Pearson Edexcel

Mark Scheme (Results)

Summer 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)	• (group of) tissues which work together to perform {a function / functions}	REJECT same tissues IGNORE join together	**(1)**

Question Number	Answer	Mark
1(b)(i)	The only correct answer is B endoplasmic reticulum *A is not correct because X is the endoplasmic reticulum* *C is not correct because X is the endoplasmic reticulum* *D is not correct because X is the endoplasmic reticulum*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	• nucleus which {contains the genetic material / DNA replication / transcription}	mark first function ACCEPT production of RNA / RNA nucleotides ACCEPT controls the activities of the cell IGNORE nuclear envelope IGNORE controls the cell unqualified IGNORE controls cell function IGNORE protein synthesis	**(1)**

Question Number	Answer	Mark
1(b)(iii)	The only correct answer is B 1 and 3 only *A is not correct because the nucleolus does not synthesise DNA* *C is not correct because the nucleolus does not synthesise DNA* *D is not correct because the nucleolus does not synthesise DNA*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(iv)	• eukarya / eukaryote / eukaryotic / eukaryota	REJECT incorrect answers	**(1)**

Question Number	Answer	Mark
1(c)(i)	The only correct answer is A amyloplast *B is not correct because chloroplasts are not found in tuber cells below the surface of the soil* *C is not correct because starch is stored in amyloplasts* *D is not correct because starch is stored in amyloplasts*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(c)(ii)	An explanation that makes reference to the following points: • polymer of glucose (1) • compact molecule so lots of {glucose / starch / energy} can be stored (1)	 ACCEPT can be hydrolysed to glucose ACCEPT glucose joined by glycosidic bonds ACCEPT takes up little space so {more / lots} can be stored IGNORE branching IGNORE osmotic effect	**(2)**

Question Number	Answer	Mark
2(a)(i)	The only correct answer is D 1, 2 and 3 *A is not correct because all three processes occur in interphase* *B is not correct because all three processes occur in interphase* *C is not correct because all three processes occur in interphase*	**(1)**

Question Number	Answer	Mark
2(a)(ii)	The only correct answer is C (V Z X Y W) *A is not correct because prophase occurs after interphase and before metaphase* *B is not correct because prophase occurs after interphase and before metaphase* *D is not correct because metaphase occurs after prophase*	**(1)**

Question Number	Answer	Additional guidance	Mark
2(a)(iii)	• (×)750	ACCEPT 0.5 mm tolerance ACCEPT answer between the range: (×)729 to 771 REJECT answers with a unit	**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)	• correct total number of cells (1) • correct number of cells in interphase (1)	<u>Example of calculation:</u> 450 ÷ 0.375 1200 - 450 = 750 only ecf is an incorrectly calculated number minus 450 shown in working Correct answer with no working shown scores full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
2(c)	A description that makes reference to two of the following points: • {chromosomes / chromatin / DNA / chromatid} condense (1) • nuclear {envelope / membrane} breaks down (1) • centrioles {move to poles of the cell / produce spindle fibres / produce microtubules} (1)	ACCEPT {DNA / chromatin} coils around histones ACCEPT chromatin starts forming chromosomes ACCEPT nuclear {envelope / membrane} disappears / nucleolus disappears ACCEPT spindle fibres form without ref to centrioles ACCEPT centrosome for centriole REJECT centromere for centriole	**(2)**

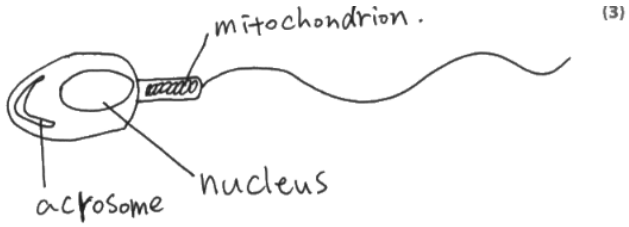
Question Number	Answer	Additional guidance	Mark
2(d)(i)	• correct example of a plant tissue (1)	mark first answer e.g. xylem, phloem, meristem, sclerenchyma, parenchyma, spongy mesophyll, palisade mesophyll, endosperm REJECT cells e.g. palisade mesophyll cell IGNORE root / root hair	**(1)**

Question Number	Answer	Additional guidance	Mark
2(d)(ii)	• asexual reproduction (1)	ACCEPT some stages from the formation of plant gametes ACCEPT cloning / reproduction of single celled organisms ACCEPT replacement of cells IGNORE asexual unqualified IGNORE replace tissues	**(1)**

Question Number	Answer	Additional guidance	Mark
3(a)	An explanation that makes reference to two of the following points: • {streamlined shape / webbed feet / wings} enable the penguin to swim (1) • {long / sharp / big / pointed} beak to {catch / eat} prey (1) • small SA: vol to reduce heat loss in cold water (1) • {layer of lipid / blubber / feathers} for {insulation / thermoregulation} (1) • colour of {feathers / skin} related to {background / habitat} (1)	ACCEPT streamlined shape to reduce {resistance / friction} ACCEPT description of webbed feet / flippers etc ACCEPT named prey IGNORE teeth ACCEPT eyes on side of head to have wider field of view ACCEPT {layer of lipid / blubber / feathers} to {withstand cold temperatures / maintain body temperature / prevent heat loss} IGNORE keep warm ACCEPT feathers for waterproofing e.g. camouflage / absorption of heat energy	**(2)**

Question Number	Answer	Additional guidance	Mark
3(b)(i)	An answer that makes reference to one of the following points: • when penguins from different islands breed together they produce {infertile / sterile} offspring (1) • differences in {genotype / phenotype} (1)	ACCEPT penguins from different islands cannot produce fertile offspring together ACCEPT detail of reproductive isolation e.g. they will have different courtship rituals ACCEPT molecular phylogeny ACCEPT identifying differences in molecular evidence e.g. differences in {DNA/mRNA/amino acid} (sequences), differences in protein structure IGNORE {DNA analysis / compare DNA} unqualified	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	An explanation that makes reference to five of the following points: • the different islands are located a long distance away from each other / the different penguin populations would not meet to breed / no gene flow between populations (1) • {genetic variation / mutations / different alleles} in penguin population(s) (1) • different selection pressure on each island (1) • {beneficial / advantageous} allele(s) may {give selective advantage in different areas / mean those individuals are more likely to survive} (1) • penguins with {beneficial / advantageous} {allele(s) / characteristics} pass these alleles onto their offspring (until the populations become genetically dissimilar to each other) (1) • the {populations / penguins} on different islands are unable to reproduce to form fertile offspring (1)	ACCEPT {geographical / allopatric} isolation (and correct descriptions of) REJECT species e.g. different {temperature / climate / predators / prey / environment} IGNORE different conditions IGNORE gene ACCEPT descriptions of advantageous characteristic linked to selection pressure ignore {survival of fittest / natural selection} unqualified IGNORE gene ACCEPT (different) populations {have different allele frequencies / different changes in allele frequency} ACCEPT {anatomical / behavioural changes} result in (different species) not being able to mate ACCEPT {reproductive / behavioural} isolation	**(5)**

Question Number	Answer	Additional guidance	Mark
4(a)	An answer that includes the following points: • acrosome correctly drawn and labelled (1) • nucleus correctly drawn and labelled (1) • mitochondrion drawn in mid-piece and labelled (1)	correct drawing includes position and suitable shape max 2 for incorrect shape of sperm cell label line must touch structure  mythical diagram (e.g. standard animal cell) scores 1 max for nucleus	**(3)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	= 5.24 x 10^5 / 524 000 (μm^3)	ACCEPT 500 000 to 524 000 5.0 x 10^5 to 5.24 x 10^5 max number of 2 dp in standard form	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	• correct ratio (1)	max number of 2 dp 0.06 (: 1) IGNORE 1 : 16.7 ecf applies	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	An answer that makes reference to three of the following points: • (egg cells are) {haploid / contain one copy of each chromosome} (1) • to ensure the zygote {is diploid / has two copies of each chromosome} (1) • (egg cell) has {cortical granules / zona pellucida} which {prevent polyspermy / additional sperm cells entering egg cell} (1) • (egg cell) has {lipid / oil / fat} (droplets) as a source of energy / mitochondria which {release energy / provide ATP} (1)	only mp2 can be awarded if referring to incorrect gamete ACCEPT so fertilised egg cell {is diploid / has two copies of each chromosome} ACCEPT diploid {zygote / embryo} after fertilisation ACCEPT cortical granules to harden zona pellucida after fertilisation IGNORE jelly coat IGNORE produce energy ACCEPT large so can contain more lipids ACCEPT {lipid (droplets) / protein / carbohydrates} for {production of new cell components / growth of embryo} ACCEPT lipids converted to glucose IGNORE {food / nutrient} stores ACCEPT releases chemicals to attract sperm	**(3)**

Question Number	Answer	Mark
4(c)	The only correct answer is A 1 and 2 only *B is not correct because the cells divide by mitosis* *C is not correct because the cells divide by mitosis* *D is not correct because the cells divide by mitosis*	**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	• {location / position} of a {gene / allele} on a chromosome	ACCEPT chromatid for chromosome IGNORE DNA unqualified	**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	An explanation that makes reference to two of the following points: • different alleles {have a different DNA base sequence / code for different mRNA} (1) • which may result in a different {polypeptide / protein / pigment} being produced (1) • flies may inherit two different alleles / (different allele combinations) may result in {further / intermediate} {phenotypes / eye colours} (in addition to colours in table) (1)	REJECT in context of polygenic inheritance ACCEPT polypeptide has different {primary / secondary / tertiary structure} ACCEPT flies may be heterozygous ACCEPT combinations of different {alleles / pigments} result in {further / intermediate} {phenotypes / eye colours} (to what is in the table) ACCEPT both of the different alleles are expressed IGNORE polygenic inheritance / meiosis	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)	An explanation that makes reference to four of the following points: • post-transcriptional modification (during development of the embryo) / RNA splicing (1) • {introns / non-coding regions} (in Dsx pre-mRNA) removed by {enzymes / spliceosomes} (1) • {rearrangement of / removal of some} {exons / coding regions} (1) • translation occurs (of active mRNA) (1) • (resulting in) a different (Dsx) {primary sequence / sequence of amino acids / polypeptide} (1) • (Dsx-F) proteins result in female specific {cell development / structures / other proteins / cell modification} / converse for males (and Dsx-M)	ACCEPT different alleles for same gene ACCEPT alternative splicing IGNORE differential gene expression / genes being {switched off / expressed} IGNORE epigenetic modification ACCEPT introns are {spliced / removed} ACCEPT different {primary / secondary / tertiary} structure ACCEPT exons determine amino acid sequence ACCEPT one sequence of {exons / amino acids} results in Dsx-F, whereas another results in Dsx-M IGNORE proteins produced which modify the cell unqualified ACCEPT transcription factor produced which will activate gene(s) responsible for {male / female} development no ecf for genes being switched off	**(4)**

Question Number	Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to the following points: • explanation of how a modification is caused (1) • correct effect of the histone modification (1) • methylation results in the gene being {switched off / silenced / not expressed / not transcribed} (1) • acetylation results in the gene being {switched on / expressed / activated / transcribed} (1) • (because) {RNA polymerase / transcription factors} can't {bind / access} (if gene is switched off) / converse (1)	e.g. methylation is addition of a {methyl / CH_3} group to {histone / lysine / arginine} e.g. acetylation is addition of an {acetyl / $COCH_3$} group to {histone / lysine} REJECT {methylation / acetylation} of {DNA / cytosine / CpG} e.g. histone methylation results in DNA being more tightly wrapped around histones / {histones /nucleosomes} closer together / heterochromatin / supercoiling} histone acetylation results in in the {histones /nucleosomes} being further apart / DNA less tightly wrapped around histones / euchromatin IGNORE DNA {more / less} coiled unqualified IGNORE distance between DNA strands IGNORE histones wrapping around DNA / histones becoming {loose / tighter} IGNORE less gene expression ACCEPT no {protein formed / protein synthesis} ACCEPT more gene expression ACCEPT protein formed / protein synthesis occurs REJECT DNA polymerase	**(5)**

Question Number	Answer	Additional guidance	Mark
6(a)(i)	• vacuole	ACCEPT permanent vacuole / sap vacuole / large vacuole	**(1)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	An answer that makes reference to the following point: • to {prevent / reduce} {water loss / transpiration / evaporation} through pore (1)	ACCEPT reducing diffusion of water out of stomata IGNORE water loss from cell IGNORE guard cell would have less water	**(1)**

Question Number	Answer	Mark
6(b)	The only correct answer is B **-46.9**% *A is not correct because the decrease is -46.9 %* *C is not correct because the decrease is -46.9 %* *D is not correct because the decrease is -46.9 %*	**(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. • there {is a lower (percentage) survival rate / are fewer plants} when there is water stress / converse • plants with water stress have a lower cellulose content / converse • plants with water stress have {a smaller root length / roots that are 4.5 cm smaller} / converse • plants with water stress have lower chlorophyll content / converse • relevant comment regarding validity of data / significant difference between the groups • lower cellulose content results in {{thinner/ weaker} cell walls / fewer cells / reduced tensile strength} / converse • {thinner cell walls / reduced calcium pectate} will result in less growth due to less support (for plants) / converse • smaller roots will absorb {less water / fewer mineral ions} in plant / converse • fewer magnesium ions results in reduced chlorophyll formation • fewer nitrates' results in reduced {amino acid / protein / chlorophyll / DNA} formation • fewer calcium ions results in reduced {calcium pectate / middle lamella} formation • less water results in {reduced photosynthesis / reduced metabolic reactions / increased wilting of plant / reduced turgidity / closure of stomata / reduced transpiration / less uptake of mineral ions} • reduced chlorophyll results in {fewer chloroplasts / less light absorption / reduced photosynthesis} • reduced photosynthetic rate results in reduced production of named photosynthetic product e.g. glucose • reduced β-glucose results in reduced cellulose formation / reduced α-glucose linked to reduced respiration • reduced {protein synthesis / photosynthetic products / mitosis} would result in decreased {growth / seed production / yield} of plants **(6)**

		Additional guidance
Level 0	0	No awardable content
Level 1	1-2	Limited number of the most important or relevant factors from the data/information provided are synthesised. No judgement is made.
Level 2	3-4	Some of the most important or relevant scientific factors from the data/information provided are synthesised. A limited accurate judgement is made.
Level 3	5-6	Most of the important or relevant scientific factors from the data/information provided are synthesised. A detailed and accurate judgement is made.

Question Number	Answer	Additional guidance	Mark
7(a)	An explanation that makes reference to three of the following points: • (the body cells of) baby will have {26 / half the} chromosomes that are {similar / identical} to those in the mothers (cells) (1) • the other {26 / half of} chromosomes in the baby body cells will be (genetically) different as they came from the {sperm cell / father} (1) • (there may be genetic differences in the gamete chromosomes inherited from the mother) due to {mutation / crossing over} (1)	ACCEPT {genetic material / DNA / alleles} for chromosomes IGNORE genes ACCEPT baby has inherited {26 / half} of the chromosomes from the mother IGNORE genetic similarities unqualified IGNORE inherited some chromosomes from mother ecf for 13 ACCEPT baby has inherited {26 / half} of the chromosomes from the father IGNORE inherited some chromosomes from father IGNORE {independent / random} assortment IGNORE incorrect stage of meiosis	**(3)**

Question Number	Answer	Mark
7(b)(i)	The only correct answer is A number of heterozygotes ÷ number of individuals in the population *B is not correct because the equation is number of heterozygotes ÷ number of individuals in the population* *C is not correct because the equation is number of heterozygotes ÷ number of individuals in the population* *D is not correct because the equation is number of heterozygotes ÷ number of individuals in the population*	**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that makes reference to two of the following points: • count the number of tapirs and {melanistic / all black} tapirs in the population (1) • use the Hardy-Weinberg equation to calculate the recessive allele frequency (1) • compare to previous recessive allele frequency to see if it has changed (1)	ACCEPT determine the number of {melanistic / all black} tapirs and the population size ACCEPT correct Hardy-Weinberg equation ACCEPT calculate {for each generation / at two(+) different time periods} and see if there is a change (over time) IGNORE see if there is a change in frequency IGNORE q^2	**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	• still found in {the same countries / area / region / islands / Thailand / Sumatra / Malaysia} (1)	ACCEPT still found in {central / highland} regions of the islands ACCEPT still found within earlier distribution area ACCEPT both still not found in {Cambodia / Vietnam}	**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	An answer that makes reference to the following point: • reason as to why human activity changed distribution (1)	E.g (deforestation resulting in) {isolated pockets of forest / habitat fragmentation / geographical isolation / loss of habitat / loss of food / disruption to food chain / migration / separation of populations e.g. reduction in the numbers of {tapirs / territories} (due to hunting) / tapir moved to other areas (due to hunting) IGNORE answers referring to extinction of tapir IGNORE hunting / deforestation / reduction in biodiversity	**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)(iii)	An explanation that makes reference to three of the following points: • analyse {individual's alleles / gene pool} / identify individuals with different alleles (1) • use a stud book (1) • breed {individuals / tapirs} {with different alleles / from different populations} (1) • (therefore) preventing loss of alleles (from gene pool) (1)	IGNORE genes ACCEPT identify individuals which are (more) genetically different ACCEPT DNA analysis / molecular phylogeny IGNORE genes / gene pools ACCEPT transfer {males / females / tapirs / sperm} from one {isolated population / zoo} to another ACCEPT breed individuals that are not closely related ACCEPT promote outbreeding / prevent inbreeding IGNORE prevent hybrids / interbreeding	**(3)**

Question Number	Answer	Additional guidance	Mark
8(a)	A description that makes reference to three of the following points: • translation occurs at rER ribosomes / {polypeptide (chain) / chain of amino acids} enters rER (1) • formation of {α-helix / β-pleated sheet / secondary structure / tertiary structure / 3D shape / globular structure} (1) • (causing) formation of {hydrogen bonds / covalent bonds / ionic bonds / disulphide bridges} • {polypeptide / protein / enzyme} packaged into (transport) vesicle to go to Golgi apparatus (1)	ACCEPT rER ribosomes join amino acids together with peptide bonds / forms primary structure / forms polypeptide REJECT if linked to wrong structure ACCEPT vesicle containing {polypeptide / protein / enzyme} {transported to / fuses with} Golgi {apparatus / body}	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	An answer that makes reference to the following points: • as time increases the mean percentage loss in mass increases (1) • there is a higher percentage mass loss with species A (at each time point) / species A digests more wood / {rate of mass loss / digestion} is faster for species A (1) • significant difference between the two species as the {error / range / SD} bars do not overlap / species B is significantly lower than A as the {error / range / SD} bars do not overlap (or converse) (1)	ACCEPT positive correlation ACCEPT as time increases the wood blocks mass decreases ACCEPT species A is more effective at breaking down wood molecules ACCEPT converse for species B ACCEPT correct calculated difference ACCEPT {steeper / non-linear} increase in mass loss in species A ACCEPT converse for species B / rate decreases over time for B ACCEPT correct statements regarding specific species and specific time period {error / range / SD} bars overlap linked to significant difference ACCEPT correct statements regarding specific species and specific time period {error / range / SD} bars size linked to {repeatability / validity} IGNORE bars do not overlap so no significant difference unqualified IGNORE incorrect statements regarding {error / range / SD} e.g. there is overlap of bars between species A& B	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	An answer that makes reference to the following point: • because the species produce different enzymes / species A broke down cellulose as well as lignin (1)	ACCEPT ideas relating to {species A had optimum conditions / species A&B have different optimum temperatures (due to natural habitat)} ACCEPT species A can breakdown the predominant molecule in the wood / converse for species B ACCEPT {more / higher concentration of / more effective} enzymes produced by species A / converse for B ACCEPT described differences in blocks IGNORE amount of enzymes released was different unqualified IGNORE stronger enzymes	**(1)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>8(c)(i)</td><td>An answer that includes the following points:

• N(N-1) correctly calculated (1)

• ∑n(n-1) correctly calculated (1)

• calculation of D for habitat two (1)</td><td>
<table>
<tr><th>Species</th><th>Number of individuals (n)</th><th>n(n-1)</th></tr>
<tr><td>A</td><td>34</td><td>1122</td></tr>
<tr><td>B</td><td>6</td><td>30</td></tr>
<tr><td>C</td><td>27</td><td>702</td></tr>
<tr><td>D</td><td>4</td><td>12</td></tr>
<tr><td>E</td><td>9</td><td>72</td></tr>
<tr><td>F</td><td>31</td><td>930</td></tr>
<tr><td>G</td><td>120</td><td>14280</td></tr>
<tr><td></td><td>N=231</td><td>∑n(n-1)=17148
D= 3.098</td></tr>
</table>
ALLOW ecf for mp3 if rounded correctly
IGNORE fractions
correct answer on answer line scores 3 marks</td><td>(3)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	• habitat 1 because it has {a higher index of diversity / more species} (1)	E.g. habitat 1 as 4.2 is larger than {3.098 / 3.1 / 3} IGNORE higher biodiversity unqualified ecf for correct conclusion using incorrect D value	**(1)**

Question Number	Answer	Additional guidance	Mark
8(c)(iii)	An explanation that makes reference to three of the following points: • collection of seeds from multiple plants of species D (to ensure different alleles) (1) • {washing / disinfecting / sterilising} seeds to remove (decomposing) microbes (1) • x-ray seeds to check {viability / presence of embryo} (1) • {freeze the seeds / dry the seeds / store in very low temperatures} to {prevent germination / maintain viability / prevent growth of microbes / reduce enzyme activity / keep them dormant} (1) • {germination / growth / pollination} of genetically different plants to collect new seeds (1)	IGNORE large number of seeds IGNORE collect seeds unqualified ACCEPT collect seeds from different areas reject from different species ACCEPT use antimicrobials to remove microbes IGNORE cool / cold IGNORE {drying / freezing} plants IGNORE {freeze / dry} seeds without explanation ACCEPT {growth / pollination} of plants to collect new seeds ACCEPT {plant/ germinate} some seeds to check viability ACCEPT cloning	**(3)**

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