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BL03 (9610)

Unit 3 Populations and Genes

Mark scheme

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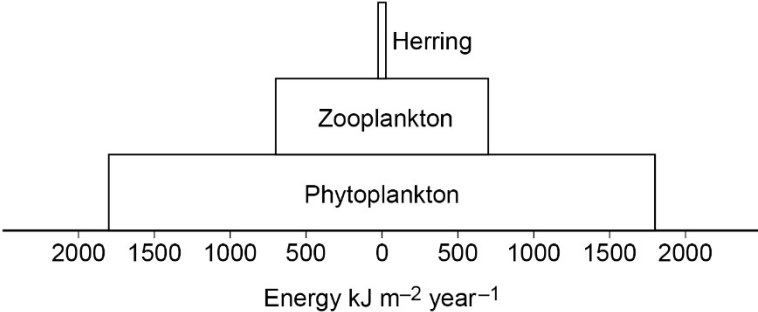
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Question	Marking guidance	Mark	Comments
01.1	Phosphorylation;	1	Accept substrate level phosphorylation
01.2	ATP;	1	Accept adenosine triphosphate Ignore extra correct information
01.3	1. Acetyl (from fatty acid oxidation) combines with coenzyme A/CoA OR formation of acetyl coenzyme A; 2. Acetyl coenzyme A/Acetyl CoA enters Krebs cycle;	2	1. Allow fatty acids produce acetyl coenzyme A/CoA If no other mark awarded, allow 1 mark for fats/fatty acids (are converted) to acetyl (groups) that enter Krebs cycle
01.4	C (no mark) (Because) Smallest scale division / each scale division 0.2 cm ³ ;	1	Letter and reason both needed for 1 mark Allow (C) has the most precise reading/scale
01.5	5.47–5.49 cm ³ ;	1	
01.6	0.9 / 0.93 / 0.927 / 0.9266;;	2	Award 1 mark for 927 / 926.6 / 926.55 Award 1 mark for 1.079 / 1.08 / 1.1

Question	Marking guidance	Mark	Comments
02.1	Interspecific (competition);	1	
02.2	1. Reduces growth <u>rate</u> (of both <i>Paramecium caudatum</i> and <i>Paramecium aurelia</i>); 2. Reduces (maximum) ~~population density~~ number / reduces (maximum) population size (of both <i>P. caudatum</i> and <i>P. aurelia</i>); 3. <i>P. caudatum</i> decreases (after 4 days) / <i>P. caudatum</i> does not level out;	3	Accept suitable use of data in mp1, 2 and 3
02.3	(<i>P. aurelia</i> and <i>P. caudatum</i> occupy the same niche) (Yes) Two organisms can't occupy same niche / competitive exclusion principle / (<i>P. aurelia</i> and <i>P. caudatum</i>) competing for same resources / <i>P. caudatum</i> driven to extinction; (No) Grown in lab, so don't know normal role within habitat; OR Could be due to another <u>named</u> factor; OR Only carried out for 16 days; OR No information about what (<i>P. aurelia</i>/<i>P. caudatum</i>) eat;	4	Allow other sensible suggestions

	(<i>P. aurelia</i> produces a toxic waste product that kills <i>P. caudatum</i>.) (Yes) Takes few days before <i>P. caudatum</i> starts to decrease so could be build-up of toxin; OR Increase in <i>P. aurelia</i> population causes decrease in <i>P. caudatum</i> population; (No) No evidence of toxin / correlation doesn't mean cause;		
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Question	Marking guidance	Mark	Comments
03.1	1. 3 bars drawn symmetrically and labelled with phytoplankton at bottom and herring at top; 2. 3 bars accurately drawn to suitable scale;	2	Allow inverted pyramid if bars are correctly labelled. 
03.2	Photosynthetic / producers / autotrophic;	1	
03.3	Energy is lost/transferred in other ways; Eg excretion / egestion;	2	Allow correct equation for 2 marks

Question	Marking guidance	Mark	Comments
04.1	Nitrogen fixation;	1	
04.2	1. High rainfall (between days 34 and 40); 2. Nitrate leached out of soil / nitrate washed out of soil / nitrate in run off; OR More water in soil <u>so</u> concentration (of nitrate) low(er) OR high rainfall so (nitrate) more dilute; OR Rapid growth (of crop) <u>so</u> more nitrate taken in; OR Water-logged soil so (anaerobic) denitrifying bacteria convert nitrates to nitrogen; OR Water-logged so (aerobic) nitrifying bacteria cannot produce nitrates;	2	Ignore numerical values for rainfall
04.3	(Yes) 1. (From 21 days) nitrate concentration higher in ploughed ~~> nitrate concentration in not ploughed;~~	3 max	Maximum 2 marks if mp 1 not awarded

	(No) 2. No data (on nitrate concentration) for intermediate times; 3. Differences (between ploughed and unploughed) may not be significant; 4. More evaporation at high temperature so nitrate concentration increases; 5. More water with high rainfall so nitrate concentration decreases; 6. Difference could be due to another factor; 7. Only two fields used; 8. No information about crop type;		3. Accept no statistical test 4. Accept converse 5. Accept converse
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04.4	1. <u>Oxygen</u> in soil / <u>aerobic</u> conditions / conditions not <u>anaerobic</u>; 2. More (aerobic) respiration so more energy/ATP; 3. (More energy) for amino acid/protein synthesis / for active transport; 4. (More) nitrification or (more) ammonia/nitrites to nitrates or more nitrifying bacteria or (less) denitrification or (less) nitrates to nitrogen or less denitrifying bacteria; 5. more nitrates for synthesis of amino acids/proteins/DNA for growth;	3 max	1. Not just more air in soil 3. Accept named process 5. Accept named proteins
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Question	Marking guidance	Mark	Comments
05.1	51;;;	3	Award 2 marks for correct answer but not to nearest whole number: 50.868 / 50.87 / 50.9 (accept any correct rounding) Award 2 marks for correct answer, not to nearest whole number and Pi button on calculator rather than 3.14: 50.894 / 50.89 / 50.9 (accept any correct rounding) Award 2 marks for 203 (diameter used instead of radius) Award 2 marks for correct method with one incorrect conversion between units and answer to whole kg Award 1 mark for $3.14 \times 9^2 \times 200$ or $3.14 \times 0.09^2 \times 2$
05.2	0.99;;	2	Award 1 mark for incorrect answer that shows $q^2 = 98\%$ or $p^2 = 98\%$
05.3	1. (Elephants with no tusks) less likely to be hunted; 2. (Reproduce more so) more likely to pass on allele to offspring; 3. Frequency of allele (for no tusks) increases (in population); 4. Dominant allele is always expressed in the phenotype; 5. Offspring only needs to inherit one copy / inherit the allele from one parent to have no tusks;	5	Accept converse for with tusks for mp 1, 2 and 3

Question	Marking guidance	Mark	Comments
06.1	Any two from: Mass/volume/amount/type/pH of soil in each tray or same nutrients/ions/minerals/named ion/fertiliser in soil; Mass/volume of water (each day); Light intensity; Temperature; (Concentration of) oxygen/carbon dioxide;	2 max	Accept same size/volume/surface area of tray
06.2	To keep the mass of seeds in each tray constant or Common mullein seeds are <u>smaller</u>; or Lesser burdock seeds are <u>larger</u>;	1	
06.3	1. (Common mullein) low(er) number of seedlings with grass / competition reduces number of seedlings; 2. (Lesser burdock) similar number of seedlings with soil and living plants / competition has less effect (on number of seedlings); 3. (Lesser burdock) produces larger seedlings; 4. (Lesser burdock) has greater water uptake/mineral uptake/light absorption than grass; 5. Lesser burdock has more food/starch stored for faster (initial) growth rate;	4	Accept suitable use of figures for mp 1 and 2 Penalise use of seeds instead of seedlings for mp1 – 3 once. 3. Accept converse for common mullein 4. Accept converse for common mullein

06.4	Seedlings used in experiment not killed at start; (10 seedlings to) give valid/representative <u>mean</u> ; Seedlings used in experiment may have soil attached or germinated on filter paper so mass of soil does not affect results; Seedlings may germinate at different rates; The mass of one seedling would be too small to weigh;	2 max	Allow reliable
06.5	6.2;;	2	Award 1 mark for correct answer but incorrect number of significant figures: 6.22 / 6.223 / 6.2234 Award 2 marks for 6.8 (taking initial mass of seedlings on day 7 of 77 days) Award 1 mark for 6.85 / 6.846 / 6.8457

Question	Marking guidance	Mark	Comments
07.1	To provide carbon dioxide / so carbon dioxide is not limiting;	1	
07.2	Removal of (sodium) hydrogen carbonate / removal of CO ₂ ;	1	Reject oxygen produced increases pH
07.3	1. Correct difference in rate of 0.08; 2. Percent per minute / % min ⁻¹ ;	2	2. Accept % / min(ute) or % per min(ute) or percent per min(ute)
07.4	1. (Tube 2) higher light <u>intensity</u> / brighter light; 2. (Tube 2) more photolysis (of water);	2	1. Accept converse for tube 1 1. Not just more light 2. Accept converse for tube 1 2. Accept description of photolysis
07.5	(Level off / plateau) CO ₂ concentration becomes limiting factor / (sodium) hydrogen carbonate used up / carbon dioxide used up;	1	
07.6	1. (Percentage of oxygen) decreases / oxygen concentration decreases / line goes down; 2. (In the dark/no light) so only (aerobic) respiration;	2	2. Do not allow anaerobic respiration

Question	Marking guidance	Mark	Comments
08.1	1. Electrons from chlorophyll/photosystem; 2. Pass down electron transfer chain / pass along electron acceptors/carriers; 3. ATP made; 4. Photolysis of water produces protons/H⁺ and electrons/e⁻ (and oxygen); 5. Protons / electrons accepted by NADP; 6. Reduced NADP made;	6	Accept correctly labelled diagram for mp 1–6
08.2	1. Carbon dioxide reacts with ribulose biphosphate; 2. Catalysed by rubisco; 3. (Two molecules of) glycerate 3-phosphate/GP formed; 4. GP (reduced) to triose phosphate/TP; 5. (using) ATP <u>and</u> reduced NADP; 6. TP/GP used to regenerate RuBP 7. TP/GP converted to <u>named</u> organic substance eg glucose, sucrose, starch, cellulose, amino acids, proteins;	6 max	5. Must be in the context of mp 4
08.3	Rate of reaction decreases because: 1. Light-<u>in</u>dependent reaction has enzymes/named enzyme/rubisco / light-dependent reaction not enzyme controlled; 2. Less kinetic energy (at lower temperature); 3. Fewer collisions (at lower temperature);	3	