

**INTERNATIONAL AS  
BIOLOGY**

**9610**

BL02 Biological systems and disease

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Mark scheme

June 2019

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Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from [oxfordaqaexams.org.uk](http://oxfordaqaexams.org.uk)

Question	Marking guidance	Mark	Comments
01.1	1. Hydrolyse/break <u>peptide</u> bonds; 2. From within the molecule/centre of the molecule; 3. Produces short(er) (poly)peptides/chains;	2 max	Accept 'hydrolyses internal peptide bonds' for mp1 and 2  3. Allow 'produces peptides'
01.2	Creates more ends (for exopeptidases to work on);	1	Ignore dipeptides
01.3	144;	1	
01.4	36;	1	E.c.f. if number of peptide bonds from 01.3 is incorrect. Reject if answer given is a decimal
01.5	100;	1	

Question	Marking guidance	Mark	Comments
02.1	Sucrose;	1	
02.2	Sap (within phloem vessels) / phloem is under high pressure;	1	
02.3	<p><b>Rate for between positions 2 – 3</b>  <math>20 \div (2.40 - 1.25) = 17.4 \text{ cm h}^{-1}</math>;</p> <p><b>Mean rate</b>  <math>(16.0 + 17.4 + 14.3) \div 3 = 15.9 \text{ cm h}^{-1}</math>;</p>	2	<p>Answer of 15.9 = 2 marks</p> <p>Allow e.c.f. for one mark</p>
02.4	<p>1. In source / leaf sucrose / sugars actively transported into phloem (by companion cells);</p> <p>2. (Source) lowers water potential of sieve cell / tube and water enters (by osmosis);  <b>OR</b>                  (Sink) increase in water potential of sieve cell / tube and water leaves (by osmosis);</p> <p>3. (Source) increase in (hydrostatic) pressure causes mass movement (towards sink / root);  <b>OR</b>                  (Sink) decrease in (hydrostatic) pressure causes mass movement (towards sink / root);</p> <p>4. In sink (e.g. root cells) sugars removed from phloem / sieve cells;</p>	4	<p>1. Accept sucrose co-transported with hydrogen ions into the phloem</p> <p>3. Accept sugars move down a pressure gradient</p>

Question	Marking guidance	Mark	Comments
03.1	Changed base (sequence) of DNA / gene;	1	
03.2	1. Different sequence of amino acids / different primary structure / change of amino acid(s) (in the sequence); 2. Change in <u>tertiary structure</u> of protein / enzyme; 3. Due to bonds / named bond(s) forming in different positions / not forming; 4. Leads to a change in the shape of the <u>active site</u> / substrate no longer fits into the <u>active site</u> ;	3 max	1. Reject produces different amino acids  3. Reject reference to peptide bonds  4. Allow other descriptions e.g. E-S complexes can no longer form.
03.3	So there is no accumulation / build-up of phenylalanine;	1	Need the idea of preventing an increase to a level that is too high.
03.4	(Phenylalanine needed) to make proteins or named protein / impossible to get diet with no phenylalanine present / (phenylalanine needed) to form other amino acids;	1	Allow essential amino acid
03.5	1. Binds to enzyme <b>and</b> changes (the tertiary structure) shape of the enzyme / active site; 2. <u>Active site</u> forms / becomes <b>complementary</b> to substrate / phenylalanine; 3. (Defective enzyme) now able to forms E-S complexes / bind to substrate / substrate can bind /attach / enter active site;	2 max	1. Accept binds to allosteric site. Ignore if drug / Kuvan binds to active site. Ignore references to non-competitive inhibition.

<p>03.6</p>	<p><b>For:</b></p> <ol style="list-style-type: none"> <li>1. Before start of drug trial there was no difference between the experimental and control group <b>as</b> range bars overlap;</li> <li>2. Kuvan reduces concentration of phenylalanine;</li> <li>3. After week 5 / between weeks 5 and 10 there was a difference between the experimental and control group <b>as</b> range bars do not overlap;</li> <li>4. Large sample size <b>so</b> increases the reliability / repeatability of the results / validity of the conclusion;</li> </ol> <p><b>Against:</b></p> <ol style="list-style-type: none"> <li>5. Large range of effect / large reduction only in some patients / doesn't bring concentration of phenylalanine below 600 units for all / works for some patients but not for all;</li> <li>6. Side effects unknown / effects after 10 weeks / after 6 weeks of treatment unknown;</li> <li>7. Allow reference to another named factor which may have affected phenylalanine concentration e.g. ethnicity / diet;</li> </ol>	<p>4 max</p>	<p>For maximum marks – answers must give at least one <b>for</b> and one <b>against</b> point.</p> <ol style="list-style-type: none"> <li>2. Accept use of figures to describe the decrease in phenylalanine concentration.</li> <li>4. Ignore references to accuracy.</li> </ol>
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Question	Marking guidance	Mark	Comments
04.1	Prevents air entering; <b>OR</b> Prevents water leaking (which would affect movement of bubble);	1	
04.2	1. Water used for support / turgidity; 2. Water used in photosynthesis; 3. Water produced in respiration; 4. Water used in hydrolysis or formed in condensation reactions / named example of these reactions;	2 max	Accept: joints may not be sealed fully / 'leaks' Ignore 'water supplied to the cells'.
04.3	Returns bubble (to start);	1	
04.4	Increases reliability (of results) / anomalous results can be (more easily) identified / allows for anomalies / allows calculation of standard deviation / to allow statistical test to be carried out;	1	Ignore references to accuracy. Allow – increases repeatability / precision / validity. Allow idea of looking for concordant / consistent results / reduces the effect of chance in the results
04.5	For three marks correct answer 20.7; For two marks: e.g. 20.73 / 20.74 / 6.91 / 82.9; For one mark: 6.908 / 82.896	3	Give two marks for the correct figures but in the incorrect order of magnitude e.g. $2.07 \times 10^{-5}$

04.6	<p>As number of leaves are reduced (no mark),</p> <ol style="list-style-type: none"> <li>1. Less surface area / fewer stomata;</li> <li>2. Less evaporation / transpiration;</li> <li>3. Less uptake / pulling of water (into shoot) (so air bubble moves a shorter distance);</li> </ol>	2 max	Accept: converse arguments;
04.7	<p>Any <b>two</b> from:</p> <ol style="list-style-type: none"> <li>1. Isolated shoot much smaller than the whole plant; <b>OR</b> Isolated shoot may not be representative of the whole plant;</li> <li>2. Shoot may have been damaged when cut;</li> <li>3. Conditions in the laboratory may be different from those in the natural conditions / examples given e.g. differences in air movements / humidity / temperature / light intensity etc.</li> </ol>	2 max	<p>Give <b>one</b> mark for two named conditions with no explanations.</p> <p>Give <b>two</b> marks for two named conditions with two suitable explanations of how water uptake would be different.</p>

Question	Marking guidance	Mark	Comments
05.1	<b>A</b> = capsid; <b>B</b> = (lipid/viral) envelope;	2	Only allow phonetic spellings of capsid <b>B</b> = allow (lipid) membrane or host cell / plasma membrane or phospholipid bilayer
05.2	2.98 x 10 <sup>5</sup> : 1;;	2	Award two marks for: (since $\frac{4}{3} \pi$ cancels out): $\frac{4000^3}{60^3}$ (Allow $\frac{8000^3}{120^3}$ ) $= \frac{64 \times 10^9}{216 \times 10^3} = 2.96 \times 10^5 : 1$ Allow 3 x 10 <sup>5</sup> for two marks One mark for correct calculation of volumes
05.3	1. Antibiotics interfere with a metabolic process / viruses do not have metabolic reactions / aren't alive; 2. Viruses <u>inside</u> / replicate <u>inside</u> (body/host) cells <b>so</b> antibiotic unable to reach virus; 3. Viruses do not contain a cell wall;	2	
05.4	1. (Integrase inhibitors / INIs) prevent HIV/viral DNA from being integrated into cell's DNA; 2. (Protease inhibitors / PIs) prevent HIV/viral proteins being produced (from host cell proteins) / prevents modification of new HIV/viral proteins; 3. Inhibits/prevents the replication of HIV / prevents new virus particles from being assembled;	3	1. Accept other terms for integrated. 1. Allow only in the correct context. 2. Prevent the virus breaking out through the host cell membrane 3. Allow mark point 3 in the context of either mark point 1 or mark point 2

Question	Marking guidance	Mark	Comments
06.1	413 cm <sup>3</sup> min <sup>-1</sup> ;	1	
06.2	1. The volunteers would have no nicotine (in their blood/body); 2. (If volunteers smoked) would be unable to determine the actual effect of caffeine on heart rate / (If volunteers non-smokers) change in heart rate likely to be due to caffeine;	2	1. allow for one mark references to heart disease caused by smoking 2. Accept 'so caffeine is the only variable'
06.3	1. Body mass / size varies; 2. Need similar / same concentration/proportion/percentage (in blood) for valid comparison / to give valid mean HR;	2	1. Allow references to larger / smaller body masses 2. Ignore dosage
06.4	To ensure that change/increase in heart rate/results was caused by caffeine / not by another factor;	1	
06.5	1. Standard error (and 95% confidence limits); 2. Looking for differences between / comparing two <u>means</u> ;	2	1. Allow t-test

<p>06.6</p>	<p><b>For:</b></p> <ol style="list-style-type: none"> <li>1. Caffeine caused a <u>significant</u> increase in heart rate of volunteers in the test group / or <u>significant</u> difference between the two groups;</li> <li>2. (Difference/increase is significant / not due to chance) as the P value is less than 0.05 / 5%;</li> <li>3. Control group / volunteers given placebo showed little change (after 1 hour);</li> </ol> <p><b>Against:</b></p> <ol style="list-style-type: none"> <li>4. Only 20 volunteers in test group/given caffeine / small sample size / only one investigation;</li> <li>5. Difference is only just significant / P value is only just less than 0.05;</li> <li>6. Allow reference to other <u>named</u> factor(s) e.g. age / BMI / gender / fitness level / ethnicity /etc.;</li> </ol>	<p>3 max</p>	<p>For maximum marks – answers must give at least one <b>for</b> and one <b>against</b> point</p> <p>3. Allow use of figures to illustrate this point e.g. experimental group increased by 5.9 <b>and</b> control only increased by 0.3;</p>
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Question	Marking guidance	Mark	Comments
07.1	Any <b>four</b> from the following: 1. Place end section of root in (hot) acid / hydrochloric acid; 2. Wash end section of root in water; 3. Cut tip from root section (and place onto microscope slide); 4. Add stain (to distinguish the chromosomes); 5. Break up the tissue (with a mounted needle); 6. Cover with a coverslip <u>and</u> squash/apply pressure;	4 max	4. Allow reference to suitable named stain / dye. 4. Reject reference to iodine.
07.2	One complete S-phase clearly labelled – i.e. time period showing increase in DNA from 2.4 to 4.8 AU;	1	
07.3	31 ;;	2	If incorrect allow one mark for: $\frac{(74 + 6 + 5 + 7)}{300} \times 100$ or $\frac{92}{300} \times 100$ or 30.6(7) or 30

Question	Marking guidance	Mark	Comments
08.1	1. Vaccines contain dead/weakened/inactive pathogens / antigens; 2. Memory cells produced; 3. Secondary immune response / B-cells / memory cells produce plasma cells; 4. (Plasma cells) <u>rapidly</u> produce antibodies / produce <u>more</u> antibodies; 5. Antibodies destroy pathogens / agglutinate pathogens / increase the efficiency of phagocytosis; 6. Herd effect / fewer people to pass on disease;	6 max	1. Accept bacteria/microorganisms but not disease.  3. Idea of memory cells responding  5. Allow descriptions of agglutination.
08.2	1. Contains glucose / starch / carbohydrate / sugar <b>and</b> (sodium) ions / salt;  2. Sodium ions and glucose absorbed (from lumen) by <u>co-transport</u> ; 3. Lowers <u>water potential</u> in cells / increases <u>water potential</u> gradient; 4. Water taken up by <u>osmosis</u> ;	4 max	1. Accept food-based ORS e.g. appropriate carbohydrate sources – flour/maize/rice  1. Allow electrolytes instead of ions  3. Accept converse