Mark Scheme (Results)

October 2024

Pearson Edexcel International Advanced Subsidiary Level In Biology (WBI12) Paper 01

Cells, Development, Biodiversity and Conservation

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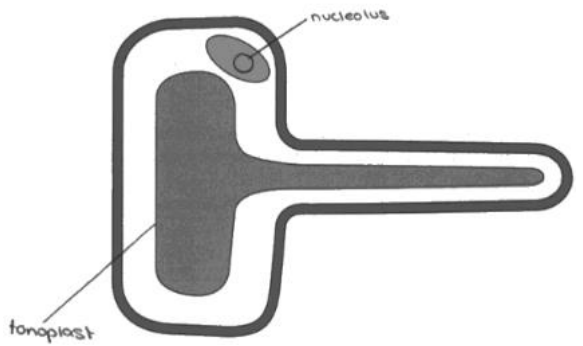
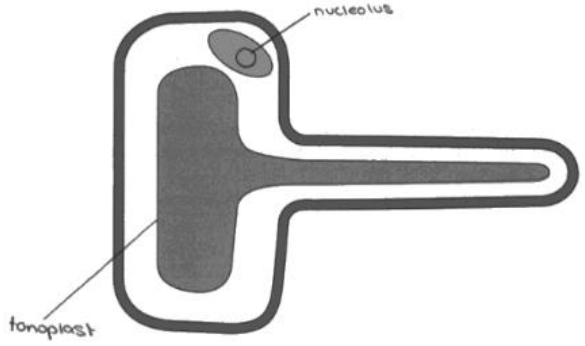
General Marking Guidance

- 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)	An answer that makes reference to the following point: • tonoplast correctly labelled (1)	line must touch structure Example of diagram  	(1)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	An answer that makes reference to the following point: • labelled nucleolus drawn inside a nucleus (1)	Example of diagram  	(1)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th>Structure</th><th>✓ if present
x if absent</th></tr>
<tr><td>amyloplast</td><td>✓</td></tr>
<tr><td>chloroplast</td><td>✓</td></tr>
<tr><td>Golgi apparatus</td><td>✓</td></tr>
<tr><td>plasmodesmata</td><td>✓</td></tr>
</table>
</td><td>all 4 correct = 2 marks
1, 2 or 3 correct = 1 mark
0 correct = 0 marks</td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
1(c)	• correct answer to two decimal places (1)	<u>Example of calculation:</u> 30 000 ÷ 250 000 = 0.12 (µm) **reject** incorrect unit ACCEPT correct standard form to 2 decimal places	(1)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	• eukarya (1)	**reject** incorrect answers accept eukaryote / eukaryota / eukaryotes / eukaryotic	(1)

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	An answer that makes reference to the following points: • one correct process (1) • second correct process (1)	e.g. DNA synthesis / DNA replication / semi-conservative replication e.g. (site of) transcription / production of mRNA e.g. post- transcriptional modification / (m)RNA splicing e.g. site of epigenetic modification e.g. (nucleolus) {produce / assemble} ribosomes / produce **r**RNA ignore mitosis / meiosis / production of RNA unqualified / storage of genetic material / protein synthesis / splicing unqualified	(2)

Question Number	Answer	Additional guidance	Mark
2(b)	A description that makes reference to three of the following points: • count number of (different) species (in the ocean habitat) / determine species richness (1) • count number of individuals in each species / determine species {evenness / abundance} (1) • calculate index of diversity (1) • calculate heterozygosity index / assess genetic diversity (1) • compare to previous {value / year} to see if there is a decrease (1)	ignore variety of organisms ACCEPT correct equation / Simpson index ignore biodiversity index ignore incorrect equation if they say LHS ACCEPT suitable methods to assess genetic diversity e.g. comparison of named molecular sequences	(3)

Question Number	Answer	Additional guidance	Mark
3(a)	• {the (Edelweiss) plant / the species} is only found in {one area / one geographical location / Indonesia}	ignore only one habitat	(1)

Question Number	Answer	Mark
3(b)(i)	The only correct answer is B 23 µm *A is not correct because the pollen grain is 23 µm* *C is not correct because the pollen grain is 23 µm* *D is not correct because the pollen grain is 23 µm*	(1)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	• how many times bigger an object appears in an image than in real life / how many times larger the image length is than the actual length	ignore zoom / magnified ignore equation to calculate magnification	(1)

Question Number	Answer	Additional guidance	Mark
3 (c)	A description that includes four of the following points: Tube nucleus (max two): • controls the growth of the pollen tube (1) • controls the production of {digestive / hydrolytic} enzymes (1) • (which allows) the (male) {nucleus / nuclei / gamete(s)} to {enter / reach} {ovule / ovary / micropyle / egg cell / polar nuclei / female gamete} (1) Generative nucleus: • (divides to) form two {male / haploid} nuclei (1) • one nucleus {fertilizes / fuses with} the egg cell nucleus / one nucleus {fertilizes / fuses with} the polar nuclei (1)	ignore forms a tube ACCEPT contains the genes to make {{digestive / hydrolytic} enzymes / enzymes to digest pathway} ignore {makes / produces / releases} the {digestive / hydrolytic} enzymes ignore tube nucleus {fusing / fertilizing} ACCEPT allows generative nucleus to {enter / reach} {ovule / ovary / micropyle} ignore gametes reject forms two × {generative nucleus / sperm} reject diploid reject generative nucleus {fusing / fertilizing} ACCEPT male {nuclei / gametes} are involved in {zygote / embryo} and endosperm formation	(4)

Question Number	Answer	Mark
4(a)	The only correct answer is D 2 only *A is not correct because sperm cells are haploid and the shape decreases resistance* *B is not correct because sperm cells are haploid and the shape decreases resistance* *C is not correct because sperm cells are haploid and the shape decreases resistance*	(1)

Question Number	Answer	Additional guidance	Mark
4(b)	A description that makes reference to the following points: • {sperm cell / acrosome} releases {enzymes / acrosin / protease} (1) • (therefore) the {enzymes / acrosin} digest the zona pellucida (1) • (resulting in) the sperm cell membrane fusing with {egg cell / oocyte} membrane (allowing the nucleus to enter the egg cell) (1)	ACCEPT acrosomal reaction occurs ignore contains ignore jelly coat / follicle cells	(3)

Question Number	Answer	Additional guidance	Mark
4(c)(i)	A description that makes reference to three of the following points: • translation occurs on the {rough endoplasmic reticulum / rER / ribosomes} (1) • formation of {2° / 3° / 3D / correct named bonds} structure in rER (1) • {polypeptide / protein} is packaged into vesicles by rER / {vesicles fuse with / protein transported to} Golgi (1) • modification occurs in Golgi (apparatus) (1)	ACCEPT correct description of translation / {1° structure / polypeptide} formed at ribosomes ignore protein synthesis ignore protein is folded ACCEPT correct modification in rER e.g. adding carbohydrate ignore modification unqualified ignore packaging by Golgi ignore enzyme ACCEPT description of a correct modification in Golgi apparatus e.g. adding carbohydrate / phosphate (group)	(3)

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An answer that makes reference to the following points: • the cortical granules fuse with cell membrane and release {enzymes / proteases} (1) • (which result in) {hardening / thickening} of the zona pellucida (1) • {acrosome enzymes / acrosin} can no longer {digest / penetrate} the zona pellucida (1)	ACCEPT enzymes released out of cell during cortical reaction ignore exocytosis unqualified ignore {hardening / formation} of {fertilisation membrane / jelly coat} ACCEPT {(cortical) enzymes / proteases} modify sperm {receptors/ binding sites} (so sperm can no longer bind to them) ACCEPT {(cortical) enzymes / proteases} clip the attachment proteins in the perivitelline, releasing any additional sperm that have attached	(3)

Question Number	Answer	Additional guidance	Mark
5(a)(i)	An answer that makes reference to the following points: • {clearing of land with / cutting down of} Boabab trees {to grow rice / to grow crops / for animal grazing / for agriculture} (1) • low pollination rate due to {fewer fruit bats / larger distances between trees} (1)	ignore competition with rice plants ignore Boabab trees are cut down unqualified ignore deforestation unqualified ignore disease ACCEPT (remaining) trees are {isolated / far apart} so reducing chances of {pollination / sexual reproduction} ACCEPT Boabab trees cannot reproduce asexually	(2)

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	An answer that makes reference to the following points: • Madagascan people will (be taught to) not cut down the Baobab trees (1) • Madagascan people will (be taught to) promote the planting of {seeds / saplings} to increase the population (1)	ACCEPT reduce {number of trees cut down / deforestation / animals eating young plants / hunting of bats} ignore prevent habitat destruction ACCEPT protection of bats ACCEPT more trees will be {planted / grown} / reforestation of baobab / artificial pollination (of baobab) ignore captive breeding programmes / seed banks	(2)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An explanation that makes reference to the following points: • calcium pectate (1) • {hold cell walls together / increase cell wall stability / form middle lamella / hold cellulose microfibrils together} (1)	ACCEPT pectin / pectate ACCEPT to increase {cell wall / tensile} strength ACCEPT increased support ignore make cell walls	(2)

Question Number	Answer	Mark
5(b)(ii)	The only correct answer is A phloem *B is not correct because sclerenchyma do not transport water down the stem of a plant* *C is not correct because vacuoles do not transport water down the stem of a plant* *D is not correct because xylem do not transport water down the stem of a plant*	(1)

Question Number	Answer	Additional guidance	Mark
5(c)	An answer that makes reference to the following points: • there were more pods per soybean plant when magnesium ions are present (1) • there were more pods per soybean plant in 2020 than 2019 (1)	ACCEPT converse for no added magnesium ACCEPT there are more pods as time passes ACCEPT converse	(2)

Question Number	Answer	Additional guidance	Mark
5(d)	An answer that includes four of the following points: • presence of magnesium ions increased the mass of both (maize grains and soybeans) (1) • mass of maize is greater than the mass of soybean / converse (1) • the percentage increase in mass of soybeans was greater than maize (1) • significant difference between maize and soybean due to no overlapping of {error / SD} bars (1) • relevant comment about methodology (1)	ACCEPT positive correlation ACCEPT difference is significant for soybean (with and without magnesium) due to no overlap of {error/ SD} bars / converse for maize ignore without clear statement which plant(s) they are referring to e.g. was same concentration of $Mg2^{+}$ added	(4)

Question Number	Answer	Additional guidance	Mark
6(a)(i)	A description that makes reference to two of the following points: • (at start of interphase) DNA unwrap from histones / {DNA / chromosomes} {uncoil / uncondensed} (1) • DNA {is replicated / synthesis / is checked for errors} (1) • DNA undergoes transcription (1)	ACCEPT genes are {activated / switched on} ACCEPT DNA is methylated / demethylated	(2)

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	• metaphase		(1)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	An explanation that makes reference to four of the following points: • centromere doesn't divide (1) • in {anaphase II / meiosis II} (1) • (therefore) both chromosome 13s pulled to same pole of cell / sister chromatids not separated (1) • resulting in {some sperm cells / some nuclei / D} containing two chromosome 13s / {some sperm cells / C} do not have a chromosome 13 (1) • the {egg cell / female nucleus / female gamete} {contains one chromosome 13 / is haploid} (1) • (male and female) **nuclei** fuse (1)	**reject** contradictions ACCEPT {some sperm cells / D} have 24 chromosomes ignore genetic material ignore diploid unless specific to just chromosome 13	(4)

Question Number	Answer	Mark
6(b)(ii)	The only correct answer is C totipotent, pluripotent *A is not correct because zygote is totipotent* *B is not correct because blastocyst cells are pluripotent and zygote is totipotent* *D is not correct because blastocyst cells are pluripotent and zygote is totipotent*	(1)

Question Number	Answer	Additional guidance	Mark
6(c)	An answer that makes reference to the following point: • error in crossing over has occurred (1)	ACCEPT translocation mutations	(1)

Question Number	Answer	Additional guidance	Mark
6(d)(i)	An explanation that makes reference to the following points: • {methyl / $-CH_3$} groups are added to {gene / cytosine / CpG} (1) • genes become {switched off / deactivated / silenced} (1)	**reject** histone / lysine / cysteine ACCEPT removal of methyl groups from {gene / cytosine / CpG} ACCEPT gene cannot be {transcribed / expressed} ACCEPT {RNA polymerase / transcription factors} cannot bind ACCEPT heterochromatin formed ACCEPT switching gene on if linked to reduction of methylation	(2)

Question Number	Answer	Additional guidance	Mark
6(d)(ii)	An explanation that makes reference to the following points: • the DNA methylation is copied when the DNA is replicated / {methylated DNA is / epigenetic changes are} replicated (1) • (therefore) daughter cells will contain the same DNA methylation after cell division / methylated DNA copies are separated in {anaphase / mitosis} (1)	ACCEPT silenced genes are duplicated ACCEPT daughter cells contain the same {silenced / switched off} genes ACCEPT daughter cells are genetically identical to parent cell ACCEPT mitosis produced genetically identical cells	(2)

Question Number	Answer	Additional guidance	Mark
7(a)(i)	An answer that makes reference to one of the following points: • adhesion to the skin (1) • prevent {bacteria drying out / dessication} (on the skin) (1) • {prevents / protection from} {digestion from enzymes / detection by immune system / phagocytosis / antibodies / antibiotics / chemicals} (1)	ignore protection unqualified	(1)

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	An answer that makes reference to one of the following points: • does not live in a liquid environment (1) • does not need to move around the skin (1)	ignore it {is transported by the blood / enters a cut}	(1)

Question Number	Answer	Mark
7(a)(iii)	The only correct answer is D 1, 2, and 3 *A is not correct because bacterial cells also have ribosomes* *B is not correct because bacterial cells also have cell membrane* *C is not correct because bacterial cells also have a cell wall*	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(i)	An answer that includes the following points: • $\sum(x - \bar{x})^2$ correctly calculated (1) • (n-1) correctly calculated (1) • correct calculation of SD (1)	<u>Example of calculation</u> $\sqrt{}(6.5 \div 2) = 1.8027$ ecf applies for mp3 only correct answer scores full marks	(3)

Question Number	Answer	Mark
7(b)(ii)	The only correct answer is A to see how widely the diameter values differ from the mean diameter *B is not correct because that is a chi squared test* *C is not correct because that is correlation coefficient and the student did not investigate different concentrations* *D is not correct because that is the mode*	(1)

Question Number	Answer	Mark
7(c)(i)	The only correct answer is A 8.3% *B is not correct because (203 ÷ 2 444) × 100 = 8.3%* *C is not correct because (203 ÷ 2 444) × 100 = 8.3%* *D is not correct because (203 ÷ 2 444) × 100 = 8.3%*	(1)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	• neither the {patient / group} **nor** the {doctor / scientist} {would know if they were taking just flucloxacillin or both flucloxacillin and clindamycin (1)	ignore references to placebo ignore references to medicine / drug / treatment unqualified	(1)

Question Number	Answer	Additional guidance	Mark
7(c)(iii)	An answer that includes four of the following points: • {swelling / circumference difference / mean (difference)} reduces (in both / over time) (1) • greater overall reduction in {swelling / difference / mean (difference)} with group B than group A / {0.21 cm / 11.6 %} more decrease in difference for group B compared to group A (1) • treatment for group B {is more effective / has higher antimicrobial effect / has higher antibacterial effect} (1) • do not know if the circumference of leg was the same as the non-infected leg before treatment started (1) • relevant comment on study (1)	ACCEPT calculated decreases ACCEPT converse ACCEPT do not know if one antibiotic reduced the swelling faster in the first 5 days ACCEPT do not know initial {difference / circumference} e.g. sample size linked to validity of conclusions / no indication if any patients {immunosuppressed / same age} / no standard deviation so {no indication of variation in data / can't judge significance} / only males used so can't apply conclusions to females	(4)

Question Number	Answer	Additional guidance	Mark
8(a)	An answer that makes reference to the following points: • correct example of molecular evidence (1) • to see if the sequences from Akhal-Teke and Turkoman breeds are {the same / very similar / few differences} (1)	e.g. {DNA / RNA / gene / allele / amino acid} sequences ignore genotype ignore {molecular phylogeny / DNA analysis} unqualified ignore breeding together to form fertile offspring ignore {similar / same} {genes / genotype}	(2)

Question Number	Answer	Mark
8(b)	The only correct answer is B 3607 *A is not correct because 0.661 × 5457 = 3607 (to whole number)* *C is not correct because 0.661 × 5457 = 3607 (to whole number)* *D is not correct because 0.661 × 5457 = 3607 (to whole number)*	(1)

Question Number	Answer	Additional guidance	Mark
8(c)(i)	An answer that makes reference to the following point: • larger hooves {prevent the Arabian from sinking into the sand / allow walking in the sand} (1)	ACCEPT large surface area (of hoof) {helps movement on the sand / prevents sinking} ignore they live in different {areas / habitats}	(1)

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	An answer that includes the following points: • p correctly calculated (1) • q correctly calculated (1) • correct calculation of number of horses with heterozygous and homozygous recessive genotype which add up to 354 (1)	<table><tr><td>genotype</td><td>two copies of the dominant allele</td><td>heterozygous</td><td>two copies of the recessive allele</td></tr><tr><td>Part of Hardy-Weinberg equation</td><td>p^2</td><td>2pq</td><td>q^2</td></tr><tr><td>Number of individuals</td><td>46</td><td>179</td><td>175</td></tr></table> ecf applies for mp2 only correct answers score full marks	(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. • there are more sperm that can swim in the fresh sample / converse for frozen and defrosted sample • sperm cells survive for longer in fresh sperm sample / converse for frozen and defrosted sample • fewer sperm cells have damaged DNA in fresh sperm sample / converse for frozen and defrosted sample • quantitative comparison, e.g. double in fresh, 59% decrease in survival • as the percentage of sperm that can swim increases then the number of successful pregnancies increase / positive correlation • the closer the correlation coefficient number is to +1.0 then the stronger the correlation between the two variables • correlation coefficient is +0.90, which is a strong positive correlation advantages of using frozen sperm samples in captive breeding programmes • can collect samples from {every male / lots of males / both captive and wild} • can do {breeding programmes / artificial insemination / IVF} • can increase population numbers (of the endangered breeds) / species does not become extinct • do not need to {transport / find} {wild / male} horses / can use samples from horses that have died / if all males died out the females could still be impregnated • idea that breeders can select which sperm sample would {maintain genetic diversity in the population / prevent decrease in genetic diversity / prevent inbreeding} • frozen sperm samples {take up less space than a male horse / can be stored for a long time} disadvantages of using frozen sperm samples • reduced chance of successful {fertilization / pregnancy} in females (using frozen sperm samples) because {reduced ability of sperm to swim / sperm may not reach egg cell to fertilise it / reduced sperm survival / reduced speed of swimming} • {damaged sperm DNA / mutations} will mean {fertilisation will not occur successfully / fewer zygotes / embryos don't develop / miscarriages occur / offspring will have genetic diseases} • cost of {equipment / procedure} / specialist staff required / storage space required • not suitable without females (of reproductive age) / reduced chance of {fertilization / pregnancy} could result in breed becoming extinct (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. 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.
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.
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.

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