Cambridge International AS & A Level

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BIOLOGY **9700/22**

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)	**C ;** **R** if more than one area given	**1**
1(b)(i)	*three from* two chromatids drawn **;** *must be connected at some point* (sister) chromatid label to correct structure **;** centromere label to correct structure **; A** kinetochore telomere label to end of chromatid **;** DNA <u>and</u> histone (proteins) label to chromatid **;**	**3**
1(b)(ii)	*two from* disassembles / breaks down / disintegrates / AW, at, prophase **; A** prometaphase re-forms / re-assembles / AW**,** after anaphase / at telophase **;** *if mp 1 and 2 not gained, one mark can be awarded for knowledge of disassembles and then reassembles* detail **;** e.g. breakdown into vesicles re-forms from vesicles / vesicles fuse to form new membranes re-forms around both sets of (daughter) chromosomes	**2**

Question 2

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>
two from
cell (surface) membrane / plasma membrane / phospholipid bilayer, damaged / AW ; A phospholipids are in cell surface membrane (and will be broken down by phospholipase)

cell, bursts / lyses / lysis / ruptures ; haemolysis is neutral

cell contents / AW / haemoglobin, leaks out / AW ; I water
</td><td>2</td></tr>
<tr><td>2(b)</td><td>
allow, fatty acids / fatty acid tails / hydrocarbon chains, for fatty acid residues

both have / similarities (max 3)
glycerol (residue) ;

fatty acids ; I ref. to saturation, R both have, two / three, fatty acids

ester, bonds / linkages ;

C <u>and</u> H <u>and</u> O ;

double bonds ; A both have C=O

differences (max 3)
<table>
<tr><th>triglyceride / fat / oil / lipid</th><th></th><th>phosphatidylcholine / phospholipid</th></tr>
<tr><td>no, choline / nitrogen
A no / small / delta, charges</td><td>or</td><td>has, choline / nitrogen ;
A choline / nitrogen, ion
A charged / ionic</td></tr>
<tr><td>three fatty acid residues
or one extra fatty acid residue ;
A triglyceride has three ester bonds</td><td></td><td>R if comparison includes phosphatidylcholine and the number of fatty acid residues is incorrect</td></tr>
<tr><td>no, phosphate (group) / phosphorus
A no, phosphoester / phosphodiester bond</td><td>or</td><td>has phosphate ;
A has phosphoester / phosphodiester bond</td></tr>
</table>
</td><td>4</td></tr>
</table>

Question	Answer	Marks
2(c)	smooth endoplasmic reticulum **;** **A** smooth ER **R** SER **R** if more than one organelle given **R** endoplastic *two from* membranous / membranes **;** **A** *ref. to* vesicles, formed / bud off **R** envelope / double membrane tubular **;** **A** cisternae but **R** if described as flattened fluid filled, channels / sacs **;** not associated with ribosomes **;**	**3**

Question 3

Question	Answer	Marks
3(a)	intracellular (enzyme) **;** **R** interacellular	**1**
3(b)(i)	8.5 mmol dm^{-3} **;;** **A** 8–8.7 *max 1 if no units* *allow one mark if only half V_{max} stated* half V_{max} = 0.5 (au)	**2**
3(b)(ii)	*two from* (K_m is the) affinity, of enzyme for its substrate **;** **G** / low K_m enzyme, has a, high(er) affinity for its substrate (than **H**) **; ora** **A** binds more easily *note that if the term 'affinity' is used, then this is also mp1* **G** / low K_m enzyme, needs a lower concentration of substrate to reach, V_{max} / maximum activity / ½ V_{max} (than, **H** / enzyme with high K_m) **; ora** **G** / low K_m enzyme more likely to be saturated with substrate **;** (so) variations in substrate have less effect on rate of reaction (for **G**) **;**	**2**
3(c)	lysosomes **;** *treat as neutral Golgi vesicles* **R** lysozyme **R** if any other organelle named	**1**
3(d)	*any one relevant e.g.* leakage (of substances) through / damage to, (mitochondrial) membranes **A** *ref. to* fewer cristae **or** impaired uptake of substances through transport proteins / AW **or** no / impaired, ATP production / aerobic respiration / oxidative phosphorylation **or** no / low, protein / enzyme, synthesis (from mitochondrial ribosomes) **or** change to, number / distribution / presence, of membrane proteins **or** no mitochondrial replication occurring **;**	**1**

Question	Answer	Marks
3(e)	*five from* 1 change in nucleotide / base, sequence (of, DNA / gene / *GBA*) **;** *must be in context of DNA, ignore if in context of RNA* 2 (because of) base substitution **; A** substitution of a base 3 altered / AW, <u>mRNA</u> codon **; A** mRNA triplet **R** genetic code **I** triplet code 4 *idea that* a, codon / triplet, specifies a particular amino acid **;** *in context of DNA or RNA* 5 (different) tRNA with different amino acid (brought to ribosome) / tRNA brings Ser instead of Asn / tRNA brings Pro instead of Leu **; R** tRNA makes a different amino acid 6 altered, primary structure **or** altered, sequence / order / arrangement, of amino acids **; R** if describing result of frameshift, deletions or insertions e.g. all amino acids changed from mutation on / missing amino acid / added amino acids 7 affects (folding into) / different, secondary structure **;** *different tertiary structure* 8 *ref. to* different interactions between, R groups / side chains (because of changed primary structure) **; A** *idea of* different bonds forming (*if R-groups not stated*) **I** peptide bonds change *9* *idea that* differences give different shapes of active site *if shape not stated, allow point if linked to idea of 'tertiary structure changes shape'* **or** *idea of* change to complementarity to substrate 10 mutation 1 / asparagine (Asn) to serine (Ser), change less effect on, active site shape / catalysis **or** mutation 2 / leucine (Leu) to proline (Pro), change greater effect on, active site shape / catalysis **;**	**5**

Question 4

Question	Answer	Marks
4(a)	*two from* (loss of ions) increases / AW, water potential within cell **; ora, A** Ψ for water potential, **I** *ref. to* solutes / solute potential water moves out of cell, down water potential gradient / from high(er) to low(er) water potential **; R** from high to low water potential gradient (out) by <u>osmosis</u> / through the partially permeable membrane **; A** selectively permeable membrane **I** osmotic gradient	**2**
4(b)	*four from* *capillary side sodium ions* 1 sodium ions out (of cell), by active transport / with use of ATP **; A** sodium ions pumped out 2 (so) lowers concentration of sodium ions within cell **or** sodium ion concentration gradient, set up / maintained **;** *intestinal lumen sodium ions and glucose* 3 sodium ions enter by facilitated diffusion **; A** diffusion / high to low concentration, through, SGLT1 / cotransporter **I** glucose enters by facilitated diffusion 4 glucose, cotransported with sodium ions into cell (through SGLT1) **; A** sodium ions cotransported with glucose **A** glucose enters by secondary active transport, **A** *idea of* glucose only able to enter if moving with sodium ions (i.e. sodium drives the process) 5 (cotransport means) glucose enters against concentration gradient **;** *capillary side glucose* 6 glucose out of cell (towards capillary) by <u>facilitated</u> diffusion **; A** by diffusion if stated through, membrane protein / GLUT2 *water uptake from lumen* 7 (higher concentrations of) sodium ions / glucose / solutes, within cell lowers water potential **;** 8 water follows, sodium ions / glucose / solutes (osmotically) **or** so water enters cell (down water potential gradient) **;** *must have idea that it follows inward movement of solutes*	**4**

Question	Answer	Marks
4(c)	*any one valid e.g.(if not stated artery or vein, assume vein)* high(er) pressure of artery (will not allow drip) **or** artery may be deeper to reach to insert needle for drip / easier to find vein **A** vein more, visible / superficial **or** greater risk / more complications / greater blood loss, associated with intra arterially AW	**1**
4(d)	*one from* no / reduced, polypeptide / protein, synthesis **or** mRNA not translated / no translation / reduced translation **; A** detail of translation e.g. tRNA cannot bind **R** DNA not translated no / few, enzyme-catalysed reactions **;**	**1**
4(e)(i)	*three from* 1 volume / AW, decreases over time for all groups **;** 2 *compared to no antibiotic* antibiotic groups, steep(er) / faster, decrease to, 32 / 48 hours **;** 3 *idea that* diarrhoea, stops / is 0 dm^3, at / after, 64 hours, for one dose 1 g / **A**, **or**, multiple dose / **C ;** **A** recovers after 64 hours / AW 4 after 48 hours, one dose 2 g / **B**, fluctuation / decreases then (slight) increase then decrease / AW **;** 5 no antibiotic / **D**, higher volumes diarrhoea than antibiotics (to approx. 110h) **or** no antibiotic / one dose 2 g / **B**, took 128 hours (for diarrhoea) to, reach 0 dm^3 / stop **;** 6 multiple dose / **C**, higher volumes than, **A** (all readings) / **B** (to 48 hours) **ora or A** has steepest decrease *in context of 16–32 hours or overall*	**3**

Question	Answer	Marks
4(e)(ii)	*alternative ways to refer to decrease in volumes of diarrhoea may be in terms of recovery, destroying bacteria, decreasing loss of glucose and salts* *two from* *support treatment* there is a difference between antibiotic and no antibiotic treatment **or** fast(er) decrease in volume of diarrhoea with antibiotics / AW **or** (generally) faster recovery with antibiotics **;** **I** *ref. to* one dose 2 g use of Fig. 4.3 to support **;** e.g. use (1 dose) 1 g or multiple dose time, to recover / reach 0 dm^3, is halved use of numerical data from Fig. 4.3 *does not support treatment* (in all cases) volume decreased to, same level / zero **or** all patients recovered **;** use of Fig. 4.3 to support **;** e.g. by 128 hours all patients 0 dm^3 one dose of 2 g same trend from 112 hours as no antibiotic one dose of 2 g patients relapse after 64 hours one dose of 2 g took 128 hours (for recovery) *not able to say* limited information available / small number of patients **;** *ref. to* one dose of 2 g antibiotic **;** e.g. does not reach 0 dm^3 until same time as no antibiotic *also see arguments above – allow once only here or for does not support*	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(f)</td><td>
answer may be from point of view of single dose or multiple dose
allow AW – note mp 3 is for starting with susceptible bacteria and mp 4 is for starting with resistant bacteria

penalise once if use virus throughout
<table>
<tr><td></td><td>single dose</td><td>multiple dose</td><td></td></tr>
<tr><td>1</td><td>easier to be sure patient has taken complete dose</td><td>course may not be completed</td><td>;</td></tr>
<tr><td>2</td><td>if (bacteria are all susceptible and) treatment completed, all bacteria killed / no reservoir of bacteria</td><td>treatment may not be completed so some (susceptible) bacteria survive</td><td>;</td></tr>
<tr><td>3</td><td>(susceptible so) no bacteria survive to, <u>mutate</u> / become resistant</td><td>(bacteria replicating so) increased chance of, <u>mutation</u> / becoming resistant</td><td>;</td></tr>
<tr><td>4</td><td>idea that (if resistance is already present) single stronger dose has greater chance of killing resistant bacteria</td><td>weaker dose spread over time, resistant bacteria, more likely to survive / have less chance of being killed</td><td>;</td></tr>
<tr><td>5</td><td>(if all killed with single dose) idea that resistance not transferred (if all killed) e.g. no vertical / horizontal, transmission
this could be suggested as follow up to mp 2 / 4</td><td>if resistant / if develop resistance, this could be transferred
A vertical / horizontal, resistance</td><td>;</td></tr>
<tr><td>6</td><td colspan="2">AVP
e.g.
one dose may mean, no / less, antibiotic enters environment (in faeces)
(more effective so) bacteria passed out for shorter time, so reduces risk of transmission (of pathogen)
idea that multiple low dose antibiotics may increase mutagenesis
suggestion that if resistant and not killed by antibiotic, there may be less of an effect on (good) gut bacteria with single dose</td><td>;</td></tr>
</table>
</td><td>2</td></tr>
</table>

Question	Answer	Marks
4(g)	*three from* 1 *ref. to* different antigens (in context of, flagellum / whole cell / toxin) **;** **A** *ref. to* epitopes instead of antigens 2 specificity **;** *in correct context (B-lymphocytes / plasma cells / antibodies /antigen binding sites)* 3 detail of B-lymphocytes **;** e.g. specific B-lymphocytes activated (by each different antigen) **A** clonal selection form plasma cells that release specific antibody, **A** B-lymphocytes release specific antibody 4 detail of antibody **;** **I** *ref. to* receptor e.g. antibody complementary (shape) to antigen, antigen binding sites on antibody, variable regions different for each antibody	**3**
4(h)	passive natural / natural passive **;**	**1**

Question 5

Question	Answer	Marks
5(a)	**A** = root hair (cell) **;** **B** = Casparian (strip) **;** **C** = plasmodesmata / plasmodesma **;**	**3**
5(b)	xylem has no cytoplasm / symplast pathway is cytoplasmic (and vacuolar) **;** **A** empty / hollow / no contents **A** cytosol for cytoplasm xylem (vessel elements) are dead cells / symplastic through living cells **;**	**2**
5(c)	*three from* stomata close **; I** stomatal pore smaller / stomata partially open only cuticular transpiration **;** no photosynthesis / carbon dioxide not needed **; I** less photosynthesis transpiration (rate) decreases **; A** less, transpiration / transpiration pull, **A** described in terms of loss of water vapour from leaves evaporation (rate) (from cell walls of spongy mesophyll cells) decreases **; R** evaporation, from leaf surface / through stomata water potential gradient between, soil / root, and leaf becomes less steep **;**	**3**

Question 6

Question	Answer	Marks
6(a)(i)	**S ;**	**1**
(a)(ii)	pulmonary vein **;** **R ;**	**2**
6(a)(iii)	wall of right atrium **; A** muscle of right atrium	**1**
6(b)	*two from* passes the, impulse / wave of excitation, to the Purkyne fibres / down the septum **; A** Bundle of His **R** nerve impulse allows a (short) delay **;** detail **;** e.g. so atria contract before ventricles allows ventricles to fill so atria have, emptied / contracted, before ventricular contraction begins so atria and ventricles don't contract at the same time	**2**