

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

**MARK SCHEME for the October/November 2009 question paper
for the guidance of teachers**

9700 BIOLOGY

9700/21

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

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UNIVERSITY of CAMBRIDGE
International Examinations

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	GCE A/AS LEVEL – October/November 2009	9700	21

- 1 (a) (i) circle around one *or* two variable regions ; [1]
- (ii) line(s) between **one** light polypeptide and **one** heavy polypeptide,
line(s) between the two heavy polypeptides ;
maximum of six lines in each site [1]
- (iii) 1 (disulfide) bonds are between, cysteine(s) / cysteine residues ;
A between R groups S-H S-H
2 covalent bond ;
3 strong bond / not easily broken ;
4 hold, polypeptides / chains / protein , together ; **R** proteins / strands
5 (in protein with) tertiary / quaternary (structure) ;
6 maintain shape / stop loss of shape / prevent deforming ;
A 3D structure **R** structure unqualified [3 max]
- (b) 1 secreted / synthesised / produced / released, by, plasma cells / B lymphocytes / B cells ;
2 combines / AW, with, antigens / pathogens / toxins / viruses / bacteria / microbes ;
A 'bonds with' / 'sticks to' / 'attaches to' **R** 'disease'
3 ref to, specificity / described ; *in context of antibody / B cells / antigen*
4 variable region is antigen binding region ; **R** 'receptors on antibodies'
5 neutralises toxins / antitoxin(s) ;
6 lysis of pathogens / described / lysis(s) ; **R** breaks down
7 prevents viruses entering cells ;
8 clumps / agglutinates / aggregates / AW, bacteria ; **R** 'coagulation'
9 opsonisation / opsonins ; **A** enable recognition
10 coats / AW, bacteria to facilitate phagocytosis ; *only in context 8 or 9*
11 receptors on phagocytes for constant regions (of antibodies) ; [4 max]
- (c) 1 (carrier / channel protein for) facilitated diffusion / described ;
A action of (co-) transport protein described
2 (carrier protein for) active transport / described ;
3 cell recognition / distinguishing self from non-self / act as antigens / AW ;
4 receptor ; **A** binding site qualified in terms of, hormones / neurotransmitters / cytokines /
cell signalling molecules ;
5 T-cell receptor / described ;
6 cell (to cell) adhesion / described ;
7 enzyme ;
8 form (hydrogen) bonds with, water / fluid surroundings, to stabilise membrane ; [3]

[Total: 12]

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
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2 (a) *marking points are independent*

iodine in potassium iodide solution / I in KI solution / iodine solution ;

R iodine / iodine test

A if 'solution' not used, but clear that it is a solution

positive result = (from yellow / red brown to) blue-black / blue / black ;

R blue-black precipitate

[2]

(b) no activity at pH 2.0 **and** pH 9.0, some activity at pH 3.0 **and** 8.0 ;

optimum between pH 5.5 and 6.5 ;

[2]

(c) *description*

1 optimum / peak / described, at pH 6.0 ; *allow ecf from graph*

A 'enzyme works best at' / 'most efficient at'

'rate of reaction / activity, is greatest at...'

2 low / no, hydrolysis / activity, with **at least one** correct pH ;

3 data quote (from table) using time ;

e.g. within 10 minutes / change within 2 minutes / 1/t

explanation to max 4 accept ora

4 at optimum pH, most successful collisions ; **A** alternative wording

greater or less than optimum

5 high / low, hydrogen ion concentration ;

6 enzyme denatured (fully) at / <pH2 or at / >pH9 ;

7 partial denaturation / AW, at other stated value(s) of pH ;

at any pH – optimum or sub-optimum

8 ref to, hydrogen bonds / ionic bonds ; **R** if other bonds named

9 ref to tertiary structure ; **A** ref to allosteric site

10 shape of active site ;

11 detail of active site ;

e.g. changes to charge on active site / no longer complementary to substrate forms, no / fewer, enzyme-substrate complexes

[5 max]

[Total: 9]

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- 3 (a) (i) anaphase / early telophase ; [1]
- (ii) 1 chromosomes / chromatids, move to / at, poles / centrosomes ;
2 attached to, spindle / microtubules ;
3 by, centromeres / kinetochores ; **A** centromeres leading
4 pulled by, microtubules / spindle fibres / AW ;
A contracting / shortening / disassembling [2 max]
- (iii) *these points are independent*
1 cannot follow, movement of chromosomes / AW ;
e.g. 'processes in mitosis'
2 can only view dead material ;
3 sections have to be thin ;
4 overstaining obscures details (of chromosomes) ; **A** artefacts
5 cannot see, all of the chromosomes / whole chromosomes ; [2 max]
- (b) (i) 1 carcinogen / cancer-causing / named carcinogen (in tobacco smoke / tar) ;
e.g. benzpyrene / phenol / nicotine *check any others*
2 mutation / change to DNA ;
3 ref to named gene ; e.g. oncogene / tumour suppressor
4 in (bronchial) epithelium ;
5 uncontrolled, cell division / mitosis / cell cycle ; **R** 'rapid'
6 grows into, mass of cells / lumen of airway(s) / lung tissue ;
A squeezes against blood vessels / enters lymphatic vessels
7 growth of blood capillaries (into tumour) ;
A angiogenesis / vascularisation / ref to thrombospondin
8 no programmed cell death ; [3 max]
- (ii) must be a sign or symptom
1 coughing up blood ;
2 persistent cough / coughing a lot ;
3 coughing up increased volume of sputum / AW ;
4 chest / shoulder / back, pain ;
5 wheezing / breathlessness / breathing difficulty ;
6 weight loss ;
7 AVP ; e.g. fatigue **R** tiredness [2 max]

[Total: 10]

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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4 (a) loss of water vapour ;
from leaves / aerial parts of plant ; R stomata unqualified
ignore evaporation [2]

(b) 1 rate for species **A** is always higher / ora for **B** ;
similarity
2 the rates of both species, increase and then decrease / reach a peak ;
3 peak is, around midday / around noon / 11.30 to 12.30 ;
difference
4 rate for species **B** decreases earlier than that for species **A** ;
A species **B** at ~11.45 **and** species **A** at ~12.15 +/- 5 mins
5 steeper / faster, increase / decrease, for **A** ;
6 comparative data quote for rates of transpiration ; +/- ½ a square
A $\mu\text{g min}^{-1}$ for unit [4 max]

(c) *two adaptations plus explanation – explanation may be the same for each answer accept ora for species A*

- f1 sunken stomata ; **A** stomata in, pits / chambers / grooves
f2 hairs / trichomes (on epidermis) ; **R** needles
f3 rolled / curled / AW, leaves ; *ignore curved unqualified*
e1 high humidity / retains moist air / high concentration of water vapour, to reduce diffusion gradient *or* water potential gradient / AW ;
R 'moisture'

f4 small leaves / leaves are spines / leaves are needles ; **R** spikes
R 'no leaves'
e2 reduce surface area (for transpiration) ;
reduce SA explained but unqualified by size of leaf = 1 mark (see F9)

f5 thick leaves ; **A** succulent
e3 reduce surface area : volume ratio ;

f6 thick (waxy) cuticle ;
e4 decreases permeability / is impermeable / provides a barrier / ora ; **A** e5

f7 reflective cuticle ;
f8 several layers of hypodermis ; **A** layers of epidermis / described
f9 epidermis with thick walled cells ;
f10 few stomata / low stomatal density ;
e5 reduce (rate of) diffusion of water ; **R** close of stomata [4 max]

[Total: 10]

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5 (a) meiosis in lowest box ;
mitosis in the other two boxes ; [2]

(b) larger / 80S, ribosomes ;
mitochondria ;
Golgi (body / apparatus) ;
(smooth / rough) endoplasmic reticulum ; **A** (smooth / rough) ER
vacuole(s) / vesicle(s) / lysosomes ;
centriole / centrosome ;
A membrane-bound organelles if no examples given
R chloroplast/ chromosomes / nucleus [2 max]

(c) *ignore any other methods of transmission given*
(spores) in droplets / moist air, coughed / sneezed / breathed, out ; **A** aerosol
breathed in (by other person) ; [2 max]

(d) 1 no (effective) vaccine ;
2 HIV has a high mutation rate ;
3 antigens change / different antigens / different strains ;
4 no cure ;
5 drugs, are expensive / not widely available / not effective / AW ;
6 vertical transmission / mother to child ;
problems with:
7 symptomless carriers (spreading the virus) ;
8 testing people for HIV status ;
9 providing, condoms / femidoms ;
10 promiscuity ;
11 educating about risks / AW ;
12 reuse of needles ;
13 tracing contacts (of infected people) ;
14 testing / screening, blood donations ;
15 treating, blood / blood products, to, destroy / inactive / 'kill', HIV ;
16 ref to cultural issues ; *accept relevant examples*
17 ref to poverty ;
18 AVP ; e.g. war / civil disturbance, out of date drugs, ref to transport links
ignore resistance of HIV [4 max]

[Total: 10]

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- 6 (a) 'self contained' / 'self-sustaining' / determined by same physical feature / defined area ;
community / all organisms / biotic factors, **and**, physical factors / abiotic factors / non-living factors / environment ;
ref. to interaction between, organisms (and physical environment) ; [2 max]
- (b) *award two marks for the correct answer (5.5%)
if no answer or incorrect answer or answer to too many decimal places, award one mark for working (88 / 1609)
88 / 1609 ($\times 100$)
5.5 (%) ;;* [2]
- (c) *these are points for producers to primary consumers – accept ora for secondary consumers to tertiary consumers*
1 some parts inedible ;
2 indigestible / cannot digest cellulose or lignin ;
3 more material goes to decomposers (rather than consumers) ;
4 plant material is less energy rich / animal flesh is more energy rich ;
5 manipulated data in support ; e.g. $\times 2$ to decomposers from producers
0.8% (energy available to primary consumers divided by the energy available to plants) [3 max]
- (d) *decomposers in recycling nitrogen*
protein \rightarrow ammonia / ammonium ions = 1 mark
1 convert protein \rightarrow amino acids ;
2 deamination ;
3 urea / amino acids \rightarrow ammonia / ammonium ions ; **A** ammonification
4 make, ammonia / ammonium ions, available to nitrifying bacteria ;
A role of nitrifying bacteria / correctly named [2 max]

[Total: 9]