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BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **October/November 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.

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Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question or by 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
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point (examples given as guidance)

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 / Ψ **(**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 / Ψ **;** 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)*

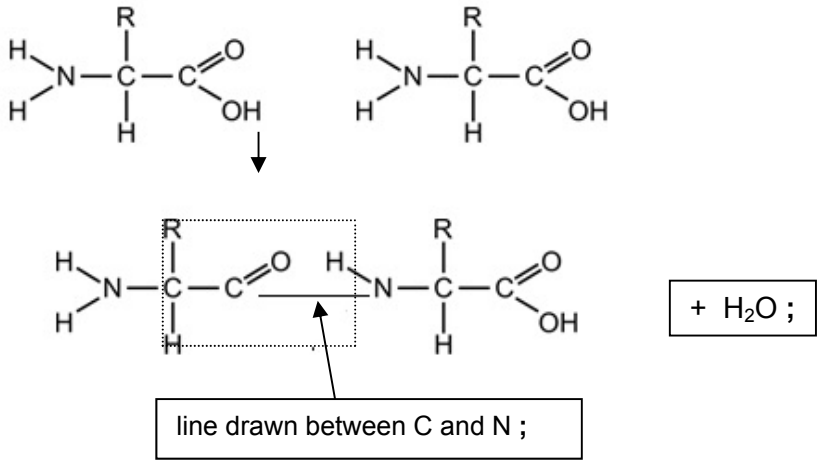
(sink)

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]

(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_2O, is formed **; A** condensation (reaction) **R** hydrolysis [2]

[Total: 9]

3 (a) *two from*

fructose		*sucrose*
no glycosidic bond **;**	(v	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*
$C_6H_{12}O_6$ **A** fewer / less, C and H and O atoms	v ora	$C_{12}H_{22}O_{11}$ **;**

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]

(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 <u>all</u> statements are correct [3]

(d) (i)

amino acid sequence	met	tyr	glu	pro	lys
student's nucleotide sequence	AUG	UAU	GAC	CCU	UGU
correct = ✓ 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 $_{met}$ [3]

[Total: 12]

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]

(c) magnification = image diameter ÷ actual diameter **;** **A** M = I ÷ 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

× 3.5 **;;** 18 (mm) / 5.2 (mm) = 3.46
A × 4 if correct working, and / or, 3.5 shown
A × 3 if 3.46 only shown from correct working

other acceptable answers using same criteria
× 3.3 **;;** 17 / 5.2 = 3.27 **A** × 3

× 3.4 **;;** 17.5 / 5.2 = 3.37 **A** × 3

× 3.6 **;;** 18.5 / 5.2 = 3.56 **A** × 4

× 3.7 **;;** 19 / 5.2 = 3.65 **A** × 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

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 <u>infectious</u> 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]

(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]

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]