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BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2017**

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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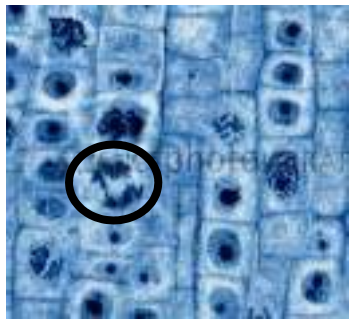
Mark scheme abbreviations

;	separates marking points
/	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

Question	Answer	Marks
1(a)	 ;	1
1(b)	*two from* can observe living, specimens / cells ; (so) the process of mitosis can be seen happening / AW ; **R** easier to see mitosis happening **I** to study cell division ease of use, qualified ; e.g. no need for heavy metal staining, preparation of specimen less time-consuming **I** *ref. to* colour **I** portable	2
1(c)	*three from* production of genetically identical cells ; asexual reproduction ; repair of damaged tissue ; **A** replace damaged cells **R** repair damaged cells replace, dead / worn out / old / non-functioning, cells ; gamete production *in context* ;	3

Question	Answer	Marks
2(a)	capillary **;** *two from* single celled wall / AW **; A** thin wall *ref. to* wall composed only of one, squamous epithelial / endothelial, cell **;** *ref. to* lumen diameter approx 7 μm **; A** 5–8 μm **A** *ref. to* similarity to dimension of red blood cell in direct contact with tissue fluid **;** *if vein named, allow one mark for, thin wall (relative to lumen)* ***or*** *wide / AW, lumen (relative to wall thickness)*	**3**
2(b)(i)	0.24 s / 0.25 s **;**	**1**
2(b)(ii)	0.08 s / 0.09 s **; A** range	**1**
2(b)(iii)	*four from* *similarity* *ref. to* increases and decreases in pressure at same time **; A** description for part of the graph e.g.starts to rise at same point as RV, returns to minimum at same point as RV *idea that* events in cardiac cycle occur are coordinated **; A** described e.g. impulses pass up both ventricles at the same time, ventricles both contract at same time *difference* reaches higher, blood pressure / peak, (than RV) **;** systolic pressure higher in LV (than RV) left ventricle pumps blood to (whole) body / RV only to lungs) overcome greater resistance / ora for RV walls of left ventricle, thicker / more muscular more force exerted by LV *any two* **;;**	**max 4**

Question	Answer	Marks
3(a)(i)	B-lymphocyte / plasma cell **;** **A** B-cell **/** white blood cell / lymphocyte / leucocyte / **R** beta / β, cells **R** T-lymphocyte / macrophage / neutrophil	**1**
3(a)(ii)	*three from* **I** ref. to receptor 1 antibody complementary (shape) to antigen **; I** matching shape *2 idea that* <u>variable regions</u> different for each antibody **;** 3 (specific) antigen / H / N, binding sites (on antibody) **;** *if mp 2 and 3 not gained, allow one mark for antigen binding regions* 4 sequence of amino acids / primary structure, varies between antibodies / gives specificity **;** 5 *ref. to* difference in, primary structure / amino acid sequence, leading to different, tertiary structure / 3-D shape **;** 6 *ref. to* R group interactions between antibody and antigen **;**	**3**
3(b)(i)	*Vibrio cholerae* **; I** bacterium	**1**
3(b)(ii)	faecal–oral route **;;** *if mode of transmission not named, allow description* *infected person* <u>faeces</u> / <u>sewage</u>, contaminates, (drinking) water / cooking utensils / vegetable plots / crops / food **A** diarrhoea *for faeces* **R** (human) waste unqualified **or** *ref. to* houseflies landing on contaminated faces **;** *uninfected person* eating contaminated food / using contaminated utensils / drinking contaminated water **;** **A** bacteria enters water in context of drinking **R** infected food or water **I** handling contaminated food *need ref. to contaminated once only*	**2**

Question	Answer	Marks
3(c)(i)	cell wall, breaks / damaged / AW **A** cell wall becomes thinner **or** cell wall weakened **;** *plus one from* detail of change to cell wall e.g. cross links break down, quantity of murein / peptidoglycan, decreases **or** cell membrane, breaks / AW **or** increase in water in cell (so increase in turgor pressure) / AW **;**	**2**
3(c)(ii)	*two from* infect only, *V. cholerae* / cholera bacteria AW **or** do not, infect human cells / infect humans **; A** do not harm human cells do not give side effects / allergic responses, (to humans) **;** able to replicate inside *V. cholerae* (to produce more bacteriophage for treatment) **;** *ref. to* remaining, active / infective / AW, with delivery method used / within gut **;**	**2**
3(c)(iii)	*antibiotics* only effective against bacteria / not effective against viruses **or** do not act on structures possessed by, (measles) virus / *Morbillivirus* **A** named structure e.g. protein coat **or** act on structures that viruses do not have **A** named structure e.g. murein cell wall **or** only act on, living / growing, cells **or** may not be able to reach virus inside (host) cell **;** AW	**1**

Question	Answer	Marks
4(a)	*codon that* terminates / AW, translation / polypeptide synthesis **R** stops production of amino acids **or** does not specify any amino acid **or** has no complementary, tRNA / anticodon **or** causes the release of the (completed) polypeptide chain **;**	**1**
4(b)	*four from* Asp and Gln R groups, hydrophilic / AW, and Ile R group, hydrophobic / AW **;** *ref. to* R group interactions and, folding / coiling, of polypeptide chain (to give globular structure) **;** *ref. to* (charged / polar R groups) forming, ionic / hydrogen, bonds **;** (amino acids with), hydrophobic / non-polar, R groups, on the inside / AW **;** **A** hydrophobic amino acids (amino acids with), hydrophilic / charged / polar, groups on outside / AW **;** **A** hydrophilic amino acids detail **;** e.g. ionic R groups can interact with water, hydrogen bonds form with water *ref. to* promotes stability / helps to maintain globular structure **;** *in context of interaction with water / formation of (compact) hydrophobic core*	**4**
4(c)	glycosidic **;**	**1**

Question	Answer	Marks
4(d)	*four from* 1 both, increase and decrease / peak **;** 2 both active, over range of temperature tested / between 20 to 55°C **;** 3 free enzyme lower, optimum temperature / temperature for maximum activity **; ora** 4 (free) 37°C v (immobilised optimum) 46°C**;** 5 free enzyme higher, maximum activity / activity at optimum temperature **; ora** 6 (free) 8.2 / 8.3, a.u. v 7.5 a.u. **;** 7 between 20°C and 39°C the activity of free is higher **; ora** 8 between 39°C and 55°C the activity of free is lower **; ora** *if mp 7 and 8 not gained, allow 1 mark for free activity higher at lower temperatures and lower at higher temperatures (than immobilised) ora* 9 comparative data to support mp 7 or 8 **; A** comparison at one temperature (stated or use of numerical data) 10 AVP **;** e.g. both have same activity at 39°C, similar activity between 20°C and 30°C	**4**
4(e)	substrate concentration that gives half V_{max} / AW **;** **A** description of how to use a graph to derive (must refer to substrate concentration)	**1**
4(f)	*two from* *look for ora throughout* free / low(er) K_m , has higher affinity for substrate **;** free needs a lower concentration of substrate to reach, V_{max} / maximum activity / ½ V_{max} **;** takes lower substrate concentration to saturate active sites in free **;** free active site more, likely to be saturated with substrate / accessible **;** active site (may be) distorted by immobilising **;** *ref. to* substrate passing through matrix when immobilised **;** *ref. to* some product retained within matrix **;**	**2**

Question	Answer	Marks
5(a)(i)	Golgi (body / apparatus / complex) **;**	**1**
5(a)(ii)	animal cell ✓ plant cell ✓ bacterial cell **;**	**1**
5(b)	magnification = scale bar length / actual length **; A** M = I / A M = I / O or magnification triangle 14 500 **;;** *for 29 mm scale bar length* **A** 14 000 (*for 28 mm*) **or** 15 000 (*for 30 mm*) *allow one mark only for* *incorrect answer but correct calculation using scale bar e.g. 29 000 ÷ 2* *correct answer but units given* *correct measurement and correct calculation but incorrect conversion*	**3**
5(c)	*mark first two only* nucleus **;** mitochondria **;** chloroplasts **;**	**2**
5(d)(i)	*fluid* *idea of* phospholipid (and protein) molecules, move about / diffuse (within their monolayer) **;** *mosaic* protein (molecules), interspersed / scattered / AW **; A** different / AW, proteins **;**	**2**

Question	Answer	Marks
5(d)(ii)	*any four from* 1 barrier between cytoplasm and, external environment / AW **;** e.g. tissue fluid **A** protects, organelles from damage / from pathogens, **I** keeps cell contents in / membrane surrounds the organelles 2 cell signalling **or** has receptors for, cell signalling substance / hormone / neurotransmitter / AW 3 cell recognition / acts as cell surface antigen **;** 4 cell-to-cell adhesion **;** 5 site for, enzymes / catalysing reactions **;** 6 anchoring the cytoskeleton / AW **;** 7 selection of substances that enter or leave a cell **;** AW 8 formation of <u>hydrogen bonds</u> with water for stability **;** 9 AVP **;** e.g. *ref. to*, changing shape of cell / flexibility of cells e.g. phagocytosis	**4**

Question	Answer	Marks
6(a)	*mark first two statements given* cellulose, cell wall / lining, allows adhesion of water **;** thick (cellulose) cell wall prevents collapse / *idea of* providing support (under tension) **;** (cell wall impregnated with) lignin, for waterproofing / prevents water loss **;** lignin, rings / spirals / thickening / AW (of walls), prevents collapse / *idea o*f providing support (under tension) **;** **A** lignified walls no cytoplasm / lack of contents / hollow / empty (lumen), gives, less resistance to / unimpeded / uninterrupted / unhindered / ease of, flow **; A** greater volume per unit time / faster rate **R** continuous, smooth **R** dead ack of end walls / continuous tube, so, less resistance to / unimpeded / uninterrupted / unhindered / ease of, flow **;** AW **R** continuous, smooth pits / pores, for lateral movement / for movement around air bubbles / supplies (water) to (surrounding), cells / tissues **;** **R** holes wide / large diameter / large lumen, so large volume of water can be transported **;** *if max 2 not gained, allow one mark for two correct explanations or descriptions where accompanying descriptions and explanations are in context*	**2**

Question	Answer	Marks
6(b)	*two from* *accept phloem vessels for sieve tubes* only sieve tubes / one type, v, arteries, veins and capillaries (any two) **A** three types**;** sieve tubes are composed of cells v blood vessels composed of tissues **; A** ref. to named tissues sieve tubes, have cytoplasm **or** blood vessels are, hollow / AW**;** sieve tubes have sieve plates **; ora** sieve tubes have companion cells (to fully function) **;** veins have valves **; ora** *ref. to* blood vessels and vasoconstriction **; ora** *idea of transport* open (phloem) v closed (blood vessels) **; A** sieve tubes have plasmodesmata *ref. to* unidirectional flow in blood vessels **; ora**	**2**
6(c)	*three from* mitochondria, synthesise ATP / carry out aerobic respiration **;** more ATP needs to be synthesised / increased ATP synthesis **; A** need to produce large quantities of ATP to provide more (metabolic) energy **; R** *in context of water uptake* for active transport / active uptake **;** *in context of mineral ions* **A** to move mineral ions against the concentration gradient	**3**