www.dynamicpapers.com

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

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.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

www.dynamicpapers.com

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 / lysin(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]

© UCLES 2009

www.dynamicpapers.com

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]

© UCLES 2009

www.dynamicpapers.com

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]

© UCLES 2009

www.dynamicpapers.com

4 **(a)** loss of water <u>vapour</u> **;**
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 µg 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]

© UCLES 2009

www.dynamicpapers.com

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]

© UCLES 2009

www.dynamicpapers.com

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 (× 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. ×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 → ammonia / ammonium ions = 1 mark
1 convert protein → amino acids **;**
2 deamination **;**
3 urea / amino acids → 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]

© UCLES 2009