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Biology BIOL4

(Specification 2410)

Unit 4: Populations and Environment

Final

Mark Scheme

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Question	Marking guidelines	Mark	Comments
1(a)	All the fish/all the species/all the populations/all the organisms;	1	Must indicate all/every species. Reject answers that suggest other fish/organisms might be present.
1(b)(i)	1. Capture sample, mark and release; 2. Appropriate method of marking suggested / method of marking does not harm fish; 3. Take second sample and count marked organisms; 4. $\text{Population} = \frac{\text{No in sample}_1 \times \text{No in sample}_2}{\text{Number marked in sample}_2}$;	3 max	2. E.g. Cutting a fin/attaching a tag/paint/marker. 3. May be awarded from equation if not given here. 4. Accept any valid alternative to equation or answer expressed as a ratio.
1(b)(ii)	One suitable reason; E.g. population increases/changes (between first and second sample)	1	Accept other valid answers, which must, however, relate to breeding/only works if population constant.
1(c)	1. With different mouth eats different food / has different way of feeding / specific mouth shape for specific food; 2. Competition between species/interspecific competition is reduced;	2	1. Catches more food and gas exchange are neutral 2. Reject intraspecific

Question	Marking guidelines	Mark	Comments
2(a)(i)	Stickleback + caddis fly (larva) + stonefly (larva);	1	All three required for mark. In any order.
2(a)(ii)	1. (With fewer fish) reduced predation / not being eaten results in more freshwater shrimps; 2. Increased competition for food/resources / more producers eaten by shrimps / more shrimps eating producers; 3. Less food/resources for mayfly;	2 max	Principles 1. Effect of fish on shrimps 2. Effect of shrimps on producer 3. Effect of food on mayfly
2(b)(i)	1. Two marks for correct answer in range 16.8 to 18.9;; 2. One mark for incorrect answer in which candidate divides 19 to 21 by 111 to 113;	2	Ignore additional decimal places. Working shown in mm. Accept working in cm/2mm squares (10/56) for 1 mark.
2(b)(ii)	1. Single-celled producers are more digestible / contain less cellulose (than plants) / less energy lost in faeces; 2. All of producer eaten/parts of plant not eaten; 3. Less heat/energy lost / less respiration;	2 max	3. May refer to either trophic level
2(c)	1. Photosynthesis/light dependent reaction/light independent reaction; 2. Carbon-containing substances;	2	Allow organic substance or named organic substance

Question	Marking guidelines	Mark	Comments
3(a)	1. Transect/lay line/tape measure (from one side of the dune to the other); 2. Place quadrats at regular intervals along the line; 3. Count plants/percentage cover/abundance scale (in quadrats) **OR** Count plants and record where they touch line/transect;	3 max	1&2. Reject random in context of placing transect/quadrats 2. Accept references to stratified sampling/different seral stages 3. Accept abundance scale
3(b)	1. Stabilises sand / stops sand shifting; 2. Forms/improves soil / makes conditions less hostile;	2	2. Allow credit for example of making conditions less hostile such as: Adds nutrients Improves water retention

Question	Marking guidelines	Mark	Comments
4(a)(i)	Non-living/physical/chemical factor/non biological;	1	Do not accept named factor unless general answer given.
4(a)(ii)	Accept an abiotic factor that may limit photosynthesis/growth; E.g. Water Named soil factor Light Carbon dioxide Incline/aspect Wind/wind speed	1	Reject altitude/height Not "soil" / "weather" Accept Oxygen
4(b)	1. Correct explanation for differences between day and night e.g. photosynthesises only during the daytime / no photosynthesis/only respiration at night; 2. Net carbon dioxide uptake during the day/in light ***OR*** No carbon dioxide taken up at night/in dark / carbon dioxide released at night/in dark; 3. At ground level <u>more</u> respiration / in leaves <u>more</u> photosynthesis; 4. Carbon dioxide produced at ground level/carbon dioxide taken up in leaves;	4	Principles **Comparing day and night/light and dark** 1. Explanation in terms of photosynthesis/respiration 2. Effect on carbon dioxide production/uptake **Comparing leaves with ground level** 3. Explanation in terms of photosynthesis/respiration 4. Effect on carbon dioxide production/uptake 2 and 4 must relate to why the change occurs
4(c)	1. Variation in original colonisers / mutations took place; 2. Some better (adapted for) survival (in mountains); 3. Greater reproductive success; 4. <u>Allele</u> frequencies change;	3 max	2. Allow "advantage so able to survive" 4. Reject gene/genotype

Question	Marking guidelines	Mark	Comments
5(a)(i)	1. Animal 2 / 5 has hair but offspring do not; 2. So 2 / 5 parents must be heterozygous/carriers; **OR** 3. 4/7/8 are hairless but parents have hair; 4. So 2 / 5 must be heterozygous/carriers;	2	Accept parents as alternative to animals 2 and 5 1 + 3: Allow reference to children/offspring for animals 7 + 8 Ignore reference to individuals 1 and 6
5(a)(ii)	Hairless males have fathers with hair / 4 is hairless but 1 is hairy / 7 and/or 8 are hairless but 6 is hairy / only males are hairless;	1	Ignore references to other individuals Ignore reference to genotypes Allow credit for candidate who states that evidence is not conclusive/pedigree possible with autosomal character;
5(b)	1. Parental genotypes X^HX^h and X^HY Gametes X^H X^h X^H Y; 2. Genotypes of offspring X^HX^H, X^HY, X^HX^h, X^hY; 3. Phenotypes of offspring female with hair male with hair male hairless; 4. 0.25 / ¼ / 1 in 4 / 25%;	4	Accept any letter for gene but capital letter must represent dominant allele. 1. Both parental genotypes and gametes must be correct 2. Allow for offspring genotypes correctly derived from <u>gametes</u> given by candidate; 3. Allow phenotypes correctly derived from offspring genotype Allow H ≡ X^H, h ≡ X^h 4. Ignore 1:3 in context of correct probability Reject 1:4

Question	Marking guidelines	Mark	Comments
6(a)	Nitrification;	1	Accept nitrifying. Do not accept nitrogen fixing.
6(b)	1. Uptake (by roots) involves active transport; 2. Requires ATP/ aerobic respiration;	2	Reject all references to bacteria
6(c)(i)	1. Not enough time / fast flow washes bacteria away; 2. (Not all/less) ammonia converted to nitrate/less nitrification;	2	"Not enough time for bacteria to convert all the ammonia to nitrate" gains 2 marks
6(c)(ii)	1. Algal bloom / increase in algae; 2. Algae block light / plants/algae die; 3. Decomposers/saprobionts/bacteria break down dead plant materials; 4. Bacteria/decomposers/saprobionts use up oxygen in respiration / increase BOD; 5. Fish die due to lack of oxygen;	3 max	4. Accept alternatives such as microbes/ saprophytes.

Question	Marking guidelines	Mark	Comments
7(a)(i)	1. Same breed so similar alleles; 2. Controls/removes variable/so genes not a factor / only temperature affects results / rate of growth affected by genes;	2	1. Allow different alleles have different effects 2. Accept idea worded in such terms as inherited.
7(a)(ii)	1. Different growth rates / gained different biomass / grew different amount; 2. Not due to temperature / the independent variable;	2	Allow "more food for growth" Ignore references to efficiency of conversion.
7(b)(i)	Rise then fall with peak at 20 °C;	1	Do not accept 0.85 as alternative to 20.
7(b)(ii)	1. Temperature may be between 10 and 30/10 and 20/20 and 30; 2. Intervals are 10 °C/large/not small/should be smaller/should be intermediates;	2	No mark for yes or no.
7(c)(i)	1. Growth rate decreasing / conversion staying same/ decreasing; 2. (Scientists would be) looking for high growth rate/ conversion / data shows unlikely to improve growth/yield; 3. Wastes time/resources/would not relate to farming conditions;	2 max	3. Ignore cruelty to pigs
7(c)(ii)	1. Will lose more heat / not as much energy used to maintain body temperature; 2. Heat resulting from respiration/more respiration; 3. More food used in respiration;	2 max	1. Must be a comparative statement Accept energy as equivalent to heat in the context of this question 2. Do not credit answers relating to energy made in respiration

7(d)	**In support** 1. Food **B** produces greater mass than control/greater than 100%; **But** 2. Error bars for **B** mean **B** could be no better / not different from control; 3. Overlap of error bars for **B** and **A**; 4. **A** no better than/not different from **B**; **Experimental limitations** 5. Experiment only ran for 10 days; 6. Experimental conditions /breed of pig may not be the same as on the farm; 7. No information about cost;	4 max	Read standard deviation as standard error 1. Must refer to control 4. Neutral: "Results not significant". Mark must compare **A** to **B**

Question	Marking guidelines	Mark	Comments
8(a)	1. Releases energy in small / manageable amounts; 2. (Broken down) in a one step / single bond broken; 3. Immediate energy compound/makes energy available rapidly; 4. Phosphorylates/adds phosphate; 5. Makes (phosphorylated substances) more reactive / lowers activation energy; 6. Reformed/made again;	4 max	1. Accept less than glucose 2. Accept easily broken down 4. Do not accept phosphorus or P on its own 6. Must relate to regeneration
8(b)	1. Substrate level phosphorylation / ATP produced in Krebs cycle; 2. Krebs cycle/link reaction produces reduced coenzyme/reduced NAD/reduced FAD; 3. Electrons released from reduced /coenzymes/ NAD/FAD; 4. (Electrons) pass along carriers/through electron transport chain/through series of redox reactions; 5. Energy released; 6. ADP/ADP + Pi; 7. Protons move into intermembrane space; 8. ATP synthase;	6 max	Accept alternatives for reduced NAD 2. Accept description of either Krebs cycle or link reaction 5. Allow this mark in context of electron transport or chemiosmosis 6. Accept H^+ or hydrogen ions and cristae 7. Allow description of movement through membrane 8. Accept ATPase. Reject stalked particles

8(c)	1. In the dark no ATP production in photosynthesis; 2. Some tissues unable to photosynthesise/produce ATP; 3. ATP cannot be moved from cell to cell/stored; 4. Plant uses more ATP than produced in photosynthesis; 5. ATP for active transport; 6. ATP for synthesis (of named substance);	5 max	1. In context of in photosynthetic tissue/leaves