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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)(i)	Nitrification/oxidation;	1	Accept 'nitrifying'
1(a)(ii)	Denitrification;	1	Accept 'denitrifying'
1(b)	1. (Nitrogen) to ammonia/NH_3/ammonium; 2. Produce protein/amino acids/ named protein/DNA/RNA;	2	1. Do not disqualify mark for any references to ammonia being converted to nitrite, nitrate etc 2. Do not disqualify mark for any references to protein being formed from nitrogen, nitrite or nitrate
1(c)	1. Soil has low(er) water potential / plant/roots have higher water potential; 2. Osmosis from plant / diffusion of water from plant;	2	1. Reference to water potential gradient is sufficient if correct direction of gradient or water movement is outlined 1. Accept WP or Ψ for water potential 2. Accept plant takes up less/not enough water by osmosis 2. Reference to movement of minerals by osmosis negates mark

Question	Marking Guidelines	Mark	Comments
2(a)	Organisms/individuals of one species in a habitat / same place;	1	Accept 'same gene pool' as 'species'
2(b)	Any two factors for one mark e.g. Improved medical care, improved nutrition, more food, improved sanitation, less disease, improved living conditions, improved economy, war ends;	1	Accept two related factors e.g. vaccination and better health care
2(c)	Correct answer in range of 269-291 (%);; One mark for incorrect answer but shows change of 6.2 (× 1000) / 6.3 (× 1000) / 6.4 (× 1000);	2	
2(d)	1. Increase in (average) life expectancy; 2. Low death rate / decrease in death rate / few(er) deaths / more survivors / fewer babies/infants die / more old(er) people;	2	Allow **one maximum mark** if candidate provides correct answer using 2007 curve 2. Allow any description which suggests more survivors or fewer deaths

Question	Marking Guidelines	Mark	Comments
3(a)	1. Large number of eggs/offspring/flies (therefore) improves reliability / can use statistical tests/ are representative / large sample (size) / reduces sampling error; 2. Small size / (breed) in small flasks / simple nutrient medium (therefore) reduces costs/easily kept/stored; 3. Size / markings / phenotypes (therefore) males/females easy to identify; 4. Short generation time / 7-14 days / develop quickly / reproduce quickly (therefore) results obtained quickly / saves times / many generations;	2 max	Each mark point requires a feature linked in mark scheme (by therefore) to an explanation 1. Do not accept a large number of eggs produces a large number of flies unless the term sample is used 1. Ignore references to accuracy or precision 2. Accept small size so can be kept in small flasks 3. Answers must relate to size, markings or use the term phenotype
3(b)(i)	1. X^RX^R and X^rY; 2. X^R and X^R plus X^r and Y; 3. X^RX^r and X^RY; ***OR*** 1. X^RX^r and X^rY; 2. X^R and X^r plus X^r and Y; 3. X^RX^r and X^RY;	3	All marking points are completely independent. Allow crosses from the following parents for a possible three marks: X^RX^R and X^r- X^RX^R and X^rY; RR and rY / rY^- RR and r- or RR and r ***OR*** X^RX^r and X^r- X^RX^r and X^rY; Rr and rY / rY^- Rr and r- or Rr and r Accept different symbols e.g. W and w 2. Accept gametes in a punnet square
3(b)(ii)	Fertilisation is random / fusion of gametes is random / small/not large population/sample / selection advantage/disadvantage / lethal alleles;	1	Mutation = neutral Random mating = neutral Accept fertilisation/fusion of gametes is due to chance

3(c)	1. Males have one allele; 2. Females need two recessive alleles / must be homozygous recessive / could have dominant and recessive alleles / could be heterozygous/carriers;	2	Answers should be in context of alleles rather than chromosomes

Question	Marking Guidelines	Mark	Comments
4(a)	1. Decrease in (percentage cover) of bare ground/water linked to more plants/species / increase in plant coverage; 2. Change in diversity / number of plant/species/named (species) as abiotic conditions altered / due to <u>competition</u> / more soil / less hostile; 3. Increase in depth of soil as plants die / humus formed;	3	Allow **one maximum mark** for answers which describe all three changes **without** a suitable explanation for any change 1. Must be idea of more/increase not just change in species/plants 2. Accept pioneer species replaced due to competition 2. Accept description of change in species 2. Accept 'more suitable' = less hostile
4(b)	1. Greater variety of food / more food <u>sources</u>; 2. More/variety of habitats/niches;	2	1. 'More food' = neutral 2. Ignore 'more homes' or reference to 'shelters'
4(c)(i)	1. Marking is not removed / marking does not affect survival/predation; 2. Limited/no immigration/emigration; 3. Sufficient time for (marked) individuals to mix (within the population); 4. No/little births/deaths/breeding; 5. Sampling method is the same;	2 max	2. Accept 'migration' and descriptions of immigration/emigration 2. and 4. Increase/decrease in population is not sufficient – there must be a reason 3. Accept – 'For mixing to occur between samples' 5. Ignore 'random sampling'
4(c)(ii)	Correct answer of ...34 = 2 marks;; Incorrect answer but shows correct formula in words or numbers e.g. 17 × 20 ÷ 10;	2	1. Allow **one mark** for an answer of 51 as candidate has misinterpreted the second sample as being = 30 2. Reject correct formula multiplied by 100

Question	Marking Guidelines	Mark	Comments
5(a)(i)	Stroma (of chloroplasts);	1	Reject: stoma
5(a)(ii)	2;	1	
5(b)	1. As oxygen (concentration) increases less Rubisco/RuBP reacts/binds with carbon dioxide; 2. Competitive inhibition / competition between oxygen and carbon dioxide for rubisco/enzyme/active site; 3. Less RuBP formed/regenerated (to join with carbon dioxide);	2 max	1. Accept - as oxygen (concentration) increases more Rubisco/RuBP reacts/binds with oxygen 1. Accept – less GP/more phosphoglycolate formed as oxygen (concentration) increases 2. Accept oxygen and carbon dioxide are complementary to active site
5(c)	1. Less glycerate 3-phosphate/GP produced; 2. (Less) triose phosphate to form sugars/protein/organic (product)/any named photosynthetic product; 3. Less RuBP formed/regenerated;	3	1. Accept one GP formed rather than two GP 3. Accept RuBP takes longer to form

Question	Marking Guidelines	Mark	Comments
6(a)	0.8;	1	
6(b)(i)	1. Aerobic respiration; 2. Increase in uptake (of oxygen) with growth/reproduction/division of yeast cells; 3. Glucose/nutrients/oxygen decreases/becomes limiting / cells die / ethanol/toxins form / heat produced / anaerobic respiration occurs;	3	1. Allow description e.g. respiration using oxygen 1. Accept 'oxidative phosphorylation' 3. Ignore any reference to time 3. Accept decrease in oxygen being linked to oxygen being 'used up' or equivalent
6(b)(ii)	1. (Ethanol produced) by anaerobic respiration / from pyruvate in anaerobic conditions; 2. (Ethanol / anaerobic respiration) increases as oxygen (uptake/concentration) decreased; 3. Decreases as glucose is used up / ethanol kills cells;	2 max	1. 'Fermentation' is not enough on its own
6(c)	1. Oxygen uptake decreases/stopped; 2. Oxygen is final (electron) acceptor/combines with electrons (and protons); 3. Ethanol produced sooner / more ethanol produced;	3	3. Accept ethanol produced at any specified time before 16 hours

Question	Marking Guidelines	Mark	Comments
7(a)	1. Provides a standard/benchmark; 2. Can compare (different pesticides/chemicals); 3. Does not kill all the tadpoles/organisms/population;	2 max	3. Accept 'kills 50% of tadpoles'
7(b)	1. Only carried out on one species of toad/African toad / not carried out on USA toads/tadpoles/species; 2. Only tested for 1-4 days/short term / not 16 days/long term; 3. Did not look at effect of predator/predation; 4. Used various pesticides / may not have used malathion;	3 max	1. Accept not carried out on all species of toad 1. Accept carried out on different species 1. Do not accept one type of toad 3. Do not accept biotic factor on its own, there must be a reference to the predator 4. Accept 'did not use malathion'
7(c)(i)	1. (See) effect of pesticide/malathion; 2. Without predator/newts/stress / to compare/see effect with predator/newts/stress present (in experiment **2**);	2	
7(c)(ii)	1. Tadpoles not killed/eaten; 2. Newts are seen/detected;	2	
7(d)	1. Large surface area to volume ratio; 2. Rapid/more diffusion / shorter diffusion pathway; 3. Longer time exposure to pesticide / adults/toads live in and out of water / tadpoles remain/stay in water;	2 max	

7(e)	1. Link between using less (pesticide) and cost/less effect on environment/organisms; 2. Pesticide/malathion diluted (in water); 3. Concentrated due to evaporation; 4. Concentrated in food chains/webs/tadpoles/habitat;	2 max	1. Accept answers which link concentration (of pesticide) to being 'cost effective' 4. Accept (pesticide) 'builds up' in the environment / bioaccumulation / biomagnification
7(f)	1. Can see effect of other biotic factors / effect on other organisms; 2. Can see effect of abiotic factors / named abiotic factor;	2	

Question	Marking Guidelines	Mark	Comments
8(a)	1. Chlorophyll absorbs light energy; 2. Excites electrons / electrons removed (from chlorophyll); 3. Electrons move along carriers/electron transport chain releasing energy; 4. Energy used to join ADP and Pi to form ATP; 5. Photolysis of water produces protons, electrons and oxygen; 6. NADP reduced by electrons / electrons and protons / hydrogen;	5 max	1. Accept light energy 'hits' chlorophyll 1. Accept photon for light energy 2. Accept higher energy level as 'excites' 3. Accept movement of H^+/protons across membrane releases energy 3. and 4. Negate 'produces energy' for either mark but not for both 4. Accept energy used for phosphorylation of ADP to ATP 4. Do not accept P as Pi 6. Accept NADP to NADPH (or equivalent) by addition of electrons/hydrogen 6. Do not accept NADP reduced by protons on their own
8(b)	1. Some light is reflected / not of appropriate wavelength; 2. Some light misses leaves/ photosynthetic tissue/chloroplasts/chlorophyll; 3. Heat loss; 4. (Energy loss via) respiration; 5. Loss via faeces/undigested food/part of organism not eaten; 6. Excretion/named excretory product;	5 max	1. Light not absorbed is not enough on its own 3. Accept (energy used to) maintain body temperature but do not accept to keep warm or warm blooded 4. Do not accept 'energy used in respiration'

8(c)	1. Variation/variety; 2. Mutation; 3. Some plants have <u>allele</u> to survive/grow/live in high concentration of copper/polluted soils; 4. (Differential) reproductive success / adapted organisms reproduce; 5. Increase in frequency of <u>allele;</u> 6. No interbreeding (with other populations) / separate gene pool / gene pool differs (from other populations);	5 max	2. Do not accept answers which suggest the mutation is caused by copper 3. Reference to immunity disqualifies this mark 3. Do not disqualify mark for references to allele providing resistance to copper 6. Accept reproductive isolation