

**BIOLOGY****9700/22**

Paper 2 AS Level Structured Questions

**October/November 2016**

MARK SCHEME

Maximum Mark: 60

**Published**

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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 as guidance)                        |

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- 1 A = chloroplast ;  
 B = tonoplast ; A vacuolar membrane  
 C = spindle / spindle fibre(s) ;  
 D = (bacterial / prokaryotic) cell wall ; R eukaryotic / cellulose / chitin / plant  
 E = nucleolus ;

[5]

[Total: 5]

- 2 (a) (i) tubing drawn more swollen ;

[1]

(ii) *three from*

1 (mass) increased / AW ;

2 water in by osmosis ; A diffuse in by osmosis

*if direction of water movement is out in mp2, allow ecf for mp 3*

3 lower / more negative, water potential /  $\Psi$  (inside tubing) ; ora

A down the water potential gradient / from high to low water potential / from less negative to more negative water potential

R across

R water moves from a high water potential gradient to a low water potential gradient

I *ref. to, solute / osmotic, potential*

I water moves down the concentration gradient

4 sucrose too large to leave (tubing) / pores too small for sucrose to leave ;

5 (Visking tubing) partially permeable membrane ; A selectively-permeable

[3]

(b) 'source' and 'sink' not required but statements should be in correct context

*three from (source)*

1 *idea that* sucrose presence in, phloem / sieve tubes, causes, low(er) / more negative, water potential /  $\Psi$  ; AW

A assimilates / photosynthates / sugars / named, *for sucrose*

2 water, enters / AW (sieve tube by osmosis) ; *can be in context of direct entry or from surrounding cells* R from root hairs

3 presence of water increases hydrostatic pressure ; A turgor (*for hydrostatic*)

A *idea of: causes high(er) hydrostatic pressure because of entry of water (hence increase in volume)*

*(sink)*

4 *idea that* water follows sucrose (via companion cell to sink cells, hence osmosis) ;

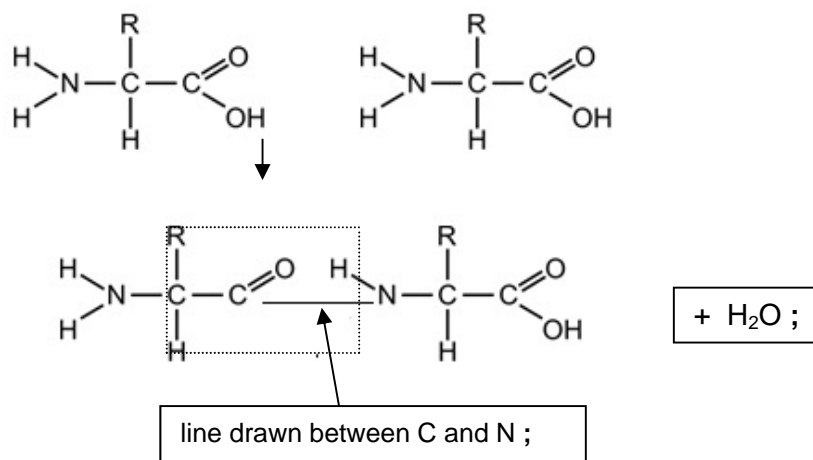
5 lower hydrostatic pressure (at sink) ; A low *if in context of high at source hydrostatic or turgor needed only once (in mp3 or mp5)*

6 movement / mass flow (of sap), down a pressure gradient / from high to low pressure ; R if osmosis implied for mass flow

[3]

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- (c) can gain 2 marks if printed diagram is clearly modified to show correct bond and formation of water or/and if described as text



dotted line area is minimum to gain mark  
 'peptide bond' label not required to gain mark

bond forms between the C of the carboxyl group and the N of the amino group ;

**A** amine for amino

water / H<sub>2</sub>O, is formed ; **A** condensation (reaction) **R** hydrolysis

[2]

[Total: 9]

- 3 (a) two from  
 fructose

no glycosidic bond ;

(v sucrose  
 glycosidic bond) look for ora

monosaccharide / one sugar unit  
**A** monomer ('sugar', is in question)

(v disaccharide / two sugar units /  
 fructose and glucose ;  
**A** two monomers / dimer  
**I** polysaccharide

**R** if a disaccharides is stated as one of the two monomers

**A** sucrose is a disaccharide made from the monosaccharides glucose and fructose

one ring (structure)

(v two rings ; **A** sketch to show one ring v two rings

C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

**A** fewer / less, C and H and O atoms

(v C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> ;

ora

additional points accepted

powder

(v crystalline

linear or ring structure

(v two rings / only ring(s)

reducing, end / AW

(v (no reducing ends)

**I** reducing sugar

**I** non-reducing sugar

[2]

|        |  |          |       |
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(b) look for ora throughout if describing the other enzyme with low optimum

three from

- 1 idea of can use high(er) temperatures for process ;
- 2 increased temperature increases, number of collisions (between enzyme and substrate) / number of ES complexes (formed) ;
- 3 more product/high(er) rate of reaction ; AW
- 4 less prone to denaturation ; **A** won't denature  
**A** described in terms of loss of active site
- 5 more stable/lasts longer ; **A** thermostable **A** reused over and over  
**I** temperature resistant

[3]

(c) accept 'glucose isomerase' for 'enzyme'  
accept '100 percent activity' for 'maximum activity'  
accept (initial) rate of reaction for activity

penalise once if 'pH' and/or percentage activity (or %) not stated

three from

- 1 maximum/peak of, activity, at lower pH for free enzyme ora  
**or**  
free enzyme lower optimum pH ora  
**or**  
free enzyme pH 7.4/7.5/7.6 v immobilised pH 8.5 ;
- 2 free enzyme has higher/AW activity, at pH, 6/6.5/7/7.5 ; **A** up to pH 8  
ora for immobilised (lower up to pH 8) \*  
**or**  
free enzyme has higher activity over greater range of pH\*\* (between pH 6–9) ;
- 3 data to support mp 2 ; \*any one pH and comparative activity  
\*\* needs two pHs and comparative activities  
**A** manipulated data
- 4 free enzyme has lower activity, pH 8 to pH 9 ; **A** after pH 8.0  
ora for immobilised (higher after pH 8)
- 5 data to support mp 4 ; any one pH and comparative activity/ manipulated data  
increase to max activity
- 6 free enzyme has (slightly) steeper increase in activity as pH increases to pH 7 ; ora
- 7 data to support mp 6 ;

allow ecf to 2 max if free and immobilised the wrong way round but all statements are correct

[3]

|        |  |          |       |
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(d) (i)

| amino acid sequence           | met | tyr | glu | pro | lys |
|-------------------------------|-----|-----|-----|-----|-----|
| student's nucleotide sequence | AUG | UAU | GAC | CCU | UGU |
| correct = ✓<br>incorrect = ×  | ✓   | ✓   | ×   | ✓   | ×   |

one mark if bottom row correct ;

[1]

(d) (ii) *three from*

- 1 genetic code is, degenerate ; A redundant
- 2 64 codons and 20 amino acids ;  
A 61 codons for 20 amino acids (3 STOP codons)
- 3 *idea that* more than one, codon/triplet, specifies an amino acid ;  
*specific to the first five amino acids of glucose isomerase*
- 4 example of choice of codons to specify the same amino acid ;  
(*must use Table 3.2 to find codons for the amino acids from Table 3.1*)  
tyr UAU UAC  
glu GAA GAG  
pro CCU CCC CCA CCG  
lys AAA AAG  
*use of another example from Table 3.2 may be used to support mp3*
- 5 AVP ; e.g.  
start codon always AUG/met has only one codon, so only sequence for amino acids 2-5 may be different  
start codon, may be different/may not always be AUG<sub>met</sub>

[3]

[Total: 12]

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- 4 (a) *allow middle coat/ intermediate layer/ middle layer, for tunica media  
allow adventitia for externa*

*one from*

a thick tunica media ;

a thicker tunica media than tunica externa ; ora

a thick layer of, (smooth) muscle / muscle and elastic tissue ;

**A** thick muscular wall

**R** striated/ skeletal, muscle

many (layers of) smooth muscle cells ;

a, well-defined/ firm/ oval/ regular/ AW, shape (in cross section) ;

narrow/ AW, lumen in relation to thickness of wall ; **A** narrow lumen

convoluted/ folded/ AW, endothelium/ tunica intima ;

[1]

- (b) *2 correct functions with no link to a structural feature – award one mark only*

**R** muscle/ collagen, stretching and recoiling/ recoiling

**R** elastic tissue contracting and relaxing

*two from*

1 (smooth) muscle/ elastic tissue, maintains (blood) pressure ;

**A** increases blood pressure

2 thick (tunica media) / elastic tissue/ (smooth) muscle/ collagen (fibres),  
withstands high pressure/ prevents rupture/ AW ; **A** bursting

3 elastic tissue to smooth out (pulsatile) flow ; **R** smooths flow to give pulses

4 muscle/ elastic tissue, helps to, maintain blood flow/ move blood/  
keep blood moving forwards/ AW ;

**R** idea of pumping/ forcing blood forward/ pushing blood

5 (smooth) muscle, contraction/ relaxation, altering volume of blood delivered ;

**A** idea of, diverting blood/ regulating blood flow

**I** muscle dilates

[2]

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(c) magnification = image diameter  $\div$  actual diameter ; **A**  $M = I \div A$

*allow one mark only if correct answer but units given*

*if calculation is shown measurement must be correct and working must lead to correct answer*

$$\times 3.5 ;; 18 \text{ (mm)} / 5.2 \text{ (mm)} = 3.46$$

**A**  $\times 4$  if correct working, and/or, 3.5 shown

**A**  $\times 3$  if 3.46 only shown from correct working

*other acceptable answers using same criteria*

$$\times 3.3 ;; 17 / 5.2 = 3.27 \quad \mathbf{A} \times 3$$

$$\times 3.4 ;; 17.5 / 5.2 = 3.37 \quad \mathbf{A} \times 3$$

$$\times 3.6 ;; 18.5 / 5.2 = 3.56 \quad \mathbf{A} \times 4$$

$$\times 3.7 ;; 19 / 5.2 = 3.65 \quad \mathbf{A} \times 4$$

[3]

(d) *three from*

1 (good) solvent ; **R** organic solvent

2 statement linking solvent properties to role of plasma ; e.g.

*standalone statements do not need mp1*

polar molecules/ions/ionic compounds/named substance(s),

dissolve in, water/plasma **R** blood cells

ions dissociate, in water/plasma

many/AW, substances dissolve in, water/plasma **R** blood cells

water is attracted to (many different) substances

water/plasma, is the transport medium for substances/transports substances

presence of solutes to maintain (constant) water potential

3 cohesion between water molecules/water is cohesive ;

**A** water molecules are sticky

4 so, continuous/uninterrupted/AW, blood flow ; *in context of mp3*

5 high specific heat (capacity) ;

6 statement linking high specific heat capacity to role of plasma ;

*allow ecf for high heat capacity/ specific heat capacity*

e.g. helps, stabilise/(body to) regulate, temperatures

helps maintain constant (blood) temperature

water resists changes to temperature

7 high (latent) heat of, vaporisation/evaporation ;

8 in body temperatures, plasma stays liquid/water does not evaporate ; AW



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*other acceptable points – note that mps 10, 12, 14 are linked to water property*

9 low compressibility ; **A** incompressible

10 maintains efficient blood flow/helps to push blood through vessels ; AW

11 low viscosity ;

12 allows efficient circulation of blood/AW ;

13 pH 7/neutral ;

14 *ref. to stability proteins* ; **A** prevents denaturation

[3]

[Total: 9]

- 5 (a) (i) *non-infectious to max 1*  
 not caused by a pathogen ; **A**  
 not, communicable/transmissible ; **A** not passed from one living,  
 organism/person, to another AW

*disease to max 1*

**R** if in context of an infectious disease

abnormal condition (affecting an organism)/condition that reduces the  
 effectiveness of the functions of the organism/lack of good health/AW ;

[2]

(ii) *four from*

1 *ref. to mutation* ;

2 further detail ; e.g.  
 change in sequence of, nucleotides/bases, of, DNA/gene  
 tumour suppressor gene, switched off/stops functioning/alters/AW  
 formation of oncogene  
 proto-oncogene altered

3 uncontrolled, mitosis / cell division / cell replication ; AW

4 *ref. to changes to checkpoints/coordination of cell cycle lost* ;  
**A** cell does not, receive/respond to, signals (to stop dividing)

5 loss of function/lack of differentiation/lack of specialisation/AW ;  
*allow loss of function idea if referring to the mass of cells*

6 other detail of, tumour cell/cellular changes ;  
 e.g. immortal/no apoptosis/no programmed cell death  
 no contact inhibition/grows to invade healthy tissue/AW  
 more protein synthesised (for growth)  
 (release cell signalling molecules for) vascularisation/blood vessel  
 formation  
 changed size compared to normal cell size  
 telomeres do not shorten/AW

[4]

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- (b) (i) **A** = protoctist ; **A** protoctista, protist(a), protozoa(n), sporozoa(n)  
**B** = bacterium ; **A** bacteria [2]
- (ii) aerosol infection/droplet infection ; **A** described **A** airborne droplets  
**A** direct contact ; **A** *description in this context*, e.g. body contact [1]
- (iii) smallpox ; [1]
- (iv) *Morbillivirus* ; [1]
- (c) *three from*
- 1 vaccination, gives (active) immunity/stimulates an immune response ;  
*must be in context of active artificial immunity*
  - 2 detail ; e.g. primary immune response  
clonal, selection/expansion (specific, B/T, lymphocytes)  
formation of antibodies  
formation of memory cells  
artificial active (immunity)
  - 3 secondary (immune) response, when, pathogen/antigen, present  
**or**  
presence of antigen/pathogen, gives, faster response/higher antibody  
production/AW ; **R** disease (for antigen/pathogen)
  - 4 (effects of vaccination/immunity) long-lived/AW ;  
**A** memory cells remain (in circulation) for a long time
  - 5 herd effect ;
  - 6 explained ; e.g. sufficient, (successfully) vaccinated/immune, so, susceptible/  
non-vaccinated, people protected
  - 7 stops the transmission cycle ;  
**A** less people with disease so reduces spread
  - 8 AVP ; *ref. to ring vaccination* [3]

[Total: 14]

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- 6 (a) (i) J = mitosis ; A mitotic division I nuclear division  
R mitotic cell division  
K = cytokinesis; A cytoplasmic, division / cleavage I cell division  
L = interphase; [3]
- (ii) interphase ; A S-phase / synthesis phase / late interphase  
R early interphase [1]
- (b) (i) bone marrow ; [1]
- (ii) lobed / irregular ; [1]
- (iii) lysosomes / vesicles ; [1]
- (c) (i) *two from*  
*ref. to loss of control over entry and exit substances ;*  
A membrane no longer partially / selectively, permeable  
A becomes more permeable  
lose, ions / nutrients ; A gains, ions / nutrients  
lose water ; R gains water (*as cell wall still intact*)  
  
metabolic reactions, prevented / impaired ; AW  
enzymes no longer function ; AW  
  
water potential affected ;  
*increase or decrease depends on rest of answer*  
*e.g. gains ions so decreases water potential*  
  
cytoplasm shrinks ; AW R lysis / bursting  
contents leak out ; [2]
- (ii) breakdown / weaken / digests / AW, cell wall ; A destroyed / damaged  
I breaks cross-links / cross-links cannot form  
  
(water enters so) lysis occurs / bursts / AW ; [2]

[Total: 11]