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BIOLOGY

9610

BL03 Populations and genes

Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking guidance	Mark	Comments
01.1	Less competition for named biotic/abiotic factor – food/space/light; One/both species would not survive;	2	Competitive exclusion principle = 1 mark
01.2	Different types of food / different methods of feeding;	1	
01.3	1 Curve of best fit shows peak around pH 7.3; 2 Variation in species richness at each pH with use of data; 3 Very similar species richness over wide range of pH / with use of data; 4 Correlation does not mean causal relationship;	4	
01.4	1 Light intensity – linked to photosynthesis and availability of food for fish; 2 Temperature – linked to enzymes or rate of respiration/metabolism/growth in fish; 3 Oxygen concentration in water – linked to rate of respiration; 4 Carbon dioxide concentration in water – linked to rate of photosynthesis and availability of food;	2 max	

Question	Marking guidance	Mark	Comments
02.1	1 Enters mitochondrion / ETC; 2 (NADH is) oxidised to NAD; 3 (NADH is) used to produce ATP; 4 Hydrogen atoms split into H^+ and electrons; 5 Passed onto next carrier/ FAD/oxygen;	3 max	
02.2	NAD is regenerated; Glycolysis/step 3/ATP production can continue;	2	
02.3	1 Less pyruvate enters mitochondria; 2 Less Krebs cycle (intermediates); 3 Less reduced coenzymes / NADH / $FADH_2$ passed to ETC; 4 Less H^+ and electrons passed to oxygen;	3 max	Idea of 'less' only needed once
02.4	Reduced proton gradient (between inner mitochondrial membrane and matrix) / some H^+ move back across (the inner mitochondrial membrane); Less diffusion/movement of protons through ATP synthase;	2	

Question	Marking guidance	Mark	Comments
03.1	1 Reduce number of chloroplasts / less photosynthetic tissue/mesophyll / less chlorophyll; 2 So less photosynthesis; 3 Less glucose/ sucrose/amino acids/organic molecules;	2 max	Responses must link to productivity
03.2	1 Pests do not develop resistance to biological agents; 2 Biological agents are specific / not harmful to beneficial organisms / non-toxic to humans eating the crop; 3 Biological agents may be cheaper in the long-term as only one application is needed; 4 Predator can locate prey (otherwise may be sheltered from pesticide spray beneath leaves);	2 max	2 Allow no toxins released into environment
03.3	1 Predatory mite B only feeds on white fly / doesn't feed on thrips or spider mites; 2 Populations of thrips/spider mites increases / thrips/spider mites still cause damage to crop plant;	2	

03.4	1 Highest number of predatory mites (per leaf) at 9 weeks; 2 No intermediate data for 8 and 10 weeks; 3 SD bars for 7, 9 and 11 weeks overlap; 4 (so) difference not significant;	3 max	

03.5	1 Increased diversity of pest species / when all three pest species are present <u>then</u> mean number of predatory mites increases; 2 Increased diversity of pest species decreases percentage leaf damage (by spider mites); 3 Mean number of predatory mites is significantly higher (with thrips + whiteflies + spider mites); 4 Less than 5% leaves damaged (with thrips + whitefly + spider mites);	4	1 Allow reference to Glasshouse 1 for increased diversity of pest species.

Question	Marking guidance	Mark	Comments
04.1	1 Males only have one X chromosome / males have X and Y chromosomes and females have two X chromosomes / females have XX; 2 Recessive allele on (non-homologous portion of) X chromosome has no (equivalent) allele on (homologous portion) Y chromosome; 3 Recessive allele on the X chromosome is expressed / male needs to inherit one recessive allele whereas female needs to inherit two;	3	
04.2	X^DY and X^DX^d;	1	
04.3	1 in 4 / 0.25 / 25% / 1:3 / ¼ ;	1	
04.4	1 (Individual 22) can only pass on X chromosome and son gets Y chromosome from father; 2 (Individual 22) only has dominant alleles / does not have recessive allele / does not have allele for DMD / is not a carrier;	2	

04.5	4.875 / 4.88 / 4.9 / 5;;;	3	Allow 1 mark for calculating frequency of normal allele. (p + q = 1.0 so) frequency of normal allele = 0.975; Allow 2 marks for calculating probability of heterozygote. (carrier / heterozygote = 2pq so) 2 x 0.975 x 0.025 = 0.04875; Allow 2 marks for incorrect rounding e.g. 4.8 / 4.87 If no other mark awarded, allow 1 mark for p + q = 1 or for p2 + 2pq + q2 = 1

04.6	(Hardy-Weinberg assumes) no selective advantage/disadvantage / no movement into/out of population;	1	Allow converse – CF is harmful / CF gives selective disadvantage

Question	Marking guidance	Mark	Comments
05.1	Temperature using a water bath; pH using buffer solution;	2	Allow 1 mark for two controls (temperature and pH) but no method/incorrect method given.
05.2	Collect gas and measure volume;	1	Allow description e.g. collect gas in a gas syringe.
05.3	Bar chart drawn with labelled axes (carbohydrate source on x-axis and number of bubbles on y-axis); Bars correctly drawn and labelled;	2	
05.4	1 Correct calculation – e.g. $\frac{(810 - 690)}{(600 - 400)}$ (= 0.6 (per s)); 2 Corrected to per min: mp1 × 60 – e.g. 0.6 × 60 = 36.0; 3 Corrected to 2 s.f. = 36;	3	Allow $\frac{(940 - 690)}{(800 - 400)}$ (= 0.625 (per s)); Allow mp1 × 60 – e.g. 0.625 × 60 = 37.5; Allow 38;
05.5	1 (Glucose) enters glycolysis immediately / can be used as a respiratory substrate immediately (so highest rate of respiration); 2 Starch hydrolysed/digested (to glucose) before it can be used for respiration; 3 Sucrose hydrolysed/digested (to glucose and fructose) but produces less glucose (so lowest rate of respiration);	3	
05.6	Substrate / carbohydrate / glucose used up; OR Ethanol / toxins build up;	1	

Question	Marking guidance	Mark	Comments
06.1	Scatter graph as looking for a correlation between two variables;	1	
06.2	1 Use Spearman rank correlation test / calculate correlation coefficient; 2 Calculated value gives strength of correlation / figure close to -1 gives negative correlation / figure close to +1 gives positive correlation;	2	2 Accept converse with reference to no correlation
06.3	Reference to data to support conclusion: 1 Larger females have deeper nests/have larger eggs/are more likely to win fights; 2 (so) eggs more likely to survive; But – against conclusion: 3 Small sample size / only 13 fish; 4 Length not only indication of size; 5 Number of eggs laid in each nest / survival of eggs/young not given; 6 No statistical test / may not be significant;	4 max	Must have at least one Pro point for full marks

Question	Marking guidance	Mark	Comments
07.1	1 Carbon dioxide and methane are greenhouse gases; 2 Greenhouse gases absorb heat; 3 Heat is radiated back to Earth; 4 Increased levels of carbon dioxide and methane increase the amount of heat absorbed and re-radiated;	4	

07.2	Increased yield because: 1 Increased temperature increases rate of chemical reactions; 2 (Increased temperature) increases number of collisions / increases kinetic energy / increases number of enzyme-substrate complexes; 3 (Increased rate of photosynthesis) increases production of sugars/amino acids/organic molecules; Decreased yield because: 4 (Increased temperature could) decrease yield of some crop plants because not optimum for enzyme action; 5 (Increased temperature could) increase the rate of transpiration/evaporation of water from plants and water is needed for metabolism/transport/support; 6 Increased predation by insect pests; 7 Unpredictable effects on rainfall;	6 max	1 Accept named chemical reactions e.g. photosynthesis

07.3	1 Some of the alleles (for less desirable characteristics) removed; 2 Variety of alleles/genetic diversity (in population) is reduced; 3 Fewer alleles (means) population is less able to adapt to change;	3	