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

9700/21 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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ecf	error carried forward
I	ignore

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1 **(a)** pulmonary artery ; **A** pulmonary arteries [1]

(b) phagocyte / macrophage ;
A neutrophil / polymorphonuclear leucocyte **R** PMN
R leucocyte / white blood cell unqualified
R any incorrect qualification [1]

(c) B-lymphocyte / (effector) B (cell) / plasma (cell) ; **R** lymphocyte alone
R effector cell unqualified [1]

(d) goblet (cell) ; [1]

(e) cartilage ; ignore plates / rings [1]

[Total: 5]

2 **(a)** **1** electron microscope has, higher / AW, resolution (than LM) / ora ;
2 explanation of resolution as ability to differentiate between two points (close together) ;
3 ref. to (internal) membranes (of **A** and **B**) which cannot be seen in LM ;
A named membranes e.g. cristae, grana
4 AVP ; e.g.
(resolution of) EM is 0.5 nm (0.0005μm) and LM is 200 nm (0.2μm)
A 0.5 to 1 nm (0.001μm)
resolution is equal to half the wavelength (of medium used)
ref. to shorter / AW, wavelength (of electrons) / ora (must have a comparison)
ref. to, width of membranes / distance apart of membranes, e.g. width of membranes in A and B is 7 nm (+/– 1) [max 3]

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(b) **C** – rough endoplasmic reticulum ; *penalise once only for ER instead of endoplasmic reticulum*
D – ribosome ; **A** ribosomes ignore 70S
E – smooth endoplasmic reticulum ; **A** smooth ER *if full term used for* ***C***

award one mark if ***E*** *= rough endoplasmic reticulum and*
C *= smooth endoplasmic reticulum* [3]

(c) *any one relevant e.g.*

store of / holds, cell sap ; **R** if contains organelles
store of / holds, water / ions / named ion(s) / minerals / salts / pigments / (named) sugars ;
R substances / molecules
R storage unqualified
pushes chloroplast to edge of cell ;
gives, turgidity / turgor pressure / hydrostatic pressure / support / AW ;
A makes, firm / rigid
A controls / maintains, turgidity
R gives shape / strengthen
store of / holds, waste (products)

R reactions occur in vacuole, unqualified [1]

(d) *no marks for identifying* ***F*** *and* ***G***
if only ***F*** *or* ***G*** *described max 3*
if ***F*** *and* ***G*** *incorrectly identified, accept mark points correctly linked to membrane and wall to max 3*

1 **F** partially permeable A selectively permeable
and **G** (fully / freely / AW), permeable / porous ;

F *is partially permeable cell surface membrane*
2 phospholipid (bilayer);
3 permeable to, lipid-soluble molecules / oxygen ;
A other terms for lipid-soluble
treat reference to water as neutral
4 impermeable to, water-soluble / AW, molecules / ions / AW ;
A other terms for water-soluble
treat reference to water as neutral
5 aquaporins / proteins, provide (increased) permeability to water ;
6 transport proteins provide permeability to, ions / polar molecules ;
A channel / pore / carrier, proteins

G is permeable cell wall
7 cellulose ;
8 fibres ;
9 ref. to, spaces / gaps / holes / pores, (between, fibres / other cell wall components) ; [max 4]

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(e) **1** allows transport of, water / sucrose / amino acids / organic substances / ions /minerals / salts / lipids / hormones / ATP, (from cell to cell / between cells) ;
R if linked to an incorrect transport mechanism e.g. sucrose moves by osmosis
2 without crossing, membranes / walls ; **A** without going through protein channels
3 this is movement through the symplast ;
4 any e.g. ; companion cell to (phloem) sieve tube (element / cell)
between mesophyll cells
mesophyll cell to companion cell
cortical cell to cortical cell / across cells of the cortex
cortical cell to endodermal cell
endodermal cell to, pericycle cell / xylem / phloem
ignore between sieve tube elements
5 allows, communication / signalling, between cells ; [max 3]

[Total: 14]

3 **(a)** **(i)** *no mark if no units used at all*
L – 3.6 kPa ; *award the mark if units only used once*
M – 4.5 kPa ; **A** in range 4.45 to 4.55 [1]

(ii) *ignore any similarities*
1 to the right / lower (affinity) / qualified ; e.g. lower percentage saturation
2 at, higher / lower, partial pressures, small(er) difference in percentage saturation (than others) ; **A** ora
3 comparative data quote ; *must refer to **L** and **M***
allow ecf from (i) [3]

(b) **1** at partial pressures in the tissues ; *where oxygen is unloaded from Hb*
2 haemoglobin is less saturated (than **L**) ;
3 because, haemoglobin / Hb, dissociates more readily ;
A idea of unloading oxygen more readily *even if Hb not mentioned*
4 to compensate for, fewer / less effective, red blood cells / Hb ; [max 3]

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(c) **1** haemoglobin less well saturated (in lungs at high altitude) ;
2 data quote from Fig. 3.1 ; **A** 80–90% saturated at 'about 7.5 kPa'
3 produce more red blood cells / increase in number of RBCs ;
4 more haemoglobin ;
5 *idea* of compensates for, smaller volume of oxygen absorbed / lower saturation (of haemoglobin) ;

also accept the following adaptations
6 increase in haematocrit / AW / decrease in plasma volume ;
A increase in RBCs per unit volume
R decrease in blood volume
7 increase in, breathing rate / tidal volume / heart rate / stroke volume ;
8 increase in, capillary density / number of mitochondria / myoglobin / respiratory enzymes, in muscle ;
9 ref. to (increased) secretion of, erythropoietin / EPO ;
10 increase in (2,3), BPG / DPG, in red blood cells ; **A** rightward shift in curve [max 4]

(d) **1** not caused by (named type of) pathogen / non-infectious / non-transmissible / non-communicable / AW ;
2 genetic / inherited / AW, disease ; **A** caused by a mutation / AW
A 'passed down from parent(s)'
R idea of congenital diseases
R 'you get it from your mother'
3 ref. to, no immune response / no antigen(s) ;
4 affects all red blood cells so vaccine would lead to their destruction ; [max 2]

[Total: 13]

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4 **(a)** *this can be answered in the context of penicillinase*

1 complementary shape ;
2 substrate, fits into / enters / binds to / with, active site ;
A enzyme-substrate complex / ESC
3 ref. to specificity ;
4 lock and key / induced fit ; **A** description of induced fit
5 ref. to temporary bonds form with, active site / R groups (of amino acid residues) ;

[max 3]

(b) *shown to max 2*

secondary structure ;
α / alpha, helix ; **R** 'helix' / helical structure unqualified by alpha
β pleated sheet ;
tertiary structure / folding ; **ignore** 3D shape or structure
globular ;

not shown to max 2

amino acids / primary structure / sequence of amino acids ;
(types of) R groups ;
bonds / named bonds ; **A** peptide
quaternary structure ;
prosthetic group ; [max 3]

(c) **(i)** one lower peak inside line than uncatalysed ;
start and finish at, dotted lines / same energy levels as uncatalysed ; [2]

(ii) activation (energy) / (energy of) activation ; [1]

(d) **1** do not prescribe for viral diseases ;
2 only use when necessary / do not overprescribe ;
3 only available on prescription / not available 'over the counter' ;
4 people must, complete the course / take as instructed ;
R take a long course
5 test to find out which is most appropriate antibiotic to use ;
A use most, appropriate / effective, antibiotics
A use narrow-spectrum antibiotics
6 details of sensitivity test ;
7 rotate / AW, antibiotics / use in combination ; **R** use many antibiotics
8 do not use same antibiotics for humans and animals ; [max 2]

[Total: 11]

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5 **(a)** *ignore **Y***
X = mitosis ;
Y = meiosis / mitosis [1]

(b) **1** chromosome number is halved / 2n → n / diploid → haploid ;
A 2 sets of chromosomes → 1 set of chromosomes

explanation to max 1
2 restore diploid number on fusion ; **R** restore full set if not qualified
3 avoids number doubling with each generation ;
4 allows expression of (recessive) alleles / AW ;
5 allows variation / new combinations of chromosomes ; [2]

(c) *if only use formulae, these must be correct – otherwise ignore*

1 nitrification / nitrifying / oxidation ;
2 ammonium ions to nitrite ions ;
3 nitrite ions to nitrate ions ; **A** one mark for ammonium to nitrate
4 *one named microorganism in correct context*
Nitrosomonas / Nitrobacter ; **R** *Rhizobium*
5 ammonium / nitrate / AW, absorbed by plants / leached / AW ;
R used by plant [max 3]

(d) **1** ammonium ions are (positively) charged ; **A** hydrophilic / polar / water-soluble
2 cannot pass through, phospholipid bilayer / membrane ;

either
3 active transport ;
4 moved against concentration gradient ;
or
3 facilitated diffusion ;
4 moves down its concentration gradient ; [max 2]

[Total: 8]

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6 (a) (i) *hydrogen bonds drawn onto Fig. 6.1*

lines must go between O-H, N-H as follows

two lines between A and T H — O and N — H ;
three lines between C and G H — O and N — H and O — H ; [2]

(ii) **1** hydrogen bonds hold (two), polynucleotides / strands / chains, together ;
A hold, (complementary) nucleotides / base pairs, together
A ora e.g. prevents, unwinding / strand separation
2 (many hydrogen bonds) give stability / DNA is stable molecule / DNA is long lasting / AW ; *ignore ref. to strength*
3 can be broken for, transcription / replication ;
4 ref. to (double) helix ; [2]

(b) **1** (named) base / nucleotide, pairing ;
2 purine – pyrimidine ;
3 percentage of A = percentage of T ; **A** very similar
4 percentage of C = percentage of G ; **A** very similar
5 data quote in support ; [max 3]

(c) (i) *idea that*

percentages of, A and T / C and G, are not the same / three percentages are similar; [1]

(ii) single-stranded <u>DNA</u> / not double-stranded / not a double helix ;
A may be other bases ; [1]

[Total: 9]

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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 poles in prophase **;**
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 chromosomes, line up / aligned / AW, at, equator / metaphase plate **;**

6 ref. separation of, sister / identical, chromatids, at anaphase (to poles) **;**
A sister chromatids move to opposite poles at anaphase
A daughter 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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1 **(a)** capillary **;**

plus one of
ref. to size relative to size of red blood cell (in lumen) **;** **A** small diameter / narrow lumen *if capillary correctly identified*
(wall is) one cell thick **;** **A** ref. to, only one layer / only endothelium / thin endothelium
[max 2]

(b) **(i)** red blood cell / erythrocyte **;** **A** red blood corpuscle [1]

(ii) water **;** **A** plasma [1]

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

(c) *if working shown, award one mark only if measurement is incorrect*
7 (μm) **;;**

one mark if correct working is shown but answer not to whole number or incorrect conversion used
39 mm / 6000 **A** ± 1 mm in measurement [2]

[Total: 7]

2 **(a)** potometer **;** **A** transpirometer **R** photometer **R** spirometer [1]

(b) *idea that*
water taken up may not all be lost in transpiration / transpiration is water loss (as water vapour) from (aerial parts / leaves, of) the plant **;**

example of use of water taken up **;;** e.g.
photosynthesis
hydrolysis reactions
maintaining turgidity / AW
cell, elongation / increase in size

ref. to water uptake rate and transpiration rate differing because of (changing) environmental conditions **;** **A** examples e.g. higher transpiration rate than uptake rate in hot and dry external conditions [max 2]

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(c) (i) *if no mp 1 and 2, accept increased rate of transpiration for one mark*

1 increased rate of evaporation **;** **A** description of evaporation
R evaporation, from leaf / from stomata / through stomata
2 increased rate of diffusion **;** *in context of water vapour out through stomata*
3 (rise in temperature), lowers (relative) humidity / decreases water potential of air (outside leaf) **;**
4, 5 AVP **;;** e.g. increased kinetic energy
steeper water potential gradient established *in correct context*
details of cohesion-tension theory linked to increased, transpiration / water uptake, rate
increased rate of photosynthesis
replacing water lost from cells in leaf [max 3]

(ii) humidity **;**
wind (speed) **;** **A** air movements
light intensity **;**
(air) pressure **;** [max 2]

(d) 1 stomata (must be) open for, gas exchange / uptake of carbon dioxide **;** **A** release of oxygen
2 carbon dioxide for photosynthesis **;** **A** oxygen from photosynthesis (when rate exceeds rate of respiration)
3 (most) water vapour, diffuses / AW, out, via / AW, (open) stomata **;**
A most transpiration occurs when stomata are open
R if incorrect transport mechanism used e.g. osmosis [3]

[Total: 11]

3 (a) (i) quarternary (structure) **;** [1]

(ii) alpha / α, helix **;** [1]

(b) (i) facilitated diffusion **;** [1]

(ii) osmosis **;**
increasing, ion / solute, concentration in lumen (of intestine) lowers water potential **;** ora water follows, from a high(er) to a low(er) water potential / down a water potential gradient**;** [3]

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(c) (i) *must have ref. to organism at least once to gain max*
bacteria / pathogen / *V. cholerae,* in faeces (of infected person) / in sewage containing faeces (from infected people) **;** AW
bacteria / pathogen / *V. cholerae,* ingested / taken in orally (by uninfected person), in (contaminated) food / water **;**
A faecal – oral route *for one mark if previous two mps not given* [2]

(ii) general ref. to problems associated with increased numbers of people and lack of infrastructure **;**
examples **;;**
e.g. problem providing, safe / uncontaminated, drinking water **;**
faeces / sewage, mixing with drinking water **; A** no / poor, sanitation
unable to practise good hygiene **; A** example e.g. hands not washed after defaecation
infected people sharing latrines with uninfected / AW **;**
lack of, medical care / treatment, leading to larger pool of infected people (at any one time)
lack of, health services / drugs / antibiotics / ORT / skilled personnel
unable to supply sufficient vaccines
lack of food / poor diet, so vaccines less effective

credit relevant examples linked to a particular type of disaster [max 2]

[Total: 10]

4 (a) 1 important in contributing to 3-D structure of molecule / AW **;**
2 many hydrogen bonds so, gives stability / strands not easily separated / long lasting **;** AW
3 (individual) hydrogen bonds (more) easily broken (than covalent bonds) **; A** hydrogen bonds weak / hydrogen bonds can be broken

consequence
4 (so strands can be separated) for (DNA) replication **; A** description
5 (so strands can be separated) for (DNA) transcription **; A** description

6 hydrogen bonds only form between, specific bases / named base pairs, so, few mistakes / faithful replication / AW **;**
7 *idea that* hydrogen bonds can easily re-form (without chemical reaction) **;** [max 4]

(b) **P** = transcription
Q = translation **;** [1]

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(c) (i) sequence will not (spontaneously) change / AW **;** **A** decreases chance of mutation
(so) gene products / proteins, produced will always be functional **;**
maintains all, genetic information / AW, throughout life of cell **;**
same, genetic information / AW, passed on to, daughter cells / offspring **;**
AVP **;** e.g. maintains size so still enclosed within nucleus [max 2]

(ii) translation / protein synthesis, will stop when mRNA breaks down **;**
allows re-use of nucleotides (for other mRNA) ;
ref. to control of gene expression **;** **A** prevents too much product forming
ref. to control of cell activity / fast response to changing rquirements **;**
ref. to efficiency in energy use **;** [max 2]

[Total: 9]

5 (a) 1 ref. vaccines contain antigens **;**
2 antigens are (mostly), proteins / glycoproteins **;**
3 antigens, denatured by heat / not denatured by radioactivity **;** **A** proteins denatured *in context of antigenic proteins*
R parasite is denatured
4 detail e.g. loss of tertiary structure / bonds break **;**
5 shape to be maintained for specificity of immune response / AW **;**
6 AVP **;** e.g. ref. to production of memory cells (for immunity) [max 3]

(b) 1 first form of, pathogen / parasite, free / exposed, in plasma **;**
A not inside cells
2 second form of, pathogen / parasite, concealed / hidden, in liver / red blood cells **;**

for either mp 2 or 3
3 ref. to degree of exposure to antibodies / lymphocytes

idea that
4 fewest number of parasites to destroy **/** earlier defence always more effective **;**

5 vaccination against form leaving liver would, not protect against liver invasion / still cause liver damage **;**
6 AVP **;** e.g. suggestion that first form of parasite is easier to harvest [max 3]

(c) 1 primary (immune) response / artificial active response **;**
2 antigen presentation / described **;**
3 clonal selection / described **;** e.g. **A** specificity to malarial antigen
4 clonal proliferation / B-lymphocyte division by mitosis / AW **;** **A** B cell
5 detail of changes occurring from B-lymphocyte to plasma cell **;**
6 B-lymphocytes / B cells / plasma cells, produce antibody **;**
7 correct ref to role of T_h cells in context **;** [max 5]

[Total: 11]

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6 (a) (i) *max 3 if no reference to examples in passage*

habitat
location / place / area *or* (type of) local / AW, environment **;**
characterised by, its physical features / the freshwater environment / its dominant producers**;**
where, an organism / a population, lives **;**

commmunity
all populations of all species / AW **;**
within a specified area / AW, at a particular time **;** [max 4]

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

(iii) *accept plants for phytoplankton*

1 photosynthetic / carry out, photosynthesis / carbon fixation **;** **A** autotrophic
2 conversion of light energy to chemical energy **;**
3 equation **;**
4 have light-absorbing pigments **;** **A** chlorophyll
5 ref. to independence *or* dependence of other organisms **;** *in context of energy*
6 ref. to input of energy to ecosystem **;**
7 base of the food chain(s) / first trophic level / AW **;** **A** consumed by, herbivores / primary consumers [max 3]

(b) (i) *energy losses*
in, egestion / faeces / undigested material **;**
in excretion **;** **A** urine / urea
heat from respiration **;**

energy other uses
ref. maintenance **;;** e.g active transport / metabolic reactions / digestion
for, muscle contraction / movement **;** [max 3]

(ii) *any one valid suggestion e.g.*
more confined space so less movement **;**
move more so greater energy loss (through respiration / as heat) **;**
more predators so use more energy escaping from them **;** [max 1]

[Total: 12]

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