2 (a) communicable / transmissible / contagious / transferable / AW **;**
A passed from one (infected), host / organism / one person, to another
A 'passed on'

caused by, a pathogen / microorganism / *at least* **two** named types of pathogen **;**
A virus, bacterium, fungus, protoctist, worm **;**
R parasite unqualified by two types [max 2]

(b) *Plasmodium, falciparum / ovale / vivax / malariae* **;**
A phonetic spellings for specific name, **A** plasmodium
R if specific name first, [1]

(c) (i) (only) female feeds on blood / male does not feed on blood **;**
female requires blood (protein) for (development of) eggs **;**
(only) female carries, pathogen / disease-causing organism / *Plasmodium* / parasite **;**
A (only) female transmits the disease
(only) female is vector **;** ***ora ignore*** female carries, the disease / malaria [max 1]

(ii) anti-coagulant (in saliva) is passed when mosquito, sucks blood / feeds / bites / takes a blood meal **;**
anti-coagulant prevents blood clotting when mosquito, sucks blood / feeds / bites / takes a blood meal **;** [max 1]

(iii) *in marking accept*
Plasmodium / pathogen / causative organism / malarial organism *where parasite is given below*

short time (in blood plasma)
for exposure to cells of the immune system / AW **;**

next stage(s) of life cycle inside cells **;**
A sporozoites into merozoites in liver /
merozoites into schizonts in red blood cells

parasite gains, food / energy, from cells **;**
parasite, reproduces / multiplies, inside (liver / red blood) cells **;**
damage to / bursting of / lysis of / impaired function of, cells **;**

(antimalarial) drugs cannot penetrate (liver / red blood) cells **;**
parasite, concealed / 'hides', from host immune system **;**
A antigen concealment **;**

no symptoms, until parasite leaves cells / while parasite is in cells **;**
idea that people incubating disease are symptomless **;**
A symptomless carriers
idea that treatment unlikely to prevent spread from infected person **;**

AVP **;** *examples*
different stages provide problems with drug / vaccine development
AVP **;** mode of action of potential drugs – block attachment sites on cells
parasite in blood cells allows testing by taking blood samples
further development of any idea given above [max 2]

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(d) *if virus / bacterium / disease used instead mark to max 3*
in marking accept
Plasmodium / pathogen / causative organism / malarial organism *where parasite is given below*

distribution described for one mark

either
(mainly in) tropics / between the tropics
or
any **two** named, areas and/or countries, affected **;**
e.g. *areas* (sub-Saharan) Africa, Central America, South America, South Asia, Central Asia, Middle East, Caribbean
e.g. *countries* India, Sri Lanka, China, Vietnam, Cambodia, Brazil, Kenya

discussion to max four

1 (areas where) both parasite, **and**, vector / mosquito / Anopheles, are present **;**
2 Anopheles / mosquito / vector, survives / breeds / lives, in, hot and humid areas / moist tropical areas **;** ***ora*** **A** standing / stagnant, water

3 parasite, needs to reproduce within the mosquito (at temperatures above 20°C) **;**

4 eradicated in some countries / any e.g. (USA, Italy) **;**

5 ref to LEDCs and, poor / non-existent, control programmes **;**
A poor health facilities / poor drug supplies / AW

6 mosquitoes resistant to, DDT / insecticides / pesticides **;**
7 parasite resistant to, chloroquine / drugs **;**

8 link between human population density and *Anopheles* **;**
e.g. human activity provides (lots of) breeding sites for *Anopheles*
9 occurs where named high risk group(s) exist **;**
e.g. refugees, HIV-positive pregnant women (more likely to pass HIV to unborn children), (young) children
10 (outside tropics) disease spread by, travellers / tourists / migrants / refugees **;**

11 AVP **;**
most cases / over 90% cases, in (sub-Saharan) Africa
not, at high altitude / in deserts
different species of *Plasmodium* differ in geographical distribution / AW
misdiagnosis (so not reported)
changing pattern linked to, global warming / changes in land use / deforestation / irrigation / other relevant named
R references to sickle cell [max 4]

[Total: 11]

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3 (a) spherical / ball-shaped / AW **;** **A** round(ed) / circular
has tertiary structure **;** **R** 3D
hydrophilic / polar, (R) group(s), on outside / face to watery exterior **;**
hydrophobic / non-polar, (R) group(s), in centre **;**
water soluble **;** [max 3]

(b) (i) *idea that plant cell walls and fungal cell walls have different components*
fungal cell walls made of, glucans / chitins / fungal cellulose / different components to plant cell walls **;** **A** peptidoglycan / murein
A plant cell walls contain cellulose, but fungi do not
idea of specificity in context of question
enzymes are specific **;**
A specificity explained e.g. both substrates not complementary / shape of active site specific to one substrate [2]

(ii) **1** (at optimum pH) maximum / peak, activity **;** **A** most efficient / works best
2 above / below, optimum, activity declines **;**
A description / graph sketched with pH and rate / activity
3 changing pH changes hydrogen ion concentration **;**
4 hydrogen / ionic, bonds (between amino acids), break / disrupted **;**
5 hydrogen / ionic, bonds, important in maintaining shape of, tertiary structure / active site **;**
R 4 and **5** if refer to disulfide, hydrophobic interactions, peptide
at sub-optimum pH
6 active site / tertiary, shape altered **;** **A** enzyme denatured
7 charges at the active site may be affected **;**
8 further detail **;** e.g. transfer of electrons may not be possible
9 the substrate may be altered by pH changes **;** **R** cell wall unqualified
10 (therefore) substrate no longer fits / ES complexes not formed **;** [max 3]

(c) osmosis, defined in terms of water potential / used in correct context **;**
0% and / or 0.4%
higher / less negative, water potential outside so water enters **;**

0%, higher / less negative, water potential than 0.4%, so cells burst **;** *ora*

0.9%
equal / same, water potential inside and outside cells, water in = water out **;**
A no net movement of water / ref. to isotonic / no water potential gradient
R 'no osmosis' / no movement of water

1.5% and / or 3.0%
lower / more negative, water potential outside so water moves out **;**

3.0%, lower / more negative, water potential than 1.5% so cells, smaller / AW **;** [max 4]

(d) cells, increase in size / burst **;** **A** vacuole increases in size **R** becomes turgid
no cell wall to, prevent cell bursting / withstand (turgor) pressure **;**
A *idea that* cell membrane alone cannot withstand increase in size / bursting [2]

[Total: 14]

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4 (a)

vaccine / macrophages ;

antigens ; lymphocytes / mitosis ;

plasma cells *and* T_h-lymphocytes ;

[3]

no ecf from **(a)** to **(b)**

(b) 1 active (artificial) immunity **;**

2 memory cells / immunological memory **;**
3 *idea that* many specific, B-cells / T-cells / lymphocytes, in the body **;**
A large(r) clones of specific, B- / T-cells *or* lymphocytes

actual invasion by the pathogen
4 fast secondary (immune) response **;**
5 fast increase in antibodies / immediate production of antibodies **;**
ignore incorrect type of cell secreting antibodies

6 high(er) concentration of antibodies are produced **;** **A** more antibodies produced
7 pathogen destroyed before person becomes ill / AW **;** **R** antigen
A pathogen do not, increase in number / infect cells / AW [max 3]

(c) *two points to look for*

(if) most / sufficient / many / AW, people / children, immunised / vaccinated **;**
A herd immunity

reduces the pool of infected, people / children, in the, community / population **;**
A fewer people can catch disease and be source of infection
A protects those unvaccinated as, disease / illness, does not spread
A less chance of transmission
A pathogen cannot develop in immunised people
A reduced exposure to pathogen [max 2]

[Total: 8]

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5 **(a)** glycogen **;** [1]

(b) xerophyte / xerophyllic **;** **A** phonetic e.g. zerophyte [1]

(c) haploid (cell) **;** **A** monoploid [1]

(d) (primary) producer **;** **R** first ***ignore*** autotrophic [1]

(e) (nitrogen) fixation **;** **A** nitrogen fixing bacteria [1]

[Total: 5]

6 **(a)** **(i)** squamous / pavement (epithelial) **;** [1]

(ii) stretch / expand, on inspiration and recoil on expiration **;** **R** contraction

(stretch) to increases, surface area / volume of air, for, diffusion / gas exchange **;**

(recoil) to help, expel air / force air out **;** **A** carbon dioxide
A if destroyed then cannot expel air

prevent alveoli, bursting / breaking / AW **;**

ref. to emphysema if elastic fibres destroyed **;** [max 2]

(b) *award two marks if correct answer (anything in range 336–346)*
allow +/– 1 mm in reading the line (74–76 mm)

75000 μm / 220 μm =
341 **;;**

if answer incorrect, award one mark for correct measurement with unit and division by 220
award one mark if correct answer given to one or more decimal places [2]

(c) *look for two ideas – follow usual rules for marking numbered answer lines*

thin, alveolar wall / epithelial lining / AW **;**
A short diffusion distance (between air in alveolus and blood in capillary)
A squamous cells are thin
R thin, membrane / cell membrane **R** large surface area

surrounded by, capillaries / capillary network **;**
A close contact with, capillaries / blood (vessels / cells)
A many capillaries
A large area of alveolus in contact with, capillaries / blood [2]

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(d) ***max 3 if no ref. to diffusion***

(named) gas(es), <u>diffuse</u> down, pressure gradients / concentration gradient / AW **;**
A from high(er) partial pressure to low(er) partial pressure
A high(er) concentration to low(er) concentration
ignore 'along a concentration gradient'

in the answers accept the following AWs
capillaries / haemoglobin for blood
lungs for alveoli
body for tissues

lungs

valid statement linking information in table below – 1 mark for each row

comparison in partial pressure may be 'higher / lower' not both or high and low, but if not then figures have to be given

blood	ref. to gas	blood partial pressure	alveolar air partial pressure	gas exchange	
in pulmonary artery / entering alveolar capillaries	pO_2	5.33 / lower	13.87 / higher	into blood from alveolus	;
	pCO_2	6.00 / higher	5.33 / lower	out of blood into alveolus	;

respiring tissue

valid statement linking information in table below – 1 mark for each row

blood	ref. to gas	blood partial pressure	tissue partial pressure	gas exchange	
in systemic artery / entering tissue capillaries	pO_2	13.33 / higher	< 5.33 / lower	into tissue from blood	;
	pCO_2	5.33 / lower	> 6.00 / higher	out of tissue into blood	;

[max 4]

R differences between pO_2 and pCO_2 in the same place

[Total: 11]

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