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General Certificate of Education

Biology 1411

BIOL2 The variety of living organisms

Mark Scheme

2010 examination - January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Question	Part	Marking Guidance	Mark	Comments
1	(a)	Differentiation/specialisation	1	
1	(b)(i)	(cellulose) Cell wall;	1	
1	(b)(ii)	Two marks for correct answer 2350– 2500;; One mark for a measured length divided by real length;	 2	Accept measured and real lengths in different units for one mark.
1	(b)(iii)	Chloroplasts absorb light; Large vacuole pushes chloroplasts to edge (of cell); Thin/permeable (cell) wall to absorb carbon dioxide;	 1 max	**Q** Do not accept chlorophyll as alternative to chloroplasts

Question	Part	Marking Guidance	Mark	Comments
2	(a)(i)	Phylum, Class, Order, Genus; Mantophasma (M)/(Mantophasma) zephyra;	 2	
2	(a)(ii)	Groups within (larger) groups; No overlap;	 2	
2	(b)	Comparison of/look for similar features/structures/appearance;	1	

Question	Part	Marking Guidance	Mark	Comments
3	(a)(i)	Deoxyribose;	1	pentose / 5C sugar = neutral
3	(a)(ii)	Phosphate/Phosphoric acid;	1	phosphorus/P = neutral
3	(b)	Hydrogen (bonds);	1	
3	(c)	381/384/387;	1	
3	(d)	(Gln) Met Met Arg Arg Arg Asn;	1	
3	(e)	Change in (sequence of) amino acids/primary structure; Change in hydrogen/ionic/disulfide bonds; Alters tertiary structure/active site (of enzyme); Substrate cannot bind / no enzyme-substrate complexes form;	3 max	**Q** Reject = different amino acids are formed

Question	Part	Marking Guidance	Mark	Comments
4	(a)	Increase in/more carbon dioxide; Curve moves to the right/depressed;	2	**Q** Any reference to haemoglobin increasing affinity for oxygen disqualifies second mark point.
4	(b)(i)	More haemoglobin; So can load/pick up more oxygen (in the lungs);	2	**Q** Second mark point must relate to idea of loading oxygen. Answers referring only to transport of oxygen should not be credited this mark.
4	(b)(ii)	(Haemoglobin) has lower affinity for oxygen / more oxygen released; In/to the cells/ tissues;	2	

Question	Part	Marking Guidance	Mark	Comments
5	(a)	Single layer of cells / few layers of cells; So that light that can pass through / cells absorb light;	2	
5	(b)	Method of determining area of field of view/area seen using microscope; Count number of stomata in field of view; Repeats and calculation of mean;	3	
5	(c)	Water <u>vapour</u> accumulates / increased humidity/ reduced air movement (around stomata); Water potential/diffusion gradient reduced;	2	

Question	Part	Marking Guidance	Mark	Comments
6	(a)	(Blood) plasma;	1	
6	(b)	More/larger proteins / less urea/carbon dioxide / more glucose/amino acids/fatty acids/oxygen/ high(hydrostatic) pressure;	1	**Q** Reference to blood cells/water potential = neutral **Q** No Protein should not be credited
6	(c)(i)	Contracts;	1	**Q** Do not accept pumping of heart/heart beating
6	(c)(ii)	Loss of fluid/volume; Friction/resistance (of capillary wall);	1 max	**Q** Reference to a narrow lumen is not sufficient to gain a mark unless friction or resistance is mentioned.
6	(d)	Water potential (in capillary) not as low/is higher/less negative / water potential gradient is reduced; More tissue fluid formed (at arteriole end); Less/no water absorbed (into blood capillary); by osmosis; (into blood capillary);	3 max	**Q** The last two marking points must be in context of movement into the blood capillary

Question	Part	Marking Guidance	Mark	Comments
7	(a)(i)	Two marks for correct answer of 4.3; One mark for incorrect answer that clearly shows understanding of ∑n(n-1) /188 as denominator;	2	**Q** An answer of 4 scores 1 mark
7	(a)(ii)	Measures number of individuals (of each species) and number of species; Some species only present in small numbers;	2	**Q** First marking point can only be awarded if there is a reference to species.
7	(b)(i)	Reduced as one crop/species grown / other species removed; Use of herbicides/weeding/ploughing; Wheat (better) competitor for named factor e.g. light/nutrients;	2 max	
7	(b)(ii)	(Reduced) as less variety of food sources; (Reduced) as fewer habitats/niches; (Reduced) by pesticides/chemicals;	2 max	**Q** Answers only referring to 'less food' should not be credited

Question	Part	Marking Guidance	Mark	Comments
8	(a)	Filaments/lamellae provide large surface area; Thin/flattened epithelium/ one/two cell layers so short diffusion pathway (between water and blood); Countercurrent/blood flow maintains concentration/diffusion gradient;	2 max	**Q** Do not credit thin cell walls/membranes
8	(b)(i)	Large/wide range of values (so can fit on graph);	1	
8	(b)(ii)	Decrease in uptake with increase in mass / negative correlation;	1	
8	(b)(iii)	Enables comparison; As animals differ in size/mass;	2	
8	(b)(iv)	Smaller animals have larger surface area to volume ratio; Lose more heat per gram of tissue; Respire more/faster (relative to body mass); Oxygen used in respiration;	3 max	Allow converse for larger animals. Allow appropriately named animal as an alternative to smaller or larger animals.

Question	Part	Marking Guidance	Mark	Comments
9	(a)	Given only saline; Otherwise treated exactly the same way;	2	
9	(b)	Ethical consideration, e.g., leads to death/suffering of mice; Large number to improve reliability / reduce sampling error; Number of mice related to cost/space available/animal husbandry;	2 max	
9	(c)	Vary in shape / do not grow uniformly;	1	**Q** Allow descriptions of variation in shape.
9	(d)	7.44 and 1.74;; 7.42 and 1.72;; (Ratio) 4.28 : 1;; (Ratio) 4.31 : 1;; (Percentage decrease) 76.6%;; (Percentage decrease) 76.8%;;	2 max	Any of the answers shown gain two marks. An answer of 23.4% or 23.2% Percentage decrease gains one mark. Correct method of calculating rate/ratio/percentage increase with an incorrect answer gains one mark.
9	(e)	Reference to Mitosis; As chromosomes cannot attach (to spindle)/ chromatids cannot separate (on spindle); Cell division/cell cycle slows down;	3	**Q** Do not penalise confusion between chromosomes and chromatids in second marking point **Q** Mitosis slows down = 2 marks **Q** Mitosis stopped = 1mark **Q** Mitosis must be spelt correctly
9	(f)(i)	(Degree of) spread/variation from the mean;	1	

9	(f)(ii)	Both chemicals (on their own) slow down growth/are effective; Taxol is more effective than OGF; Combined treatment (seems) most effective; SD overlap for OGF with taxol and taxol (on its own) so not conclusive/could be chance/both treatments could be equally effective;	4	**Q** Ignore all references to significance

Question	Part	Marking Guidance	Mark	Comments
10	(a)	Recognition of same species; Stimulates release of gametes; Recognition of mate/opposite gender; Indication of sexual maturity/fertility;	2 max	
10	(b)(i)	Internal fertilisation / fertilisation occurs in pouch/limited area;	1	**Q** The term fertilisation is not required in the answer but must be implied.
10	(b)(ii)	Protection from predators (developing in pouch);	1	
10	(c)(i)	Less stress caused to seahorse / quicker/more accurate method / body is curved / head is linear;	1	**Q** Do not accept “easier” unless qualified.
10	(c)(ii)	Head length proportional to body length/or described;	1	
10	(d)	Positive correlation between head/body lengths of male and female/ female and male with similar head/body lengths pair together;	1	
10	(e)	Use line of best fit; And extrapolate/extend line as required;	2	

10	(f)	(Compare) DNA; Sequence of bases/nucleotides; DNA hybridisation; Separate DNA strands / break hydrogen bonds; Mix DNA/strands (of different species); Temperature/heat required to separate (hybrid) strands indicates relationship; Compare same/named protein; Sequence of amino acids /primary structure; <u>Immunological evidence</u> – not a mark Inject (seahorse) protein/serum into animal; (Obtain) antibodies/serum; Add protein/serum/plasma from other (seahorse) species; Amount of precipitate indicates relationship;	6 max	**Q** The marks awarded for reference to DNA and sequence of bases/nucleotides must be in a different context to DNA hybridisation.

Unit 2 6BI02

Question Number	Answer	Mark
1(a)	1. {one / few / similar} cell types ; 2. working together / for the { same / eq } function / often cells come from the same origin / eq ;	**(2)**

Question Number	Answer	Mark
1(b)(i)	1. three (or more) cisternae drawn ; 2. cisternae curved ; 3. cisternae getting smaller ; 4. cisterna /pre- or post-Golgi vesicle correctly shown ; **max 2 for drawing** 5. arrow(s) pointing from convex / forming side to concave / mature side ;	**max (3)**

Question Number	Answer	Mark
1(b)(ii)	1. some (amino acids) do not enter the cell / eq ; 2. some amino acids are not used (in protein synthesis) / eq ; 3. some protein is {elsewhere in the cell / on ribosome / in RER / in cytoplasm / in mitochondria / in vesicles / in nucleus /eq} ; 4. not modified / eq ; 5. some {metabolised / eq} ; 6. some has been ejected from cell / eq ; 7. reference to radioactive decay / decrease ;	**max (3)**

Question Number	Answer	Mark
2(a)	chloroplast / (sap / large / permanent) {vacuole / vacuole membrane / tonoplast} / cellulose cell wall ;	**(1)**

Question Number	Answer	Mark
2(b)(i)	1. spindle fibres contract / eq ; 2. {chromatids / daughter chromosomes / eq} ; 3. {pull apart / separate / eq} ; 4. reference to kinetochore / centromere leads ; 5. move to opposite {poles / eq} of cell ;	**max (3)**

Question Number	Answer	Mark
2(b)(ii)	1. membrane bound organelles {present / eq} / correctly named organelle e.g. mitochondrion ; 2. has {80s / large} ribosomes ; 3. nucleus will reform / eq ; 4. presence of cellulose cell wall ;	**max (2)**

Question Number	Answer	Mark
2(c)(i)		**(2)**

Stage of the cell cycle	**Number of cells in each stage**	**Percentage in each stage (%)**
Interphase		
Prophase		
Metaphase	2 ;	
Anaphase		
Telophase		
Cytokinesis	4 ;	
TOTAL		

Question Number	Answer	Mark
2(c)(ii)	1. interphase ; 2. most found at this stage (at any one time) / correct reference to figure from table ;	**(2)**

Question Number	Answer	Mark
2(c)(iii)	not enough {data / samples / cells / slides} {observed / counted} / (data) only taken from one point in time ;	**(1)**

Question Number	Answer	Mark
3(a)(i)	graph shows {positive correlation / eq} between nitrate concentration and seedling growth ;	**(1)**

Question Number	Answer	Mark
3(a)(ii)	some seedling growth without any nitrates added / eq ;	**(1)**

Question Number	Answer	Mark
3(a)(iii)	0 (mmol dm^{-3}) ;	**(1)**

Question Number	Answer	Mark
3(a)(iv)	reference to seedlings could have all been different lengths to start off / final length is not a measure of growth / growth needs to take into account change (and time) / eq ;	**(1)**

Question Number	Answer	Mark
3(a)(v)	plants grow in other {dimensions / eq} / idea of more likely to be an error in measuring length ;	**(1)**

Question Number	Answer	Mark
3(a)(vi)	1. temperature ; 2. volume of solution ; 3. light / eq ; 4. measuring technique / eq ; 5. stage of development e.g. same number of leaves / eq ; 6. idea of seedlings raised in same {environment / eq} / named environmental condition ; 7. idea of seedlings being genetically similar to start with e.g. same parent plant ;	**max (3)**

Question Number	Answer	Mark
3(b)	0.125 to 0.13 ; mmol dm^{-3} ;	**(2)**

Question Number	Answer	Mark
3(c)		**(2)**

Inorganic ion	**Molecule made**	**Main role of the molecule in a plant**
nitrate	amino acid / protein / named protein / enzyme / nucleic acid / named nucleic acid / base ;	plant growth
calcium	calcium pectate (pectin)	{sticking / holding / eq} (adjacent) plant cells {together / eq} / component of middle lamella ;

Question Number	Answer	Mark
4(a)(i)	1. idea that {cell B / eq} can give rise to {many / eq} cell types ; 2. idea that cell B cannot give rise to {embryonic cells / eq} ;	**max (2)**

Question Number	Answer	Mark
4(a)(ii)	(red) bone marrow (of long bones / ribs) ;	**(1)**

Question Number	Answer	Mark
4(a)(iii)	1. different genes active in different cells / different genes active at different times / some genes {active / inactive} / eq ; 2. active genes make mRNA / eq ; 3. active genes make proteins / polypeptides /eq ; 4. (proteins) control cell {processes / eq} ; 5. idea of permanent change (to cell) / eq ;	**max (3)**

Question Number	Answer	Mark
4(b)	the gender of turtles is determined by the temperature of the ground in which the eggs are laid ;	**(1)**

Question Number	Answer	Mark
5(a)(i)	**A**= acrosome ; **B** = flagellum ;	**(2)**

Question Number	Answer	Mark
5(a)(ii)	1. has {23 / half} the (required) chromosome complement ; 2. (so at fertilisation) full {complement / 46} (of chromosomes) is restored / diploid number restored / eq ; 3. correct reference to allowing mixing of alleles / allowing for {genetic variation / eq} ;	**max (2)**

Question Number	Answer	Mark
5(a)(iii)	1. idea of {jelly layer / eq} hydrolysed ; 2. sperm {nucleus/eq} enters the egg cell / egg cell membrane penetrated (by sperm) / eq ; 3. reference to meiosis completes / eq ; 4. cortical {granules / vesicles / eq} (in egg) {move towards / fuse with} egg cell surface membrane ; 5. release {contents / enzymes} ; 6. zona pellucida hardens / eq ; 7. to prevent polyspermy / eq ; 8. egg nucleus envelope breaks down / eq ; 9. spindle forms / eq ;	**max (3)**

Question Number	Answer	Mark
5(b)(i)	1. length increases between 15°C to 30°C ; 2. decreases after 30°C ; 3. correct manipulation of the data ;	**(2)**

Question Number	Answer	Mark
5(b)(ii)	1. mean pollen tube length increases as temperature increases (from 15°C) to 30°C for both ; 2. variety B has a greater mean pollen tube length than A (up to 30°C) / allow converse ; 3. both have {longest length / maximum length} at 30°C ; 4. correct comparative manipulation of the data e.g. mean pollen tube length is 50% more for cotton variety B at 30°C ;	**max (2)**

Question Number	Answer	Mark
5(b)(iii)	pollen tube dies / enzyme(s) denature / eq ;	**(1)**

Question Number	Answer	Mark
6(a)	<table><tr><th>Statements</th><th>true</th><th>false</th></tr><tr><td>Polymer of glucose</td><td>✓ ;</td><td></td></tr><tr><td>Molecule contains α and β glucose</td><td></td><td>✓ ;</td></tr><tr><td>Glycosidic bonds present</td><td>✓ ;</td><td></td></tr><tr><td>Molecule may have side branches</td><td></td><td>✓ ;</td></tr><tr><td>Molecule can form H bonds with adjacent molecules</td><td>✓ ;</td><td></td></tr></table>	**(5)**

Question Number	Answer	Mark
6(b)	1. starch from a renewable {resource / eq} ; 2. plastic from oil / eq ; 3. oil is a non-renewable resource/ eq ;	**max (2)**

Question Number	Answer	Mark
6(c)	**<u>Similarity</u>** (sclerenchyma fibres and xylem vessels) both for {support / eq} / both contain lignin / both associated with vascular bundles / both dead / eq ; **<u>Differences</u>** only xylem vessels transport {water / mineral / mineral ion / named ion} / position within vascular bundle / only xylem has open ends / type of lignin deposition / eq ;	**(2)**

Question Number	Answer	Mark
7(a)(i)	1. appropriate feature ; 2. linked to appropriate explanation ; e.g. 1. {streamlined / hydrodynamic / flattened /eq} {body / shape} 2. reduces {drag / eq} 1. {hooked feet / claws / eq} 2. to {cling / attach / hold / eq} onto {rocks / eq} 1. wide spread legs 2. {to spread over rock / grab rocks / eq}	**max (4)**

Question Number	Answer	Mark
7(a)(ii)	1. (tube) {breaks water surface / reaches into the air / eq} ; 2. acts as a snorkel / description ; 3. (atmospheric) air / oxygen obtained ;	**max (2)**

Question Number	Answer	Mark
7(b)	1. camouflaged in its environment ; 2. (more likely) to catch {prey / eq} / {selective advantage / eq} ; 3. (therefore) survive to adulthood / eq ; 4. to breed / eq ; 5. pass on {coat colour allele /genetic information / eq} ; 6. to offspring / eq ; 7. change in allele frequency over generations ; 8. reference to disruptive selection ; 9. idea of genetic variation present in ancestral population ;	**max (4)**

Question Number	Answer	Mark
8(a)	1. eukarya / eukaryote ; 2. archaea ; 3. bacteria ;	**(3)**

Question Number	Answer	Mark
8(b)(i)	1. idea that the species is reproductively isolated ; 2. produce offspring that are {sexually viable /fertile / eq} ; 3. many features in common / reference to homologous ;	**max (2)**

Question Number	Answer	Mark
8(b)(ii)	1. the number of different alleles / eq ; 2. in a population / gene pool ; 3. reference to allele frequency ;	**(2)**

Question Number	Answer	Mark
8(b)(iii)	1. breeding programme / eq ; 2. careful selection of mate / eq ; 3. allowing only to mate with a different individual to previous mating / eq ; 4. only allowing those with different genes to mate / eq ; 5. use of genetic testing / eq ; 6. record keeping (studbooks) ; 7. reason for outbreeding ; 8. reintroduction to the wild / eq ;	**max (4)**

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