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General Certificate of Education (A-level)
June 2013

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)(i)	Centromere;	1	Accept: if phonetically correct Reject: centriole
1(a)(ii)	1. Holds chromatids together; 2. Attaches (chromatids) to spindle; 3. (Allows) chromatids to be separated/move to (opposite) poles / (centromere) divides/splits at metaphase/ anaphase;	2 max	3. **Q** Neutral: chromosomes or chromatids split/halved/divided 3. Reject: reference to homologous chromosomes being separated Accept 'chromosomes' instead of 'chromatids' Ignore incorrect names for **X**
1(a)(iii)	(Homologous chromosomes) carry different alleles;	1	Accept alternative descriptions for 'alleles' eg different forms of a gene / different base sequences Neutral: reference to maternal and paternal chromosomes
1(b)(i)	(In **Figure 2**) 1. Chromatids have separated (during anaphase); 2. Chromatids have not replicated; 3. Chromosomes formed from only one chromatid;	1 max	1. **Q** Neutral: split/halved/divided 1. Reject: reference to homologous chromosomes being separated 1. & 2. Accept 'chromosomes' instead of 'chromatids' Accept converse arguments for **Figure 1** Ignore references to the *cell* not dividing as in the question stem Ignore: named phases
1(b)(ii)	1. Three chromosomes; 2. One from each homologous pair;	2	Ignore shading Only one mark for three chromosomes shown as pairs of chromatids

1(b)(iii)	Crossing over / alleles exchanged between chromosomes or chromatids / chiasmata formation / genetic recombination;	1	Accept: description of crossing over eg sections of chromatids break and rejoin Neutral: random fertilisation Reject: reference to sister chromatids **Q** Neutral: genes exchanged Neutral: mutation

Question	Marking Guidance	Mark	Comments
2(a)	1. Group of similar organisms / organisms with similar features / / 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. **Q** Neutral: similar genes/chromosomes 2. Accept: breed/mate 3. Neutral: that are 'viable' 'Produce fertile offspring' = 2 marks
2(b)(i)	Correct answer of 6.97 to 7 = 2 marks; One mark for 6320 as numerator or 906 as denominator;	2	
2(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. Neutral: fewer plants 2. Neutral: fewer homes/less shelter 3. Neutral: less food 3. Accept: less variety of prey 4. Neutral: clearing forest unqualified

Question	Marking Guidance	Mark	Comments
3(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
3(a)(ii)	(Grouped according to) evolutionary links/history/relationships / common ancestry;	1	Neutral: closely related Neutral: genetically similar
3(b)(i)	1. (Only) one amino acid different / least differences / similar amino acid sequence / similar primary structure; 2. (So) similar DNA sequence/ base sequence;	2	
3(b)(ii)	1. Compared with humans / not compared with each other; 2. Differences may be at different positions / different amino acids affected / does not show where the differences are (in the sequence);	1 max	Accept: degenerate code / more than one triplet (codes) for an amino acid
3(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. Neutral: cytochrome c is conserved

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>4(a)</td><td>1. Separates/unwinds/unzips strands/helix / breaks H-bonds;
2. (So) nucleotides can attach/are attracted / strands can act as templates;</td><td>2</td><td>1. Q Neutral: strands/helix split
1. Accept: unzips bases
2. Q Neutral: bases can attach
2. Neutral: helix can act as a template</td></tr>
<tr><td>4(b)</td><td><table><tr><th rowspan="2">Sample</th><th colspan="3">Type(s) of DNA molecule present in each tube</th></tr><tr><th>$^{15}N/^{15}N$</th><th>$^{15}N/^{14}N$</th><th>$^{14}N/^{14}N$</th></tr><tr><td>1</td><td>✓</td><td></td><td></td></tr><tr><td>2</td><td></td><td>✓</td><td></td></tr><tr><td>3</td><td></td><td>✓</td><td>✓</td></tr></table></td><td>3</td><td>One mark for each correct row</td></tr>
<tr><td>4(c)(i)</td><td>1. Similar shape/structure (to cytosine) / added instead of cytosine / binds to guanine;
2. Prevents (complementary) base pairing / prevents H-bonds forming / prevents formation of new strand / prevents strand elongation / inhibits/binds to (DNA) polymerase;</td><td>2</td><td>1. Accept: idea that only one group is different
1. Reject: same shape
2. Accept: prevents cytosine binding
Neutral: ‘prevents DNA replication’ as given in the question stem
Neutral: ‘competitive inhibitor’ unqualified
Neutral: inhibits DNA helicase</td></tr>
<tr><td>4(c)(ii)</td><td>(Cancer cells/DNA) divide/replicate fast(er)/ uncontrollably;</td><td>1</td><td>Accept: converse argument for healthy cells</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
5(a)(i)	Prevent cell wall formation / cause (cell) lysis / inhibit ribosomes / inhibit protein synthesis / prevent DNA replication / affect function of cell membrane;	1 max	Accept: weaken the cell wall Neutral: damage/break down the cell wall **Q** Reject: if in context of a cellulose cell wall Accept: bind to ribosomes
5(a)(ii)	(Plasmid/genes transmitted through) cell division/reproduction/replication/generations;	1	Accept: multiply Accept: binary fission Reject: within generations Reject: reference to horizontal gene transmission Reject: mitosis Ignore reference to immunity
5(b)	Representative/typical/reliable / different types of bacteria;	1	Neutral: accurate Neutral: reference to anomalies **Q**: Neutral: different strands of bacteria
5(c)	(Yes) 1. Largest clear zone/diameter/mean (so more bacteria killed); (No) 2. Standard deviations of chlorhexidene overlap/share values; 3. (Overlap means difference) is not significant / is due to chance;	3	Ignore references to methodology 2. Neutral: diameters overlap/share values 3. Can still be awarded if SD overlap or non-overlap is correctly interpreted 3. Accept: (difference) is not real/not reliable 3. Neutral: spread is not reliable
5(d)	1. Mutation (in bacterium); 2. Gene/allele for resistance;	2	1. Neutral: different strains 2. Reject: if in the context of 'immunity' 2. Accept: resistant gene/allele

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>6(a)</td><td>
<table>
<tr><th>Statement</th><th>Haemo-globin</th><th>Cellulose</th><th>Starch</th></tr>
<tr><td>Has a quaternary structure</td><td>✓</td><td></td><td></td></tr>
<tr><td>Formed by condensation reactions</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Contains nitrogen</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td>3</td><td>One mark for each correct row</td></tr>
<tr><td>6(b)</td><td>16;</td><td>1</td><td></td></tr>
<tr><td>6(c)</td><td>1. High<u>er</u> affinity / loads <u>more</u> oxygen;
2. At low/same/high <u>partial pressure</u>/<u>pO_2</u>;
3. Oxygen moves from mother/to fetus;</td><td>2 max</td><td></td></tr>
<tr><td>6(d)</td><td>1. Low affinity / oxygen dissociates;
2. (Oxygen) to respiring tissues/muscles/cells;</td><td>2</td><td>Assume ‘it’ is adult haemoglobin
1. Accept: converse if ‘fetal haemoglobin’ is clearly stated
2. Q: Neutral ‘respirate’</td></tr>
<tr><td>6(e)</td><td>Enough adult Hb produced / enough oxygen released / idea that curves/affinities/Hb are similar / more red blood cells produced;</td><td>1</td><td>Neutral: ‘adult Hb is also produced’ as in the question stem
Reject: curves/affinities/Hb are the same</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
7(a)	1. Population formed by a small number of founders/people /30 people; 2. (Founders show) less genetic diversity / small(er) gene pool / less variety of alleles; 3. Individuals breed within group / do not breed with outsiders; 4. High(er) chance of inheriting <u>allele</u> (than in non-Amish population);	3 max	Accept: converse arguments for the non-Amish population 2. **Q** Neutral: fewer alleles 3. Accept: inbreeding for 'individuals breed within group' 3. Accept: do not interbreed 3. **Q** Reject: interbreeding for 'individuals breed within group' 4. Do not award for 'allele passed on' only
7(b)	250 000;	1	
7(c)(i)	Loss of 3 bases/triplet = 2 marks;; Loss of base(s) = 1 mark;	2	'Stop codon/code formed' = 1 mark max unless related to the last amino acid eg triplet for last amino acid is changed to a stop codon/code = 2 marks 3 bases/triplet forms an intron = 2 marks Accept: descriptions for 'intron' eg non-coding DNA 'Loss of codon' = 2 marks
7(c)(ii)	1. Change in tertiary structure/ active site; 2. (So) faulty/non-functional protein /enzyme;	2	Neutral: change in 3D shape/ structure Accept: reference to examples of loss of function eg fewer E-S complexes formed

Question	Marking Guidance	Mark	Comments
8(a)	(In the root) 1. Casparian strip blocks apoplast pathway / only allows symplast pathway; 2. Active transport by endodermis; 3. (Of) ions/salts into xylem; 4. Lower water potential in xylem / water enters xylem by osmosis /down a water potential gradient; (Xylem to leaf) 5. Evaporation / transpiration (from leaves); 6. (Creates) cohesion / tension / H-bonding between water molecules / negative pressure; 7. Adhesion / water molecules bind to xylem; 8. (Creates continuous) water column;	6 max	Assume all points are in the correct location unless context suggests otherwise 4. **Q** Neutral: 'along' a water potential gradient 'Transpiration pull' = 2 marks (5. & 6.) 6. Accept 'pulling' 6. **Q** Neutral: 'suction'
8(b)	Correct answer of 342.8-343 = 2 marks;; Credit incorrect answers that show the numerator as 144 (or 186-42) or denominator as 42 for 1 mark;	2	
8(c)	1. More air/oxygen enters / air/oxygen enters quickly/quicker; 2. (So) maintains/greater diffusion or concentration gradient;	2	1. Accept: converse for carbon dioxide 1. Can be in any correct context eg insect, tracheoles, muscle 1. Neutral: air/oxygen enters
8(d)	Large(r) SA:VOL / short(er) diffusion distance (to tissues);	1	Accept: thin diffusion pathway
8(e)	6 / 6.6 / 6.7 / 7 / 7.5 / 8 = 2 marks;; Award 1 mark for incorrect answers that have divided 60 by any number;	2	Different answers given for different interpretations of the graph

8(f)	Less/no water lost / (more) water retained;	1	Accept: less dehydration / less evaporation **Q** Reject: less 'transpiration' **Q** Reject: less water lost by osmosis

8(g)	1. Greater <u>surface area</u> exposed to air; 2. Gases move/diffuse faster in air than through water; 3. Increases volume/amount of air;	1 max	Neutral: shorter diffusion distance 2. **Q** Neutral: 'harder to diffuse' 2. Accept gases diffuse directly, rather than through water

Question	Marking Guidance	Mark	Comments
9(a)	Any two suitable suggestions eg 1. Volume/concentration of skin lipid; 2. Age/sexual maturity; 3. Species of snake; 4. Size of male; 5. Colour; 6. Temperature; 7. Light; 8. Time of day/year/breeding season; 9. Duration/length of time observing; 10. Diet; 11. Filter paper; 12. Size of cage;	2 max	1. Accept: amount Neutral: environment / health / body mass / number of snakes
9(b)	To avoid bias;	1	
9(c)	1. To avoid change in (courtship) behaviour (due to past experience); 2. To observe a typical/general/representative (response);	1 max	Accept: ethical arguments eg causing distress to snakes Neutral: reference to anomalous results
9(d)	Filter paper without (skin) lipids / untreated filter paper / filter paper with water / (female) snakes with lipids removed;	1	Accept: filter paper qualified eg *only* filter paper Neutral: reference to using male snakes/lipids from male snakes
9(e)	1. Similar response to lipids and (whole) snakes; 2. (So males are) responding to lipids; 3. (So males are) not responding to (whole) snakes/visual clues;	2 max	Neutral: greater response to long snakes and lipids from long snakes as in the question stem

9(f)	(Parent/offspring) 1. Produce more/larger offspring/eggs; 2. Better predators / fitter / more successful at gaining food / less likely to be eaten / more able to protect offspring/eggs; 3. (More) sexually mature / fertile; 4. Have more food stores for offspring/eggs;	2 max	3. Neutral: mature
9(g)	1. (Males) respond to/sense (unsaturated) <u>fatty acids</u>; 2. (Long females) produce/have more fatty acids / positive correlation;	2	1. Reference to courtship behaviour on its own is not sufficient Reference to 'lipids/fats' is neutral for both mark points. However, if fatty acids are mentioned for either mark point, accept lipids/fats = fatty acids for the other mark point
9(h)	1. Draw a line of best fit; 2. Extrapolation / extend line;	2	
9(i)	Results vary for a particular body size/% / values overlap / small sample size / idea of reaching maximum/100%/ a plateau;	1	Neutral: reference to inaccurate line of best fit Neutral: 'results vary'
9(j)	(Other females/species) produce different fatty acids;	1	Must refer to fatty acids rather than just 'lipids/fats' Accept: lack of receptors