Mark Scheme (Results)

January 2021

Pearson Edexcel International Advanced Level
In Biology (WBI12)
Paper 01 Cells, Development, Biodiversity and Conservation

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional guidance	Mark
1(a)(i)	The only correct answer is B one A is not correct because starch only contains α-glucose and is stored in amyloplast C is not correct because starch only contains α-glucose and is stored in amyloplast D is not correct because starch only contains α-glucose and is stored in amyloplast		**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	The only correct answer is C two *A is not correct because they are all correct apart from contains α-glucose and β-glucose* *B is not correct because they are all correct apart from contains α-glucose and β-glucose* *D is not correct because they are all correct apart from contains α-glucose and β-glucose*		**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	• (bacterial) chromosome and • (70S) ribosomes	Both structures required for the mark Accept nucleoid / (circular) DNA / plasmid / (m)RNA ignore size of ribosome	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation that includes three of the following points: • oxygen for (aerobic) respiration (1) • glucose for respiration / amino acids for protein synthesis (1) • optimum temperature for (faster) {enzyme / metabolic} reaction (1) • optimum pH for (faster) {enzyme / metabolic} reaction (1)	accept lack of oxygen for survival of obligate anaerobes accept water for {hydrolysis reactions / solvent} accept suitable stated temperature for {faster/optimum} enzyme rate of reaction accept suitable stated pH for {faster/optimum} enzyme rate of reaction	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)	• anatomical • behavioural		**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)(i)	electron (microscope)		**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	A description that includes the following points: • aerobic respiration (1) • produce ATP (1) • for cell metabolism / named cell process (1)	 Accept {Krebs / citric acid} cycle / oxidative phosphorylation accept cell {reactions / processes} / named process e.g. mitosis, protein synthesis, muscle contraction, active transport etc accept contains ribosomes for protein synthesis	**(3)**

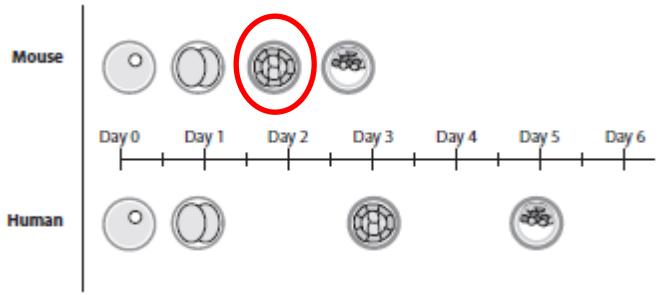
Question Number	Answer	Additional guidance	Mark
2(c)	An answer showing: • at least two tubules with ribosomes on surface (1) • {cisternae / membrane} labelled (1) • ribosomes labelled (1)	Accept tubules ignore cell membrane	**(3)**

Question Number	Answer	Additional guidance	Mark
3(a)	A description that includes five from the following points: • (pollen) tube grows down (style) to {ovary / ovule / egg cell / micropyle} • (by releasing) {digestive / hydrolytic} enzymes (1) • the generative nucleus {divides / undergoes mitosis} • to form two {male / haploid} nuclei (1) • one {male / haploid} nucleus fertilises the egg cell (to form the zygote) (1) • one {male / haploid} nucleus fertilises the (two) polar nuclei to form the endosperm (nucleus) (1)	{Male / haploid} only needs to be stated once and then will apply for subsequent mp piece together mp1 Accept pollen tube transports {generative nucleus / male nuclei} down the style Accept male gamete / sperm nucleus Accept male gamete / sperm nucleus Accept female {nucleus / gamete} for egg cell Accept male gamete / sperm nucleus ignore polar nucleus (singular)	**(5)**

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that includes the following points: • each male nucleus and egg cell nucleus (from silver trumpet trees) is genetically different (from each other) / (each ovule) may have been fertilised by {pollen / gamete} from (many) different trees (1) • due to crossing over of {alleles / DNA} (between chromatids) / mutation (1) • due to {independent / random} assortment (of chromosomes) (1) • in meiosis (1)	accept each male and female gamete is genetically different (from each other) accept description of crossing over forming {recombinant chromatids/ different combinations of alleles}	**(4)**

Question Number	Answer	Additional guidance	Mark
4(a)	A calculation showing the following steps: • correct difference (1) • correct percentage difference to 2 significant figures (1)	Mark the answer on answer line first <u>Example of calculation:</u> 170 - 105 = 65 (65 ÷ 105) × 100 = 62% Correct answer (62) with no working gains full marks Accept 38% for both marks	**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	The only correct answer is B 2.85×10^{-3} (mm^3) *A is not correct because that is the volume in cm^3* *C is not correct because that is not the volume in mm^3* *D is not correct because that is the volume in μm^3*		**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)		accept circle without morula label accept morula label without circle	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	A description that includes the following points: • fusion of cortical granules with cell (surface) membrane and release of enzymes (1) • hardening of zona pellucida (to prevent polyspermy) (1) • fusion of two haploid nuclei (to form diploid nucleus) (1)	Accept joining of two haploid nuclei	**(3)**

Question Number	Answer	Additional guidance	Mark
4(c)	An answer that includes the following points: • it is a short distance between (mitochondria and lipid (1) • quicker diffusion of {lipid / fatty acid / glycerol} (into mitochondria) (1) • lipids used in {respiration / ATP production} (1)	accept they are close together Accept (lipid droplets) converted to glucose ignore energy storage	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	The only correct answer is A *W* *B is not correct because X is the phloem* *C is not correct because Y is the xylem* *D is not correct because Z is the parenchyma*		**(1)**

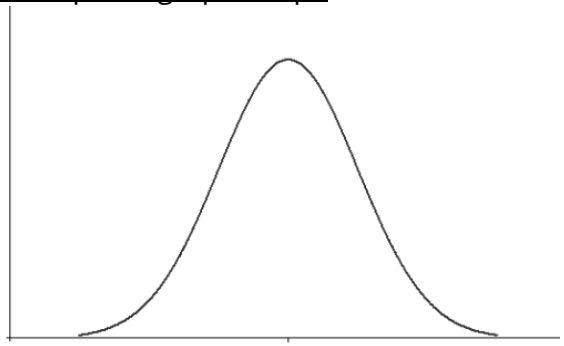
Question Number	Answer	Additional guidance	Mark
5(a)(ii)	The only correct answer is B X *A is not correct because X is the phloem which transports substances in both directions* *C is not correct because X is the phloem which transports substances in both directions* *D is not correct because X is the phloem which transports substances in both directions*		**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	The only correct answer is D Y *A is not correct because Y is the xylem* *B is not correct because Y is the xylem* *C is not correct because Y is the xylem*		**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(iv)	The only correct answer is D xylem vessels and sclerenchyma fibres *A is not correct because phloem sieve tubes do not have secondary thickening* *B is not correct because phloem sieve tubes do not have secondary thickening* *C is not correct because sclerenchyma fibres also have secondary thickening*		**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An explanation that includes the following points: • magnesium is needed to form chlorophyll / chlorophyll contains magnesium (ions) (1) • for the production of {glucose / carbohydrate / ATP} in photosynthesis (1)	ignore plant growth accept for the conversion of light energy to chemical energy in photosynthesis Accept for one mark ATP / enzymes must be bound to magnesium ion to be biologically active	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An answer that includes the following points: • increasing magnesium ion concentration increases {mass / growth} / positive correlation (1) • {same / similar} effect on proportion of mass increase in shoots and roots (1) • significant difference between results as the {SD/range/error} values do not overlap (1) • comment on size of SD linked to reliability of data (1)	accept magnesium deficiency decreases the {mass / growth} accept greater increase of shoot mass than roots accept data is {valid / reliable} as the {SD/range/error} values do not overlap	**(4)**

Question Number	Answer	Additional guidance	Mark
6(a)	• graph showing normal distribution (1) • both axes labelled (1)	Accept peak shifted to left or right Accept suitable labels e.g. phenotype / characteristic / height (cm) on x axis frequency / number of individuals on y axis ignore population <u>Example of graph shape</u> 	**(2)**

Question Number	Answer	Additional guidance	Mark
6(b)	An explanation that includes the following points: • (because) mutation resulted in these genes {becoming switched on / being expressed / not being switched off / remaining switched on} (1) • {transcription of / (active) mRNA made from} (active tooth production) genes (1) • (therefore) translation (of mRNA) occurs / proteins formed (for teeth development) (1) • (proteins cause) structural change to (beak) cells changes them into teeth cells (1)	Accept differential gene expression Accept proteins result in (embryo) cells differentiating into teeth cells	**(4)**

Question Number	Answer	Additional guidance	Mark
6(c)	A calculation showing the following steps: • calculation of q^2 (1) • value for q (1) • value for p to two decimal places (1)	Mark the answer on answer line first Example of calculation 140 ÷ 610 = 0.23 √0.23 / 0.48 0.52 Correct answer with no working scores full marks Allow 52.04% for 3 marks	**(3)**

Question Number	Answer	Additional guidance	Mark
7(a)	correct calculation of magnification	(40 ÷ 4.4 = 9.091) (x) 9.1 reject units	**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)	The only correct answer is B 0.20% *A is not correct because* 0.20% *of infected people died* *C is not correct because that is the percentage of infected people who survived* *D is not correct because* 0.20% *of infected people died*		**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	produce ribosomal subunits	Accept produce ribosomes ignore contains genetic material	**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	A description that includes three from the following points: • plant cell would have {starch (grain) / amyloplast} (instead of glycogen granule) (1) • plant cell would have cell wall made from cellulose (not chitin) (1) • plant cell would contain {plasmodesmata / one nucleus} (whereas this cell does not) (1) • the plant cell vacuole would be larger (1)	ignore chloroplast accept plant cells do not have glycogen granules accept plant cell would have lignin accept plant cells do not have chitin cell wall ignore pores	**(3)**

Question Number	Answer
7 (d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. • description of the table data e.g. comparison of numbers of mosquitoes {killed / survived} • consideration of GM fungus being most effective treatment • consideration that most mosquitoes were resistant to the insecticide used / some were not resistant to insecticide and were killed / inheritance of resistance • consideration that resistance arose due to mutation / natural selection / genetic variation in population • as gene is only {switched on / expressed} when the fungus has infected an *Anopheles* mosquito • the toxin is only produced when the fungus has infected an *Anopheles* mosquito • consideration of protein synthesis / detail of the role of rER and Golgi apparatus • evaluation of methodology / limitations of method e.g. mosquitoes escaping, small sample size • consideration of wider effects on biodiversity e.g. toxin will not poison other insects / humans / organisms whereas insecticides would kill other insects / effect on food chains / biodiversity

	• transfer of (spider venom) gene to other fungal species **(6)**		
			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	Limited scientific judgment made with a few strengths / weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	1 mark – description of results using table data. 2 marks consideration of one from: consideration of most effective treatment resistance / inheritance of resistance mutation gene expression protein synthesis limitations of method biodiversity and transfer of gene to other fungi
Level 2	3-4	A scientific judgment is made through the application of relevant evidence, with strengths / weaknesses identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.	all level one plus: 3 marks – two from list 4 marks – three from list consideration of: consideration of most effective treatment resistance / inheritance of resistance mutation gene expression protein synthesis limitations of method

			biodiversity and transfer of gene to other fungi
Level 3	5-6	A scientific judgment is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding, with evidence to support the judgement being made.	all level 2 content 5 marks – consideration of four from the list 6 marks – consideration of five from the list consideration of most effective treatment resistance / inheritance of resistance mutation gene expression protein synthesis limitations of method biodiversity and transfer of gene to other fungi

Question Number	Answer	Additional guidance	Mark
8(a)	An explanation that includes three of the following points: • (habitat loss) due to {deforestation / urbanisation / water drainage} (1) • reduction in food due to {habitat loss / competition with other species / pollution} (1) • (reduction in population) due to {hunting / fewer mates / disease} (1) • introduction of new predator (by humans) (1)	accept pollution of habitat e.g. water pollution, pesticides accept outcompeted by other species	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)	An explanation that includes four of the following points: • (genetic) mutation occurred (1) • (new) allele (coding for protein) involved in fungal resistance (1) • frogs resistant to the fungus {survive and breed / have selective advantage} (1) • pass this (resistant) allele onto the offspring (1) • increase in resistant allele frequency (1)	ignore gene ignore immunity Accept clear statement that fungus is acting as selection pressure	**(4)**

Question Number	Answer	Additional guidance	Mark
8(c)	A description that includes the following points: • {analyse the DNA of (Sehuencas water) frogs / determine the number of heterozygotes} / determine the population size of (Bolivian Sehuencas water) frogs (1) • divide the number of heterozygotes by the total number of (Sehuencas water) frogs (in the Bolivia population) (1)		**(2)**

Question Number	Answer
8 (d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. • genetic diversity identified as the variety of alleles in the population • genetic analysis of the frog in the zoo and the frogs in Bolivia / method of analysis • consideration of maintaining genetic {diversity / variation} / reducing inbreeding / {maintain / increase} gene pool • captive breeding / breeding in zoos or in natural habitat • use of stud books (without ref to maintaining genetic diversity) • {conservation of / increase} frog habitat in Bolivia • guidance to local government / raising awareness of need for protected area e.g. national park • conservation in zoos / recreating similar habitat in zoos / protection from predators (in zoos) / food provision • eradication / treatment of {fungal / other} disease • protection from predators (in-situ) • reintroduction of frogs from captive breeding programme • suggested details of method of reintroduction • education of local population in {Bolivia / country where zoo is located}

	• research **(6)**		
			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	Demonstrates isolated elements of biological knowledge related to the given context with generalised comments made. The description will contain basic information with some attempt made to link knowledge and understanding to the given context.	level 1 1 mark – one aspect described 2 marks – two aspects described
Level 2	3-4	Demonstrates adequate knowledge by selecting and applying some relevant biological facts/concepts to provide the description being presented. The description shows some linkages and lines of reasoning with some structure.	3 marks – three aspects described 4 marks – four aspects described
Level 3	5-6	Demonstrates comprehensive knowledge by selecting and applying relevant knowledge of biological facts/concepts to provide the description being presented. The description is clear, coherent and logically structured.	5 marks – five aspects described 6 marks – six aspects described

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