CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

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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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the equation, or by extra guidance)
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point

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1 **(a)** arrow towards food web box **;** [1]

(b) respiration ; A respiring [1]

(c) saprophytic / saprobiotic / saprotrophic **;** **A** saprobic **A** detritivore

ammonifying / putrefying **;**

bacteria **;** **A** bacterium **R** nitrifying / denitrifying, bacteria

fungi **;** **A** fungus [max 1]

(d) excretion **;** **A** excrete **A** urination / urinating **A** release / **AW**, of urine

egestion **;** **A** egest / defaecation **A** release / **AW**, of faeces

death **;** **R** decay ***A*** death and decay **A** dying

idea of shed body parts **;** e.g. leaf fall / shed petals / fruit drop / moulting [max 2]

[Total: 5]

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2 (a) **A =** nucleus **;** **R** nucleolus **R** nuclear **R** nuclei

B = chloroplast **;** **A** chloroplasts

C = vacuole **;** **A** vacuoles **A** large / central / **AW**, vacuole [3]

(b) *both must be correct*

microvillus / microvilli
centriole / centrioles
cilium / cilia
flagellum / flagella
} *any two structures for one mark* **;**
A lysosome(s) [1]

(c) **1** apoplast = cell wall (and intercellular spaces) (pathway) **;**
A between cell walls
R if cell wall and, cytoplasm / vacuole / plasmodesmata
R if linked to osmosis / facilitated diffusion / active transport

2 symplast = cytoplasmic (pathway) **;** **R** if facilitated diffusion / active transport
reference to only cytoplasmic / not including vacuoles

mps 1 and 2 allow one mark only if no ref. to terms apoplast and symplast
e.g.cell wall v cytoplasmic pathway

symplast

3 osmosis, linked to passage across membranes **;** *must be in correct context*

4 detail of membranes involved **;** *either* tonoplast / vacuolar membrane *or* cell (surface) membrane of, 'first cell' entered directly from xylem / **AW**

5 via plasmodesmata **;** *ignore ref. to mechanism*

6 (includes) vacuolar pathway / (through) vacuoles **;**

apoplast

7 non-living pathway **; ora**

8 *ref.* greater volume / higher rate / less resistance / **AW ; ora**
A faster / fastest **R** amount *for volume*

9 *ref. to*, hydrogen bonding / adhesion, to cell walls **;** [max 4]

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(d) (i) (maintain) turgor / turgidity / prevents flaccidity / prevents plasmolysis **;**
A provides support for cell **R** provides support for plant
A pushes chloroplast to edge (of cell)

(reactant in) photosynthesis **;**

hydrolysis (reactions) **; A** named reaction that involves hydrolysis solvent
A (medium) for cell, / metabolic / chemical, reactions (to take place)
R *if in context of outside cell or entering cell or as a transport medium* [max 2]

(ii) (part / used in synthesis, of) <u>chlorophyll</u> (molecule) **;**
R gives chlorophyll green colour

in translation / joining of large and small subunits (of ribosomes) **;**

enzyme, cofactor / activator / described **;** *idea of role in enzyme catalysis*
A correctly named enzymes, e.g. DNA polymerase

AVP ;
e.g. stabilizing, cell wall / proteins / nucleic acids / membranes **;**
important in energy transfers / ATP synthesis **;**
DNA, synthesis / replication **;**
ref. to role in, light absorption / capture (for photosynthesis) **;** [max 1]

[Total: 11]

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3 **(a)** trachea and, bronchi / bronchus **;** **A** windpipe *for trachea*
R *if* bronchioles *also included* [1]

(b) **(i)** (as altitude increases), both of them / atmospheric pressure and oxygen partial pressure, decrease **;**
(one) correct comparative data quote **;**
altitude and pressure, with units once, for either atmospheric pressure ***or*** *oxygen partial pressure*

non-linear decrease **; A** almost linear decrease
decrease in oxygen partial pressure proportionate to decrease in atmospheric pressure **;** [max 2]

(ii) difference of / reduction of, 34 kPa **;;**
A 33 / 35 kPa
A – 34 / 35 / 33, kPa
A 33 / 34 / 35% decrease for two marks only if evidence of kPa in working

100 kPa at sea level – 66 kPa at 3500 m ***A*** *65 / 67kPa*

one mark only if correct answer but no units / kPa

one mark if correct values taken from graph but no subtraction carried out

one mark if 3500 m value read as 63 kPa, so answer stated as 37 kPa [2]

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(c) *lower, atmospheric pressure / partial pressure of oxygen so*

lower partial pressure of / less / **AW**, oxygen in, alveolar / inspired / inhaled, air**;**
A breathed in *for inspired*
A less oxygen goes into lungs

decreased, diffusion / concentration / pressure, gradient **;**

between, alveolus / alveoli, and capillary **;**

less / **AW**, oxygen, enters / **AW** (pulmonary) capillaries / the blood **;**
A less / **AW**, oxygen, transported / **AW**, by, haemoglobin / red blood cells / blood (to tissues)

(so) percentage saturation of haemoglobin is lower **;**
A haemoglobin is less saturated
A fewer molecules of / less, oxygen combine with haemoglobin

(as) haemoglobin has lower affinity (for oxygen than at sea level) **; AW**
A *ref. to* effect of 2,3 DPG
allow correct explanation in terms of oxygen dissociation curve

ref. to insufficient red blood cells to compensate **;**
ora e.g. more red blood cells, need to be / will be, produced [max 4]

(d) (i) greater concentration of / (proportionately) more / **AW**, red blood cells (through pulmonary capillaries per unit time) / **AW ;**
A haemoglobin for red blood cells

increases, the haematocrit / the percentage of red blood cells to the total blood volume / **AW ;** [max 1]

(ii) more, blood / red blood cells, flowing to lungs (per unit time) **;**
A blood flows faster to lungs

to maximise oxygen uptake (from alveoli) / takes in more oxygen / **AW** / compensates for lack of oxygen **;**

more blood pumped through, systemic circulation (per unit time) / rest of body / to tissues / **AW ; A** blood flows faster *for more blood*

compensates for the lowered plasma volume
or
ref. need to, maintain supplies of required substances / remove waste / prevent decrease in pH **;**
allow named required substances e.g. glucose / oxygen / amino acids
allow named waste substances e.g. carbon dioxide [max 2]

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(e) 1 nucleotide / base, sequence of, DNA / gene, changed / **AW ;**
A new allele (formed)

2 base substitution (mutation) / (DNA) thymine replaced by adenine / (DNA is) CTC to CAC / CTT to CAT (template codon) **;**
this cannot be used for mp 1 as well

3 altered / changed, mRNA codon **;** *(allow codons)* **A** *idea of different mRNA*
R altered genetic code

4 (mRNA codon is) GAG to GUG **/** GAA to GUA **;**

5 glutamic acid, substituted / replaced / AW, by valine **; A** glutamate
A glu *and* val

6 tRNA / anticodon, with different amino acid (to ribosome) **;**
A tRNA with different anticodon

7 AVP ;
e.g.amino acid substitution at position 6
valine, hydrophobic / **AW** (R-group)
glutamic acid, polar / **AW** (R-group) [max 3]

[Total: 15]

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4 **(a)** *5/6 correct = 3 marks 3/4 correct = 2 marks 1/2 correct = 1 mark*
hint: use green blobs for correct

infectious disease	name of causative organism(s)	type of causative organism	main mode of transmission
HIV/AIDS	human immunodeficiency virus (HIV)	virus	sexual contact
cholera	*Vibrio cholerae*	bacterium **A** bacteria	ingestion of contaminated water and food
tuberculosis	*Mycobacterium, tuberculosis* or *M. bovis*	bacterium	aerosol / droplet infection **A** described **A** airborne droplets **R** air droplets alone
measles	*Morbillivirus* **;** **A** morbillivirus **A** Morbilivirus **A** Morbilli	virus	aerosol / droplet, infection
malaria **;**	*Plasmodium vivax* or *P. malariae* or *P. falciparum* or *P. ovale*	protoctist **;** **A** protozoa **A** protist(a)	feeding / sucking blood / **AW**, by *Anopheles* / mosquito **;** **A** mosquito / *Anopheles*, bite **A** mosquito / *Anopheles*, is vector

[max 3]

(b) *responses do not have to be presented as a table or confined to any one column*
for <u>each</u> numbered mark point, accept point either in left hand column or right hand column

***A** femidom for condom where relevant*
***A** prophylactic for condom*

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mp	factors to consider	recommendations
1	(geographical) availability of condoms	condoms should be available (in all relevant locations) **;**
2	where available, insufficient stock of condoms	condoms should be stocked in sufficient quantities **;**
3	condoms (available but) unaffordable	free / affordable, condoms (should be provided) **;** **A** condoms should be provided
4	low level / no, advertising campaigns for condom use	*ref.* advertising campaigns for, condom use / safe sex / protective sex **;**
5	poor condom storage (idea of deterioration)	safe storage of condom supplies (to avoid deterioration) **;**
6	lack of education in, use of condoms / how HIV is spread / other relevant **R** low level of awareness of HIV / lack of education about HIV	*ref.* education **;** e.g. should use condoms / proper use of condoms **A** (should practice) safe sex / protective sex
7	low level of (interest in) condom use or, religious / cultural, objections **A** few people use condoms	*ref.* changing perception of people to encourage use (of condoms) **;**
8	identifiable, high risk / named high risk, groups e.g. sex workers, (male) homosexuals, multiple partners, IV drug abusers *(in context of sexual activity)*	idea of targeting, high risk / named high risk, groups **;** e.g. sex workers, homosexual males, multiple partners, IV drug abusers IV drug abusers *(in context of sexual activity)*
9	low rate of male circumcision	encourage circumcision procedure / train health personnel **;**
10	poor treatment of sexually transmitted infections	treatment of sexually transmitted infections (as risk of contracting HIV increases) **;**
11	no / poor / **AW**, antiretroviral therapy	*ref.* antiretroviral therapy reducing risk of sexual transmission **;**
12	*ref.* extent of contact tracing	*ref. to* contact tracing **;**

[max 4]

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(c) (i) correct sequence **;**
mark sequentially from first stated process as this is a cycle

growth		DNA replication
DNA replication	**or**	growth
mitosis		mitosis
cytokinesis		cytokinesis

[1]

(ii) *this may be answered in one of two ways* ***ora***

mp	*because normally T_h cells so,*	*without / with fewer, T_h cells*
1	release / **AW**, cytokine / lymphokine / interleukin **;**	no / less,cytokine / lymphokine / interleukin ased / **AW ;**
2	stimulate / **AW**, humoral / B-lymphocyte / B-cell, response **;** humoral / B-lymphocyte / B-cell, response not stimulated **;** **R** beta-cells	
3	(stimulate B-cell response so) antibodies produced **;** **A** secreted / released **R** if antibodies from T-cells	poor / **AW**, antibody production / **AW ;** **A** no antibodies **A** secrete / release **R** if antibodies from T-cells
4	stimulate / **AW**, **A** (result in) angry macrophages **A** make macrophages more active (in phagocytosis)	macrophages / phagocytes, not stimulated / **AW ;** **A** fewer / no, angry macrophages **A** macrophages less active (in phagocytosis)
5	remain in circulation for second encounter with antigen **; AW**	none remain in circulation for second encounter with antigen **; AW**

[max 3]

[Total: 11]

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5 **(a)** (gives) flexibility / described, e.g. *ref. to*, changing orientation / movement to bind antigen / allows binding when two antigens are apart / allows each antigen binding site to move independently **;**
A (acts as) hinge region [1]

(b) **(i)** antigen binding sites / bind to antigen / both bind to same (type of) antigen **;**
A *other terms for binding* e.g. attaches to antigen *ignore ref. to receptor* [1]

(ii) binding to phagocyte / monocyte / macrophage / neutrophil / B-lymphocyte / named cell type with Fc receptor **;**
A gives class of antibody / determines the class of antibody **;** [max 1]

(c) *secreted*
(antibodies need to be) soluble (to function) **;** **AW** e.g. needs to be transported in, aqueous / watery plasma

located on surface
(**X** is region required to) hold / anchor / **AW**, (antibody), in membrane **/** phospholipid bilayer **;**

ref. hydrophobic core / fatty acid tails of phospholipids hydrophobic **;**

interaction provides, stability / anchorage / **AW ;**

ref. hydrophobic region of antibody will have tendency to move back into membrane as repelled by, hydrophilic / watery, exterior solution **;** [max 2]

(d) **(i)** one / 1 ; [1]

(ii) folding / coiling (to form tertiary structure) **;**

ref. interaction of, side chains / R groups (of amino acids) **;** **R** react

two of ionic / electrovalent, bond
hydrogen bond
disulfide bonds
hydrophobic interaction
Van der Waal's (forces) **;** *one mark only for any two*

hydrophobic, side chains / R-groups / amino acids, in centre / **AW ;**
A hydrophobic region faces, towards centre / **AW**
or
amino acids with hydrophilic R groups face, outwards / watery environment / **AW ;**
A hydrophilic amino acids *for hydrophilic R groups* [max 2]
[Total: 8]

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6 (a) small / **AW**, surface area to volume ratio / SA:V (compared to unicellular) **;**
ora large volume to surface area

A as organisms increase in size, surface area to volume ratio / SA:V, decreases

ref. long(er) distances (to reach cells / tissues) **;**
A transport system reduces diffusion distance *(as it takes materials close to cells)*

diffusion (alone), too slow / insufficient / unable to satisfy needs / **AW ;**
A transport system decreases time to supply cells
ignore ref. to named substances diffusing

ref. efficient / **AW**, supply (to cells) of, glucose / amino acids / dissolved food **;**
/ nutrients / hormones **;**
A *idea of* greater volume (containing required materials) or higher concentration of materials
R oxygen, *unless only transport in mammals*

ref. xylem, phloem, circulatory system **;** *must have all three*
A arteries and veins / blood transport system / blood vessels [max 3]

(b) (i) **P** = atria / atrium / auricle, **Q** = ventricle / ventricles **;** [1]

(ii) *any sequence of letters within each row*

systole	**V Y ;**
diastole	**W X Z ;**

[2]

(c) 1 assimilates / sucrose, lowers water potential **;**
A more negative / decreases, water potential
A Ψ for water potential

2 water enters by osmosis **;**

3 (increased volume) increases hydrostatic pressure **;**
ref. to hydrostatic required once only in mp 3 or 5

4 assimilates / sucrose, leave at the, sink / named sink **;**

5 (so) lowers hydrostatic pressure / low pressure at sink **;**

6 mass flow **;**

7 down pressure gradient / from high to low (hydrostatic) pressure **;** [max 4]

[Total: 10]

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