Cambridge International AS & A Level

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BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 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.

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Mark scheme abbreviations:

;	separates marking points
/	alternatives answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or 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
ecf	error carried forward
I	ignore
mp	marking point (with relevant number)

1 *must have correct spellings of* Plasmodium *and* Vibrio cholera

feature	malaria	tuberculosis	cholera
name of pathogen	*Plasmodium* ;	*Mycobacterium tuberculosis*	*Vibrio cholerae* ;
type of organism	protoctist / protoctistan ; **A** protist / protozoan / sporozoan	bacterium	bacterium ; **A** bacteria
mode of transmission	by, a vector **or** (feeding or biting by) *Anopheles* / mosquito ;	via, (airborne) droplets / aerosol(s) (infection) ;	drinking water and food contaminated with human faeces

[6]

[Total: 6]

2 **(a)** **(i)** phagocytosis / endocytosis ; **R** pinocytosis **I** engulfing [1]

(ii) **E** transcription ;
F translation ; **A** post translation(al) modification [2]

(iii) **B** (phagocytic / endocytic) vacuole / phagosome ; **A** vesicle
R incorrectly qualified vacuole or vesicle (e.g. permanent / large / secretory / Golgi / excretory)
I food / pathogenic
G (80S) ribosome ; **A** rough endoplasmic reticulum **R** RER / rough ER
I 70S or any other type of incorrect S as a qualification
H Golgi (body / apparatus / complex) ;
J mitochondrion ; **A** mitochondria [4]

(b) **I** *fusion of lysosomes with phagosome and diffusion of products of digestion*

1 bacteria are, killed / destroyed / broken down / digested ; **A** hydrolysed
A cell wall broken down
R bacteria are cut up
2 (by hydrolytic) enzymes ;
3 any example, e.g. carbohydrase / lysozyme / protease / nuclease ;
4 killed by, hydrogen peroxide / H_2O_2 / free radicals / AW ;
5 AVP ; e.g. correctly named substrate for enzyme
murein / peptidoglycan, polysaccharide(s), polypeptides, nucleic acids, lipids
e.g. correctly named bonds broken
glycosidic, peptide, ester, phosphodiester [max 3]

(c) **1** *idea that* only, a few / some / small number / AW, with correct specificity **;**
2 (different) T-lymphocytes are specific to different antigens **;**
3 (T cell) receptor is, complementary (in shape to antigen) **;**
4 AVP **;**
e.g. this may be during a primary immune response so no memory cells
e.g. disease state (HIV / AIDS and leukaemia) or treatment where few T-lymphocytes in the body [max 2]

[Total: 12]

3 **(a)** **(i)** **N** ciliated **; A** pseudostratified **I** columnar / cuboidal **R** cilia [1]

(ii) **O** mucous glands **; A** mucus glands / serous glands [1]

(iii) **P** cartilage **;** [1]

(b) **I** more air can enter unqualified
1 more air / oxygen, reaches the, alveoli / gas exchange surface **;**
2 more gas exchange / greater absorption of oxygen / excretes more carbon dioxide **;** AW
A maximises oxygen obtained
3 satisfies increased demand for oxygen / AW **;**
4 trachea / bronchi / airways, widen / AW **;**
e.g. dilate / expand / enlarge **A** diameter of lumen increases
5 reduces resistance to air flow **; R** rate of air flow increases [max 2]

(c) *collagen has*
three polypeptides / a quaternary structure **;**
I more than one polypeptide unqualified
glycine is every third amino acid **; I** at regular intervals **R** roughly / approximately
(triple) helix / helical (shape) **; I** regular coils' **R** alpha helix [max 2]

[Total: 7]

4 **(a)** *transpiration is an inevitable consequence because*
1 stomata open **;**
2 for diffusion in of carbon dioxide / carbon dioxide required for photosynthesis **;**
3 water vapour, diffuses out / moves out down the water potential gradient **;**
A description of water potential gradient / high to low water potential
A vapour pressure gradient / water vapour gradient
allow water vapour if it is clear that evaporation has occurred
A water evaporates and diffuses out
R water evaporates out
I water (vapour) concentration gradient [3]

(b) **1** adhesion of water to, cellulose / lining / walls (of xylem vessels) **;**
A adhesive force
2 ref to, hydrophilic / polar, property of cellulose (fibres) **;**
A hydrophilic / polar, parts of lignin
3 cohesion between water molecules **;** cohesive force
4 maintains column of water / prevents water column breaking / AW **;**
5 *ref. to* transpiration pull / AW **; I** transpiration *unqualified* [max 3]

(c) *mp3 – units for rates of transpiration must appear once correctly in the whole answer to award this point*

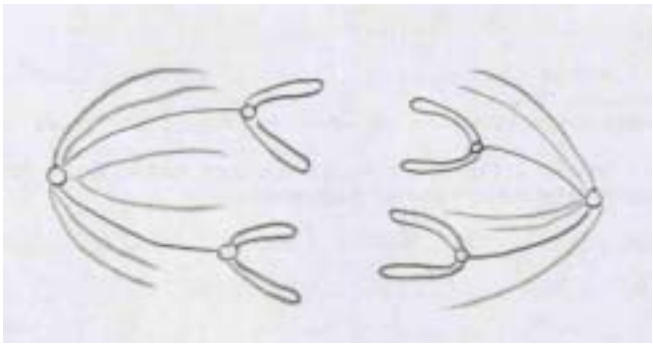
1 rate (of transpiration) of all trees is 0 at, 06.00 / start **; A** no transpiration
2 rates (of transpiration) increase and decrease (in all three) **; A** peaks
3 highest rates:
emergent trees at 14.30 at 8.5 kg h^{-1}
canopy trees at 14.30 at 3.5 kg h^{-1}
suppressed trees at 13.00 at 1.6–1.7 kg h^{-1} **;**
must have units at least once
accept kg / h or kg per hour
4 emergent trees (always) have highest rate **or** suppressed trees have lowest rate **;**
A emergent trees have higher rate than, canopy and suppressed, trees
5 rate of emergent trees is, much / AW, higher than rates for canopy and suppressed trees **;**
6 emergent trees have, steeper / steepest, increase in (transpiration) rate **;**
A emergent trees have, steeper / steepest, decrease in (transpiration) rate [max 4]

(d) *following factors may be given in answers, any three of these factors = 1 mark*

light, intensity / wavelength **I** 'more light'
humidity
temperature
wind speed / air movement
size of tree / height / area of leaves
water availability / depth *or* length of roots
transpiration rate for emergent trees is higher because … accept ***ora*** *for suppressed trees*
accept vapour pressure gradient / water vapour pressure gradient / water vapour diffusion gradient for water potential gradient
1 high(er) light intensity for emergent trees increase in stomatal aperture **;** ora
A more sunlight
A stomata open more
I more stomata open
2 lower humidity for emergent trees so steeper water potential gradient **;** ora
A description of water potential gradient
3 higher temperature / AW, for emergent trees so higher rate of, evaporation / diffusion **;** ora
4 higher wind speed for emergent trees so, steeper water potential gradient / lower humidity **;** ora
A *ref. to* diffusion shells / descriptions of water potential gradient
5 emergent trees have longer roots so take up more water **;**
6 emergent trees have more leaves so, greater surface area / more stomata per unit area (of leaf) **;** [max 4]

[Total: 14]

5 (a) (i) *if draw other stages mark first one only – either left to right or top to bottom*



four chromatids / daughter chromosomes, drawn as single structures between equator and poles **;**
V shaped, chromatids / daughter chromosomes, in correct orientation **;**
spindle (fibres) attached to all four, centromeres / kinetochores / apex, and centrioles **; R** if these extend between chromatids [max 3]

(ii) **1** attach to the, centromeres (at prophase) **; A** kinetochores
I *if attach at metaphase*
2 attach to, centrioles **; A** centrosome / MTOC
3 arrange the chromosomes on the, equator / metaphase plate **;**
4 pull / move, (daughter) chromosomes, apart / to the poles **;**
A separates *for moves apart* **A** (sister / identical) chromatids
I ends **R** homologous chromosomes [max 2]

(b) (i) **1** produces / makes / synthesises, haemoglobin **; I** fills up
2 produces / makes / synthesises, carbonic anhydrase **; I** fills up
3 loss / AW, of the nucleus **;**
4 loss / AW, of (named) organelles **;**
e.g. ribosomes / (R)ER / mitochondria
5 becomes biconcave / described **;**
6 AVP **;** e.g. cell surface / antigens / named antigens
ref. to cytoskeleton [max 3]

(ii) *cell Y*
1 remains / stays as a, stem cell **;**
2 divides / undergoes mitosis **;**
I *ref. to* becoming a type of blood cell / platelet
R if it becomes a cell other than a blood cell / platelet [max 1]

(c) (i) 13.5 **;** [max 1]

(ii) **1** low(er) partial pressure of oxygen (at high altitude) **;**
A pO_2 / ppO_2
2 less oxygen in, inhaled air / lungs / alveoli **;**
3 so haemoglobin, is not fully saturated / has lower saturation (with oxygen) (than at sea level) / lower affinity for oxygen **;**
4 *idea that* more red blood cells so, higher concentration of / more haemoglobin **;**
5 allows, same / similar / enough, volume of oxygen to be transported in the blood as at sea level **;**
6 volume of oxygen transported in the blood is less **;**
7 less oxygen for (aerobic) respiration / lack leads to anaerobic respiration **;**
8 any consequence, e.g. fatigue, altitude sickness **;** [max 4]

[Total: 14]

6 (a) *fluid*
phospholipids (and proteins), move / AW **;**

mosaic
proteins / glycoproteins, scattered / AW (in the phospholipid bilayer) **;**
A different types of proteins
I pattern unqualified [2]

(b) 7 nm **;** **A** any size or range within 6 nm and 10 nm
A 7 nanometres [1]

(c) cholesterol **;**
unsaturated fatty acids **;** **A** phospholipid tails
carbohydrate chains added to protein(s) / glycoproteins **;**
A oligosaccharides *for carbohydrate chains*
carbohydrate chains added to lipids / glycolipids **;**
glycocalyx **;**
channel protein(s) / AW **;** **A** aquaporin(s) **;**
carrier proteins / AW **;**
peripheral / extrinsic, proteins **;**
attachment to, cytoskeleton / microfilaments **;**
receptor(s) **;**
antigen(s) **;**
AVP **;** [max 4]

[Total: 7]