

## **CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

### **MARK SCHEME for the October/November 2015 series**

#### **9700 BIOLOGY**

**9700/21**

Paper 2 (AS Structured Questions), maximum raw mark 60

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Mark scheme abbreviations:

|                         |                                                                             |
|-------------------------|-----------------------------------------------------------------------------|
| <b>;</b>                | separates marking points                                                    |
| <b>/</b>                | alternative answers for the same point                                      |
| <b>R</b>                | reject                                                                      |
| <b>A</b>                | accept (for answers correctly cued by the question, or by extra guidance)   |
| <b>AW</b>               | alternative wording (where responses vary more than usual)                  |
| <b><u>underline</u></b> | actual word given must be used by candidate (grammatical variants accepted) |
| <b>max</b>              | indicates the maximum number of marks that can be given                     |
| <b>ora</b>              | or reverse argument                                                         |
| <b>mp</b>               | marking point (with relevant number)                                        |
| <b>ecf</b>              | error carried forward                                                       |
| <b>I</b>                | ignore                                                                      |
| <b>AVP</b>              | alternative valid point (examples given)                                    |

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- 1 (a) ATP production ; **A** supply energy (to the cell/for cell reactions) **R** energy production  
(site of) aerobic respiration/oxidative phosphorylation ;  
AVP ; e.g. lipid metabolism/beta oxidation [max 1]
- (b) crista/cristae/inner membrane ; [1]
- (c) (×) 48 571      **or**      (×) 50 000 ;;  

$$\frac{34\,000}{0.7} \quad \text{or} \quad \frac{35\,000}{0.7}$$
  
*if answer incorrect award one mark for:*  
*correct measurement (34 or 35 mm) and correct formula used ( $M = I/A$ ), as above*  
*but incorrect conversion to  $\mu\text{m}$*   
**or**  
*correct calculation but units given*  
**or**  
*correct calculation but decimal places given* [2]
- (d) 1 resolution/resolving power, too low ;  
2 further detail ; e.g. only 250 nm resolution  
resolution only half wavelength of light  
wavelength of light, too long/not short enough  
width of membranes only 7 nm ;  
3 (such) thin sections not possible ;  
4 inner membrane/cristae/internal structure, could not be seen ;  
5 magnification this high not possible ;  
*mp1 and mp5 allow correct comparative statement with electron microscope* [max 2]
- (e) circular DNA ;  
small/similar, size ; **A** 0.5–15  $\mu\text{m}$   
70S/small(er) / 18 nm, ribosomes ;  
AVP ; e.g. binary fission/naked DNA [max 2]

[Total: 8]

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2 (a) (i) facilitated diffusion ; [1]

(ii) ions are, charged / water-soluble ; **A** hydrophilic  
 unable to pass, through hydrophobic core / hydrophobic (fatty acid) tails of,  
 phospholipid bilayer / phospholipids(s) ;  
 (channel of) protein lined with amino acids with, hydrophilic / polar, R groups /  
 side chains ; **A** hydrophilic channels [max 2]

(b) (i) quaternary / 4°, (structure) ; [1]

(ii) secondary structure ; **A** alpha /  $\alpha$ , helix [1]

(c) *bonds must be named in the correct context of maintaining 4° structure and interactions with phospholipids*

*polypeptides held together*

bonds between, R groups / side chains ;

two named bond types ; *from*

ionic

hydrogen

hydrophobic interactions

disulfide

van der Waal's forces

**I** peptide bond

*polypeptides interact with phospholipids*

(regions with) hydrophilic / charged / polar (R groups / side chains, of) amino acids

interact with, phosphate / hydrophilic head , of phospholipid ;

(regions with) hydrophobic / non-polar (R groups / side chains, of) amino acids

interact with, fatty acid / hydrocarbon / hydrophobic, tails / chains ;

further detail of named bond ; [max 3]

**[Total: 8]**

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3 (a) (late) anaphase / (early) telophase ; **R** early anaphase [1]

(b) produce more genetically identical cells / AW ;  
for growth (of the root) ;  
asexual reproduction ;  
replace (old / worn out) cells ;  
repair (damaged tissue) ; **A** *ref. to* wounds **R** repair cells [max 2]

(c) (i) 8 ; [1]

(ii) for sexual reproduction ;  
to form gametes ; **A** pollen and, egg / ovum **R** sperm  
  
*ref. to* diploid number must be restored (in zygote)  
**or**  
fusion / fertilisation, of two haploid cells results in, diploid cell / zygote ;  
  
prevents chromosome number doubling each generation ; [max 3]

(d) 1 DNA double helix unwinds ; **I** unzips **R** DNA strand unwinds  
2 hydrogen bonds break between, base pairs / bases / strands ;  
3 both strands used as templates ;  
4 catalysed by / AW, DNA polymerase ;  
5 *ref. to* (free) activated nucleotides / AW ;  
6 complementary DNA nucleotides added ;  
**A** described in terms of complementary base pairing  
7 step-by-step / sequentially / AW ;  
8 *idea that* process, occurs / continues, along whole DNA molecule ;  
9 replication bubbles / described  
**or**  
*ref. to* Okazaki fragments ;  
10 replication is semi-conservative / each newly formed molecule contains one original and one newly synthesised strand  
11 AVP ; e.g. *ref. to* repair / proofreading  
*ref. to*, helicase / ligase *in correct context* [max 5]

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- 4 (a) (i) loss from, leaves / aerial parts of plant ;  
of water vapour ; *link to first point*

*plus one from:*

evaporation of water, from surface of spongy mesophyll cells / into air spaces ;  
diffusion of water vapour, out / to atmosphere ; **R** evaporation movement / diffusion, (out) through (open) stomata ; **R** evaporation water vapour moves (out) down the water potential gradient ;

[max 3]

- (ii) *adaptation for 1 mark, explanation to max 2*

thick (waxy) cuticle ;

*explanation*

*idea that* wax is, (mainly) impermeable to water / hydrophobic / barrier to water vapour movement ;

reduces, water loss from parts with no stomata / uncontrolled water loss / cuticular transpiration ;

*idea that* increased distance decreases rate of diffusion of water vapour

**or**

reflective cuticle ;

*explanation*

reduces heat load ;

reduces evaporation (from spongy mesophyll cells surfaces) ;

reduces rate of diffusion of water vapour (through cuticle) ;

**or**

folded inner surface / AW ; **A** trichomes / hairs ;

*explanation*

traps water vapour / AW ;

reduces, diffusion / water potential, gradient ;

(water potential gradient) between sub-stomatal air space and outside / AW ;

**or**

no stomata (visible) on the, outer / exposed, surface ;

*explanation*

*idea that* stomata are main route for water loss ;

*idea that* reduces area where there is a high rate of water loss ;

surface directly exposed to air currents has no stomata ; ora

**R** curled or rolled *given as adaptation but allow explanation to max 2*

*explanation*

stomata on inside ;

no / away from, air currents ; **A** increases humidity within enclosed space / AW

reduces, diffusion / water potential, gradient (between sub-stomatal air space and outside);

[max 3]

| Page 7 | Mark Scheme                                                | Syllabus | Paper |
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(b) (i)  $18 \text{ g h}^{-1}$  ;;

*one mark if no units given*

*one mark if incorrect answer but correct values extracted from Fig. 4.2*

*(60–42  $\text{g h}^{-1}$ )*

[2]

(ii) *describe to max 3*

rate of, transpiration / water absorption, increases and decreases / reaches a peak ;

time delay between high rates of transpiration and water absorption / AW ;

lower values for water absorption until (approx.) 1645 ; **ora** **A** 1630 to 1700

data quote to support ;

*explain to max 3*

*ref. to* daylight and night and stomatal, opening / closure / AW ;

higher light intensity / greater stomatal opening, higher rate of transpiration ;

**ora**

*idea that* transpiration drives water absorption ;

further detail ; e.g. explanation in terms of water potential gradient

*ref. to* cohesion-tension from leaf to root

[max 4]

(iii) xerophyte ;

example of xeromorphic feature ; **A** *ref. to* adaptation(s) (for dry areas)

high light intensity during middle of day / AW (for species **P**) ;

*idea that* loss of water during the day needs to be minimised ;

suggestion that (most) stomata, closed during the day / only open at night ;

[max 2]

[Total: 14]

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5 (a) Morbillivirus ; [1]

(b) *must have one ref. to either infected or uninfected to gain max*  
aerosol, infection / route ; **A** droplet infection **I** *ref. to contact*  
infected person, sneezes / coughs / talks / spits, to release airborne droplets;  
inhaled by, uninfected / healthy, person ; [max 2]

(c) RNA nucleotides ;  
contains uracil ; **A** no thymine  
ribose (instead of deoxyribose) ;  
no (double) helical structure ;  
AVP ; e.g. small enough to pass through nuclear pores ; [max 2]

(d) cell has no enzyme for RNA replication ;  
*ref. to enzyme specificity ;*  
RNA polymerase (in cell) uses DNA template / not RNA template / AW ; [max 2]

(e) *ref. to recognition and activation by presence of antigen (on APCs / infected*  
cells) ;  
T helper and T killer, lymphocytes / cells ; **A** T cytotoxic  
*T helper*  
secrete cytokines ;  
(cytokines) stimulate / AW, (specific) B-lymphocytes ; **A** humoral response  
stimulate / AW, macrophages / phagocytes / phagocytosis / T killer response ;  
*T killer*  
kill infected cells ;  
detail of killing ; e.g. perforin / H<sub>2</sub>O<sub>2</sub>  
punching 'holes' in membrane  
*ref. to T lymphocytes become memory cells (for secondary immune response) ;* [max 5]

[Total: 12]

6 (a) (i) grass ; [1]

(ii) rabbit(s) / grasshopper(s) ; [1]

(iii) fox(es) ; [1]

(b) denitrification ;  
nitrification ;  
nitrogen fixation ; **A** Haber process [3]

[Total: 6]