Cambridge International AS & A Level

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BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **October/November 2016**

MARK SCHEME

Maximum Mark: 60

Published

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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)
<u>underline</u>	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
AVP	alternative valid point (examples given)

1 **(a)** *one mark per column* [4]

feature	amylopectin	cellulose	RNA	polypeptide
synthesised from amino acid monomers				✓
contains glycosidic bonds	✓	✓		
polymer is branched	✓			
contains nitrogen			✓	✓
can be found in both animal and plant cells	;	;	✓ ;	✓ ;

(b) *points can be awarded as annotations to the diagram*

max 2 for structure – ***mp1*** *to* ***mp3***

1 *ref. to* hydrophilic / polar, phosphate, head / group
<u>and</u>
hydrophobic / non polar, hydrocarbon / fatty acid, tails / chains **;**
R *if labelled correctly but incorrectly described in the text*
2 *ref. to* forms part of a bilayer **;**
3 (fatty acid) tails / chains, may be saturated or unsaturated **;**

max 2 for function – ***mp4*** *to* ***mp7***

head
4 forms hydrogen bonds with water / interacts with water / AW **;**
5 stabilises the membrane **;**

tails
6 *idea that* unsaturated fatty acids contribute to fluidity (of membrane) **;**
7 barrier to, hydrophilic substances / water soluble substances / polar substances / ions / AW **; ora**
A movement of, non-polar / AW, substances [3]

(c) *max two components, one mark each*
one mark for function to match the stated component

I carbohydrate chains *for component but allow ecf 'cell recognition' for function*

glycoprotein **;**
one of
antigen / markers / tags / described in terms 'self' **;**
receptor (for signalling molecule) / AW **;**
cell recognition **;**
cell adhesion **;**
interacts / AW, with water to stabilise the membrane **;**

cholesterol **;**
one of
stabilises membrane **;**
regulates / maintains / AW, fluidity of membrane **;**
A in <u>low temperatures</u> increases fluidity / in <u>high temperatures</u> decreases fluidity
prevents passage of ions / polar molecules, through membrane **;**

glycolipid **;**
antigen / markers / tags / described in terms 'self' **;**
cell adhesion **;**
interacts / AW, with water to stabilise the membrane **;**

protein **; I** *any qualification of component* e.g. *channel / carrier / transport*

receptor (for signalling molecule) / AW **;**
enzyme / co-enzyme **;**
anchoring cytoskeleton ;
for cell to cell adhesion / any named type *e.g. desmosome, tight junction* **;**

channel / carrier, allows facilitated diffusion / description **;**
A for, protein **/** carrier protein **/** channel protein / transport protein

carrier, for active transport / description **;**
A for protein **/** carrier protein **/** transport protein [4]

[Total: 11]

2 (a) *two from*
1 provide an alternative pathway **;**
2 brings reactants close together (in active site / to form ESC) **;**
3 put a strain on the reactant(s) **;**
4 so bonds, break / form, more easily **;**
5 transfer of, charges / groups **;**
6 AVP **;** e.g. involvement of R groups [2]

(b) (i) *quoting figures with no qualitative description =* ***mp4*** *only*

four from

1 as time increases the concentration of PABA increases **;**
2 increasing the concentration of inhibitor, decreases concentration of PABA / slows the reaction **;**
3 from 0 to 2 / 2.5 / 3 minutes, no difference in concentration of PABA produced / same rate, for all concentrations of inhibitor **;**
4 use of data **;** *from plotted points or from curves*
e.g. concentrations of PABA at different times for any one inhibitor
e.g. concentrations of PABA at same time for two different inhibitor concentrations
e.g. concentration of PABA = 2 – 3.5 μM at a specific time
5 AVP **;**
e.g. for all concentrations of inhibitor, rate becomes less steep after approximately 5 minutes
e.g. for last 20 minutes rate of reaction is linear (for all or any one concentrations of inhibitor)
e.g. little difference, in rate / final [PABA], between 0 and 1 μM
e.g. greater difference, in rate / final [PABA], between 1 μM and 3 μM [4]

(ii) *three from*

1 carry out / AW, with different concentrations of substrate **;**
A use a low concentration and a high concentration of substrate *if a number of different concentrations of substrate without any reference to high and low this must be a minimum of 5*
2 with and without inhibitor **;**
3 all other variables constant **;**
A one key variable, e.g. enzyme concentration / temperature / pH
4 interpretation of results **;**
e.g. draw a graph to see change to, K_m / V_{max}
e.g. *idea that* if the effect of the inhibitor decreases with an increase in substrate concentration then inhibitor is competitive **ora**
e.g. competitive: increase in K_m / no change in V_{max}
e.g. non-competitive: no change in K_m / decrease in V_{max} [3]

(iii) *one from*

bacteria, cannot make / make less, folic acid, so they die / cannot grow / cannot reproduce / cannot multiply **;**
inhibitor targets only bacterial cells **;**
inhibitor will not harm human cells **;** [1]

(iv) *allow drugs for antibiotics throughout*

two from

1 *idea that* there are few targets for drugs **;**
A e.g. virus has no, cell wall / cell membrane / ribosomes
2 no / few, enzymes **;**
3 antibiotics only work on, growing / living, cells **;**
A viruses have no, metabolism / growth
4 viruses are inside (host) cells / not within reach of antibiotics **;**
R if antibodies
5 antibiotics do not work on, protein coat / capsid / viral envelope **;**
I capsule [2]

(c) *two from*
do not use for viral infections **;**
do not use as preventative medicine **;**
antibiotics should only be used (for treatment) when necessary **;**

carry out antibiotic sensitivity test **;**
ensure, correct / effective, antibiotic, prescribed / used ; AW
ensure people take the correct dose **;**
ensure people complete the course of their antibiotic **; A** ensure people follow the instructions
ensure people do not use, left-over / other people's, antibiotics **;**
only supply on prescription / not over the counter / AW **;**

only use, wide / broad, spectrum antibiotic when pathogen not known **; A ora** use narrow spectrum antibiotic when pathogen is known
use more than one antibiotic (at the same time) **; A** mixture of antibiotics / antibiotics in combination
monitor antibiotics to check that they are effective **;**
report cases of antibiotic resistance **;**
reporting patterns of antibiotic resistance (temporal and geographical) **;**

rotate antibiotics so not used all the time **;**
keep some antibiotics to use as a last resort **;**
do not use the same antibiotics for animals as for humans **;**
reduce use of antibiotics in, food production / (livestock) agriculture **;**

use other antimicrobial drugs **;**
develop new, types of antibiotics / drugs, to kill bacteria **;**
ensure / improve, knowledge of, healthcare professionals / public **; A** *ref. to* education about awareness of antibiotic resistance
ref. to breaking transmission cycle / described example of a method **;** e.g. vaccines / good hygiene in hospitals
break transmission cycle of resistant bacteria / described example **;** e.g. quarantine [2]

[Total: 14]

3 (a) **A** = cortex / parenchyma **; A** cortical **R** cortical / parenchyma, cells

B = <u>endodermis</u> **; A** endodermal **R** endodermal cells / pericycle

C = xylem **; I** vessels / tracheids

D = phloem **; I** sieve tube (elements) [4]

(b) *allow ecf from incorrect naming of* ***A*** *and* ***B*** *in (a)*

four from
from ***X*** *to endodermal cell (****B****) or* ***X*** *to* ***Y*** *to 3 max*
1 (movement of water) via cell membrane / via tonoplast / by osmosis **;**
2 (movement of water) through plasmodesmata **;** *do not award* ***mp1****for 'by osmosis through plasmodesmata'*
3 symplast pathway **;** *in correct context only*

from after ***B*** *to* ***Y*** *to 3 max*
4 water moves by apoplast pathway **;** *in correct context only*
5 water moves through cell walls **;**
6 via pits in cell walls of, xylem (vessel) / **Y ;**
7 down a water potential gradient / described as higher water potential at **X ;** [4]

[Total: 8]

4 (a) hydrogen (bond) **;** [1]

(b) *three from*
1 tRNA carries an amino acid to ribosomes **;**
2 (each type of) tRNA carries a specific amino acid **;**
3 anticodon (on tRNA) binds to <u>codon on mRNA</u> **;** *anticodon may be labelled on Fig. 4.1*
4 tRNA molecules hold amino acids, in place / in P and A sites (of ribosome), for peptide bond formation **;**
5 tRNA molecules, reused / described **; I** tRNA leaves ribosome unqualified
6 AVP **;** e.g. amino acid is attached to ACC region **I** examples of complementary base pairing between codon and anticodon [max 3]

(c) *max 2 if in context of making mRNA*

1 gene for each tRNA (molecule) is transcribed **;**
2 hydrogen bonds in DNA are broken **;**
I unwinding / unzipping
3 one strand of DNA is the template **;**
4 RNA polymerase **;**
5 (free RNA) nucleotides joined together / formation of phosphodiester bonds **;**
I complementary base pairing
6 AVP **;** e.g. correct ref. to helicase in breaking hydrogen bonds [max 3]

[Total: 7]

5 **(a)** **(i)** 98.5 / 98 / 98.48 (%) **;** **R** 98.4 [1]

(ii) (in solution / dissolved) in the plasma / cytoplasm of red blood cells **;** [1]

(iii) *two from*
carbon monoxide, combines with haemoglobin / forms carboxyhaemoglobin **;**
irreversible / permanent / stable compound / AW **;**
reduces haemoglobin available to transport oxygen **;**

alveolar walls / elastin, broken down (in emphysema/COPD) **;**
less surface area for, absorption of oxygen / gas exchange **;** [2]

(b) *accept steps of reaction if in reverse – as in the lungs*

1 catalyses / AW, the reaction (in red blood cells), between carbon dioxide and water / to form carbonic acid **; A** correct equation
2 (carbonic acid dissociates to form) hydrogencarbonate ions / bicarbonate ions / HCO_3^- **;**
3 very fast reaction **;**
4 maintains (steep) concentration gradient for diffusion of carbon dioxide from tissues to blood **;**
5 catalyses reverse reaction in the lungs **;**
6 hydrogencarbonate ions / bicarbonate ions / HCO_3^- , diffuse / AW, into the plasma **;** [3]

(c) **1** Bohr, effect / shift **;**

AND

to max 2 (‘more’ only needs to be used once)
2 carbon dioxide decreases affinity of haemoglobin for oxygen **;**
3 more oxyhaemoglobin dissociates (than at a lower concentration of carbon dioxide) **;**
A oxyhaemoglobin dissociates more readily
A haemoglobin, releases / AW, more oxygen
4 more oxygen for (rapidly) respiring, tissues / cells **;**
5 to meet the demand for increase in (aerobic) respiration **;**
A to provide, enough / sufficient, oxygen for respiration
ora e.g. delays onset of / prevents, anaerobic respiration [3]

[Total: 10]

6 **(a)** *Morbillivirus* **;** **A** *Morbilivirus / Morbili virus / morbillivirus* [1]

(b) *three from*

1 number of cases fluctuates (between 2008 to 2012 / in all years) **;**
2 number of cases (much) higher in 2010 **;**
3 epidemic lasted longer in 2010 **;**
4 highest peak is 42 000 – 43 000 in 2010 **;** **R** 45 000 **A** 30 000 – 35 000 <u>in Africa</u>
5 numbers are higher at beginning of each year (than at end) **;**
6 five, outbreaks / peaks / epidemics / AW **;** **A** four as no data before Jan 2008
7 numbers of cases in rest of world are greater than in Africa in every year except 2010 **;** **ora** numbers of cases in Africa were less than in the rest of the world in every year except 2010 [3]

(c) **I** *the term primary immune response*
I *any ref. to, T cytotoxic / T killer cells*

four from

1 antigen presentation **;**
2 clonal selection / described **;**
3 clonal expansion / described **;**
4 B-lymphocytes / B cells, develop / AW, into plasma cells **;**
5 plasma cells, secrete / produce / AW, antibody **;**
6 any correct ref. to T helper cells **;** [4]

(d) **I** virus mutates / different strains *(as one vaccine is effective)*

two from

1 measles introduced by people who caught the disease when abroad **;**
A any e.g. tourists / visitors / travellers / returning tourists / migrants / displaced people
2 *idea that* herd immunity, needs to be >90% / is not 100% **;**
A herd immunity not achieved
3 some people in these countries have not been vaccinated **;**
A too young to receive vaccine / refusal of vaccination / live in remote places / war zones / AW **;**
4 some people do not respond to the vaccine **;** **A** people have weak immune system / malnutrition
5 some people do not receive booster(s) **;**
6 (reconstituted) vaccine is not thermostable / difficult to maintain the cold chain **;** [2]

[Total: 10]