

BIOLOGY

9700/21

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 |
| 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 |

| | | | |
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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/slow ;

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) ;

| | | | |
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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]

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(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]

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(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 successful 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]

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(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) CO₂, partial pressure/AW ;

haemoglobin 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]