Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/21**

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

MARK SCHEME

Maximum Mark: 60

Published

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
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
AVP	alternative valid point

1 (a)

A nuclear envelope **;** **A** nucleus **A** nuclear membrane
I nuclear pore

B mitochondrion **;** **A** mitochondria **A** mitochondrial envelope

C lysosome / Golgi vesicle / secretory vesicle **;** **A** vesicle / vacuole **A** plural
I qualification e.g. transport / temporary / phagocytic [3]

(b) ribosome(s) / cell surface membrane **;** **A** vesicles **A** plasma membrane **I** cytoplasm [1]

(c) *two from*
organise microtubules **;**
(to), form spindle / assemble spindle fibres (in prophase) **;** AW
ref. to centriole pair / centrioles, at (both) poles **;** **R** if description is linked to incorrect mitotic stage
ref. to role in contraction of spindle fibres, at anaphase / to separate sister chromatids **;**
AVP **;** e.g. make microtubules (as part of the centrosome) [2]

(d) *three from*
(sodium ions are) charged / hydrophilic **;** **I** *ref. to* size / polar
cannot pass through hydrophobic, core / interior, (of phospholipid bilayer) **;**

(so) must pass through, transport proteins / carrier proteins / channel proteins *(facilitated diffusion)* **;**

ref. to hydrophilic (amino acids lining) channels **;**
ref. to active transport only way to move sodium ions against concentration gradient / AW **;** [3]

[Total: 9]

2 (a) (i) loss of water vapour from the, leaves / aerial parts of a plant **;**
R water evaporates from the surface of the leaf [1]

(ii) *each factor 1 mark, explanation for each factor 1 mark*
look for ora for explanation

temperature **;** **I** high / low or hot / cold

increased temperature, increased rate as higher rate of, evaporation (from spongy cell surfaces) / diffusion (of water vapour out via stomata)
or
at very high temperature stomata close so transpiration, stops / slows **;**

humidity **;** **I** high / low

one from
increased humidity, decreased rate as, less steep water potential gradient / decreased diffusion rate (of water vapour out via stomata) **;**

wind (speed) / air movement **;** **I** fast / slow

higher wind speed steeper, water potential gradient / higher diffusion rate
(of water vapour out via stomata) / diffusion shells do not build up /
wind moves moist air away / AW
or
at high wind speed the stomata close so transpiration slows **;**

water availability **;** **I** high / low
reduced water availability causes stomata to close (so reduced rate of
diffusion)
or
more water available, steeper water potential gradient between roots and leaves **;**

light intensity **;** **I** high / low

higher light intensity, increased rate as stomata open more widely
A more light (as ecf from stating factor)
or
at very high light intensity the stomata close so transpiration slows **;** **A** stops [4]

(b) *three from*
cohesion and adhesion **;** *in correct context*
transpiration stream / transpiration pull **;** **A** continuous column of water moving up (to leaves)
attraction / cohesion, between water molecules **;** **A** water is cohesive
A stickiness between water molecules
adhesion / AW, of water molecules to lining of xylem (vessels) **;**
only needs 'molecules' once
adhesion to / AW, cellulose molecules / hydrophilic parts of lignin **;** [3]

[Total: 8]

3 **(a)** **(i)** peptide and disulfide **;** **R** sulfide [1]

(ii) sequence / arrangement / order, of amino acids **;** **I** *ref. to* disulfide bonds [1]

(b) **(i)** breaking a (covalent) bond with addition of water **;** [1]

(ii) peptidoglycan / murein **;** **A** carbohydrate / polysaccharide / amino sugar [1]

(iii) *four from*
substrate shape not (exactly) complementary to active site shape / AW **;**

active site (partially) flexible / changes shape slightly, when substrate,
enters / binds **;**
(so) active site and substrate, now complementary / better fit **;**

(allows) formation of enzyme-substrate complex **;** **A** ES complex / ESC

AVP **;** e.g. role of R-groups in active site interacting with substrate
lowers, activation energy / E_A, so products form [4]

(c) outside cells **;** *can be in a general context or in context of enzymes* [1]

(d) (i) 2.9 mmol **; A** 2.75–3.0 mmol [1]

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

(e) single graph line with lower gradient **;**
reaches or approaches plateau **;** [2]

[Total: 13]

4 (a) (i) *Vibrio cholerae* **;** [1]

(ii) **R** if other modes of transmission listed

ref. to 'infected' and 'uninfected' not required (as in question) but statements must be in correct context

I polluted water

one mark for infected person
passed in, faeces / stools / sewage **; R** waste, unqualified

one mark for uninfected person
ingests / eats, contaminated, food / crops
or
drinks / ingests, contaminated, water / liquids **;**
A uses utensils washed in contaminated water / AW

if above 2 mps not gained, one mark for
idea of (infected person) sharing drinking bottles / utensils (with uninfected person)

two marks for
faecal-oral, route / transmission **;;** [2]

(iii) **A** poor sanitation *once only for mp 1 or 3*
two from
1 damage to, sewers / drains / foul water systems **;**
2 (so) mixing of sewage and drinking water **;**
3 (contaminated) water supplies cannot be treated **;**
A water (for drinking) from untreated (contaminated) sources
4 *ref. to* spread by flies exposed to, contaminated faeces / untreated sewage **;**

5 *idea of* people in high density temporary accommodation facilitating spread **;**
6 unable to practice good hygiene **; A** examples e.g. lack of soap
restrictions on (treated) water for cleaning
7 unable to thoroughly cook foods **;**
8 need to share (contaminated) water containers / cooking pots / AW **;**

9 disruption to health care facilities / AW **; A** example
e.g. lack of ORT (so higher proportion of infected people)

10 AVP **;** e.g. increased risk of malnutrition linked to increased risk of disease [2]

(b) (i) *two from*
different mRNA codon (formed during transcription) **;**
A triplet / triplet of bases / triplet code / 3-base code
R codons
idea that, each codon specifies a particular amino acid / a different codon specifies a different amino acid **; A**

(different) tRNA with different amino acid binds to, ribosome / mRNA **;** [2]

(ii) *two from*
change in, tertiary / quaternary, structure (of enzyme) **;**
A change in polypeptide, folding / coiling **;**

(enzyme) binding site for antibiotic, lost / changes shape **;**
R active site *unless clear that substrate binding and catalytic site remains unchanged*

antibiotic / nalidixic acid, cannot bind (so enzyme remains active) **;**
allow ecf for active site [2]

(c) *four from*
1 risk of, further spread / wider epidemic, (from people still infected) **;** AW
2 reduces chance of succesful treatment / higher death rates **;**
3 increased, treatment / hospitalisation times **; A** takes longer to treat
A more complex treatment
4 increased costs of treatment / strain on health budget / AW **;**

5 risk of, further resistance / resistance to all antibiotics **;**
6 fewer antibiotics left that are effective **;**
A risk that no antibiotics will be left to successfully treat

7 need to find, new antibiotics / alternative treatment **;**
A difficulty in finding new treatments / AW
8 (so) cost of research **;** *allow cost once*

9 AVP **;** e.g. strain on, resources / health personnel, to treat other diseases
need to identify type of resistance so that effective treatment is given
education, qualified [4]

[Total: 13]

5 (a) (i) antigen binding site / variable region / V_H and V_L **;** **A** F_V [1]

(ii) *four from*

1 *ref. to* monoclonal antibody, is recognised as, non-self / foreign **;**
or
diseased cell (now) recognised as non-self / foreign **;**

2 stimulates an immune response **;**

max three suggestions from

3 recognition and binding by / activation of / AW, T-lymphocytes / B-lymphocytes / AW **;** **A** clonal selection
A T- / B-, cell

4 *ref. to* specificity so healthy cells not destroyed **;**

5 clonal expansion / mitosis **;**

6 plasma cells (formed that) secrete antibody **;** **A** B-lymphocyte

7 consequence **;** e.g. antibody binds monoclonal antibody to lead to cell destruction

8 T-helper lymphocyte secretes cytokine, to activate macrophages / B-lymphocyte response / T-killer response **;** AW
e.g. stimulates humoral response

9 T-killer / T-cytotoxic, releases, perforin to, punch holes in (cell) membrane / cause death of cell **;** AW

10 detail of involvement of phagocytes / macrophages **;**
e.g. receptor recognition of (monoclonal) antibody
engulf the diseased cells with monoclonal antibody attached / AW
A diseased cell (with monoclonal antibody) destroyed by phagocytosis [4]

(b) *one of*
failure to distinguish self and non-self (antigens) **;** **A** foreign *for non-self*
immune response / antibodies produced, against self antigens **;**

in context of lack of good health **R** does no harm [1]

[Total: 6]

6 (a)

	cartilage	cilia	elastic fibres	
trachea	✓	✓	✓	;
bronchioles	✗	✓	✓	;
alveoli	✗	✗	✓	;

[3]

(b) *changes max 2*
fewer / no / damaged / AW, cilia **;** **A** paralysed / destroyed **R** killed
A ciliated (epithelial) cells destroyed
scar tissue, develops / replaces ciliated (epithelial) cells / AW **;**
goblet cells enlarged **;**

increased risk max 2
thicker layer / more, mucus traps bacteria **;**
mucus not removed (by cilia action) so, (trapped) bacteria remain / longer time for bacteria to infect cells / AW **;**
bacteria multiply / bacterial population growth, in mucus
(so increases chance of infection) **;** [3]

(c) *four from*
oxygen used up in (aerobic) respiration (in tissues) **;**
low(er) / decrease in, partial pressure of oxygen / AW **;**
allosteric mechanism / described **;**
small decrease in partial pressure leads to a large dissociation of oxygen **;**

ref. to decrease in haemoglobin affinity for oxygen (so oxygen released) **;** AW

high(er) CO_2, partial pressure / AW **;**
haemoglobinic acid formation / H^+ combines with haemoglobin (causes oxygen release) **;**
AVP **;** e.g. H^+ from carbonic acid dissociation
A H^+ results from action of carbonic anyhydrase to form carbonic acid
effects of carbaminohaemoglobin formation [4]

(d) too large to pass through, (endothelial) pores / capillary walls **;** [1]

[Total: 11]