UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

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 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 excepted)
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) *one mark each column*

transport mechanism
(passive / simple) diffusion **R** facilitated diffusion
endocytosis / phagocytosis **R** bulk transport
} ;

example
glucose / amino acids / ions / named ion **A** polar / hydrophilic, molecules
accept any relevant
water
} ;
[2]

(b) *ignore correct examples of materials if given in addition to transport mechanism*
***R** if incorrect examples given*

facilitated diffusion ;
active, transport / uptake ; **A** sodium-potassium pump (mechanism)
(passive / simple) diffusion or osmosis ;
endocytosis or exocytosis ;
A (for endocytosis) pinocytosis / micropinocytosis / phagocytosis [4]

[Total: 6]

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2 (a) *allow immunoglobulin for antibody*

structure	name of structure	function of structure within plasma cell
A	nucleus ; **A** (eu)chromatin **R** heterochromatin **R** chromosome	ref. gene(s) / genetic information / genetic material / DNA, (coding) for, antibody / protein / polypeptide ; transcription (occurring) / mRNA synthesis ; AW (ref. antibodies) *allow ecf for nucleolus*
B	mitochondrion ; **A** mitochondria	provides / synthesises / produces / makes, ATP (for antibody synthesis / exocytosis) ; *treat as neutral other uses of ATP* *allow ecf for lysosomes*
C	rough endoplasmic reticulum ; ignore RER	synthesis / modification / processing / transport, of, antibody / protein / polypeptide ; **A** translation *allow ecf for Golgi or SER or ER*

[max 6]

(b) (i) 1 part of the immune response ; **A** primary / secondary, response

many plasma cells

2 to produce high, concentration / level / AW, of, antibody / immunoglobulin ;

3 (high concentration antibody so) more effective against pathogens / AW ;

identical plasma cells

4 specific / particular / AW, to an, antigen / epitope ;
in context of antibodies or plasma cells

5 antibody (molecules) produced are all the same ; **A** ora, qualified

6 only the gene coding for particular antibody, switched on / transcribed / expressed ;

[max 3]

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(ii) *accept from annotated diagrams*

cell cycle stages are not required for mark points 1, 3, 4 and 7
reject if incorrect mitotic stage given for these mark points

1 ref. to, duplication / replication, of centrioles (in late interphase / before prophase)**;**
A dividing
R splitting

2 (centriole pairs) move to opposite <u>poles</u> in <u>prophase</u> **;**
accept asters or centrosomes for centrioles

3 (movement allows) spindle formation / organisation of spindle fibres / microtubule assembly / microtubule organisation / AW, (in prophase) **;**

4 (late prophase / early metaphase / metaphase), chromosomes / centromeres, attach to, spindle fibres / microtubules **;**

5 <u>chromosomes</u>, line up / aligned / AW, at, equator / metaphase plate **;**

6 ref. separation of, <u>sister</u> / <u>identical</u>, chromatids, at <u>anaphase</u> (to poles) **;**
A sister chromatids move to opposite poles at anaphase
A <u>daughter</u> chromosomes *for sister chromatids*

7 ref., pulling / shortening, by, microtubules / spindle fibres **;** AW [max 4]

[Total: 13]

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3 (a) *max 3 if no attempt at comparison*

evaporation

1 formation of water vapour from water / conversion of water from liquid (form) to gas(eous form) **;**

2 requires, energy / heat **;**

3 (water loss) from, surface / cell walls, of (spongy) mesophyll (cells)**;**

transpiration

4 idea of loss of water vapour, to external atmosphere / from the aerial parts of a plant **;** **A** from leaves

5 ref. diffusion, down water potential gradient / from high to low water potential / from less negative to more negative water potential **;** **A** Ψ for water potential

6 through stomata **;**

air spaces

7 correct ref. to, intercellular / air, spaces **;** e.g. evaporation into air spaces, diffusion from air spaces through stomata [max 4]

(b) (i) *max 3 if no attempt at explanation*
penalise once for lack of units
mp for describing shown by (D)
mp for explaining shown by (E)

temperature

T1 (D) (mean) transpiration rate hot dry day lower than warm dry day ;
A lower than warm rainy day **A** lowest rate

T2 (D) comparative data quote to support **;**

T3 (E) stomata close to prevent excess water loss / excessive water loss causes closure of stomata **;** AW

humidity

H1 (D) (mean) transpiration rate warm dry day higher than warm rainy day **;**
A highest rate

H2 (D) data quote to support **;**

H3 (E) decrease in / low, humidity increases rate of, transpiration / evaporation / diffusion **;** ora

H4 (E) more steep / AW, water potential gradient **;**

stomatal density

S1 (D) peach (mean) transpiration rate, lowest / lower than, apple / sour cherry **;**

S2 (D) data quote to support **;**

S3 (E) ref. (far) fewer stomata (mm^{-2}) so less water (vapour) lost **;**

AVP **;** e.g. ref. ABA and stomatal closure **(T)**
less water (vapour) leaves plant as only cuticular transpiration possible **(T)**
ref. to higher rate for apple (dry days) and suggestion that stomata are larger [max 4]

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(b) (ii) decreased / lower, rate during night **;** ora
stomata closed at night **;** ora
further detail **;** e.g. closed to prevent water loss
closed as no photosynthesis
no light for photosynthesis
open (during day) for, gas exchange / CO_2 in [3]

(iii) peach / *Prunus persica / P. persica* **;** [1]

(c) (i) (repairing damaged DNA) reduces risk of cancer **;** **A** prevents

further detail **;** *in context of reducing risk*
e.g. because tobacco smoke contains mutagens
because tobacco smoke contains carcinogens
ref. to mutation (as result of damaged DNA) [2]

(ii) reduces risk of, <u>chronic</u> bronchitis / emphysema / COPD **;**

further detail **;** *in context of reducing risk*
e.g. (reducing inflammation)
reduces risk of infection
prevents excess mucus production **R** if linked to emphysema
prevents alveolar wall breakdown **R** if linked to bronchitis
no / less, scar tissue forms [2]

[Total: 16]

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4 (a) (i) *DNA because*
RNA (has uracil) does not have thymine **;** [1]

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

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

(b) collects / attaches to, specific amino acid
or
takes specific amino acid / activated tRNA, to ribosome **;**

idea of, adjacent / two, amino acids and codon-anticodon binding **;**
peptide bond formation / ref. elongation, (to form polypeptide) **;** [max 2]

(c) *accept points from a diagram*

1 loss of a water molecule / condensation reaction **;**

2 OH / O^- , from, carboxyl / -COOH / COO^- (group) of one amino acid **;**
3 H / H^+ , from, amine / NH_2 / NH_3^+(group) of other amino acid **;**
2/3 *allow one mark for ref. to involvement of carboxyl and amine group*

4 (peptide bond) links C–N **;** [3]

[Total: 8]

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5 (a) *Vibrio cholerae* **;** [1]

(b) 1 binding / AW, to, active site / site other than active site / allosteric site **;**

2 further detail / consequence of, binding **;**

if binds to active site

complementary shape to active site

similar shape to substrate **A** same shape **A** similar structure

competes with substrate for active site

if binds to other site

changes shape of active site

shape of substrate no longer complementary to active site

enzyme-substrate / ES, complex (already in active site) cannot make product

for both types of binding

3 substrate unable, to enter / bind to, active site **;**

A fewer / no, enzyme-substrate / ES, complexes form

4 AVP **;** e.g.

ref. to decreased enzyme activity, qualified e.g. less ATP produced / lower respiration rate

preference for, permanent / irreversible, inhibitor (to maximise effect)

correct ref. to concentration of inhibitor and effect [max 3]

(c) (i) 2.70 **/** 2.71 **;;**

1 mark if answer incorrect but correct calculation

5 143 / 190 130 [2]

(ii) *max 3 if no reference to particular regions*

for differences in cases *accept ora for mark points*

1 idea of overall greater exposure to <u>contaminated</u>, water / food **;**

2 no, safe (drinking) water sources / bottled water / water treatment plants **;**

3 lack of hygiene, qualified **;** e.g. hands not washed after defaecation

4 faeces / sewage, mixing with drinking water **/** onto crops**;** **A** poor sanitation

5 insufficient / poor access to, (oral cholera) vaccines **;**

6 vaccine less effective in some areas **;**

7 lack of education about the way cholera is transmitted **;**

8 differences in effectiveness of surveillance and reporting **;**

9 qualified ref. to, natural disasters / wars / refugee camps **;**

for differences in fatality rates

10 increase in, antibiotic / drug, resistant strains (in some areas) **;**

11 lack of, health services / drugs / antibiotics / ORT / skilled personnel **;** **A** lack of medicines

12 AVP **;** [max 4]

[Total: 10]

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6 (a) **G ;**
A ;
B ;
F ; [4]

(b) *do not accept list ATP, DNA, RNA, phospholipid as these must be qualified*

1 idea of, increase in cell numbers / more cells ; **A** ref. to mitosis / cell division
2 ATP, qualified **;** e.g. for, cell growth / anabolic reactions
3 (activated) nucleotides for, DNA / RNA, synthesis **;**
4 phospholipid for membranes **;**
5 DNA replication (for cell division) **;**
6 RNA for, protein synthesis / AW **;**
7 AVP **;** e.g. activate glucose for glycolysis
ref. NADP, light-dependent reaction [max 3]

[Total: 7]

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