
BIOLOGY**9700/22**

Paper 2 AS Level Structured Questions

October/November 2017

MARK SCHEME

Maximum Mark: 60

Published

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This document consists of **14** printed pages.

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

Question 2

| Question | Answer | Marks | | | | | | | | | | | | |
|--|--|---|--|------------------------------------|--|-----------|---|--|--|---|---|-----------|--|----------|
| 2(a) | <p><i>two from</i> cell (surface) membrane / plasma membrane / phospholipid bilayer, damaged / AW ; A phospholipids are in cell surface membrane (and will be broken down by phospholipase)</p> <p>cell, bursts / lyses / lysis / ruptures ; <i>haemolysis is neutral</i></p> <p>cell contents / AW / haemoglobin, leaks out / AW ; I water</p> | 2 | | | | | | | | | | | | |
| 2(b) | <p><i>allow, fatty acids / fatty acid tails / hydrocarbon chains, for fatty acid residues</i></p> <p><i>both have / similarities (max 3)</i> glycerol (residue) ;</p> <p>fatty acids ; I ref. to saturation, R both have, two / three, fatty acids</p> <p>ester, bonds / linkages ;</p> <p>C <u>and</u> H <u>and</u> O ;</p> <p>double bonds ; A both have C=O</p> <p><i>differences (max 3)</i></p> <table border="1" data-bbox="349 1027 1637 1398"> <tbody> <tr> <td data-bbox="349 1027 938 1078">triglyceride / fat / oil / lipid</td> <td data-bbox="943 1027 1010 1078"></td> <td data-bbox="1014 1027 1637 1078">phosphatidylcholine / phospholipid</td> </tr> <tr> <td data-bbox="349 1082 938 1193">no, choline / nitrogen A no / small / delta, charges</td> <td data-bbox="943 1082 1010 1193">or</td> <td data-bbox="1014 1082 1637 1193">has, choline / nitrogen ; A choline / nitrogen, ion A charged / ionic</td> </tr> <tr> <td data-bbox="349 1197 938 1308">three fatty acid residues or one extra fatty acid residue ; A triglyceride has three ester bonds</td> <td data-bbox="943 1197 1010 1308"></td> <td data-bbox="1014 1197 1637 1308">R <i>if comparison includes phosphatidylcholine and the number of fatty acid residues is incorrect</i></td> </tr> <tr> <td data-bbox="349 1311 938 1398">no, phosphate (group) / phosphorus A no, phosphoester / phosphodiester bond</td> <td data-bbox="943 1311 1010 1398">or</td> <td data-bbox="1014 1311 1637 1398">has phosphate ; A has phosphoester / phosphodiester bond</td> </tr> </tbody> </table> | triglyceride / fat / oil / lipid | | phosphatidylcholine / phospholipid | no, choline / nitrogen A no / small / delta, charges | or | has, choline / nitrogen ; A choline / nitrogen, ion A charged / ionic | three fatty acid residues or one extra fatty acid residue ; A triglyceride has three ester bonds | | R <i>if comparison includes phosphatidylcholine and the number of fatty acid residues is incorrect</i> | no, phosphate (group) / phosphorus A no, phosphoester / phosphodiester bond | or | has phosphate ; A has phosphoester / phosphodiester bond | 4 |
| triglyceride / fat / oil / lipid | | phosphatidylcholine / phospholipid | | | | | | | | | | | | |
| no, choline / nitrogen A no / small / delta, charges | or | has, choline / nitrogen ; A choline / nitrogen, ion A charged / ionic | | | | | | | | | | | | |
| three fatty acid residues or one extra fatty acid residue ; A triglyceride has three ester bonds | | R <i>if comparison includes phosphatidylcholine and the number of fatty acid residues is incorrect</i> | | | | | | | | | | | | |
| no, phosphate (group) / phosphorus A no, phosphoester / phosphodiester bond | or | has phosphate ; A has phosphoester / phosphodiester bond | | | | | | | | | | | | |

| Question | Answer | Marks |
|----------|---|----------|
| 2(c) | <p><u>smooth</u> endoplasmic reticulum ; A <u>smooth</u> ER R SER R if more than one organelle given R endoplasmic</p> <p><i>two from</i></p> <p>membranous / membranes ; A <i>ref. to vesicles, formed / bud off</i> R envelope / double membrane</p> <p>tubular ; A cisternae but R if described as flattened</p> <p>fluid filled, channels / sacs ;</p> <p>not associated with ribosomes ;</p> | 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) <u>affinity</u> , 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 / $\frac{1}{2} V_{max}$ (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 ; <i>treat as neutral Golgi vesicles</i> R lysozyme R if any other organelle named | 1 |
| 3(d) | <i>any one relevant e.g.</i> leakage (of substances) through / damage to, (mitochondrial) membranes A <i>ref. to fewer cristae</i> 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) | <p><i>five from</i></p> <p>1 change in nucleotide / base, sequence (of, DNA / gene / <i>GBA</i>) ; <i>must be in context of DNA, ignore if in context of RNA</i></p> <p>2 (because of) base substitution ; A substitution of a base</p> <p>3 altered / AW, <u>mRNA</u> codon ; A mRNA triplet R genetic code I triplet code</p> <p>4 <i>idea that a, codon / triplet, specifies a particular amino acid ; in context of DNA or RNA</i></p> <p>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</p> <p>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</p> <p>7 affects (folding into) / different, secondary structure ;</p> <p><i>different tertiary structure</i></p> <p>8 <i>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</i></p> <p>9 <i>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</i></p> <p>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 ;</p> | 5 |

Question 4

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

| Question | Answer | Marks |
|----------|---|-------|
| 4(c) | <p><i>any one valid e.g. (if not stated artery or vein, assume vein)</i> 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</p> | 1 |
| 4(d) | <p><i>one from</i> no / reduced, polypeptide / protein, synthesis or <u>mRNA</u> not translated / no translation / reduced translation ; A detail of translation e.g. tRNA cannot bind R DNA not translated no / few, enzyme-catalysed reactions ;</p> | 1 |
| 4(e)(i) | <p><i>three from</i> 1 volume / AW, decreases over time for all groups ; 2 <i>compared to no antibiotic</i> antibiotic groups, steep(er) / faster, decrease to, 32 / 48 hours ; 3 <i>idea that</i> diarrhoea, stops / is 0 dm³, 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 dm³ / stop ; 6 multiple dose / C, higher volumes than, A (all readings) / B (to 48 hours) ora or A has steepest decrease <i>in context of 16–32 hours or overall</i></p> | 3 |

| Question | Answer | Marks |
|----------|---|-------|
| 4(e)(ii) | <p><i>alternative ways to refer to decrease in volumes of diarrhoea may be in terms of recovery, destroying bacteria, decreasing loss of glucose and salts</i></p> <p><i>two from</i></p> <p><i>support treatment</i> 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 <i>ref. to one dose 2 g</i></p> <p>use of Fig. 4.3 to support ; e.g. use (1 dose) 1 g or multiple dose time, to recover / reach 0 dm³, is halved use of numerical data from Fig. 4.3</p> <p><i>does not support treatment</i> (in all cases) volume decreased to, same level / zero or all patients recovered ;</p> <p>use of Fig. 4.3 to support ; e.g. by 128 hours all patients 0 dm³ 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)</p> <p><i>not able to say</i> limited information available / small number of patients ;</p> <p><i>ref. to one dose of 2 g antibiotic ; e.g. does not reach 0 dm³ until same time as no antibiotic</i> <i>also see arguments above – allow once only here or for does not support</i></p> | 2 |

| Question | Answer | | | Marks | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|---|---|---|-------|-------------|---------------|--|---|---|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|---|---|
| 4(f) | <p><i>answer may be from point of view of single dose or multiple dose</i> <i>allow AW – note mp 3 is for starting with susceptible bacteria and mp 4 is for starting with resistant bacteria</i></p> <p><i>penalise once if use virus throughout</i></p> <table border="1" data-bbox="349 352 1919 1142"> <thead> <tr> <th></th> <th>single dose</th> <th>multiple dose</th> <th></th> </tr> </thead> <tbody> <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><i>idea that</i> (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) <i>idea that</i> resistance not transferred (if all killed) e.g. no vertical / horizontal, transmission <i>this could be suggested as follow up to mp 2 / 4</i></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) <i>idea that</i> multiple low dose antibiotics may increase mutagenesis <i>suggestion that</i> 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> </tbody> </table> | | | | single dose | multiple dose | | 1 | easier to be sure patient has taken complete dose | course may not be completed | ; | 2 | if (bacteria are all susceptible and) treatment completed, all bacteria killed / no reservoir of bacteria | treatment may not be completed so some (susceptible) bacteria survive | ; | 3 | (susceptible so) no bacteria survive to, <u>mutate</u> / become resistant | (bacteria replicating so) increased chance of, <u>mutation</u> / becoming resistant | ; | 4 | <i>idea that</i> (if resistance is already present) single stronger dose has greater chance of killing resistant bacteria | weaker dose spread over time, resistant bacteria, more likely to survive / have less chance of being killed | ; | 5 | (if all killed with single dose) <i>idea that</i> resistance not transferred (if all killed) e.g. no vertical / horizontal, transmission <i>this could be suggested as follow up to mp 2 / 4</i> | if resistant / if develop resistance, this could be transferred A vertical / horizontal, resistance | ; | 6 | 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) <i>idea that</i> multiple low dose antibiotics may increase mutagenesis <i>suggestion that</i> if resistant and not killed by antibiotic, there may be less of an effect on (good) gut bacteria with single dose | | ; | 2 |
| | single dose | multiple dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | easier to be sure patient has taken complete dose | course may not be completed | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | if (bacteria are all susceptible and) treatment completed, all bacteria killed / no reservoir of bacteria | treatment may not be completed so some (susceptible) bacteria survive | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | (susceptible so) no bacteria survive to, <u>mutate</u> / become resistant | (bacteria replicating so) increased chance of, <u>mutation</u> / becoming resistant | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | <i>idea that</i> (if resistance is already present) single stronger dose has greater chance of killing resistant bacteria | weaker dose spread over time, resistant bacteria, more likely to survive / have less chance of being killed | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | (if all killed with single dose) <i>idea that</i> resistance not transferred (if all killed) e.g. no vertical / horizontal, transmission <i>this could be suggested as follow up to mp 2 / 4</i> | if resistant / if develop resistance, this could be transferred A vertical / horizontal, resistance | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 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) <i>idea that</i> multiple low dose antibiotics may increase mutagenesis <i>suggestion that</i> if resistant and not killed by antibiotic, there may be less of an effect on (good) gut bacteria with single dose | | ; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

Question 5

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