Pearson
Edexcel

Mark Scheme (Results)

October 2019

Pearson Edexcel International Adavanced 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)	The only correct answer is C polysaccharide *A is incorrect because starch and cellulose are not phospholipids* *B is incorrect because starch and cellulose are not polypeptides* *D is incorrect because starch and cellulose are not triglycerides*		**(1)**

Question Number	Answer	Additional guidance	Mark
1 (b)	The only correct answer is A amyloplast *B is incorrect because starch is not stored in a mitochondrion* *C is incorrect because starch is not stored in a tonoplast* *D is incorrect because starch is not stored in a vacuole*		**(1)**

Question Number	Answer	Additional guidance	Mark
1(c)	An answer that makes reference to three of the following: Similarity • both {polymers / polysaccharides} containing (1,4) glycosidic bonds (1) • both consist of glucose (1) and max two differences: • cellulose contains β-glucose (molecules) whereas starch contains α-glucose (molecules) (1) • cellulose contains 1,4 (glycosidic bonds) whereas {starch / amylopectin} contains 1,4 and 1,6 (glycosidic bonds) (1) • cellulose is linear (molecule) whereas {starch / amylopectin} contains branches (1)	Full marks can only be awarded if there is a similarity in the answer. Do not piece together. Accept cellulose is unbranched whereas {starch / amylopectin} is branched	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)(i)	The only correct answer is D 1.6 x 10^3 µm *B is incorrect because the diameter is 1.6 x 10^3 µm* *C is incorrect because the diameter is 1.6 x 10^3 µm* *D is incorrect because the diameter is 1.6 x 10^3 µm*		**(1)**

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	A calculation showing the following steps: • correct volume from frog egg cell (1) • correct calculation (1) • correct calculated answer to 2 significant figures (1)	Mark the answer on answer line first <u>Example of calculation</u> v of frog (=4/3 ∏ 800^3) = 2.14 x 10^9 (2.14 x 10^9) ÷ 1.8 x 10^6 = 1189 Allow ECF = 1200 times larger Correct answer (1200 or 1.2 x10^3) to 2 sig figs with no working gains full marks	**(3)**

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to four of the following: • egg cell contains {23 chromosomes/ half the genetic material of the skin cell} / egg cell is haploid (whereas skin cell is diploid) (1) • (therefore) fertilisation can occur to form a {diploid cell / zygote} (1) • (the egg cell genetic material is different from the skin cell) due to meiosis (1) • (the egg cell genetic material is different from the skin cell) due to crossing over (1) • (the egg cell genetic material is different from the skin cell) due to {random / independent} assortment (of homologous chromosomes) (1)	Accept {full set / original number} of chromosomes formed after fertilisation Accept fusion of nuclei Accept egg cell is formed by meiosis	**(4)**

Question Number	Answer	Additional guidance	Mark
3(a)(i)	The only correct answer is C plant cells and prokaryotic cells *A is incorrect because prokaryotic cells also have a cell wall* *B is incorrect because animal cells do not have a cell wall* *D is incorrect because animal cells do not have a cell wall*		**(1)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	**Drawing** (2): • {double (nuclear) membrane / nuclear envelope} obvious • nuclear pores shown and (1 or more) nucleoli present **Labels** (max 2): • (nuclear) envelope / <u>double</u> membrane / {<u>inner</u> / <u>outer</u>} (nuclear) membrane • (nuclear) pore • nucleolus • correct reference to chromatin / nucleoplasm	if one incorrect label, max of 1 label mark if two incorrect labels then no label marks can be awarded Ignore DNA	**(4)**

Question Number	Answer	Additional guidance	Mark
3(b)(i)	An explanation that includes the following points: • the two {layers (of the membrane) /membranes} are very close together / there is a very small distance between the {two layers / membranes} (1) • therefore, the **resolution** of a light microscope is not high enough (1)	Accept the bilayer structure is very close together Ignore the bilayer is too {small / thin}	**(2)**

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	A calculation showing the following steps: • length of XY measured correctly +/- 1mm (1) • calculation of actual size (1) • correct answer given in μm (1)	Mark the answer on answer line first <u>Example of calculation</u> 26 mm / 2.6 cm 26 ÷ 200= 0.13 (mm) = 130 (μm) Correct answer scores full marks	**(3)**

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	A description that makes reference to the following: • form spindle {fibres / poles} in {prophase / mitosis / meiosis / cell division} (1) • to separate {chromosomes/ chromatids} (1)	lgnore DNA / genetic material	**(2)**

Question Number	Answer	Additional guidance	Mark
4(a)(i)	The only correct answer is C Eukarya *A is incorrect because plants are found in the domain Eukarya* *B is incorrect because plants are found in the domain Eukarya* *D is incorrect because plants are found in the domain Eukarya*		**(1)**

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	A description that makes reference to the following: • (evidence from) molecular phylogeny (1) • identification of {similarities / differences} in {DNA / RNA / proteins / enzymes / ribosomes / membrane components / cell wall components} (1)	Accept comparing {DNA / RNA / proteins / enzymes / ribosomes / membrane components / cell wall components} Ignore {looking at / analysing} the {DNA / RNA / proteins / enzymes / ribosomes / membrane components / cell wall components / genetic makeup}	**(2)**

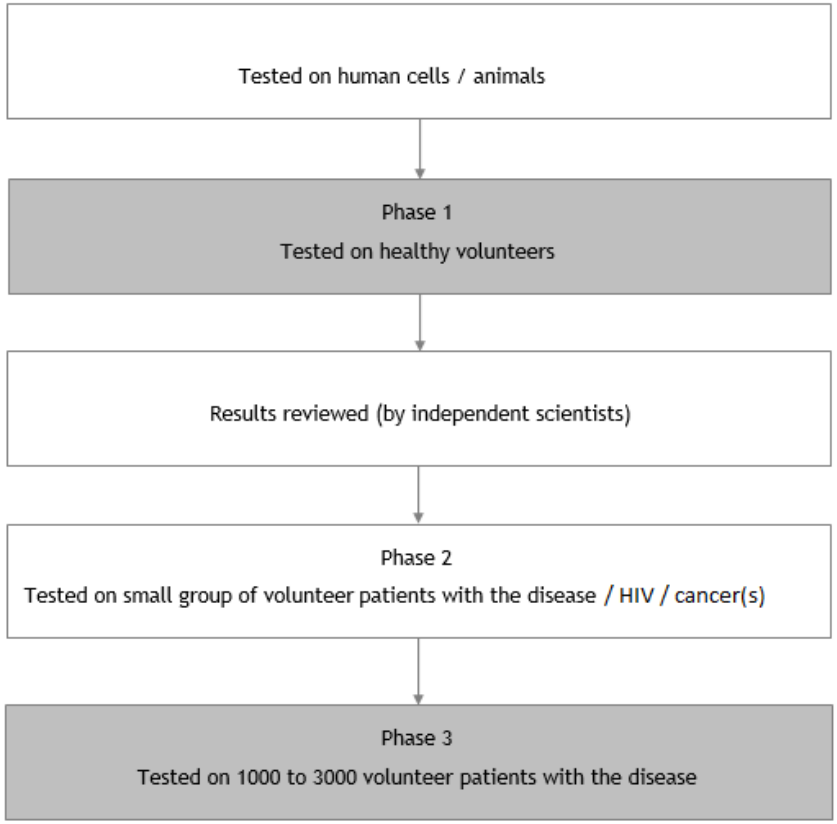
Question Number	Answer	Additional guidance	Mark
4 (b)	An explanation that includes three of the following points: • (tube) grows (through style) to {ovary / ovule / egg cell} / transports the {male nuclei / generative nucleus / male gametes} to {ovary / ovule / egg cell} (1) • (and secretes) digestive enzymes used to aid growth of tube (to ovule) (1) • (therefore) male nuclei can fuse with {egg cell (nucleus) / polar nuclei} (1)	Ignore micropyle Accept forms pathway to reach {ovary / ovule / egg cell} Accept enzymes digest through the style Accept fertilisation occurs to form {zygote / endosperm} Accept double fertilisation occurs / zygote and endosperm formed	**(3)**

Question Number	Answer	Additional guidance	Mark
4(c)(i)	An answer that makes reference to the following: • as the Verapamil concentration increases the length of the pollen tube decreases (1) • credit a correct manipulated mathematical statement (1)	Accept negative correlation	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An answer that makes reference to the following: • lower concentration of calcium ions (in the cells) (1) • fewer {pectin / calcium pectate} molecules formed (1) • therefore increased flexibility of {microfibrils / cellulose} (due to fewer {pectin / calcium pectate} molecules) (1)	Accept no calcium ions present (in the cells) Accept calcium (ions) needed to produce {pectin / calcium pectate} Accept {calcium pectate / pectin} (are needed to) hold {microfibrils / cellulose} together (in a matrix) Accept {microfibrils / cellulose} are not held together by {calcium pectate / pectin} Accept calcium pectate helps middle lamella to hold adjacent cell walls together	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)	An answer that makes reference to the following: • named nitrogen containing compound synthesised (1) • credit role of this compound in the plant (1)	 e.g. amino acids / proteins / nucleic acids / ATP / NADP e.g. {Proteins/ (peptide) hormones} are needed for {growth / repair} / DNA is needed for protein synthesis Ignore amino acids needed to form proteins Ignore nucleotides needed to form DNA/RNA	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)	A description that makes reference to two of the following: • modification of protein (into enzyme) (1) • **enzyme**(s) packaged into (secretory) vesicles (1) • **enzyme**(s) leave cell by exocytosis (1)	 Accept vesicles fuse with cell (surface) membrane and release enzyme(s) outside cell	**(2)**

Question Number	Answer	Additional guidance	Mark
5(c)		Accept identification of side effects Ignore identification of appropriate dosage Accept tested on 100-500 volunteer patients with {disease / HIV/ cancer} Ignore patients unqualified	**(3)**

Question Number	Answer	Additional guidance	Mark
6(a)	The correct answer is B endemic *A is incorrect because the correct term is endemic* *C is incorrect because the correct term is endemic* *D is incorrect because the correct term is endemic*		**(1)**

Question Number	Answer	Additional guidance	Mark
6(b)	An answer that makes reference to the following: • anatomical (adaptation) (1) • physiological (adaptation) (1) • anatomical (adaptation) (1)		**(3)**

Question Number	Answer	Additional guidance	Mark
6(c)	An answer that makes reference to the following: • {poison / skin colour/ spots} deters predators / reduce risk of predation (1) • adhesive discs allow the frog to {climb / cling to} surfaces (to find food) (1)	 Accept reduce risk of being eaten / protects frog from predators Ignore camouflage e.g. trees / leaves	**(2)**

Question Number	Answer	Additional guidance	Mark
6(d)	An answer that makes reference to four of the following: • (genetic) mutation(s) occurred (1) • (new) **allele** coding for poison production (1) • (which then) conferred a selective advantage / (those with poison) more likely to {survive and reproduce / pass alleles to offspring} (1) • (therefore) increasing **allele** frequency (1) • (resulting in) new species of frog with the ability to produce poison evolved (1)	Ignore genes Accept those without the {mutation / poison / advantageous allele} were less likely to survive and reproduce	**(4)**

Question Number	Answer	Additional guidance	Mark
7(a)(i)	The correct answer is C two *A is incorrect because lignin gives waterproofing properties and can form spiral shapes* *B is incorrect because lignin gives waterproofing properties and can form spiral shapes* *D is incorrect because lignin does not add strength to the cell membranes*		**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	Similarity (1) • both contain {cellulose / pits / dead cells / secondary walls} • both {are hollow / do not contain cytoplasm} Difference (1) • sclerenchyma contain end walls whereas xylem do not	Ignore cell walls unqualified Ignore no nucleus Accept sclerenchyma are {pointed/closed} at each end whereas xylem are {not / open at each end} Accept xylem contain tracheids whereas sclerenchyma do not	**(2)**

Question Number	Answer	Additional guidance	Mark
7(b)	An explanation that makes reference to the following: • hemp is renewable / more can be grown / will not run out (1) • available to future generations (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	• calculation of mean yearly increase (1) • calculation of total volume in 2020 (1) • correct answer for total volume in 2020 with units (1)	Example of calculation (84,600,000,000 - 17,000,000,000) ÷11 = 6145454545.45 (6145454545.45 x 20) =1229090909 + 17,000,000,000 = 1.39×10^{11} / 1.4×10^{11} / 139909×10^{6} = 1.39×10^{11} dm^3 / 1.4×10^{11} dm^3 / 139909×10^{6} dm^3 Correct answer with no working gains full marks	**(3)**

Question Number	Answer
***7(c)(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. Advantages • indication of sustainability in the context of biofuel production e.g. more plants can be grown, renewable • available for future generations • consideration of carbon neutral or removal of carbon dioxide from atmosphere (by photosynthesis) as plant is growing • consideration of lower carbon emissions than fossil fuels • linkage to greenhouse effect / global warming • some biofuels require limited resources • hemp produces the least carbon dioxide emissions of all fuels • hemp and sugar beet require the least water • hemp and soybean require fewer fertilisers • hemp requires fewer fertilisers • hemp requires fewest resources • consideration of reduced water requirements for producing biofuels than food production • hemp requires fewest resources so lowest production costs • bioethanols require fewer resources so lower production costs Disadvantages • rapeseed and soybean production require high levels of water • rapeseed and sugar beet production require high levels of fertilisers • rapeseed, soybean and sugar beet production require high levels of pesticides • rapeseed requires highest level of resources • consideration of effect of fertilisers on ecosystem

<table>
<tr><td></td><td colspan="3">

- consideration of effect of pesticides on ecosystem
- disadvantage of reduced land available for food production
- disadvantage of reduced water available for food production
- disadvantage of reduced water available for population
- cost of providing resources
- biodiesels require more resources so higher production costs

- supported conclusion of which bioethanol fuel would be most sustainable

(6)
</td></tr>
<tr><td></td><td></td><td></td><td>Additional guidance</td></tr>
<tr><td>Level 0</td><td>0</td><td>No awardable content</td><td></td></tr>
<tr><td>Level 1</td><td>1-2</td><td>Limited scientific judgement 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 judgment being made.</td><td>simple description of trends shown in the graph / table linked to basic advantages or disadvantages = lower mark

simple description of trends shown in the graph / table linked to basic advantages AND disadvantages = higher mark</td></tr>
<tr><td>Level 2</td><td>3-4</td><td>A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses identified.

A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.</td><td>All level 1 plus
sustainability should be considered to access level 2

conclusion of which biofuel would be best attempted linked to the information given for lower mark

linked to the farmer OR population OR ecosystem for higher mark</td></tr>
<tr><td>Level 3</td><td>5-6</td><td>A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific</td><td>all level 2 plus
consideration to effect on **two** from farmer OR population OR ecosystem lower mark</td></tr>
</table>

		information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.	consideration to effect on **three** from farmer OR population OR ecosystem higher mark

Question Number	Answer	Additional guidance	Mark
8(a)	The correct answer is **C** Y *A is incorrect because the nucleus contains the genetic information used in the synthesis of acrosomal enzymes* *B is incorrect because the nucleus contains the genetic information used in the synthesis of acrosomal enzymes* *D is incorrect because the nucleus contains the genetic information used in the synthesis of acrosomal enzymes*		**(1)**

Question Number	Answer	Additional guidance	Mark
8 (b)	• morula		**(1)**

Question Number	Answer	Additional guidance	Mark
8(c)(i)	A description that makes reference to one of the following pairs: Either: • DNA methylation / adds methyl groups to **DNA** (1) • (DNA methylation) causes the {switching off / silencing} of gene(s) (1) Or: • histone modification / {methylation / phosphorylation/ acetylation} of histone (1) • (histone modification) causes the {switching off / silencing / activation} of gene(s) / (1)	 Accept prevents {transcription / expression} of gene(s) Accept activates genes Accept ubiquitylation / sumoylation Accept prevents {transcription / expression} of gene(s) / allows {transcription / expression} of gene(s)	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	An explanation that makes reference to the following: • transcription of active genes / active mRNA produced (1) • therefore {certain / specific} proteins produced / (1) • these proteins {determine / change} cell {structure / function} (1)	 Accept named example Accept translation at the ribosomes produces proteins Accept description Ignore modifies the cell unqualified	**(3)**

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. Basic information • genotype is shown by the different allele combinations • the gene has {multiple / four} alleles • one copy of each allele is inherited from each {parent / gamete} • phenotype is the result of interaction between the genotype and the environment / phenotype can sometimes just be determined by genotype • fur colour is affected by {genotype /allele combinations} and the {environment /(body) temperature} • colour may be camouflage Enzyme production • the {gene / alleles} code(s) for the production of an enzyme involved in producing fur colour • (active) mRNA is produced from the allele(s) leading to synthesis of {protein / enzyme} Black rabbit • black rabbit has the dominant allele (C) / is homozygous dominant / heterozygous dominant • C is the dominant allele Albino rabbit • albino has recessive alleles / is homozygous recessive Himalayan linked to enzyme • {Himalayan albino / c^hc^h, c^hc^a} produce the enzyme which becomes inactive at high temperatures • the enzyme must be involved in producing the dark colour of the fur Himalayan explanation • the colour is not produced at body temperatures in Himalayan albino, causing the {warmer part of the body to have white fur / cooler parts of the body to have dark fur} **(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.	1 aspect correctly discussed with some attempt made to link knowledge and understanding to the given context = 1 mark 2 aspects correctly discussed with some attempt made to link knowledge and understanding to the given context = 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.	3 aspects correctly discussed which some linkages and lines of scientific reasoning with some structure = 3 marks 4 aspects correctly discussed which some linkages and lines of scientific reasoning with some structure = 4 marks
Level 3	5-6	Demonstrates comprehensive knowledge and 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 and procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	A well-developed and sustained line of scientific reasoning for 5 of the 6 aspects which is clear and logically structured = 5 marks A well-developed and sustained line of scientific reasoning for all 6 aspects which is clear and logically structured = 6 marks

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