Mark Scheme (Results)

Summer 2019

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

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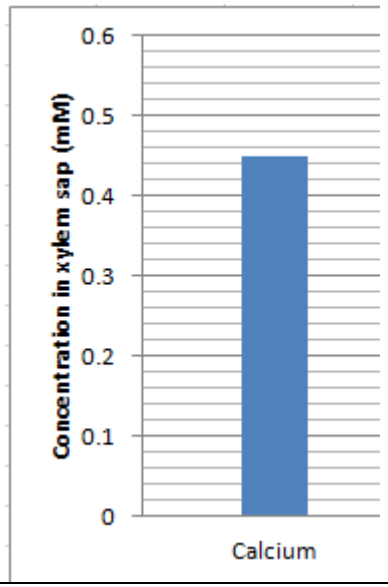
General Marking Guidance

- 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	Mark
1 (a)(i)	The only correct answer is D Z *A is incorrect because it is not a xylem vessel* *B is incorrect because it is not a xylem vessel* *C is incorrect because it is not a xylem vessel*	**(1)**

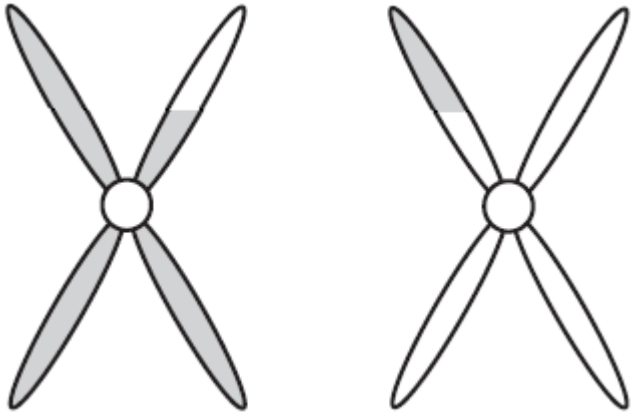
Question Number	Answer	Mark
1(a)(ii)	The only correct answer is B V *A is incorrect because it is not a sclerenchyma fibre* *C is incorrect because it is not a sclerenchyma fibre* *D is incorrect because it is a xylem vessel*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	An answer showing:  	Plotted top of the bar must not touch a printed grid line above or below 0.45 IGNORE the width of the bar	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation that includes the following points: • calcium ions to make calcium pectate to {hold cells together / increase cell wall stability / form middle lamella} (1) • magnesium ions to make chlorophyll so {photosynthesis can occur / light energy can be absorbed / glucose can be made} (1) • nitrates are needed to make {amino acids / proteins / polypeptides / DNA / RNA / nucleic acid} (1)	Accept calcium ions to make calcium pectate to increase cell wall strength Ignore make cell walls Ignore chloroplasts Accept 'sugars'	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)	• (a group of) organisms that are capable of {(inter)breeding / mating / reproducing} and producing fertile offspring (1)	Do not accept inbreeding Accept 'offspring capable of producing offspring' as equivalent to fertile	**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that includes four of the following points: • as the concentration of herbicide increases the (mean) number of (insect) species decreases (1) • increase of 100 mg dm^{-3} results in a decrease of {6.2 species /68.9%} (1) • use of herbicides results in {fewer plant species / reduced plant diversity / reduced food supply (for insects)} (1) • (therefore) some insects (species) {leave habitat / die (from lack of food)} (1) • (fewer plant species results in) fewer habitats for insects (1)	Ignore converse statement Accept negative correlation Accept other correct reductions Ignore herbicides kill insects Accept reduced shelter for insects	**(4)**

Question Number	Answer	Additional guidance	Mark
3(a)	An answer in which: • crossing over section shaded correctly (1) • non crossing over sections shaded correctly (1)		**(2)**

Question Number	Answer	Mark
3(b)(i)	The only correct answer is B Q *A is incorrect because that cell is in metaphase* *C is incorrect because that cell is in anaphase* *D is incorrect because that cell is in telophase*	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	0.5 / half / ½ (hour)	ALLOW answer 30 **minutes** if clear	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	256		**(1)**

Question Number	Answer	Mark
3(c)(i)	The only correct answer is A anaphase *B is incorrect because spindle fibres do not shorten in metaphase* *C is incorrect because spindle fibres do not shorten in prophase* *D is incorrect because spindle fibres do not shorten in telophase*	**(1)**

Question Number	Answer	Additional guidance	Mark
3(c)(ii)	An answer that makes reference to the following: • Vincristine is the most effective and SRT1720 is the least effective (when given on their own) (1) • Resveratrol reduces the effectiveness of Vincristine / Vincristine increases the effectiveness of Resveratrol (1) • SRT1720 increases the effectiveness of Vincristine / Vincristine and SRT1720 is the most effective treatment (tested) (1) • comment on variability of data (1)	Accept description of correct order (V>R>SRT) Ignore drug combinations Accept Resveratrol and Vincristine more effective than Resveratrol by itself / Resveratrol and Vincristine less effective than Vincristine by itself e.g. {range / SD / error} bars do not overlap / size of error bars	**(4)**

Question Number	Answer	Mark
4(a)(i)	The only correct answer is B Golgi apparatus *A is incorrect because centrioles do not have several curved membrane-bound sacs of decreasing size* *C is incorrect because rough endoplasmic reticulum does not have several curved membrane-bound sacs of decreasing size* *D is incorrect because smooth endoplasmic reticulum does not have several curved membrane-bound sacs of decreasing size*	**(1)**

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	An explanation that includes the following points: • the {magnification / resolution} of a light microscope is not high enough (to see this organelle) (1) • because it is very small (1)	 Accept higher {magnification / resolution} of electron microscope is needed to see this organelle Accept small	**(2)**

Question Number	Answer	Additional guidance	Mark
4(a)(iii)	An answer that includes the following points: • organ has many functions whereas a tissue has {one / fewer} (1) • organ has {many / several / group of} {cell types / tissues} whereas a tissue has {one cell type / similar cells } (1)	Do not piece together	**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)	An answer that includes two of the following: • cilia (1) • glycogen (granules) (1) • flagella (1)	Accept centrioles, lysosomes Ignore vesicles, temporary vacuoles	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)	An explanation that includes four of the following points: • (the percentage of) labelled amino acids {decreases inside the cell / increases outside the cells} (1) • polypeptide is packaged into vesicles by rER / {(rER) vesicles fuse with / protein enters} Golgi (1) • {protein is modified / carbohydrate added to protein} (in Golgi) (1) • (enzyme(s) / glycoprotein(s)) packaged into (secretory) vesicles (by Golgi) (1) • {enzyme(s) / (glyco)protein(s)} leave cell by exocytosis / some (intracellular) {enzyme(s) / (glyco)protein(s)} remain in cells (1)	Accept green fluorescence Accept modified proteins ignore amino acids Accept vesicles fuse with cell (surface) membrane and release {enzyme(s) / (glyco)protein(s)} outside cell ignore amino acids	**(4)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	• Tabebuia		**(1)**

Question Number	Answer	Mark
5(a)(ii)	The only correct answer is A amyloplast *B is incorrect because middle lamella is not a structure that stores starch* *C is incorrect because plasmodesmata is not a structure that stores starch* *D is incorrect because tonoplast is not a structure that stores starch*	**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An answer that includes the following points: • slime capsule prevents dehydration of cell (1) • pili allow bacteria to adhere (to surfaces) (1)	Accept protection of cell from a correct factor e.g. {white blood cells / phagocytes / antibodies / antibiotics / from harsh conditions} Accept conjugation / exchange of genetic information / exchange plasmids / attachment Ignore sexual reproduction	**(2)**

Question Number	Answer
5 (b)(ii)	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. • compound needs to be extracted from trees and used to make a drug • compounds tested on *Y. pestis in vitro* • tested on {animals / human cells} • (phase 1 / preliminary) (small scale) tests on healthy {people / volunteers} • review by independent {scientists / medics} to see if work can progress to stage 2 • (phase 2) - drug tested on {small / 100 to 500} groups of {patients / people} who have the {plague / disease} • appropriate concentrations identified • (phase 3) - drug tested on {larger groups of / 1000 to 3000} {patients / people} who have the plague • placed randomly in two groups - one group receives {treatment / drug containing the chemical compounds} and the other receives placebo • double blind test • analyse results with (appropriate) statistical test / test for significant difference

			(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.	outline of drug test given but no reference to either the plague or *Y. pestis* or bacteria core prac only = 1 mark other human drug trial = 2 marks
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 scientific reasoning with some structure.	Testing on {animal / human cells} plus at least two other phases correctly described In context of people having the disease / plague or *Y. pestis* or bacteria gives lower mark plus reference to double blind test or placebos gives higher mark
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.	Testing on {animal / human cells} plus three phases correctly described including double blind test and placebos In context of people having the disease / plague or *Y. pestis* or bacteria gives lower mark plus correct ref to use of stats / analysis of significant difference to placebo gives higher mark

			or in vitro testing of drug on *Y. pestis* or bacteria gives higher mark

Question Number	Answer	Mark
6(a)(i)	The only correct answer is B heterozygosity index *A is incorrect because the Hardy-Weinberg equation is not used to calculate genetic diversity* *C is incorrect because index of diversity is not used to calculate genetic diversity* *D is incorrect because mitotic index is not used to calculate genetic diversity*	**(1)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	An answer that makes reference to the following: • genetic diversity considers one species whereas species richness considers {different / number of} species (1)	Mark as a whole Accept genetic diversity considers one population whereas species richness considers {one habitat / several populations}	**(2)**

	• genetic diversity considers {alleles / genotypes} whereas species richness {is within a habitat / considers whole organisms / counts number of species (in an area)} (1)	Accept gene pool Ignore genes Accept specific area / ecosystem	

Question Number	Answer	Additional guidance	Mark
6(b)	An answer that makes reference to two of the following: • can store more seeds as they {take up less space / are smaller} (1) • seeds need less {maintenance / cost} (1) • seeds can {survive longer than plants / be frozen } (1)	Accept growing plants takes up more space Accept more seeds stored aids maintenance of genetic diversity Accept converse for plants Accept seeds can be stored for longer	**(2)**

Question Number	Answer	Additional guidance	Mark

6(c)(i)	A calculation showing the following steps: • correct difference (1) • correct percentage increase (1)	Mark the answer on answer line first <u>Example of calculation:</u> $8.2 - 3.3$ / $8.2\times10^5 - 3.3\times10^5$ / 4.9 / 4.9×10^5 / 490000 $(4.9 \div 3.3) \times 100 = 148$ / 148.48 / 148.5 Correct answer (148 / 148.48 / 148.5) with no working shown gains full marks Accept for one mark only 59.8 / 59.756 / 59.76 / 60	**(2)**

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that makes reference to four of the following: • (all Cavendish plants) are susceptible to the fungus because they are {genetically identical / clones} (1) • whereas different varieties may have resistance to the fungus / contain an allele for resistance (to fungus) (1) • (therefore breeding could) increase genetic {diversity / variation} (1) • resulting in (new banana) plants with resistance to {fungus / Panama disease} (1)	Ignore mutations / immunity Accept do not contain an allele for resistance (to fungus) Accept contain an advantageous allele Ignore 'genes' unless qualified with alleles Accept increase gene pool Accept {offspring / new varieties} survive and reproduce	**(4)**

Question Number	Answer	Mark
7(a)(i)	The only correct answer is B 2 *A is incorrect because the nucleus and mitochondria contain DNA* *C is incorrect because the nucleus and mitochondria contain DNA* *D is incorrect because the nucleus and mitochondria contain DNA*	**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	A description that includes two of the following points: • (mitochondria carry out) aerobic respiration (1) • provide {ATP / energy} (1) • to move the flagellum (1)	Accept respiration Do not accept '{produce / make} energy' unqualified Accept tail	**(2)**

Question Number	Answer	Additional guidance	Mark
7(a)(iii)	A calculation showing the following steps: • conversion of actual length of scale into μm (1) • actual length divided by the given length (1)	<u>Example of calculation:</u> 40 mm = 40000 μm Allow answer in the range of 40000 to 41000 μm (40000 ÷ 60) = 666.67 to 683.3 Correct answer with no working shown gains both marks Allow ECF	**(2)**

Question Number	Answer	Additional guidance	Mark
7(b)	An answer that includes the following points: • sperm (with longer flagellum) swim {fast / faster} (to the egg cell) (1) • (sperm have) increased chance of fertilising (the egg cell) (1) • competition with **sperm** from other (male Chinese) hamsters (1)	Accept (longer flagellum) gives more {force / movement} Accept to be the first to fertilise the egg cell Ignore to be the first to reach the egg cell Accept description of competition with sperm from other (male Chinese) hamsters Accept as a consequence of natural selection / evolution	**(3)**

Question Number	Answer	Additional guidance	Mark
7(c)	An explanation that includes the following points: • cortical {granules / vesicles} fuse with (egg cell surface) membrane and release enzymes (1) • **zona pellucida** hardens (1) • to prevent {polyspermy / more than one sperm (nucleus) entering egg cell} / to ensure that the nucleus is diploid (1)	Ignore chemicals Accept 'thickens' or 'becomes impermeable' Accept 'no other sperm can enter'	**(3)**

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Question Number	Answer	Additional guidance	Mark
7(d)	A description that includes three of the following points: • **differential gene expression** (1) • some genes have been (permanently) {inactivated / switched off} (1) • by epigenetic modification (1) • {proteins / enzymes} {made / synthesised} (from active genes) which permanently modify the cell (1)	 Accept only some genes are {active / switched on} Ignore genes activated Accept named example of modification e.g. histone modification, DNA methylation Accept {proteins / enzymes} {made / synthesised} produce a {structural / functional / metabolic change}	**(3)** **exp**

Question Number	Answer	Additional guidance	Mark
8(a)	An explanation that makes reference to the following: • introduction of new (beaver) species increased the {species richness / biodiversity} (1) • reduction in (plant) biodiversity due to trees being cut down / reduction in (animal) biodiversity as {habitat / food} reduced (by the trees being cut down) (1) • (increase in biodiversity) due to {pond being created / new habitat / increased space (due to trees being cut down)} (1) • (increase in biodiversity) due to new food source (1)	Accept number of {species/ organisms} for biodiversity Ignore genetic diversity Accept reduction in animal biodiversity due to {competition with / predation from} beavers Accept plant or beaver as food source	**(4)**

Question Number	Answer
8 (b)	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 • only small numbers of introduced beavers could reduce the genetic diversity • loss of alleles from population • increased homozygosity • introducing more Norwegian beavers could increase genetic diversity • but could have same alleles so no effect on genetic diversity • introducing beavers from different European locations could increase genetic diversity • could be many different alleles in wider populations of European beavers • however the map shows many geographically isolated populations • these small populations could also have low genetic diversity • reproductive isolation could have occurred • preventing introduced beavers mating with Scottish beavers

			(6)
			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.	Discussion of at least one solution and the impact on genetic diversity 1 solution = 1 mark 2 solutions = 2 marks
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.	Discussion of both solutions and their impact on genetic diversity plus consideration of effect of geographically isolated populations on genetic diversity 1 mark (accept description e.g. scattered populations) plus alleles 1 mark
Level 3	5-6	Demonstrates comprehensive knowledge and	all level 2 content

		understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	plus reproductive isolation one mark plus inbreeding / heterozygosity index one mark

Question Number	Answer	Additional guidance	Mark
8(c)	A calculation showing the following steps: • value for q (1) • value for p (1) • calculation of correct percentage for p^2 (1)	<u>Example of calculation</u> Accept values for either p or q: √0.09 / 0.3 (1 − 0.3) / 0.7 p^2 = 49% Correct answer with no working scores full marks	**(3)**

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