A-LEVEL
BIOLOGY

BIOL4 – Populations and environment
Mark scheme

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Question	Marking Guidance	Mark	Comments
1(a)	1. Higher mean/average number of children (per female) in 1700; 2. Higher life expectancy in 2010 / higher proportion/percentage of older people in 2010; 3. Greater range/spread/variation of life expectancies in 2010;	2 max	Accept: converse answers for all mark points. Accept: use of figures for all mark points. Neutral: birth rate / death rate.
1(b)	Two suitable suggestions e.g. 1. Medical/health care / vaccination / antibiotics / lower infant mortality; 2. Diet / nutrition / food availability; 3. Sanitation / water supply / sewage treatment; 4. Contraception / birth control; 5. Work related example / occupation / education; 6. Financial considerations of having children; 7. Government/state policy; 8. War;	2 max	Neutral: better living conditions / improved economy.
1(c)	The following answers = 2 marks;; 60,175,920 / 60.1759 million / 60.176 million / 60.18 million;; Incorrect answer with following working = 1 mark 60 200 × 0.4 / 24 080 / 583 940 / 559 860;	2	Reject: 60,199,600 and reject 60.2 million if rounded up from 60,199,600. Accept: 60.2 million for two marks if rounded up from correct answer shown in working. 60.2 million without indication if derived from correct or incorrect answer = 1 mark. Accept: 60.18 / 60.176 for one mark. Accept: 60.175 million for one mark but 60.175 = no marks.

Question	Marking Guidance	Mark	Comments
2(a)(i)	1. Amino acid/protein/enzyme/urea/nucleic acid/chlorophyll/DNA/RNA//ATP/ADP/AMP/ NAD/NADP; 2. DNA/RNA/nucleic acid/ATP/ADP/AMP/ NADP/TP /GP/ RuBP /phospholipids;	2	1. and 2. Accept any named equivalent examples e.g. nucleotides. Neutral: ammonia/nitrite /nitrate/ phosphate.
2(a)(ii)	1. Saprobiotic (microorganisms/bacteria) break down remains/dead material/protein/DNA into ammonia/ammonium; 2. Ammonia/ammonium ions into nitrite and then into nitrate; 3. (By) Nitrifying bacteria / nitrification;	3	1. Accept: saprobionts /saprophytes/saprotrophs 1. Neutral: decomposer 2. Allow correct chemical symbols. 2. Accept: correct answers which use incorrect bacteria e.g. nitrogen-fixing but then reject m.p. 3.
2(b)	1. Nitrate/phosphate/named ion/nutrients for growth of/absorbed/used by plants/algae/producers; 2. More producers/consumers/food **so** more fish / fish reproduce more / fish grow more / fish move to area;	2	2. Must have idea of more plants related to some increase in fish.

Question	Marking Guidance	Mark	Comments
3(a)	Succession;	1	Ignore any word in front of succession e.g. secondary/ecological succession. Neutral 'forestation'
3(b)	1. Greater variety/diversity of plants/insects / more plant/insect species; 2. More food sources / more varieties of food; 3. Greater variety/more habitats/niches;	3	1. Neutral: more plants 2. Neutral: more food / more/greater food source (singular) 3. Accept: more nesting sites 3. **Q** Neutral: more homes/shelters.
3(c)(i)	Temperature and carbon dioxide;	1	Neutral: water, chlorophyll
3(c)(ii)	Shows (gross) photosynthesis/productivity minus respiration / more carbon dioxide used in photosynthesis than produced in respiration;	1	1. Correct answers are often shown as: net productivity = (gross) photosynthesis – (minus) respiration.
3(c)(iii)	1. (Shade plant) has lower (rate of) respiration/ respiratory losses; 2. (Shade plant) less CO_2 released at 0 light intensity/in dark; 3. Greater (net) productivity / less sugars/glucose used / more sugars/glucose available;	2	1. Accept use of figures. 1. Accept: lower compensation point. Neutral: any references to rate of photosynthesis.

Question	Marking Guidance	Mark	Comments
4(a)	(Recessive) allele is always expressed in females / females have one (recessive) allele / males need two recessive alleles/ males need to be homozygous recessive / males could have dominant and recessive alleles/be heterozygous/carriers;	1	Accept: Y chromosome does not carry a dominant allele. Other answers must be in context of allele not chromosome or gene.
4(b)(i)	1. 1, (2) and 5; 2. 1 must possess/pass on the recessive allele / 1 must be a carrier / heterozygous / if slow (feather production) is recessive all offspring of (1 and 2) would be slow (feather production) / if rapid (feather production) was dominant 1 would have rapid (feather production);	2	1. Accept: for 1 mark that 1 and 2 have slow (feather production) but produce one offspring with rapid (feather production). Neutral: any reference to 3 being offspring of 1. 2. Reject: both parents must be carriers / possess the recessive allele. 2. Reject: one of the parents (i.e. not specified) must be a carrier/heterozygous.
4(b)(ii)	5 = X^fY / X^fY^- / f / f- / fY ; 7 = X^FX^f **and** X^FX^F (either way round) / **or** X^fX^F**and** X^FX^F (either way round) / **or** X^FX^f**,** X^fX^F **and** X^FX^F(in any order)**;**	2	Note: allow 5 = X^fY, X^fY. Accept: for both 5 and 7 a different letter than F. However, lower case and capital letter must correspond to that shown in the answer. For example accept 7 = X^RX^r and X^RX^R.
4(b)(iii)	X^FX^f **and** X^fY **or** X^fX^F **and** X^fY **or** X^FX^f **and** X^fY^- **or** X^fX^F **and** X^fY^- / **or** Ff **and** fY / **or** Ff **and** fY^- / **or** Ff **and** f- / **or** Ff **and** f;	1	Accept: a different letter than F. However, lower case and capital letter must correspond to that shown in the answer. Accept: each alternative either way round.

4(c)	Correct answer of 32 (%) = 3 marks;;; If incorrect answer, allow following points 1. p^2/q^2 = 4%/0.04/ or p/q = 0.2; 2. Shows understanding that 2pq = heterozygotes / carriers;	3	Accept: 0.32 = 2 marks 2. Accept: answer provided attempts to calculate 2pq. This can be shown mathematically i.e. 2 x two different numbers.

Question	Marking Guidance	Mark	Comments
5(a)	1. Allows (valid) comparison; 2. Number/sample size may vary;	2	
5(b)	1. Increased chance of (severe malaria) with blood group A **/** decreased chance of (severe malaria) with sickle cell; 2. One mark for one of the following: almost equal chance with blood group O /slightly greater chance of mild malaria with O /slightly lower chance of severe malaria with O /2.5 x/2.48 x/more than twice the chance of severe with blood group A /(almost) 50%/half the chance of severe malaria with sickle cell /twice the chance of mild malaria with sickle cell;	2	1. Accept: converse for mild malaria i.e. increased chance of mild malaria with sickle cell / decreased chance of mild malaria with blood group A. 1. Accept: if answer is comparative e.g. greatest risk of severe malaria with blood group A. 2. Neutral: answers which only refer to or use ratios.
5(c)	1. Individuals with the **Hb^C** (allele) reproduce; 2. Pass on **Hb^C** (allele) which increases in frequency; 3. **Hb^A Hb^A** individuals less likely to survive/reproduce / frequency of **Hb^A** (allele) decreases;	3	

Question	Marking Guidance	Mark	Comments
6(a)	Prevents <u>oxygen</u> being taken up/entering/being absorbed;	1	Accept: any idea of no contact with oxygen. Neutral: for anaerobic respiration / anaerobic conditions. Neutral: prevents entry of air. Reject: prevents entry of oxygen and another named gas.
6(b)(i)	0.0155 / 0.016 = 2 marks;; 0.0775 / 0.077 / 0.078 / 0.08 = 1 mark / 0.62 = 1 mark	2	
6(b)(ii)	Glucose decreases/is a limiting factor / increase in ethanol / yeast/cells die / toxins build up;	1	Accept: glucose is used up.
6(b)(iii)	1. (Stays the) same/level/(relatively) constant; 2. Same volume/amount of oxygen uptake and carbon dioxide release;	2	Note: if m.p.1 is awarded m.p 2 can be obtained without referring to 'same volume/amount'
6(c)	1. Oxygen is final/terminal (electron) acceptor / oxygen combines with electrons and protons; 2. Oxidative phosphorylation / electron transport chain provides ATP; 3. Only glycolysis occurs without oxygen / no Krebs / no link reaction;	2 max	

Question	Marking Guidance	Mark	Comments
7(a)	1. No/few consumers/pests/pathogens; 2. Outcompetes/better competitor for resources/light/CO_2/abiotic factor / ideal niche;	2	1. Accept: No/few predators. 1. Accept: description of competition for a named resource with reference to 'other species'. 1. Accept: More resistance to disease 2. Neutral: competition for food.
7(b)	1. (Cost of) control/removal; 2. (Cost of) restoring habitat / conservation; 3. (Loss of income) from fishing; 4. (Loss of income) from boating/tourism/recreation;	2 max	4. Accept: any valid recreational activity e.g. canoeing.
7(c)(i)	1. Removes water; 2. Water content can vary in sample/plant;	2 max	Note: Reweighing/constant mass indicates all water removed = 2 marks. ;
7(c)(ii)	1. 0.5 is not effective/has little effect / 1.0 is less effective (than 5.0) /concentrations below 5.0 less effective; 2. At 5.0 biomass/growth is reduced; 3. Small difference between using 5.0 and 25.0; 4. Using 5.0 is cost effective / using 25.0 is expensive; 5. 25.0/high concentrations may affect the environment / other organisms / chemical may remain in habitat / bioaccumulation;	4 max	Accept: for first 3 mark points effect on growth/biomass as a measure of effectiveness. Accept: references to 'this concentration' = 5.0. 1. Accept: 5.0 is the minimum effective concentration. 1. and 2. 5.0 is the minimum effective concentration that reduces growth = 2 marks. 5. Accept: any impact on the habitat e.g. contaminate water supply.

7(d)(i)	To compare/see effect with/without fungus/fluridone/control agent/s;	1	Neutral: for comparison on its own. Neutral: to see effect of variables/results/treatments /factors without further qualification.
7(d)(ii)	1. Is specific / grows/survives in Hydrilla/habitat; 2. Can reproduce / only one application required; 3. Does not become a pest;	2	1. Accept: 'known to work'
7(d)(iii)	1. Fluridone/chemical acts quickly / quickly reduces Hydrilla; 2. Fungus/biological control keeps Hydrilla in low numbers; 3. Fungus/biological control works over a long time/can reproduce 4. Resistance does not develop against fungus/biological control;	2 max	3. Neutral: only one application as not always valid for integrated pest management.

Question	Marking Guidance	Mark	Comments
8(a)	1. Carbon dioxide combines with ribulose bisphosphate/RuBP; 2. Produces two glycerate (3-)phosphate/GP; 3. GP reduced to triose phosphate/TP; 4. Using reduced NADP; 5. Using <u>energy</u> from ATP; 6. Triose phosphate converted to glucose/hexose/RuBP/ ribulose bisphosphate/named organic substance;	6 max	2. Accept: any answer which indicates that 2 x as much GP produced from one RuBP. 3. Must have idea of reduction. This may be conveyed by stating m.p. 4. 4. **Reject**: Any reference to reduced NAD for m.p.4 but allow reference to reduction for m.p. 3. 5. Must be in context of GP to TP.
8(b)	1. Carbon dioxide is a greenhouse gas; 2. Deforestation/trees removed so less carbon dioxide removed by photosynthesis; 3. Burning/combustion releases/produces carbon dioxide; 4. Methane is a greenhouse gas; 5. Any valid reference to source of methane, e.g. rice fields, landfills, cattle;	4 max	1. Accept: carbon dioxide contributes to greenhouse effect. 4. Accept: methane contributes to greenhouse effect. Neutral: any references to other gases.
8(c)	1. Use a grid / split area into squares/sections; 2. Method of obtaining random coordinates / numbers, e.g. calculator/computer/random numbers table/random number generator; 3. Count number/frequency of plants in a quadrat; 4. Calculate mean/average number (per quadrat/section); 5. Valid method of calculating total number of bluebells/plants. e.g. mean number of plants per quadrat/section/m^2 multiplied by number of quadrats/sections/m^2 in wood;	5	Neutral: any reference to using belt/line transects. 1. Accept: use of tape measures/map/area with coordinates. 3. Accept: determine percentage cover. 4. Accept: method of calculating mean. 5. Neutral: 'scale up' without further qualification.