



Mark Scheme (Results)

January 2023

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

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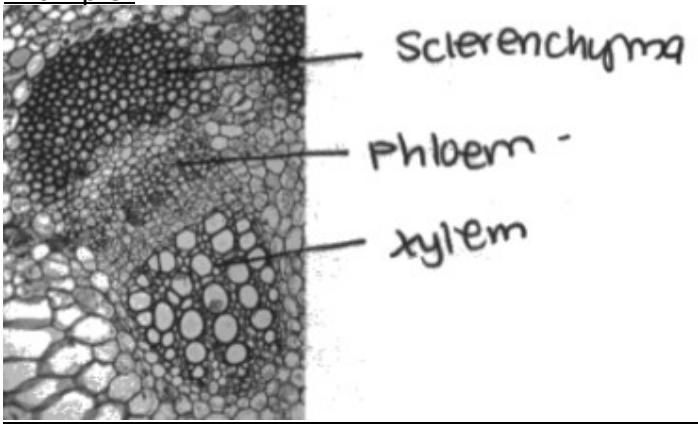
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General Marking Guidance

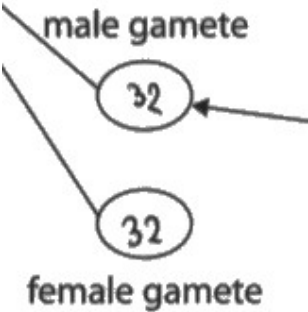
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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.

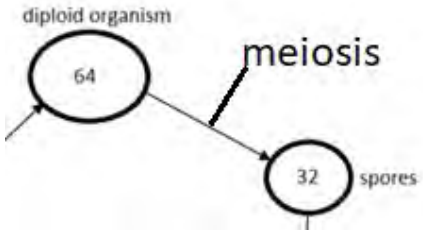
Question Number	Answer	Additional guidance	Mark
1(a)(i)	An answer that includes the following points: • correct phloem position (1) • correct sclerenchyma position (1) • correct xylem position (1)	Example:  The micrograph shows a cross-section of a plant stem. Handwritten labels with leader lines point to three specific tissues: 'Sclerenchyma' (a dense cluster of small, dark cells), 'Phloem' (a layer of cells), and 'xylem' (large, circular vessels).	(3)

Question Number	Answer	Mark
1(a)(ii)	The only correct answer is D three <i>A is not correct because phloem transport water and organic solutes and are connected to other cells via plasmodesmata and moves substances by translocation</i> <i>B is not correct because phloem transport water and organic solutes and are connected to other cells via plasmodesmata and moves substances by translocation</i> <i>C is not correct because phloem transport water and organic solutes and are connected to other cells via plasmodesmata and moves substances by translocation</i>	(1)

Question Number	Answer	Additional guidance	Mark
1(b)(i)	An answer that includes the following points: - cellulose (1) {peptidoglycan / murein} (1)	mark first answer on each line accept polysaccharide / hemicellulose / lignin / (calcium) pectate Accept small {proteins / peptides}	(2)

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation that includes three of the following points: - cellulose (microfibrils) {in layers / in a mesh / at different angles / embedded in pectin} (1) (cellulose / microfibrils / hemicellulose / middle lamella) for {reduced flexibility / strength} (1) - shape of lignin (1) (lignin/ secondary thickening / secondary walls) for {strength / related to lateral movement of water} (1)	accept cellulose (molecules) bonded together by hydrogen bonds accept support / rigidity / stability e.g. helices ignore lignin unqualified accept support / rigidity / stability / reduced flexibility ignore impermeable to water	(3)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	An answer that includes the following point: • correct number of chromosomes for both (1)		(1)

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	An answer that includes the following point: • correct label (1)		(1)

Question Number	Answer	Mark
2(b)(i)	The only correct answer is A P <i>B is not correct because Q is an anther</i> <i>C is not correct because it is a polar nucleus</i> <i>D is not correct because T is an egg cell</i>	(1)

Question Number	Answer	Mark
2(b)(ii)	The only correct answer is C T <i>A is not correct because that is the ovule</i> <i>B is not correct because it is the polar nucleus</i> <i>D is not correct because it is a male nucleus</i>	(1)

Question Number	Answer	Mark
2(b)(iii)	The only correct answer is D U <i>A is not correct because they are pollen grains</i> <i>B is not correct because they are the polar nucleus</i> <i>C is not correct because it is an egg cell</i>	(1)

Question Number	Answer	Mark
2(b)(iv)	The only correct answer is B S <i>A is not correct because it is a pollen grain</i> <i>C is not correct because it is an egg cell</i> <i>D is not correct because it is a male nucleus</i>	(1)

Question Number	Answer	Additional guidance	Mark
2(b)(v)	A description that includes two of the following points: - controls the growth of the pollen tube (1) - contains the genes to make {digestive / hydrolytic} enzymes (1) (which allows) the male {nucleus / nuclei / gamete(s)} to {enter ovule / enter ovary / enter egg cell / fertilise the egg cell / fertilise the polar nuclei / fertilise female gametes} (1)	accept {forms / makes} pollen tube ignore forms a tube accept {produce / make / secrete / uses} {digestive / hydrolytic} enzymes ignore tube nucleus fusing / fertilising	(2)

Question Number	Answer	Additional guidance	Mark
3(a)	An answer that includes the following point: eukarya (1)		(1)

Question Number	Answer	Additional guidance	Mark
3(b)(i)	- correct line measurement and conversion (1) - correct answer to two significant figures (1)	<u>Example of calculation:</u> $22 \times 1000 = 22\,000\,\mu\text{m}$ $(22\,000 \div 1.5) = 15\,000$ ecf for $\pm 1\text{mm}$ Correct answer with no working shown scores full marks	(2)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	An explanation that includes the following points: • an electron microscope was used for (photograph) B (1) • more structures {can be seen / are distinguishable as being separate} due to high resolution (1)	a light microscope was used for (photograph) A ignore scanning ignore high resolution unqualified accept converse for light microscope accept {internal structures (of chloroplast) / ultrastructure / ribosomes} can be seen due to high resolution Accept higher resolution results in (two) points being distinguishable as separate	(2)

Question Number	Answer	Mark
3(b)(iii)	The only correct answer is A amyloplast <i>B is not correct because amyloplasts contain starch</i> <i>C is not correct because amyloplasts contain starch</i> <i>D is not correct because amyloplasts contain starch</i>	(1)

Question Number	Answer	Additional guidance	Mark
3(c)	An answer that includes the following points: • centriole (1) • form spindle (fibres) / separate {chromosomes/chromatids} (in cell division) (1)	accept centrosome / microtubules ACCEPT form microtubules / involved in cell organisation accept involved in cilia/flagella formation accept line up chromosomes {in metaphase / along equator}	(2)

Question Number	Answer	Additional guidance	Mark
4(a)(i)	6.4 (mm ³) (1)	= 1.3r x 3.14 x 1.15 ³ = 6.4	(1)

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	An answer that includes two of the following points: - contains {more cytoplasm (than sperm cell) / contains named organelles} (1) - contains {oil / lipid / triglyceride} (droplets) (1) (which) provides {energy / ATP / monomers} (for developing embryo) (1)	e.g. endoplasmic reticulum, Golgi apparatus, more mitochondria, ribosomes accept contain cortical granules ignore nucleus / zona pellucida ignore mitochondria unqualified ignore food / nutrients ACCEPT (to supply materials) for {mitosis / cell division / development of embryo / growth of embryo} ignore {make/create/produce} energy accept reasons as to why the egg cell has {ER / ribosomes / Golgi apparatus} linked to protein synthesis	(2)

Question Number	Answer	Mark
4(b)(i)	The only correct answer is B metaphase <i>A is not correct because the cell is in metaphase</i> <i>C is not correct because the cell is in metaphase</i> <i>D is not correct because the cell is in metaphase</i>	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	An answer that includes the following point: a {stain / dye} was applied (to the cell) to make the {DNA / chromatin / chromosomes / spindle fibres / histone proteins} visible (1)	ignore stain unqualified accept {stain / dye} linked to a named structure inside the cell seen during mitosis e.g. add stain to chromosomes	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	An answer that includes three of the following points: Similarities • both contain diploid cells (1) • both contain cells dividing by mitosis (1) Differences • morula contains totipotent cells whereas blastocyst contains pluripotent cells (1) • morula {is a solid ball of / mass of} cells whereas blastocyst {is a hollow ball of / contains many} cells (1)	Full marks can only be awarded if there is a similarity in the answer Can piece together from adjacent sentences accept both have diploid number of chromosomes ignore they have both formed by mitosis accept morula is totipotent whereas blastocyst is pluripotent accept morula has {undifferentiated cells / all genes switched on} whereas blastocyst {doesn't / has some differentiated cells / genes switched off} accept labelled diagram showing these aspects accept blastocyst contains {more cells / is larger} (than morula) / converse accept blastocyst contains a {trophoblast / inner cell mass / fluid filled cavity} whereas morula doesn't	(3)

Question Number	Answer	Additional guidance	Mark
4(c)(i)	A description that includes two of the following points: • flagellum rotates (1) • {energy/ATP} released by the mitochondria (in the mid piece) (1) • streamlined shape to reduce {resistance / friction} (1)	accept has a flagellum unqualified ignore has a tail unqualified accept tail {has whip like motion / rotates} do not accept {makes / generates / produces} energy accept provides energy accept {makes / generates / provides / produces} ATP	(2)

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An answer that includes the following points: • as time (after release into water) increases, the sperm {velocity / speed} decreases (1) • sperm have a greater {velocity / speed} in March (1)	Accept negative correlation ignore sperm cells slow down after being added to water accept converse for February ignore references to numbers of sperm	(2)

Question Number	Answer	Additional guidance	Mark
5(a)	A description that includes two of the following points: • analysis of an aspect of phenotype (1) • analysis of (the sequences in) biological molecules (1) • (to see if) there are (many) differences (to existing types of bacteria) (1)	e.g. {named / described} aspect of physical appearance / analysis of growth characteristics / biochemical tests accept compare named aspect of structure / named organelle / ribosomes accept see if other bacteria survive in those conditions ignore behaviour e.g. looking at (circular) DNA, genetic material, proteins accept molecular phylogeny / genetic profiling / create genetic fingerprint ignore compare to other bacteria species unqualified ignore similarities	(2)

Question Number	Answer	
*5(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. • description of growth rate for {one / both} bacteria e.g. growth rate increased and then decreased • growth rate of bacteria B was higher than growth rate of bacteria A (at optimum temperatures) • Bacteria A {can survive in temperatures between -4-21°C / is not tolerant of temperatures above 21°C} whereas bacteria B {can survive in temperatures between 66-105°C / is not tolerant of temperatures below 66°C} • Bacteria A {optimum / highest growth} rate is around 10°C whereas bacteria B {optimum / highest growth} rate is around 95°C • explanation of the increase and decrease in growth rate as temperature increases e.g. linkage to enzyme activity / optimum temperature (linked to highest growth) / denaturation / death of bacteria • explanation linking enzyme activity linked to how it would affect growth rate of bacteria e.g. new cell wall production / production of cell structures / protein synthesis / metabolic reactions / respiration linked to energy available for growth • explanation of how bacteria B can survive in the hot temperatures, e.g. {proteins / enzymes} that are thermostable • The percentage survival of bacteria reduces (when water was removed) / negative correlation • Bacteria C survived for longer (without water) / more bacteria C survived (than mutated bacteria) • The percentage survival of bacteria C reduced by over 70% after one day and no bacteria survived after 9 days / the percentage survival of mutated bacteria C reduced by 10% after one day and 60% bacteria C survived after 15 days • error bars overlap so no significant difference • Mutated bacteria C had a mutation that did not protect it from dehydration e.g. {thinner / no} capsule / thinner cell wall / can't do reactions which produce water • mutation could lead to different protein produced / mutation could lead to change in cell structure / description of how mutations change protein structure • explanation of why bacteria need water e.g. {hydrolysis / respiration / chemical reactions / metabolic reactions / solvent / osmosis}	(6)

			Additional guidance
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.	description of data from graphs only 1 mark = description of one graph 2 marks = description of both graphs
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.	all level 1 plus 3 marks = basic explanation for one graph 4 marks = detailed explanation for one graph OR basic explanation for both graphs
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.	all level 2 plus detailed explanation for both graphs 5 marks = detailed explanation for one graph AND basic explanation for one graph 6 marks = detailed explanation for both graphs

Question Number	Answer	Additional guidance	Mark
6(a)	An answer that includes the following points: - the extract {was effective / had anti-microbial properties} against all three types of bacteria (1) - as it {prevented growth of / killed} bacteria (around the disc soaked in extract) (1) - it was most effective against bacteria A / least effective against bacteria B (at both concentrations) (1)	accept positive correlation accept higher concentration of extract has more antimicrobial properties accept as the (extract) concentration increases, the {diameter / zone of inhibition} increases accept it inhibited (the growth of) A the most / B had most resistance	(3)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	An answer that includes four of the following points: - as concentration increased the duration of headaches decreased / the lower the concentration of the drug the higher the duration of headaches (1) - no data for 50 and 100mg kg⁻¹ for drug B / no data below 200 mg kg⁻¹ for drug B / drug B tested over smaller range of concentrations (1) - the duration of headaches was shorter with drug A (than with drug B) / drug A is more effective (at reducing duration of headaches) (1) - can't say which drug is more effective due to overlap of {error/ SD} bars (1) - relevant comment about methodology (1)	accept negative correlation accept drug B was only tested for {the range 200-400 mg kg⁻¹ /above 200 mg kg⁻¹ / 2 concentrations} ignore drug B doesn't work below 200 mg kg⁻¹ ignore there are no headaches below 200 mg kg⁻¹ with drug B ACCEPT converse for drug B accept there is {no significant difference / low validity / low reliability} as {error / SD} bars overlap ignore size of error bars e.g. lack of information about controlled variables / sample size / age	(4)

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	An answer that includes three of the following points: Similarities (max 2) • both test on patients with headaches (1) • both can include {placebos / double-blind testing} (as well as drug A) (1) • results from both phases would be {analysed with appropriate statistical test / tested for significant difference to placebo} (1) Differences • (drug A is) tested on {small group of / 100 to 500} people in phase II whereas III tested on {large groups of / 1000-3000} people (1) • appropriate {concentration/ dosage} (of drug A) would be identified in phase II (but not in phase III) (1)	Can only piece together from adjacent sentences accept both test on affected patients / both test on patients with the {disease / symptom} ignore patients unqualified accept both look for side effects accept III tested on larger group (than II) / converse accept {effective dose found / different concentrations used/ check dosage / determine dosage} in phase II	(3)

Question Number	Answer	Additional guidance	Mark
7(a)	• correct calculation (1) • correct answer to the nearest whole number (1)	<u>Example of calculation:</u> $52\,892 \times (1.016)^3 = 55471.65$ = 55472 alternative method $52\,892 \times (1.016) = 53\,738$ and repeat 2 more times Correct answer with no working shown scores full marks	(2)

Question Number	Answer	Mark
7(b)(i)	The only correct answer is C two <i>A is not correct because two varieties had a DI higher than 50</i> <i>B is not correct because two varieties had a DI higher than 50</i> <i>D is not correct because two varieties had a DI higher than 50</i>	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes four of the following points: • seeds would be (prepared by being) dried (1) • seeds would be treated with an antimicrobial (1) • seeds would be stored in suitable conditions (1) • samples of seeds would be {germinated / x-rayed / scanned} (to check viability) (1) • replacement seeds would be collected from (these plants) (1)	accept seeds are {sterilised / disinfected} e.g. seeds are frozen, placed in temperatures below 0°C, placed in dry conditions ignore 'low temperatures' unless linked to preventing {germination / growth / microbial growth} ACCEPT (some) seeds {'allowed to grow' / 'planted'} (to check viability) ignore gather more seeds from other places	(4)

Question Number	Answer	Additional guidance	Mark
7(b)(iii)	An explanation that includes four of the following points: • set up a {breeding programme / stud book} (1) • {cross / breed} variety A with variety D (1) • (because) D has {lowest wilt percentage / lowest disease index / best resistance} and variety A has the highest yield / A and D will produce offspring with resistance and high yield (1) • infect grown offspring with the bacterium / check to see if offspring are resistant (1) • repeat using offspring with required characteristics (to get a new high-yielding and resistant variety) (1)	Accept keeping records of offspring ACCEPT analysis of more plant varieties in seed bank to see if any have more resistance to the <i>R. solanacearum</i> bacteria accept {cross/breed} high yield varieties with (disease) resistant varieties	(4)

Question Number	Answer	Additional guidance	Mark
8(a)(i)	An answer that includes one of the following points: • (errors in genetic sequence of gene) occur in crossing over (1) • the chiasmata may be at slightly different points (in the gene) (1)	accept formation of recombinant alleles Reject independent assortment Do not accept crossing over of sister chromatids	(1)

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	A calculation showing the following steps: • value for q (1) • value for p² (1) • number of people without a mutated allele for ARD1 (1)	<u>Example of calculation:</u> $\sqrt{(1 \div 300\,000)}$ OR $\sqrt{(26000 \div 7800\,000)}$ = $1.825741858 \times 10^{-3}$ $\{1 - 1.825741858 \times 10^{-3}\}^2 = 0.9981742581$ answer in range 7 768 800 000 to 7 771 545 079 Correct answer on answer line scores full marks	(3)

Question Number	Answer	Additional guidance	Mark
8(b)	An explanation that includes the following points: • (active) mRNA only contains exons whereas pre-mRNA contains both introns and exons / active mRNA doesn't have introns whereas pre-mRNA does (1) • active mRNA may have {fewer / different order of} exons (than pre-mRNA) (1)	accept (active) mRNA is shorter / converse accept pre-mRNA contains a different sequence of bases (in final exon order to active mRNA)	(2)

Question Number	Answer	Additional guidance	Mark
8(c)(i)	An answer that makes reference to the following points: • {pluripotent stem cells / hiPSC} can give {differentiate / specialise / change into} into {most types of / some types of / liver} cells (1) • through differential gene expression (1) • gene for arginase is {active / switched on / not switched off} • by {epigenetic modification / histone modification / (DNA) methylation} (1) • therefore {transcription / translation} occurs (to produce protein) (1)	ignore pluripotent cell becomes a cell that can synthesise arginase do not accept can differentiate into {any / all} type of cell Accept some genes are {switched off / not active / silenced} accept arginase gene expressed accept acetylation accept description e.g. adding methyl groups (to DNA) Accept protein synthesis can occur	(5)

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	An answer that makes reference to three of the following points: • (hiPSC) are {from skin cells / from (another) adult} (1) • (therefore) no {destruction / harming} of {embryos / life} (1) • treatment occurs in {liver/somatic} cells, therefore no changes to {gametes / germ cells} (1) • treatment {is long lasting / doesn't need to be repeated} (1)	accept easier to obtain hiPSC ignore from own body accept embryonic stem cells are not used accept more ethical than using embryonic stem cells / {fewer / no} ethical issues (for hiPSC) Accept there are ethical issues with using embryonic cells accept consent given / converse for embryos ignore no risk of rejection accept to provide treatment for a fatal disease / may be only effective treatment / can save life (of someone with AD) / to reduce death from AD ignore to treat patients with AD	(3)

