Cambridge International AS & A Level

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BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 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)
underline	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

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1 (a) (i) letter **X** written in space above cilia **;** **A** label line into this space [1]

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

(iii) cilia **;**
columnar / tall / not flat / not thin **;**
nuclei rounded / AW **;**
presence of goblet cells **;** [max 1]

(b) (i) mitosis **;** [1]

(ii) *presence of any 3 of:*
1 shorter / no / fewer / damaged, cilia **;** **A** paralysed
2 undifferentiated / AW, cells **;**
3 flattened / squamous, cells / epithelium **;**
4 scar tissue **;** **A** scar tissue forms
5 enlarged goblet cells **;**
6 excess / accumulated / AW, mucus **;** **A** excess mucus secreted
7 tar deposits **;** **A** description of tar on lining
8 phagocytes **;**
9 AVP **;** e.g. inflammation (of bronchial lining)

[max 3]

[Total: 7]

2 (a) (i) 3.4 μM min^{-1} **;** **A** 3.4 μM / min [1]

(ii) 0.15 mM **;;** **A** ecf from **(a) (i)**
allow 1 mark if no units given

if answer incorrect allow one mark for evidence of ½ V_{max}
3.4 / 2 = 1.7 [2]

(b) *max 3 if no attempt at description (D) with explanation (E)*

at lower substrate concentrations
1 *(D)* rate of reaction proportional to substrate concentration **;** AW
2 *(D)* up to 0.25 mM **;** **A** range 0.25–0.30 mM
3 *(E)* not all active sites occupied **;**
A few, enzyme-substrate complexes / ES complexes / ESC
A more active site occupied as substrate concentration increases
4 *(E)* substrate concentration is limiting **;**

at higher substrate concentrations
5 *(D)* less steep increase in rate (from 0.25 mM) **;**
6 *(D)* further increase in substrate concentration gives, no further increase / plateau / levelling out, in rate **;** **A** rate remains at 3.4 μM min^{-1}
7 *(D)* greater than / at, 0.45 mM **;** **A** 0.46 / 0.47, mM
8 *(E)* enzyme concentration is limiting **;** **A** idea that some other factor is limiting
9 *(E)* all active sites occupied / AW **;**
10 *(E)* **A** *for mp3 / mp6* description in terms of enzyme-substrate collisions in context **;** [max 4]

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(c) (i) folding / coiling, (of polypeptide chain) **;**
tertiary structure **;**
(held in position by) *ref. to* R group interactions **;**
A two or more bond types in context
brings distant, amino acids / parts of the chain, close **;** AW [max 3]

(ii) water **;** **A** H_2O [1]

[Total: 11]

3 (a) *non-self*
foreign / AW **;** **A** not from the person's own body
triggers / AW, an immune response / production of antibodies **;**
A other events in immune response described

antigen
protein / glycoprotein **;** **A** polysaccharide
ref.to, binding of specific antibody / formation of antigen-antibody complex **;** [max 3]

3 (b) (i) **P** antigen-binding site / site for antigen attachment **;** **A** variable region

Q hinge region **;**

R constant region / site of attachment to receptors on phagocytes / AW **;** [3]

(ii) disulfide (bonds) **;** **R** *if more than one type of bond stated* [1]

(c) (i)
1 TNF-α / antigen, introduced into, mice / small mammals / named **;**
2 (antibody-producing), B-cells / B-lymphocytes / plasma cells / splenocytes, isolated (from spleen) **;** **A** produced
3 fused with myeloma cells **;**
4 using fusogen / PEG **;**
5 hybridoma cells formed **;**
6 *ref. to* screening / testing, for hybridoma producing desired antibody **;**
7 *ref. to* scaling up / large-scale production **;**
8 AVP **;** e.g. HAT medium for, hybridoma growth / inhibiting myeloma growth [max 3]

(ii) antibodies bind to TNF-α **;**
inactivate / destroy TNF-α **;**
inflammation cannot be triggered / AW **;** in context of destroying TNF- α [max 2]

[Total: 12]

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4 **(a)** label line to wall or lumen of any phloem sieve tube **;** [1]

(b) transport of assimilates **;** **A** named assimilate e.g. sucrose / amino acids / auxins
from source to sink **;** **A** from leaves to named sink e.g. roots / fruits
translocation / mass flow **;** [max 2]

(c) lignin for, waterproofing **;**
lignin, for support / to prevent (inward) collapse / AW (of vessel or plant) **;**
R prevent bursting **I** withstand (high) pressure
cellulose for, adhesion of water / formation of hydrogen bonds with water **;**
A hydrophilic parts of lignin
pits for lateral movement of water **;**
AVP e.g. rings / spirals, for, extension / growth **;** [max 3]

(d) **(i)** *surface area* $(0.1 \times 0.1 \times 6 =) 0.06$ (m^2) **;**
volume $(0.1 \times 0.1 \times 0.1 =) 0.001$ (m^3) **;** **A** 1×10^{-3}
surface area to volume ratio
(0.06 / 0.001 =) 60 **;** **A** ecf using values given for surface area or volume [3]

(ii) *idea that*
diffusion (via, body surface / to cells), cannot satisfy needs / too slow **;**
or
transport system delivers materials to cells more quickly **;**
A efficient supply of, nutrients / oxygen, to all cells

long(er) distances (to reach some, cells / tissues) **;**
takes, materials / AW, close to cells **;** [max 2]

[Total: 11]

5 **(a)** *0 marks if another mode of transmission given (e.g. faecal-oral / contact / sexual)*
I in unpasteurised milk / contaminated meat (*M. bovis*)

1 aerosol / droplet, infection **;**
only need to have one of 'infected' / 'uninfected' to gain mp2 and mp3
2 infected / AW, person, coughs / breathes / spits / talks / sneezes **;**
3 uninfected / AW, person, inhales / inspires / breathes in, droplets **;**

allow one mark if mp2 and mp3 given with no reference to, infected / uninfected
4 organism / pathogen / bacteria / *M. tuberculosis*, in, airborne droplets / droplets in air **;** **A** without 'airborne ' or 'in air' if mp2 gained [max 2]

(b) **1** incomplete treatment / dose not finished **;**
2 not all bacteria killed / some bacteria survive **;** **R** TB for bacteria
3 mutation **;** **R** mutation to give immunity
4 further detail of mutation **;**
5 selection of resistant bacteria / resistant bacteria selected for **;**
6 resistant bacteria reproduce / vertical resistance **;**
7 death of, susceptible / non-resistant, bacteria **;**
8 AVP **;** e.g. horizontal resistance / described [max 4]

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(c) **(i)** making / synthesis of, (m)RNA **;**
from a DNA, template / sequence of bases / sequence of nucleotides **;**
A from a gene [2]

(ii) *idea that* pathogen and human RNA polymerase are (slightly) different **;** e.g. (slightly) different shaped active sites
A rifampicin unable to, cross cell surface membrane / enter nucleus / cross nuclear envelope [1]

(d) *points can be general or TB specific*
1 prescribing / take, antibiotics, only when (absolutely) necessary **;**
2 ensure, correct / effective, antibiotic(s) prescribed / used **;**
3 complete course / follow instructions for use, of antibiotics **; A** *ref. to* DOTS
4 patients to, use only antibiotics prescribed / not use leftover antibiotics at a later date / AW **;**
5 *ref. to* monitoring situation to check if antibiotic is effective **;**
6 use other antibacterials **;**
7 develop new, drugs / antibiotics **;**
8 ensure / improve, knowledge of, healthcare professionals / public **;** AW
9 reduce / control, antibiotics in, agriculture / animals used for food **;**
10 reporting patterns of antibiotic resistance / AW **;**
11 *ref. to* breaking transmission cycle / described example **;** e.g. vaccines good hygiene in hospitals
12 break transmission cycle of resistant bacteria **;** e.g. quarantine
13 AVP **;** e.g. WHO Global Plan Stop TB
14 *further detail of mp1 or mp2* **;** e.g. only prescribe wide-spectrum antibiotics when narrow spectrum not known [max 3]

(e) *idea that* antibiotics act at a cell structure not possessed by a virus **;**
e.g. viruses, do not have, a cell wall / a cell surface membrane / ribosomes

suggestion that viruses, are inside host cells / not within reach(of antibiotics) **;**
antibiotics act only on, living / growing, cells (viruses do not grow) **;**
A can prevent metabolic processes not occurring in viruses
antibiotics do not act on, protein coat / capsid / capsomeres / viral envelope **;** [max 2]

[Total: 14]

6 **(a)** (superior / inferior) vena cava **;** [1]

(b) left (ventricle) pumps blood to the body / right ventricle pumps blood to lungs **;**
A further distance
(left ventricle) requires higher pressure **;** ora
ref. to overcoming greater resistance / lungs less resistance **;**
pulmonary capillaries damaged by higher pressure **;**
higher pressure requires more muscular force / AW **;** ora [max 3]

(c) sinoatrial node **;** [1]

[Total: 5]

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