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General Certificate of Education (A-level)
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Biology BIOL2

(Specification 2410)

Unit 2: The Variety of Living Organisms

Final

Mark Scheme

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Question	Marking Guidance	Mark	Comments
1(a)	Cell wall; Starch (store); Chloroplast;	2 max	Accept: phonetic spelling
1(b)	Insoluble; Reduces/'stops' water entry/osmosis / does not affect water potential / is osmotically inactive;	2	Accept: description for first point e.g. 'does not dissolve'.
1(c)	Light sensitive eyespot / eyespot detects light; Flagellum enables movement towards light; Chloroplast/chlorophyll absorbs light/ for photosynthesis;	3	Do not penalise references to 'many chloroplasts'.

Question	Marking Guidance	Mark	Comments
2(a)	Difference in DNA/base sequence / difference in alleles/genes/gene pool;	1	Neutral: 'fewer alleles' unless qualified e.g. fewer different alleles.
2(b)	Environmental;	1	Accept: Environment
2(c)	Reduced (genetic diversity); As fewer different/varied alleles/genes / reduced gene pool; (Genetic) bottleneck;	2 max	Neutral: 'fewer alleles' unless qualified e.g. fewer different alleles.

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>3(a)(i)</td><td>9;</td><td>1</td><td>Accept: nine</td></tr>
<tr><td>3(a)(ii)</td><td>Introns / non-coding DNA / junk DNA;
Start/stop code/triplet;</td><td>1 max</td><td>Neutral: Repeats.
Accept: ‘Introns and exons present’.
Reject: ‘Due to exons’.</td></tr>
<tr><td>3(b)</td><td>Change in amino acid/s /primary structure;
Change in hydrogen/ionic/ disulfide bonds;
Alters tertiary structure;</td><td>3</td><td>Reject: ‘Different amino acid is formed’ – negates first marking point.
Neutral: Reference to active site.</td></tr>
<tr><td>3(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>26</td><td>19</td><td>20</td><td>9</td></tr><tr><td>Strand B</td><td>19</td><td>26</td><td>9</td><td>20</td></tr></table>Second column correct;
Columns three and four correct;</td><td>2</td><td></td></tr>
</table>

Question	Marking Guidance	Mark	Comments
4(a)(i)	Spindle formed / chromosome/centromere/chromatids attaches to spindle; Chromosomes/chromatids line up/move to middle/equator (of cell);	2	Do not award second mark for answers referring to chromosomes 'pairing up'. Ignore reference to homologous chromosomes unless context suggests pairing which negates second mark. Neutral: Details on nuclear membrane. Accept: Diagram for second marking point
4(a)(ii)	Chromosome/centromere splits / chromatids/ 'chromosomes' separate/pulled apart; To (opposite) sides/poles/centrioles (of cell);	2	Reject: Homologous chromosomes separate for first marking point. Accept: Diagram for second marking point. Chromatids/ 'chromosomes' move to poles/sides/centrioles = 2 marks.
4(b)(i)	Form/replace cells quickly/rapidly / divide/multiply/replicate rapidly;	1	Neutral: Repair cells. Answers must convey idea of 'speed'.
4(b)(Ii)	Correct answer = 774 minutes/ 12 hours 54mins = 2 marks;; Incorrect answer but indicates 3 cell cycles involved = one mark;	2	
4(c)	Prevents/slows DNA replication/doubling; Prevents/slows <u>mitosis</u>; New strand not formed / nucleotides(of new strand) not joined together / sugar-phosphate bonds not formed;	2	First marking point must be in context of DNA replication not cell replication. Do not negate first marking point if role of DNA polymerase is described incorrectly e.g. Reject: 'joins bases/strands together'. Role of DNA polymerase must be correct for last marking point.

Question	Marking Guidance	Mark	Comments
5(a)	Light; Humidity / moisture in air; Air movement / wind; Temperature;	2 max	
5(b)	Decreases chance of error / larger difference in mass / improves accuracy/precision;	1	Neutral: Reliability, references to anomalies.
5(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	Must clearly indicate that stomata are open for third marking point. However, allow correct descriptions of guard cells being turgid or flaccid as being equivalent to stomata being open or closed. 'Loss through stomata' on its own is not sufficient. Neutral: Any reference to 'loss by osmosis'.
5(d)	Stomata (on upper surface) covered / stomata close due to lack of light / (grease provides) longer diffusion pathway; Less evaporation/transpiration/ diffusion out;	2	Accept: Evaporation /transpiration/diffusion 'stops' for second point as this could be referring to upper surface.

Question	Marking Guidance	Mark	Comments
6(a)	High(er) affinity for oxygen / absorbs/loads more oxygen; At lower partial pressure (of oxygen) / lower pO_2;	2	Accept: Loads oxygen 'quicker', 'more readily', 'higher saturation', use of figures from graph for first point. Neutral: References to unloading.
6(b)	1. (Hydrostatic) pressure lower in capillary/blood / higher in tissues/tissue fluid; 2. Water (returns); 3. By osmosis; 4. Water potential lower/more negative in blood/capillary / higher/less negative water potential in tissues / via water potential gradient; 5. Due to protein (in blood); 6. (Returns) via lymph (system/vessels);	3 max	First marking point must be in context of between blood and tissue fluid. Neutral: References to hydrostatic pressure and water potential at arteriole end of capillary.

Question	Marking Guidance	Mark	Comments
7(a)	Is species specific / allows recognition of same species; Greater similarity in calls the closer the relationship (between the species);	2	Accept: 'Similar species have similar calls' as first marking point. Reference to courtship on its own is not sufficient for a mark. Must refer to relationship for second marking point.
7(b)(i)	*G. americana* and *G. monachus;* Highest percentage (DNA hybridisation) / more bases are similar/complementary / more hydrogen bonds / more base pairings;	2	Second marking point can be awarded without first marking point.
7(b)(ii)	Higher temperature / more energy (required) the higher the percentage DNA hybridisation / more bases are similar/complementary / more base pairings; Correct reference to breaking <u>hydrogen</u> bonds / more/less <u>hydrogen</u> bonds being present;	2	Accept: 'The greater the number of hydrogen bonds the higher the temperature/more energy required to break them' for one mark.
7(c)	1. More closely related (species) have more similarities in amino acid sequence/primary structure; 2. In <u>same</u> protein / named protein e.g. albumin; 3. Amino acid sequence is related to (DNA) base/triplet sequence; ***OR*** 4. Similar species have a similar immune response to a protein/named protein; 5. More closely related (species) produce more 'precipitate' / antibody-antigen (complexes) / agglutination;	2 max	Accept: 'Similar species have similarities in amino acid sequence' for first marking point. Accept: Converse for marking points 1, 4 and 5. Marking point 5 is for measuring the extent of the immune response.

Question	Marking Guidance	Mark	Comments
8(a)	Greater variety / different foods; More habitats/niches;	2	Answers only referring to 'more food' should not be credited but allow 'more food sources'.
8(b)	Also measures number of individuals in a species / different proportions of species; Some species may be present in low/high numbers;	2	First marking point can only be awarded if there is a reference to species.
8(c)(i)	Large surface area to volume (ratio); Correct reference to diffusion; (Eggs) cannot move (out of water); Permeable/thin (outer layer);	2 max	
8(c)(ii)	Concentration (of pesticide) is increased;	1	

Question	Marking Guidance	Mark	Comments
9(a)	More red blood cells; More haemoglobin;	2	
9(b)	Given (only) salt solution; (Otherwise) treated the same way;	2	Accept: 'Placebo' in salt solution. Reference to salt solution is essential for first marking point.
9(c)	Allows comparison to be made; Different masses/weights (of volunteers); Different weeks/lengths of treatment;	2 max	Accept: 'Both were different' for one mark. Neutral: Size for second marking point.
9(d)	To determine (most effective) dose; To determine (most effective) length of treatment; Investigate long term effect / toxicity / side effects; To find the most cost effective treatment;	2max	Do not credit marks for descriptions of the information in the table in terms of dose and length of treatment.
9(e)	More haemoglobin / more red blood cells; (More) oxygen can be absorbed/transported; (For) respiration / to respiring tissues/cells; (More) energy released/more ATP; For muscle <u>contraction</u>; Delays <u>anaerobic</u> respiration / delays build up of lactate/lactic acid;	4 max	Reject: 'Energy produced or made' but allow energy made in form of ATP'.

9(f)	Large sample / wide range (of individuals tested); Random (sampling); Tested at different times/more than once; Mean/average value determined; Idea of establishing a range for the normal concentration / reference to use of standard deviation;	2 max	
9(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'. Neutral: 'more red blood cells' / 'more blood' on its own. Neutral: 'Heart pumps/beats more/harder'

Question	Marking Guidance	Mark	Comments
10(a)(i)	Antibiotics kill other bacteria / *Clostridium* is resistant; Less/no competition so (*Clostridium)* reproduces/replicates/multiplies/increases in number;	2	Reference to bacteria being 'immune' negates first marking point. Reference to mitosis negates second marking point.
10(a)(ii)	Immune system less effective / more likely to have other infections/been in hospital;	1	Accept: 'Weak/lower' immune system'.
10(b)	Attaches to <u>active</u> <u>site</u> (of enzyme); (Methicillin) is a competitive inhibitor / prevents monomers/substrate attaching (to enzyme);	2	'Competes for active site = 2 marks. Neutral: 'Prevents monomers joining/attaching to each other'. Allow one mark max for answers relating to non-competitive inhibitor changing active site / preventing substrate attaching. Do not penalise Methicillin forms an enzyme/substrate complex
10(c)(i)	Have other illness/medical condition/'weak' immune system/disease/infection;	1	Reject: Due to 'other factors', 'are smokers', 'are obese' unless related to disease or illness.
10(c)(ii)	Increase up to 2006/20 (per 100 000) then decreases;	1	
10(c)(iii)	Correct answer in range of 52 – 59.1% = two marks; Incorrect answer but shows change as between 4.8 – 5.2 / shows correct subtraction giving this change e.g. 14 - 9 = one mark.	2	

10(d)	1. (Antibiotic) resistant gene/allele; 2. Vertical (gene) transmission; 3. Resistant bacteria (survive and) reproduce / population of resistant bacteria increases; 4. Increase in frequency of (resistant) allele/gene (in future generations); 5. Horizontal (gene) transmission; 6. Plasmid; 7. Conjugation / pilus (tube); 8. (Horizontal transmission/ conjugation) can occur between bacteria of different species;	6 max	Penalise reference to mitosis once when linked to either marking point 2 or 3. Penalise reference to immunity once when linked to either marking point 1, 3 or 4. Accept: Binary fission for reproduction in marking point 3. Accept: 'Transfer' for transmission.

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