



Mark Scheme (Final)

Summer 2023

Pearson Edexcel International Advanced
Subsidiary Level In Biology (WBI12)

Paper 01

Unit 2: 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	Mark
1(a)(i)	The only correct answer is D Z <i>A is not correct because xylem would have been stained by the dye</i> <i>B is not correct because xylem would have been stained by the dye</i> <i>C is not correct because xylem would have been stained by the dye</i>	(1)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	An answer that includes the following points: - because the stain has been {taken up / absorbed / transported} (by xylem / stem) (1) - as xylem {transports / absorbs} water (and mineral ions) (1)	allow piecing together ACCEPT {dye/pigment} for stain ignore taken up the colour reject idea of horizontal absorption into stem unless taken up stem first ACCEPT idea that water moves up xylem due to transpiration ignore xylem absorbs the solution	(2)

Question Number	Answer	Additional guidance	Mark
1(b)(i)	amyloplast / chloroplast	list rule applies ignore vacuoles unqualified ACCEPT sphaerosomes and amyloosomes ACCEPT starch granule ignore starch grain ignore mitochondria	(1)

Question Number	Answer	Mark
1(b)(ii)	The only correct answer is C two <i>A is not correct because the first shows part of an amylose molecule and the third shows part of an amylopectin molecule</i> <i>B is not correct because the first shows part of an amylose molecule and the third shows part of an amylopectin molecule</i> <i>D is not correct because the first shows part of an amylose molecule and the third shows part of an amylopectin molecule</i>	(1)

Question Number	Answer	Additional guidance	Mark
1(b)(iii)	store of {glucose / energy}	ACCEPT source of {glucose / energy} ACCEPT {provides / releases} {glucose / energy} Ignore production of {energy / ATP} ignore stores {carbohydrates / food}	(1)
Question Number	Answer	Additional guidance	Mark
1(c)	An answer that includes one of the following points: - carbon neutral (1) {plant / source of starch} is renewable / more can be regrown / available to future generations / biodegradable (1)	list rule applies ignore converse ignore more easily broken down unqualified ignore recyclable	(1)

Question	Answer	Mark
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Number		
2(a)	The only correct answer is A allele <i>B is not correct because locus is not the correct term</i> <i>C is not correct because phenotype is not the correct term</i> <i>D is not correct because polygenic is not the correct term</i>	(1)

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that includes the following points: • (loci of the genes) are {on same chromosome / close together} (1) • • (therefore the different versions of the) two genes have a higher chance of being {inherited together / not separated by crossing over} (1)	ACCEPT on same chromatid ACCEPT they are inherited {together / as a single unit} ACCEPT they are not {split up / separated} in {crossing over / meiosis} ignore independent assortment	(2)

Question Number	Answer	Additional guidance	Mark
2(c)	An explanation that includes three of the following points: • some exons can be {cut out / removed} (1) • (exons cut / exons joined) by enzymes (1) • exons can be joined together in different orders (1) • translation occurs (at ribosome) (1) • (therefore) different {amino acid sequences / primary structure / polypeptide chains} are produced (1)	do not award for all exons being removed ACCEPT not all exons are included ignore introns ACCEPT (exons cut / exons joined) by spliceosomes ACCEPT alternative splicing occurs ACCEPT different sequences of exons produced ACCEPT mRNA isoforms produced ACCEPT different {bonding/ tertiary structure} ACCEPT different arrangement of amino acids ignore different proteins produced	(3)

Question	Answer	Additional guidance	Mark
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Number			
3(a)	A description that includes the following points: • modifies the {enzyme / protein / polypeptide} (1) • packages enzyme into a (secretory) vesicle (1)	ACCEPT enzyme(s) {leave (cell) / secreted} by exocytosis ACCEPT enzymes leave cell via secretory vesicle	(2)

Question Number	Answer	Additional guidance	Mark
3(b)	An answer that includes two of the following points: • for nucleic acid production (1) • amino acids for {enzyme / hormone / (structural) protein} production (1)	ignore nitrates e.g. to make (organic) {bases / nucleotides / DNA/ RNA / modified nucleotide e.g. ATP} accept amino acids {to form a named protein / for protein synthesis} accept to convert {glucose / product of photosynthesis} into another molecule (1) accept to form chlorophyll	(2)

Question	Answer	Mark
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Number		
3(c)(i)	The only correct answer is D <i>A is not correct because bacterial cells do not have a cellulose cell wall</i> <i>B is not correct because plant cells do not have pili</i> <i>C is not correct because plant cells do not have a capsule</i>	(1)

Question Number	Answer	Additional guidance	Mark
3(c)(ii)	An explanation that includes two of the following points: • optimum temperature for enzyme reactions (to occur) / {suitable/ best} temperature for {optimum / fastest / increased rate of} enzyme reactions (to occur) (1) • optimum pH for enzyme reactions (to occur) / suitable pH for {optimum / fastest / increased rate of} enzyme reactions (1) • (some bacteria require) oxygen for (aerobic) respiration (1)	ACCEPT metabolic reaction for enzyme reaction ACCEPT named enzyme reaction e.g. respiration ACCEPT suitable temperature so enzymes do not denature ACCEPT {suitable / optimum} temperature for enzymes to work best at} ACCEPT suitable pH so enzymes do not denature ACCEPT {suitable / optimum} pH for enzymes to work best at} ACCEPT (some bacteria require) no oxygen for anaerobic respiration	(2)

Question Number	Answer	Additional guidance	Mark
4(a)	An answer that includes two of the following points: • {outer / single} cell layer / trophoblast (1) • inner cell mass / embryoblast / contains pluripotent cells (on the inside) (1) • hollow / fluid filled / (fluid filled) cavity / blastocoel (1)	ignore totipotent ignore totipotent	(2)

Question Number	Answer	Additional guidance	Mark
4(b)	An answer that includes the following: • calculation of number of mitotic cells (1)	<u>Example of calculation:</u> $= (15 \div 100) \times 60 = 9$	(1)

Question	Answer	Additional guidance	Mark
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Number			
4(c)	An explanation that includes five of the following points: • (DNA methylation is the) addition of {methyl / CH₃} group(s) (1) • to cytosine (1) • (histone modification is the) {methylation / phosphorylation/ acetylation} of {histones / lysine} (1) • (resulting in) compacting chromatin / DNA wrapped more tightly around histones (1) • (resulting in) inhibition of {transcription factor / RNA polymerase} binding (1) • (therefore) preventing {transcription / gene expression} (1)	ACCEPT addition of methyl base ACCEPT CpG site / between cytosine and guanine ignore cysteine / genes ACCEPT ubiquitylation / sumoylation ACCEPT {adding / removing} of acetyl groups {in histone modification / to histones / to lysine} ACCEPT (histone modification results in) {euchromatin / heterochromatin / supercoiling / (highly) condensed DNA} Accept converse for acetylation e.g. loosening supercoiling ACCEPT converse for acetylation only ACCEPT silencing of gene / preventing mRNA production ACCEPT acetylation can allow {activation / transcription / expression} of gene	(5)
Question	Answer		Mark

Number		
5(a)(i)	The only correct answer is B endemic <i>A is not correct because endemic is the correct term</i> <i>C is not correct because endemic is the correct term</i> <i>D is not correct because endemic is the correct term</i>	(1)

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	An answer that includes the following points: - increases the survival (of fertilised egg cells / offspring) / increase {chance / number} of egg cells hatching (1) - by {reducing predation / providing suitable conditions for development} (1)	ACCEPT increase {number of offspring / population} / prevent decrease in population accept so the egg cells {survive/ more hatch} ignore protection unqualified ACCEPT egg cells {are not eaten / can develop safely / protect from predators / are safe from other species / are safe from other fish} ACCEPT suitable conditions e.g. increased oxygen / nutrients / maintain temperature ACCEPT so the egg cells are not washed away/don't get lost	(2)

Question	Answer	Additional guidance	Mark
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Number			
5(b)(i)	An answer that includes the following point: as (sperm) length increases the (sperm swimming) speed increases / positive correlation between (sperm) length and (sperm swimming) speed (1)	ignore {linear / positive / proportional} relationship	(1)

Question Number	Answer	Mark
5(b)(ii)	The only correct answer is B correlation coefficient <i>A is not correct because chi squared test is used to test the significance of the difference between observed and expected results</i> <i>C is not correct because index of diversity is used to compare biodiversity in different habitats</i> <i>D is not correct because a students t-test is used to compare two independent groups of data to see if they are significantly different</i>	(1)

Question Number	Answer	Additional guidance	Mark
5(b)(iii)	An answer that includes the following point: (a faster swimming speed) increases chance of fertilising an egg cell (before competitors / before death of sperm) (1)	ACCEPT increases chance of fertilisation (of egg cell) ACCEPT higher reproductive success / more likely to pass on alleles to offspring / fertilise the egg cell before competitors sperm ignore faster fertilisation ignore reaching the egg cell	(1)

Question Number	Answer	Mark
5(c)(i)	The only correct answer is A W <i>B is not correct because X is not the acrosome</i> <i>C is not correct because Y is the haploid nucleus</i> <i>D is not correct because Z is a mitochondrion</i>	(1)

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	• conversion of actual length of scale into μm (1) • correct magnification given to 2 significant figures (1)	<u>Example of calculation:</u> $39 \pm 1 \text{ mm} = 39\,000 \mu\text{m}$ ALLOW answer in range of 38 000 - 40 000 μm $(39\,000 \div 60) = 650$ ALLOW 630 / 670 Allow ecf Correct answer with no working shown gains both marks	(2)

Question Number	Answer	Additional guidance	Mark
5(c)(iii)	An answer that includes three of the following points: <u>Similarities</u> • both contain (digestive / hydrolytic) enzymes (1) • both {have single membrane / membrane bound (organelles)} (1) <u>Differences (max 2)</u> • a lysosome is spherical whereas an acrosome is {curved / not} (1) • a lysosome is involved with intracellular digestion whereas an acrosome is involved with extracellular digestion (1) • a lysosome (enzyme) is involved in breaking down {cell components / microbe cells / virus} whereas an acrosome (enzyme) is involved in digesting the {outer layers of an egg cell / zona pellucida} (1)	ACCEPT both {use enzymes / involved in digestion} do not credit both are enzymes ACCEPT both surrounded by phospholipid bilayer ignore references to size ACCEPT a lysosome (enzyme) is involved in breaking down {cell components / microbe cells / virus / phagocytosis / autophagy / worn out cells / autolysis} whereas an acrosome is not ACCEPT an acrosome (enzyme) is involved in {digesting / penetrating} the {outer layers of an egg cell / zona pellucida} whereas a lysosome is not	(3)

Question Number	Answer	Additional guidance	Mark
6(a)(i)	An explanation that includes the following points: • (due to) crossing over / {independent / random} assortment (1) • (crossing over) results in different allele combinations (in the chromosomes) (1) • (independent assortment) results in different combinations of {chromosomes / alleles} (in gametes) (1)	ACCEPT crossing over results in recombinant chromosomes ACCEPT alleles are exchanged reject gene ACCEPT (independent assortment results in) {different / random} arrangement of (maternal and paternal) chromosomes ACCEPT description of random assortment e.g. (homologous) chromosomes randomly aligning at equator ignore above and below equator	(3)

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	An answer that includes two of the following points: • (at the beginning of) interphase the DNA is {in the nucleus / surrounded by nuclear membrane / surrounded by nuclear envelope} whereas it is not at the end of prophase (I) (1) • DNA is uncoiled at the beginning of interphase whereas it is condensed at the end of prophase (I) (1) • DNA has not been replicated at the beginning of interphase whereas it has been replicated at the end of prophase (I) (1)	ignore references to {presence/absence} of {nucleus/nuclear envelope} without linking to location of the DNA reject nucleolus ACCEPT it is {condensed / coiled / chromosomes / chromatids} at the end of prophase but not at the beginning of interphase / converse ACCEPT it is chromatin in interphase and {chromosomes / chromatids} in prophase ignore visible ACCEPT there is {double the quantity of DNA / $4n$} at the end of prophase than at the beginning of interphase / converse	(2)

Question Number	Answer	Mark
6(b)	The only correct answer is B <i>A is not correct because there would be 3 picograms in each of cell B's daughter cells</i> <i>C is not correct because there would be 6 picograms in each of cell A's daughter cells</i> <i>D is not correct because there would be 3 picograms in each of cell B's daughter cells</i>	(1)

Question Number	Answer
*6(c)	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 of preventing self-fertilisation (date palm / orchid) • increased genetic variation (of seeds / new plants) / increased genetic diversity of population / reduced risk of inbreeding (depression) • benefits of increased genetic diversity e.g. idea that not all susceptible to {new selection pressure / change in the environment} / increased chance of survival for more (already) adapted individuals • chemical releasing plants can produce both ovules and pollen / chemical releasing plants prevent growth of pollen tube carrying male nuclei to ovule disadvantages of preventing self-fertilisation (date palm / orchid) • reduced chance of {pollination / fertilisation} • they need both male and female date palm plants in habitat / consideration of lack of other plants of same species nearby / low chance of wind pollination • consideration of lack of insect pollinators • if (successful) pollination doesn't occur then there will be no {seeds / new plant} production / could lead to {plant / species} becoming {endangered / extinct} / increased risk of becoming {endangered / extinct} / population could decrease • offspring may not inherit advantageous alleles / mutations could cause some pollen from another plant to not develop a pollen tube self-pollination advantages (fireweed and dandelion) • (guaranteed) production of {seeds / new plants / clones} (even if no pollination has occurred) / guaranteed (self)fertilisation • reduced risk of extinction / idea of (more) likely to {increase / maintain population} • dandelion egg cells are genetically different so resulting seeds will be genetically different self-pollination disadvantages (fireweed and dandelion) • {no / reduced} genetic variation in offspring • disadvantage of {no / reduced} genetic variation e.g. idea that all could be susceptible to a {new selection pressure / change in the environment} / genetic diseases / inbreeding depression / reduced evolution (of species)

Level 0	0	No awardable content
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.

Question Number	Answer	Mark
7(a)	The only correct answer is D 20 000:1 <i>A is not correct because 100 cm is 20 000 times larger than 0.05mm</i> <i>B is not correct because the ratio is the wrong way round</i> <i>C is not correct because 100 cm is 20 000 times larger than 0.05mm</i>	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(i)	An answer that includes the following point: group of (similar) cells working together to perform a (specific) function (1)	ACCEPT group of cells performing {the same /a similar} function	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An answer that includes the following points: - from the phloem (of vine plant) / phloem is involved in translocation / phloem is involved in transport of {sucrose / organic solutes} (1) (because part) of the corpse lily plant has {grown into the phloem / grown into vascular bundle / made a (physical) connection to the phloem} (1) (corpse lily plant absorbs organic solutes / sucrose) by {diffusion / facilitated diffusion / active transport} (1)	ignore xylem ACCEPT has digested (part of) the phloem ignore connecting cytoplasm ignore {grow in / attach to} {tissues/ xylem} of vine plant ACCEPT through plasmodesmata do not accept osmosis ignore using ATP	(3)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	An explanation that includes the following points: - gel is used to apply the extract to the wound / extract dissolves in the gel (1) - gel has no effect on the rate of wound healing (1) - therefore can be used as a comparison (to extract / current wound treatment) (1)	ACCEPT gel acts as a base / helps extract stay on wound / helps application process / {faster / slow-release} absorption of extracts into {skin / wound} ACCEPT gel acts a {placebo / control} ignore controlled variable ACCEPT to make all of the treatments look the same (to scientist) / idea of blind trial	(3)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	An answer that includes four of the following points: • both the extracts and the current wound treatment {reduced the mean healing time (compared with just gel) / were more effective than just using gel} (1) • increasing the concentration of the extract decreased the time (taken for the wound to heal) / {little / no significant} difference in the healing time of the two extracts (1) • the current wound treatment is the most effective treatment / extract is less effective than the current wound treatment (1) • significant difference as the times for different groups do not overlap (1) • small sample size reduces validity of {conclusions / data / experiment} (1)	ignore just descriptions of the results ACCEPT {gel (only) / group 1} {had the longest healing time / was least effective} ignore current wound treatment had lowest healing time unqualified ACCEPT significant difference as the {standard deviations/data} do not overlap ACCEPT relevant comment about {size / overlap} of standard deviations linked to {repeatability / validity / reliability} (of data / investigation) ACCEPT a larger sample size should be used / not enough data collected to make a (valid) conclusion	(4)

Question Number	Answer	Additional guidance	Mark
8(a)	An answer that includes the following point: • correct reason for adaptation seen in the photograph (1)	mark response as a whole e.g. {thick / lots of} fur to {conserve heat / conserve energy / prevent heat energy loss / act as insulator / protection from cold} large paws to walk on snow (coat) {colour / pattern / spots} for camouflage sharp teeth for {biting / tearing / eating / catching} {meat / animals / prey} {sharp / long} claws for {added traction / catching prey / climbing (mountains)} small ears to reduce heat loss large tail for {balance / to wrap around to reduce heat energy loss} ignore helps it to survive	(1)

Question Number	Answer	Additional guidance	Mark
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8(b)	An explanation that includes three of the following points: - analyse {the numbers of (different) species (in each habitat) / species richness} (1) - analyse {the number of individuals in each species / species evenness} (1) - calculate {index of diversity / diversity index} (1) - compare {D / index of diversity} values (for habitats in different areas) (1)	ACCEPT determine {genetic diversity / number of different alleles / heterozygosity index} ACCEPT the formula $D = \frac{N(N-1)}{\sum n(n-1)}$	(3)
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Question Number	Answer	Additional guidance	Mark
8(c)(i)	- correct subtraction (1) - correct calculated answer given to 1 dp (1)	<u>Example of calculation:</u> 7100-1200 = 5900 (5900 ÷ 7100) × 100 = (-)83.1 (%) Allow ecf Correct answer with no working shown gains both marks	(2)

Question Number	Answer	Additional guidance	Mark
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8(c)(ii)	An answer that includes one of the following points: - reduction in habitat size (1) - decreased numbers of prey (1) {disease / hunting (by humans) / poaching} (1)	ACCEPT habitat {destruction/ loss} ACCEPT global warming if linked to unfavourable change in habitat ignore {global warming / climate change / change in the environment} unqualified ACCEPT increased competition {for food / territory} ignore killed unqualified	(1)
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Question Number	Answer	Additional guidance	Mark
8(d)(i)	- correct calculation (1) - correct answer in standard form (1)	<u>Example of calculation:</u> $(250 \div 5) \times 6.5 = 325$ line X = 6 to 7 mm (0.6-0.7cm) 0 to 250 km = 5 to 5.5 mm (0.5-0.55cm) accept 2.7×10^2 to 3.5×10^2 Correct answer with no working shown scores full marks	(2)

Question Number	Answer
*8(d)(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. • consideration of fragmentation of snow leopard range / separation of different populations / geographical isolation / populations in {central / northern/western / different areas in Asia} • consideration of how the fragmentation developed • consideration of different {environment / conditions} in each of the different locations (northern/eastern/southern) • idea of (different) selection pressures / (new) selection pressure occurs • idea of genetic variation in population / some individuals have different alleles / mutations have occurred / mutations resulted in different alleles • idea that different {mutations / alleles / adaptations} will be advantageous in different habitats • natural selection occurs / survival of the fittest • individuals with advantageous {allele / mutation} will have an increased chance of {surviving / reproducing} • passing on {advantageous allele / mutation} to offspring / increasing frequency of (advantageous) allele in gene pool • example of an advantageous {allele / phenotype} linked to the {habitat / location} • consideration of differences {in gene pool / phenotypes / anatomical, behavioural and physical adaptations} developing in different snow leopard populations • idea that inbreeding could occur / consideration of founder effect • consideration of (little) reproductive isolation / different populations having different (mating) behaviour or breeding times • sub-species can still breed together to form fertile offspring (6)

Level 0	0	No awardable content
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.

Question Number	Answer	Additional guidance	Mark
8(d)(iii)	An answer that includes the following point: individuals (from different sub-species) can (still) breed together to produce fertile offspring (1)	ACCEPT they can {breed / interbreed / reproduce / mate} (together) to produce fertile offspring ignore they can produce fertile offspring	(1)

