AQA

A-LEVEL
BIOLOGY

BIOL2 – The variety of living organisms
Mark scheme

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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 aqa.org.uk

Question	Marking Guidelines	Mark	Comments
1(a)	1. **X**-Stroma; 2. **Y**-Granum/grana/thylakoid;	2	Allow phonetic spellings. 2. Ignore references to membranes, stacks or discs.
1(b)	1. Absorbs/traps/uses light; 2. For photosynthesis; 3. Produces carbohydrates/sugars/ lipids/protein;	2 max	1. Accept: Light dependent reaction. 3. Accept any named product of photosynthesis. Two marks for reference to light dependent and light independent reactions.
1(c)	Answer in range 15 300 – 16 000;;	2	Any length divided by 5 = 1 mark

Question	Marking Guidelines	Marks	Comments
2(a)(i)	Diffusion;	1	Ignore references to structures, membrane components etc. Allow simple diffusion. Reject facilitated diffusion.
2 (a)(ii)	1. (Thin / flat body) so short distance for diffusion / short diffusion pathway; 2. (Thin / flat body so) large surface area to volume ratio;	2	Ignore references to membrane, wall, body surface. 'It' refers to flatworm's body. 2. Ignore: "surface area" on its own.
2(b)(i)	A group of tissues;	1	Ignore references to function. Accept: Group = more than one.
2(b)(ii)	1. Water moves past the gill filaments or gill lamellae; 2. Provide large surface area/short diffusion pathway; 3. Countercurrent flow (of blood and water); 4. (countercurrent flow) Maintains diffusion gradient;	3 Max	3. Accept description of countercurrent.

Question	Marking Guidance	Mark	Comments
3(a)	Difference in DNA/base sequence; OR Difference in alleles/genes/gene pool;	1	Ignore: 'fewer alleles' unless qualified e.g. fewer different alleles.
3(b)	1. Reduced (genetic diversity); 2. As fewer different/varied alleles/genes; OR Reduced gene pool; 3. (Genetic) bottleneck;	2 max	2. Ignore: 'fewer alleles' unless qualified e.g. fewer different alleles.
3(c)	1. Measure seeds from large number of plants; 2. Select plants at random;	2	1. Accept: 20 or more for large number. 1. Ignore: many. 1. Ignore: large sample/large sample size.

Question	Marking Guidance	Mark	Comments
4(a)	1. Group of similar organisms / organisms with similar features/characteristics Or Organisms with same genes/chromosomes; 2. Reproduce/produce offspring; 3. That are fertile;	2 max	1. Accept: same number of chromosomes. 1. Accept: smallest taxonomic group. 1. Reject: genetically identical. Only allow 1 max if mentioned 1. 1. **Q** Ignore: similar genes/chromosomes. 2. Accept: breed/mate. 3. Ignore: that are 'viable'. 'Produce fertile offspring' = 2 marks.
4(b)(i)	3.5/3.54/3.55/3.54518371;;	2	Accept for one mark, wrong answer but 7140 as numerator or 2014 as denominator.
4(b)(ii)	1. Decrease in variety of plants / fewer plant species; 2. Fewer habitats/niches; 3. Decrease in variety of food / fewer food sources; 4. Aspect of clearing forest (killing insects) eg machinery, pesticides;	3 max	1. Accept: reference to monoculture or description. 1. Ignore: fewer plants. 2. Ignore: fewer homes/less shelter. 3. Ignore: less food. 3. Accept: less variety of prey. 4. Ignore: clearing.

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>5(a)(i)</td><td>8;</td><td>1</td><td>Accept: eight</td></tr>
<tr><td>5(a)(ii)</td><td>Introns / non-coding DNA;
OR
Start/stop code/triplet;</td><td>1 max</td><td>Ignore: repeats.
Accept: introns and exons present.
Accept: codon for code/triplet.
Reject: ‘Due to exons’.</td></tr>
<tr><td>5(b)</td><td>1. Change in amino acid/s /primary structure;
2. Change in hydrogen/ionic/ disulfide bonds;
3. Alters tertiary structure;</td><td>3</td><td>1. Reject: different amino acid formed/produced.
Ignore: Reference to active site.</td></tr>
<tr><td>5(c)</td><td><table><tr><td></td><td colspan="4">Number of bases</td></tr><tr><td></td><td>C</td><td>G</td><td>A</td><td>T</td></tr><tr><td>Strand A</td><td>29</td><td>18</td><td>16</td><td>11</td></tr><tr><td>Strand B</td><td>18</td><td>29</td><td>11</td><td>16</td></tr></table>Second column correct;
Columns three and four correct;</td><td>2</td><td></td></tr>
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Question	Marking Guidance	Mark	Comments
6(a)(i)	1. Groups within groups; 2. No overlap (between groups);	2	1. Accept: idea of larger groups at the top / smaller groups at the bottom.
6(a)(ii)	(Grouped according to) evolutionary links/history/relationships; OR Common ancestry;	1	Ignore: closely related. Ignore: genetically similar. Ignore: ancestry/same ancestry.
6(b)(i)	1. Forty three amino acids different; OR Most differences; OR Very different amino acid sequence / very different primary structure; 2. (So) very different DNA sequence/base sequence;	2	2. Ignore: different genes/ alleles.
6(b)(ii)	1. Compared with humans / not compared with each other; 2. Different amino acids affected; OR Differences may be at different positions / does not show where the differences are (in the sequence);	1	2. Accept: degenerate code / more than one triplet (codes) for an amino acid. Ignore: references to 'How Science Works' ideas, eg. lack of repeats/absence of control.
6(b)(iii)	1. All organisms respire/have cytochrome c; 2. (Cytochrome c structure) is more conserved / less varied (between organisms);	1 max	Accept: converse arguments for haemoglobin 1. Accept 'more' instead of 'all'. 1. Accept 'animals' instead of organisms'. 2. Ignore: cytochrome c is conserved (must be comparative).

Question	Marking Guidance	Mark	Comments
7(a)	Light; Humidity / moisture in air; Air movement / wind; Temperature;	2 max	
7(b)	Decreases chance of error; OR Larger difference in mass; OR Improves accuracy/precision;	1	Ignore: reliability, references to anomalies, calculate mean.
7(c)	1. (Water) transpired/evaporates /diffuses out; 2. (Via) water potential gradient / leaf has higher water potential; 3. Stomata open; 4. Water potential/diffusion gradient reduces (during investigation); 5. Water not being replaced / no water supply; 6. Stomata close/closing;	3 max	3. Must clearly indicate stomata are open. 3. Ignore: 'loss through stomata' is not sufficient for 'stomata open'. 3. & 6 Accept: correct description of guard cells being turgid or flaccid as being equivalent to stomata being open or closed. Ignore: Any reference to 'loss by osmosis'.
7(d)	1. Stomata (on upper surface) covered; OR Stomata close due to lack of light; OR (Grease provides) longer diffusion pathway; 2. Less evaporation/ transpiration/diffusion out;	2	1. Ignore: grease is waterproof. 2. Accept: Evaporation /transpiration/diffusion 'stops' as this could be referring to upper surface.

Question	Marking Guidelines	Mark	Comments
8(a)(i)	(Human cells) do not have a cell wall;	1	Accept "they" refers to human cells.
8(a)(ii)	(Affects) protein synthesis;	1	Allow description e.g. 'amino acids not joined together / translation. Reject: affects transcription.
8(b)	1. Mutation present/occurs; 2. Resistance gene/allele; 3. Resistant bacteria (survive and) reproduce; 4. Vertical (gene) transmission; OR Horizontal (gene) transmission; OR Conjugation;	3 max	1. Ignore antibiotic causes mutation. 1. or 2. Reject if reference to immunity (not both marks). 2. Must clearly state marking point. 3. Do not award by implication e.g. resistance passed on by vertical gene transmission = one mark (marking point 4). Reference to mitosis negates marking point 3 or 4 (not both marks).
8(c)	1. Horizontal (gene) transmission; 2. Via conjugation/pilus; 3. Plasmid/Gene/DNA replicated/copied; 4. Plasmid transferred (to *S.aureus)*;	3 max	Ignore reference to mitosis.

Question	Marking Guidance	Mark	Comments
9(a)	1. Strands separate; OR H-bonds break; 2. DNA helicase (involved); 3. Both strands/each strand act(s) as (a) template(s); 4. (Free) nucleotides attach; 5. Complementary/specific base pairing; OR AT <u>and</u> GC; 6. DNA polymerase joins nucleotides (on new strand); 7. H-bonds reform; 8. Semi-conservative replication; OR New DNA molecules contain one old strand and one new strand;	6 max	1. **Q** Ignore: strands split. 1. Accept: strands unzip. 4. Ignore: bases attach. 4. Accept: nucleotides attracted. 6. Reject: if wrong function of DNA polymerase. 8. Reject: if wrong context e.g. new DNA molecules contain half of each original strand.
9(b)(i)	16;	1	Reject: 16.5
9(b)(ii)	8;	1	
9(b)(iii)	1. Horizontal until 16 minutes; 2. (Then) decreases as straight line to 0 μm at 24 minutes;	2	1. Allow +/- one small box. 2. Allow lines that start from the wrong place, ending at 0 at 24 minutes.
9(c)(i)	24.6;; OR 24 hours 36 minutes;;	2	Allow one mark for incorrect answers that clearly show 82% of 30 (hours). Allow one mark for incorrect answers in which candidate clearly multiplies by 0.82.
9(c)(ii)	1. No visible chromosomes/chromatids; 2. Visible nucleus;	1 max	Reject: nuclear membrane/ envelop visible. Ignore: nuclear membrane/ envelop present.

9(c)(iii)	**D** (no mark) 1. Lower % (of cells) in interphase; OR higher % (of cells) in mitosis/named stage of mitosis; 2. (So) more cells dividing / cells are dividing quicker;	2	1. Accept: 'less' or 'more' instead of '%'. 1. Do not accept: higher % (of cells) in each/all stage(s). 2. Accept: uncontrolled cell division. 2. Do not award if Tissue **C** is chosen.

Question	Marking Guidance	Mark	Comments
10(a)	1. More red blood cells; 2. More haemoglobin;	2	
10(b)	1. Given (only) salt solution; 2. (Otherwise) treated the same way;	2	1. Accept: 'Placebo' in salt solution. Reference to salt solution is essential for first marking point.
10(c)	1. Mass/weight of volunteers;	1	
10(d)	1. To determine (most effective) dose; 2. To determine (most effective) time/weeks/length of treatment; 3. Investigate long term effect / toxicity / side effects; 4. To find the most cost effective treatment;	3 max	Do not credit marks for descriptions of the information in the table in terms of dose and length of treatment.
10(e)	1. More haemoglobin; OR More red blood cells; 2. (More) oxygen can be absorbed/transported; 3. (For) respiration / to respiring tissues/cells; 4. (More) energy released/more ATP; 5. For muscle contraction; 6. Delays anaerobic respiration; OR Delays build up of lactate/ lactic acid;	4 max	4. Reject: 'Energy produced or made' but allow energy made in form of ATP'. 6. Ignore: no anaerobic respiration / no build up of lactate/lactic acid.

10(f)	1. Large sample; OR Wide range (of individuals tested); 2. Random (sampling); 3. Tested at different times; OR More than once; 4. Mean/average value determined; 5. Idea of establishing a range for the normal concentration; OR Reference to use of standard deviation;	2 max	Answer may refer to individuals or populations of people. 1. Reject if one or two people used. OR one athlete and one non-athlete used.
10(g)	Blood thicker/denser/more viscous/more 'concentrated' / heart <u>contraction</u> greater / increases volume of blood;	1	Accept: More blood cells in same volume/'space'. Ignore: 'more red blood cells' / 'more blood' on its own. Ignore: 'Heart pumps/beats more/harder'