

Cambridge  
International  
AS & A Level

**Cambridge International Examinations**  
Cambridge International Advanced Subsidiary and Advanced Level

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**BIOLOGY**

**9700/02**

Paper 2 AS Level Structured Questions

**For Examination from 2016**

SPECIMEN MARK SCHEME

**1 hour 15 minutes**

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**MAXIMUM MARK: 60**

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This document consists of **8** printed pages.

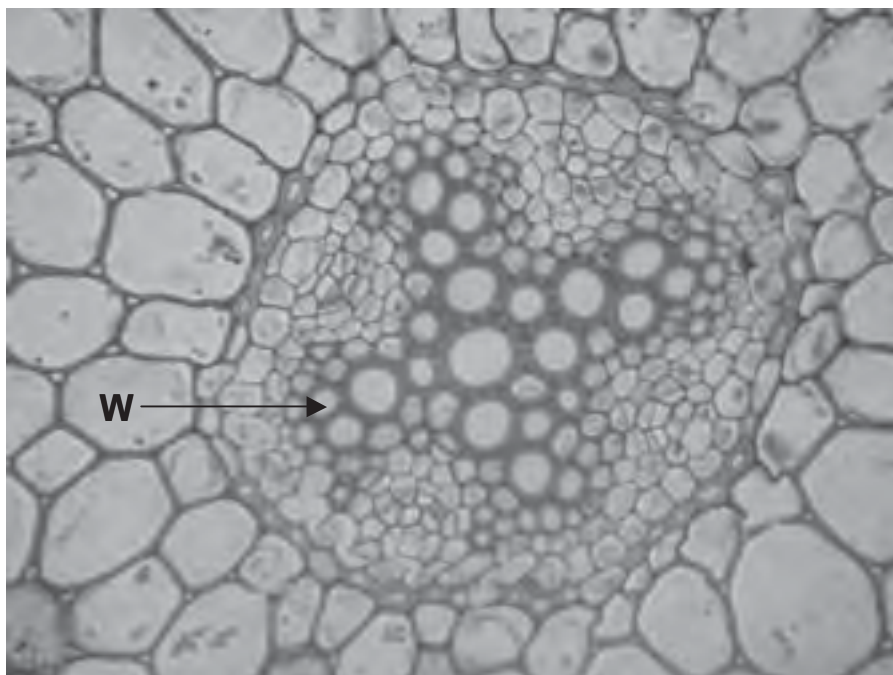
**Mark scheme abbreviations:**

<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 excepted)
<b>max</b>	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 as guidance)

- 1 (a) 2,3,1,4 ; [1]
- (b) (i) nuclear envelope, disassembling / fragmenting / breaking down / forming vesicles;  
A membrane *for envelope* R disappears [1]
- (ii) telomere ; [1]
- (c) (i) resolving power, not high enough / poor / low / 250 nm / 0.25  $\mu\text{m}$  / half the wavelength of light (used) ; A resolution *for resolving power*  
resolution limited by wavelength of light ;  
microtubule (diameter) too small to interfere with light waves / AW ; [max 2]
- (ii) forms part of, spindle / spindle fibres ;  
attachment to centromeres / chromosomes / chromatids ;  
detail ; e.g. movement of, sister chromatids / (daughter) chromosomes, to (opposite) poles / spindle fibres shortening at anaphase [max 2]
- (iii) *monomer*  
protein / tubulin, composed of / AW, amino acid, monomers / building blocks / sub-units;  
A protein / tubulin, composed of / AW, amino acids joined, together / by peptide bonds
- macromolecule*  
protein / tubulin, is a large molecule, composed of / AW, many / AW, amino acids / smaller molecules ; [2]

[Total: 9]

- 2 (a) arrow from **W** to any xylem vessel element ; e.g.



[1]

- (b) through cytoplasm / cytoplasmic pathway ;  
 via plasmodesmata ; *in context of* parenchyma to endodermal cell *or*  
 endodermal cell to pericycle cell through, endodermis / endodermal cells / passage cells ;  
 water moves down water potential gradient ;  
 parenchyma cell higher water potential than, adjacent cell / endodermal cell / xylem vessel  
 element ; **A** *idea of* overall higher water potential in soil (solution) than in xylem / (external)  
 atmosphere around leaf  
 diffusion (through cytoplasm / plasmodesmata) *or* osmosis *in context of* across vacuolar  
 membranes ;  
 ref. to cohesive nature of / hydrogen bonding between, water molecules ; [max 4]

- (c) (i) iodine in potassium iodide (solution) ; **A** iodine solution [1]

- (ii) amylose, spiral / spiralled / helix / helical ; **R**  $\alpha$ -helix **R** coiled  
 amylopectin branched ;  
 compact / AW ;  
 qualified ; e.g. for maximum storage  
 (so) insoluble / osmotically inactive / inert ;  
 amylopectin, many free ends (so easily supplies glucose) ;  
 (amylose / amylopectin / starch) contain glucose for immediate use as respiratory  
 substrate (on hydrolysis) ; [max 4]

[Total: 10]

- 3 (a) P = right, atrium / auricle ;  
Q = aorta ; [2]
- (b) SAN to max 2  
pacemaker / sets rate of heart beat / responsible for rhythmic contraction ;  
sends out, impulses / waves of excitation ;  
initiates / brings about / AW, heart beat / contraction of the heart / atrial contraction / atrial systole ;  
Purkyne tissue to max 2  
conducts, impulses / waves of excitation, down septum to, ventricles / apex of heart / base of heart ;  
conducts, impulses / waves of excitation through ventricle walls ;  
to cause, ventricular contraction / ventricular systole (from base upwards) ;  
**to an overall max 4** [max 4]
- (c) closed  
blood, contained / AW, in, blood vessels / arteries, veins and capillaries ;  
double  
blood, travels through / AW, the heart twice during one, complete circuit / circulation ;  
or  
pulmonary and systemic, circulation /systems / circuits ; **A** description [2]
- (d) (i) oxygen in(to blood), carbon dioxide out (of blood) ;  
diffusion / from a high(er) concentration to a low(er) concentration ;  
through alveolar wall and capillary, endothelium / wall ;  
oxygen enters red blood cells ;  
oxygen taken up by haemoglobin ; AW [max 3]
- (ii) carbon monoxide (in inhaled smoke) binds to haemoglobin / carboxyhaemoglobin formed ;  
carbon monoxide competes with oxygen for, haemoglobin binding sites / AW;  
haemoglobin has a higher affinity for carbon monoxide than oxygen ; [max 2]
- [Total: 13]

- 4 (a) (i) protein / peptide, hormones ;  
too large to cross membrane ;  
hydrophilic / water soluble ; **A** not, hydrophobic / lipid soluble  
unable to pass through hydrophobic core / AW, of phospholipid bilayer ; [max 2]
- (ii) chemicals released are circulating hormones ;  
hormones combine with cell surface receptors ;  
on target cells / cells where transcription is triggered ;  
action of kinases and phosphatases (within the cell) lead to (specific) response ;  
specific response = transcription / production of mRNA ; [max 3]
- (b) (i) optimum is, pH 5 / between pH 4–5.5 ; **A** optimum pH value between 4–5.5  
increasing activity as pH increases to, optimum / pH 5 ;  
decreasing activity as pH increases above, optimum / pH 5 ;  
active, over a wide pH range / between pH 1–9 ; [max 2]
- (ii) low pH equivalent to high, hydrogen ion / H<sup>+</sup>, concentration ;  
hydrogen / ionic, bonds, disrupted / broken / AW ;  
active site shape, changed / AW ; **A** active site no longer complementary to substrate  
ref. to partial denaturation / some enzymes denatured ;  
(active site change so) decreases effective collisions / fewer enzyme substrate complexes  
formed ;  
(only) some (phosphatase) enzymes active / all enzymes partly active ; [max 3]
- (c) (i) in (sodium) alginate (beads) / encapsulation ;  
**A** other named methods, e.g.  
entrapment / trapped in pores of silica gel  
adsorption onto, clay / glass / resin  
(within) polymer / partially permeable membrane, microspheres  
covalent bonding to support, material / collagen [1]
- (ii) *any one acceptable suggestion, e.g.*  
enzyme / phosphatase, can be reused ;  
enzyme / phosphatase, easily recovered ;  
enzyme / phosphatase, doesn't contaminate, DNA / product ;  
less purification of product / DNA, required ; **A** less downstream processing required  
enzyme / phosphatase, longer shelf life / AW ;  
enzyme / phosphatase, more stable to, temperature / pH ; [max 1]
- (d) *similarities*  
both have, pentose / 5C sugar ;  
both have, organic / nitrogenous, base ; **A** both have purine (base)  
both have phosphate ;  
*differences*  
(ATP) ribose not deoxyribose ;  
(ATP) adenine not guanine ;  
(ATP) three phosphates, not one ; [max 4]

[Total: 16]

5 (a) one mark each row

statement	measles	smallpox	malaria
caused by a virus	✓	✓	✗
caused by <i>Plasmodium</i>	✗	✗	✓
eradicated by vaccination	✗	✓	✗
transmitted by contaminated water	✗	✗	✗

[4]

(b) *idea that* viruses have no, sites / targets, where antibiotics can work ;  
viruses have no, cell walls / ribosomes / cell membranes ;

**A** have different enzymes

*idea that* even if antibiotics could affect viruses, they are within cells, antibiotics cannot reach them ;

[max 1]

[Total: 5]

## 8

- 6 (a) antigen-presenting cell ; **A** description e.g. macrophage that has phagocytosed pathogen and has antigens on surface  
vaccine containing antigen ; [2]
- (b) transcription, translation, RER / rough endoplasmic reticulum / Golgi (body) ; [1]
- (c) (i) soluble in, blood / plasma / tissue fluid / lymph ;  
tertiary / quaternary, structure allows formation of, variable site ; AW  
*idea of easier to transport (than fibrous proteins) ;* [max 1]
- (ii) more than one, polypeptide ;  
(antibodies have) two heavy and two light, polypeptides / chains ; [2]
- (d) hybridoma (cell) ; [1]

[Total: 7]