CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

9700/23 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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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 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

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1 (a) (i) **B ;** [1]

(ii) **D ;** [1]

(iii) **A ;** [1]

(b) (i) amylose / amylopectin / glycogen **;** **A** starch [1]

(ii) part **1** is saturated / part **2** is unsaturated **;**

part **1** has no double bonds / part **2** has one double bond **;**

part **1** has 27 hydrogens and part **2** has 25 **;**
A part **1** has more hydrogens **ora** [max 1]

(iii) *any two from:*
ionic / electrovalent (bond) **;**
hydrophobic (interaction) **;**
hydrogen (bond) **;**
disulfide (bond) **;**
A Van der Waal's (forces) [max 2]

[Total: 7]

2 (a) (i) **1** (method to) stimulate / AW, an immune response **;**
A gives immunological memory

2 giving / **AW**, antigens **;**

3 (method to provide long-term) artificial active immunity **;**

4 one relevant detail **;**
e.g. no ability to cause disease
ref. to, harmless / **AW**, form of pathogen used
(protection through) production of (specific) memory cells
(contains, pathogen / antigen) in an injection or an oral dose

A (to provide long-term) artificial active immunity
if not already credited in mp 3 [max 2]

(ii) (disease) caused by, a pathogen / microorganism **;**
A *two of* bacteria, virus, fungus, protoctist

one relevant detail e.g.
transmissable / communicable / passed from one organism to another / **AW ;**
A spread to others *if qualified*

affecting the normal function of the body / causing ill health **;** [max 2]

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(b) (number of cases per 100 000) shows, proportion / **AW**, of population affected **;** **AW**

idea that easier to visualise, the severity of the problem **;**

useful / more reliable, qualified **;** e.g. for making comparisons between different countries

(as) countries with larger populations will usually have more cases **/** higher number of cases may just mean larger population of country **;**

comparative data quote to support **;** [max 2]

(c) **1** infected person, coughs / sneezes / breathes out / **AW**, droplets **;**

2 droplets containing, bacteria / pathogen / *M. tuberculosis* **;**

3 airborne droplets / droplets in air / moist air, inhaled / inspired / breathed in (by uninfected person) **;**
A droplets if mp 2 given
A by, aerosol, infection / transmission

4 consumption of, milk / meat, containing, bacteria / pathogen / *M. tuberculosis* / *M. bovis* **;** [max 3]

(d) (HIV/AIDS leads to) weak immune system / reduced immunity (to disease) **;**

detail **;** e.g. reduced action of phagocytes
Th lymphocytes low in number
B-lymphocyte response low

(so TB) pathogens, can multiply faster / are not destroyed before they cause disease **;**

idea that important, organs / systems, may already be suffering from consequences of HIV / AIDS (so more likely to stop functioning) **;**

ref. to, inactive / dormant / latent, TB more likely to become active **;** [max 2]

[Total: 11]

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3 (a) *allow mps 1, 5 and 6 if non-competitive or both described*

1 (glutamycin) similar shape to, substrate / glutamyl-tRNA **;**

2 competes with substrate / competitive inhibition **;**

3 (glutamycin) binds to / fits into / enters, active site **;**

4 (glutamycin) complementary (shape) to active site **;**

5 (so) substrate / glutamyl-tRNA, cannot, enter / bind **;**
A no / few, ES complexes
A prevents formation of ES complexes
A glutamyl-tRNA forms enzyme inhibitor complex

6 slows the rate of reaction / **AW ;**

7 *ref. to* increasing concentration of inhibitor has greater effect on inhibition**;** [max 4]

(b) transport is against the concentration gradient / **AW ;**

requirement of, energy / ATP **;**

use of, membrane / carrier / transport / pump, protein **;**
R channel / pore, protein

ref. to conformational change (of pump protein) **;**

ref. to specificity **;** [max 3]

(c) (i) nitrogen fixation **;** [1]

(ii) *idea that Rhizobium* will receive, photosynthates / assimilates (from plant) **;**
gains, carbohydrate / amino acids **;**
for energy / growth / replication **;**
receives oxygen **;**
idea of (nodules provide) correct living conditions / ideal habitat / anaerobic conditions (for nitrogenase) / **AW ;**
A *ref. to* protection, qualified mutualistic relationship **;** **A** described [max 2]

(iii) production of, ammonium / NH_4^+ / ammonia / NH_3 **;**

(fixed / useable) nitrogen transferred to plant **;**

used for amino acid production (in plants) **;**

ref. to other uses relevant to growth **;** e.g. in DNA replication / transcription

increased / used in, protein synthesis **;** **A** named protein

(for) production of new, cells / tissues **;** [max 2]

[Total: 15]

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4 (a) stomata in, pits / cavities / chambers / crypts **;** **I** sunken stomata

no stomata on upper surface **;**

few stomata **;**

hairs / trichomes **;**

thick (waxy) cuticle **;**

thick walled epidermal cells **;**

several layers of, upper epidermis / hypodermis **;** [max 3]

(b) 300 **;;**

(18 000 / 60 or 19 000 / 60 or 20 000 / 6)

allow one mark
if correct measurement is divided by magnification but incorrect conversion factor is used if answer not to nearest 100 μm [2]

(c) **1** loss of water vapour from, leaves / aerial parts of the plant **;**

2 water evaporates from, walls / surface, of mesophyll cells **;**

3 into air spaces **;**

4 water vapour diffuses(out to atmosphere) **;** **A** water *if mp2 awarded*

5 through open stomata (to atmosphere) **;**

6 down a water potential gradient **;**

A *idea that* water potential gradient established [max 4]

[Total: 9]

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5 (a) *accept Hb for haemoglobin throughout*

low(er), partial pressure / **AW**, of oxygen / O_2 **;**

high(er), partial pressure / **AW**, of, carbon dioxide / CO_2 **;**

formation of carbaminohaemoglobin **;**

carbonic acid disocciation to form, hydrogen ions / H^+ (and hydrogen carbonate ions) **;**

formation of haemoglobinic acid / binding (of Hb) with, hydrogen ions / H^+, causes release of oxygen **;** *allow HHb*

ref. to Hb affinity for oxygen **;** e.g.
Hb has higher affinity for, hydrogen ions / H^+, than oxygen **;**
reduces / lowers, affinity of Hb for oxygen

Bohr effect **;**

AVP **;** e.g. *ref. to* allosteric effects [max 3]

(b) lower, partial pressure / **AW**, of oxygen (at high altitudes) ***or*** less oxygen in inhaled air / **AW ;**

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

more haemoglobin needed (so more red blood cells) **;**
A (more red blood cells) so more haemoglobin / more oxyhaemoglobin can be formed

idea of compensation **;** e.g. (to transport) same amount of oxygen to, cells / tissues **;**

ref. to (increased) secretion of, erythropoietin / EPO **;** [max 3]

(c) (i) making a (complementary) copy of, DNA**;** **A** a gene
ref. information / **AW**, for production of a polypeptide **;**

one (DNA) strand acts as a template **; AW**
production of (pre) mRNA **;**
detail of process **;** e.g. assembly of nucleotides
RNA polymerase [max 3]

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

ref. to altered mRNA / **AW ;**
this may be in context of a named type of mutation
consequence on tRNA

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

change in amino acid(s) / different amino acid sequence / change in primary structure **;**

affects, secondary structure / tertiary structure / 3D shape / function, of protein ;

ref. to one type of mutation **;**
e.g. base substitution means
deletion / insertion, leads to frameshift
ref. to premature stop codon [max 3]

(iii) *may prevent*
breaking of hydrogen bonds between, base pairs / bases / nucleotides,
(and access of RNA polymerase) **;**

attachment of, RNA polymerase (to DNA) **;**

progress / functioning, of RNA polymerase (along gene) **;**

synthesis / elongation of (pre) mRNA **;**

AVP **;** e.g. interfere with action of helicase [max 2]

[Total: 14]

6 (a) (i) deposit / build-up / presence / **AW**, of atheroma / (atheromatous) plaque **;**

thicker wall **;**

narrowing of the lumen **;** **R** lumen, blocked / clogged

lumen no longer round **;**

rougher / **AW**, lining **;** **A** idea of damaged endothelium [max 2]

(ii) damage / **AW**, to, endothelium / tunica intima / **AW ;**

promotes blood clotting / makes platelets sticky / increases risk of thrombosis / **AW ;**

(so) contributes to plaque / atheroma **; A** atherosclerosis

ref. (vaso) constriction **;** **A** reduces diameter
A reduces resistance to blood flow [max 1]

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(b) (i) *one correct structural feature with one relevant corresponding function e.g.*

thick / muscular, wall **;** **A** thick tunica media **A** smooth muscle
withstand high blood pressure / maintains pressure / provides strength **;**

elastic tissue ;
provide, stretch / recoil / **AW** ;

smooth tunica intima ;
maintain, laminar / smooth, flow ; **AW**

presence of collagen ;
prevents rupture / **AW** ;

allow the function mark for general statement
transports blood away from the heart to the (lungs and) rest of the body **;** [max 2]

(ii) one cell thick (wall) / endothelium only / thin wall / **AW ;**
short diffusion distance / high rate of diffusion **; I** easy diffusion

pores / gaps / spaces, between, cells in wall / endothelium **;**
to allow exchange of substances / example described / formation of tissue fluid **;**

small, diameter / cross sectional area **; A** range 7–12 μm
ref. efficient, exchange / delivery / collection, of materials **;**
e.g. reaches all cells / **AW**
slows down blood flow
maximises time for red blood cells to collect / deliver, oxygen
reduces distance for diffusion to cells [max 2]

[Total: 7]

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