Version 1.0

General Certificate of Education (A-level)
June 2011

Biology BIOL4

(Specification 2410)

Unit 4: Populations and Environment

Final

Mark Scheme

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<table>
<tr><th>Question</th><th>Marking Guidelines</th><th>Marks</th><th>Notes</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th></th><th>Photosyn-thesis</th><th>Anaerobic respiration</th><th>Aerobic respiration</th></tr>
<tr><td>ATP produced</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Occurs in organelles</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Electron transport chain involved</td><td>✓</td><td></td><td>✓</td></tr>
</table>
</td><td>3</td><td>1 mark per column
Mark ticks only. Ignore anything else if different symbols such as crosses are used as well.
If crosses are used instead of ticks allow cross as equivalent to a tick.
Reject tick with a line through ✓</td></tr>
<tr><td>1(b)</td><td>ADP + P_i ⟶ ATP;</td><td>1</td><td>Both sides correct, but allow other recognised symbols or words for phosphate ion. Reject P unless in a circle.
Accept = as equivalent to arrow
Accept reversible arrow
Ignore any reference to kJ/water</td></tr>
<tr><td>1(c)</td><td>1. Energy released in small/suitable amounts;
2. Soluble;
3. Involves a single/simple reaction;</td><td>2 max</td><td>1. In context of release, not storage. Ignore producing energy/manageable amounts.
2. Reject "broken down easily/readily" Reject "quickly/easily resynthesised"</td></tr>
</table>

1(d)	1. ATP is unstable; 2. ATP cannot be stored / is an immediate source of energy; 3. Named process uses ATP ; 4. ATP only releases a small amount of energy at a time;	2 max	3. Accept processes such as active transport, muscle contraction, glycolysis. Reject answers such as keeping warm, movement, respiration, metabolism, growth.

Question	Marking Guidelines	Marks	Notes
2(a)	1. High temperature allows enzymes to work faster/allows more collisions/ allows more e-s complexes to be formed ***OR*** A lot of light so light not limiting; 2. Photosynthesis reactions are faster/more photosynthesis;	2	1. Accept enzymes more effective. Ignore references to respiration. Ignore references to optimum (temperature or light)
2(b)(i)	Gross productivity = net productivity + respiratory loss/respiration;	1	Accept any correct rearrangement of this equation Accept recognisable abbreviations Reject respiratory <u>rate</u>
2(b)(ii)	1. Respiration slower /less respiration; 2. Light-dependent reaction/photosynthesis less affected by temperature increase; 3. Lower (energy) loss;	2 max	1. Unspecified references refer to August . Allow converse of respiration faster but must specify July / high<u>er</u> temperature 3. Unspecified references refer to August . Allow converse of higher loss but must specify July "Lower respiratory losses (in August)" can meet both points 1 and 3 and gain 2 marks.
2(c)	1. Stored as fat/glycogen/biomass; 2. Used for growth/movement/reproduction / process involved in growth/movement/reproduction;	2 max	1. Reject stored energy. Ignore respiration
2(d)	1. More heat/energy is lost (in March)/colder (in March); 2. Maintain/regulate body temperature/more heat generated; 3. By respiration/metabolism;	2 max	2. Accept keep warm

Question	Marking Guidelines	Marks	Notes
3(a)(i)	1. Gases / correct named gas not released; 2. Conditions (in digester) can be controlled; 3. Products/named product can be collected; 4. Open ponds associated with health risk/environmental damage/eutrophication;	2 max	Correct named gases include: methane, carbon dioxide, hydrogen sulphide, nitrogen oxides 1. Allow substance = product 4. Accept 'pond' in any context
3(a)(ii)	1. Respiration causes temperature increase/release of heat; 2. Enzymes would be denatured/microorganisms killed;	2	
3(b)(i)	1. Increase algae/algal bloom; 2. Light blocked out; 3. Plants can't photosynthesise / plants and/or algae die; 4. Bacteria/saprobionts/EW feed off/breakdown dead organisms; 5. Bacteria/saprobionts/EW use up oxygen/bacteria respire/BOD rises;	3 max	On its own, the word eutrophication does not gain a mark, the stages need to be described. EW = equivalent word
3(b)(ii)	1. Acts as soil conditioner/improves drainage/ aerates soil/increases organic content of soil; 2. Contains other elements/named element/wider range of elements; 3. Production of artificial fertiliser energy-consuming; 4. Less leaching / slow release (of nutrient);	1 max	Unspecified answers relate to natural fertiliser. Ignore references to cost / eutrophication 2. i.e. elements other than nitrogen, phosphorus and potassium

Question	Marking Guidelines	Marks	Notes
4(a)	Births per thousand/given number of the population and per year/given period of time;	1	Accept if expressed as equation births per year (x 1000) total population (in that year)
4(b)(i)	1. Females have higher life expectancies; 2. UK has higher life expectancies;	2	
4(b)(ii)	1. Females tend to outlive males linked to reason e.g. male risk of CVD more males smoke/drink to excess males involved in fighting / war; 2. Medical care/vaccination programmes better in UK/infectious disease common in Sudan; 3. More food/better diet in UK; 4. Food preservation/sanitation/clean water supply better in UK;	2 max	1. Females healthier is insufficient 2. Credit specific examples of medical care, for example during childbirth 4. Principle underlying this mark is bacterial contamination of food/water

Question	Marking Guidelines	Marks	Notes
5(a)(i)	1. Parents are heterozygous; 2. Kittens receive white allele from parents /black cat;	1 max	1. Accept carriers/carries white allele
5(a)(ii)	1 :1;	1	Answer must be expressed as a ratio that could be reduced to 1 : 1
5(b)(i)	Black, Chocolate, Black;	1	All three correct for the mark
5(b)(ii)	Parental phenotypes: Chocolate male — Black female 1. Parental genotypes: bb^i — Bb^i; 2. Parental gametes: b b^i — B b^i; 3. Offspring genotypes: Bb, Bb^i — bb^i — b^ib^i; Offspring phenotypes: Black — Chocolate — cinnamon	1 1 1	1. Both genotypes needed for the mark. 2. Allow credit if gametes are correctly derived from candidate's incorrect parental genotypes. 3. Genotype(s) must be with correct phenotype Allow credit if symbols other than B/b/b^i have been used correctly. Ignore genetic diagrams unless clearly annotated

5(b)(iii)	1. Offspring ratios are a probability/not fixed/arise by chance/ 2. gametes may not be produced in equal numbers/ 3. fertilisation/fusion of gametes is random/ 4. small sample;	1	
5(b)(iv)	1. Possible if parents homozygous/ bb; 2. Don't know genotype of chocolate cat / chocolate cat could be homo- or heterozygous / chocolate cat could be bb or bb^{i} ; 3. Two chocolate cats could give cinnamon kittens;	2 max	

Question	Marking Guidelines	Marks	Notes
6(a)(i)	Two marks for correct answer of 4;; One mark for calculation involving 0.2 x 0.2 or 0.04;	2	
6(a)(ii)	0.2/ the frequency remains the same ;	1	Reject if wrong frequency is quoted
6(b)(i)	1. There is a <u>probability</u> of 5%/0.05; 2. That difference in frequencies / difference in results are due to <u>chance</u>;	2	Accept 95% probability changes in frequencies not different as a result of chance
6(b)(ii)	1. Directional; 2. The recessive allele confers disadvantage/ the dominant allele confers advantage/more likely to survive / reproduce;	2	Assume "it" to refer to the recessive allele 2. References to selection do not gain credit as the term is in the question. Allow reference to phenotype / enzyme functionality (instead of allele) when describing advantage/disadvantage.

Question	Marking Guidelines	Marks	Notes
7(a)	1. Breeding less successful; 2. Feathers in poor condition; 3. Less energy for breeding/reproduction/ stated aspect of reproduction;	2 max	1. Reject cannot breed. 2. Ignore "wings damaged"
7(b)(i)	1. Avoids bias; 2. Data representative/choice of nest not influencing results; 3. Allows use of statistical tests/named statistical test;	2 max	
7(b)(ii)	Accept general statements or statements based on data that make the required points. 1. Correct statement about range of 0 – 15; 2. Correct statement about 0; 3. Correct statement about 170; 4. Correct statement about gap between 15 and 170;	3 max	1. e.g. No pattern/no correlation between 0 and 15 2. e.g. Birds with no feather mites did not have (the) high(est) breeding success / 86% 3. e.g. Highest number of feather mites linked to lowest breeding success 4. e.g. No data between 15 and 170
7(c)(i)	There is no correlation between the number of feather mites and breeding success /the number of feather mites does not affect breeding success;	1	These specific variables must be stated. Reject difference between feather mite and breeding success.
7(c)(ii)	Breeding success decreases as feather mites increases/ negative correlation between feather mites and breeding success ;	1	Accept reproductive or breeding success

7(d)(i)	1. The larger the size of the oil gland the larger the number of feather mites; 2. Positive correlation; 3. (Wide) scatter of points / points not on line;	2max	3. Accept any answer that conveys the idea of a wide spread. Ignore any reference to anomalies
7(d)(ii)	No mark for effect on reliability, marks are for explanation. 1. Oil gland size/number of mites could vary; 2. At different times of the day/due to preening;	2	Ignore responses that state oil gland affects numbers of mites Allow preening affects mite numbers/size of oil gland;
7(e)	1. Improve health of birds/reduces disease/reduces harm; 2. Healthier birds may find more food for young/do not pass on disease/ have greater specified aspect of breeding success;	2 max	1. Ignore death of birds 2. specified aspect can include longer breeding life

Question	Marking Guidelines	Marks	Notes
8(a)	1. Saprobionts/saprophytes; 2. Digest/break down proteins/DNA/nitrogen-containing substances; 3. Extracellular digestion/release of enzymes; 4. Ammonia/ammonium produced; 5. Ammonia converted to nitrite to nitrate/ammonia to nitrate; 6. Nitrifying (bacteria)/ nitrification; 7. Oxidation;	5 max	Ignore all references to other parts of the nitrogen cycle 1. Accept saprotrophs. Allow this mark if saprobionts linked to fungi. 2. Ignore"nitrogen in plants" Ignore enzymes excreted 6. Accept *Nitrosomonas*/*Nitrobacter*
8(b)	1. Carbon dioxide concentration increases; **Clearing** 2. No/Less vegetation so no/less photosynthesis / photosynthetic organisms; 3. No/Less carbon dioxide removed (from the atmosphere); **Burning** 4. Burning/combustion releases / produces carbon dioxide;	4	Ignore correct references to respiration or animals For mark points 2 and 3 idea of 'no/less' must be stated not just implied. 3. Must not include 'by respiration' 4. Do not credit references to burning fossil fuels. Only give credit for combustion increases carbon dioxide if mark point 1 has not been given.

8(c)	1. Carbon dioxide combines with ribulose bisphosphate/RuBP; 2. Produces two molecules of glycerate (3-)phosphate/GP; 3. Reduced to triose phosphate/TP; 4. Using reduced NADP; 5. Using energy from ATP; 6. Triose phosphate converted to other organic substances/ named organic substances/ribulose bisphosphate; 7. In light independent reaction/Calvin cycle;	6 max	3. Accept add hydrogen for reduced 4. Accept alternatives such as NADPH for reduced NADP/GALP for TP/ribulose biphosphate

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