

Mark Scheme (Results)

Summer 2023

Pearson Edexcel GCE
In Biology Spec A (8BN0) Paper 02
Development, Plants and the Environment

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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)	The only correct answer is – D Golgi apparatus, mitochondria and rough endoplasmic reticulum A is incorrect because animal cells do not have amyloplasts or chloroplasts B is incorrect because animal cells do not have amyloplasts C is incorrect because animal cells do not have a cell wall	(1)

Question Number	Answer	Mark
1(b)	The only correct answer is – C the nucleus divides A is incorrect because the cell divides after mitosis is completed B is incorrect because the cell membrane does not break down during mitosis D is incorrect because the organelles do not multiply during mitosis	(1)

Question Number	Answer	Mark
1(c)(i)	The only correct answer is – A anaphase B is incorrect because the cell is not in metaphase C is incorrect because the cell is not in prophase D is incorrect because the cell is not in telophase	(1)

Question Number	Answer	Mark
1(c)(ii)	The only correct answer is – C 7 : 1 A is incorrect because 9 : 1 is not approximate to 873:127 B is incorrect because 9 : 2 is not approximate to 873:127 D is incorrect because 7 : 2 is not approximate to 873:127	(1)

Question Number	Answer	Additional guidance	Mark
1(c)(iii)	A description that makes reference to four of the following: • spindle fibres break down (1) • chromosomes {decondense / uncoil} (1) • nucleoli form (1) • nuclear {membrane / envelope } forms (1) • two separate { nuclei / sets of chromosomes }(1)	ALLOW nucleolus reforms ALLOW sets of chromosomes at opposite sides of the cell	(4)

Question Number	Answer	Additional guidance	Mark
2(a)	A description that makes reference to the following: • nitrates are used to make {amino acids / protein} (1) • { growth is reduced / plants are stunted } if nitrates are lacking (1) • (nitrates) needed to make { nucleic acids / DNA / RNA / ATP / chlorophyll } (1)	ALLOW proteins needed for growth ALLOW nitrogenous bases	(3)

Question Number	Answer	Mark
2(b)(i)	The only correct answer is D chlorophyll A is incorrect because there is no magnesium in amylose B is incorrect because there is no magnesium in calcium pectate D is incorrect because there is no magnesium in cellulose	(1)

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	An answer that makes reference to four of the following: • use of plants that are {clones / same age / same variety} (1) • provide a range of magnesium ion concentrations (1) • two abiotic factors to be controlled (1) • grown for the same given time period (1) • relevant method for growth to be measured (1) • repeats at each concentration to calculate a mean (1)	ALLOW same type / same species ALLOW (minimum of) 5 different concentrations IGNORE units e.g. temperature / light intensity / volume of water / other mineral ion concentration ALLOW time in units of days / weeks / months e.g. height/length of shoot or root, mass of plant, number of leaves ALLOW repeats to calculate average	(4)

Question Number	Answer	Mark
3(a)(i)	The only correct answer is – B 2pq A is incorrect because p^2 represents the proportion of homozygous dominant individuals C is incorrect because q^2 represents the proportion of homozygous recessive individuals D is incorrect because 1.0 represents the whole population	(1)

Question Number	Answer	Mark
3(a)(ii)	The only correct answer is – A 0.09 B is incorrect because 0.30 is the value for q C is incorrect because 0.51 is the value for $1.0 - p^2$ D is incorrect because 0.70 is the value for p	(1)

Question Number	Answer	Additional guidance	Mark
3(b)(i)	An answer that makes reference to the following: • values for p and q correctly calculated (1) • 2pq correctly calculated (1) • correct (whole) number of hedgehogs calculated (1)	<u>Example of calculation</u> q = √0.6 = 0.77 p = 1.0 – 0.77 = 0.23 / 0.225 2pq= 2 (0.23 x 0.77) = 0.354 500 x 0.354 = 177 ALLOW 173, 174, 175 or 176 Correct answer with no working gains full marks.	(3)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	An explanation that makes reference to three of the following: • description of selection pressure (1) • hedgehogs with { lighter coats / advantageous characteristic } survive and reproduce (1) • passing on { advantageous allele / allele for blonde spines} (1) • alleles for advantageous characteristic become more common in the population over time (1)	e.g. cars running over and killing hedgehogs IGNORE cars unqualified ALLOW 'have offspring' for reproduce ALLOW increased frequency of allele for light spines in the population	(3)

Question Number	Answer	Additional guidance	Mark
4(a)	• the location of genes on chromosomes (1)	ALLOW 'allele' for 'gene' and 'chromatid' for 'chromosome'	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	An answer that makes reference to the following: • AaBBCC, AABbCC and AABBCc		(1)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation that makes reference to the following: • higher frequency for phenotype 3 than phenotype 7 (1) • {fewer combinations of alleles/ only one genotype} for phenotype 7 (1)	ALLOW phenotype 3 more likely than phenotype 7 / ALLOW converse ALLOW converse – more combinations/ genotypes give rise to phenotype 3 ALLOW six different genotypes can give rise to phenotype 3	(2)

Question Number	Answer	Additional guidance	Mark
4(c)(i)	• 174 (cm)		(1)

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An explanation that makes reference to three of the following: • not all fulfil genetic potential / not all achieve the height determined by their genotype (1) • due to dietary factor (1) • due to disease (1) • (dietary factor or disease occurring) during childhood (1)	ALLOW genotype determines maximum possible height ALLOW example such as lack of {protein /calcium/ vitamin D} / malnutrition	(3)

Question Number	Answer	Additional guidance	Mark
5(a)	An explanation that makes reference to three of the following: • methyl groups attached to DNA (1) • prevent transcription (of the gene) (1) • {transcription factors / RNA nucleotides} cannot bind to { DNA / promoter region of gene} (1) • {deactivating / switching off} a gene (1)	ALLOW methyl group attached to {cytosine / CpG site} ALLOW { mRNA / RNA polymerase} cannot bind to {DNA/gene} ALLOW prevents activation of a gene	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An answer that makes reference to the following: • certain stimuli cause {some genes to be activated / some genes to be deactivated } (1) • (activated) genes are {transcribed / used to produce mRNA } (1) • (mRNA) translated to produce proteins (1) • (proteins) determine {structure/function} of cell (1)	ALLOW polypeptide for protein	(4)

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An answer that makes reference to the following: • reduced DNA methylation results in activation of (AHRR) gene / DNA methylation prevents activation of the (AHRR) gene (1) • (reduced DNA methylation) results in { transcription of / production of mRNA from} (AHRR) gene (1) • increases cell division / cells (in the lung) may divide out of control (1)	ALLOW DNA methylation {switches off / suppresses} (AHRR) gene ALLOW cell cycle goes through stages more rapidly ALLOW cells may become cancerous	Exp (3)

Question Number	Answer	Additional guidance	Mark
6(a)(i)	• calculation of area for ethanol extract (1) • difference between the areas to one decimal place (1)	<u>Example of calculation</u> Π x (12.5 ÷ 2) ^{2} = 122.718 122.718 – 50.3 = 72.4 (mm^2) ALLOW 72.5 Correct answer with no working gains full marks	Exp (2)

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	A description that makes reference to four of the following: • reference to aseptic technique (1) • bacterial culture controlled (1) • same size disc of paper / same size well in agar (1) • same mass of plant material / same volume of solvent used for each plant / same concentration of extract (1) • {same/stated} (incubation) temperature (1) • {same/stated} time allowed (to incubate) (1)	ALLOW method described to prevent contamination of plate e.g. volume of culture added / method of inoculating plates / species of bacteria ALLOW same volume water / ethanol e.g. 25-40°C e.g. 24 – 48 hours , no more than 1 week	(4)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	An explanation that that makes reference to the following: • {tested on animals / tissue samples} (1) • to determine {toxicity / safe dosage} (1)	ALLOW – tested for safety IGNORE side effects	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation that makes reference to two of the following: • a trial using {a placebo / pre-existing medication} (1) • where the patients and the doctors do not know who has been given the drug and who has not (1) • to prevent bias (1)	ALLOW reduction of bias	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	An answer that makes reference to three of the following: • stage I is conducted on healthy volunteers (1) • stage I is to determine {side effects / safety} (1) • stage II is to determine the effectiveness of the drug / drug may not progress to stage III if it is ineffective (1) • (fewer progress from Stage II to Stage III because) { patients / people with the condition} are more likely to have side effects (1)	ALLOW people without the condition ALLOW drug progresses from Stage I to Stage II if it is safe/non-toxic ALLOW 'patients' for 'people with the condition'	(3)

Question Number	Answer	Additional guidance	Mark
7(a)(i)	An answer that makes reference to two of the following: • plasmid (1) • circular DNA (1) • 70S ribosomes (1)	ALLOW mesosome ALLOW nucleoid for circular DNA	(2)

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	An explanation that makes reference to two of the following: • (molecular phylogeny) compares { RNA / DNA / protein} (1) • compare sequences of { bases /amino acids } (1) • to determine if sequences more similar to Archaea than Bacteria (1)	ALLOW {study/analyse} instead of compare	(2)

Question Number	Answer	Additional guidance	Mark
7(b)(i)	An answer that makes reference to one of the following: • (a niche is) the role an organism plays in the { habitat / ecosystem / community } (1) • (a niche is) how an organism {exploits / interacts with } its { habitat / environment } (1)	ALLOW habitat for ecosystem ALLOW species for organism ALLOW interaction with abiotic and biotic factors in environment	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An description that makes reference to the following: • correct values read from graph and difference calculated (1) • decrease from original calculated (1) • answer expressed as a percentage correct to 3sf (1)	<u>Example of calculation</u> 11600 - 5200 = 6400 6400 ÷ 11600 = 0.55172 55.2 (%) ECF max 2 marks if incorrect values used from graph in working. Correct answer with no working gains full marks.	(3)

Question Number	Answer	Additional guidance	Mark
7(b)(iii)	An answer that makes reference to four of the following: • maintenance of genetic diversity (1) • by { selection of mates / use of stud books } (1) • (use of stud books in order) to prevent {inbreeding depression / genetic drift } (1) • habitat protected (from development) (1) • relevant requirement of area into which flamingos re-introduced (1)	ALLOW maintaining the gene pool / increase genetic diversity ALLOW loss of alleles for genetic drift e.g. presence of {Archaea / bacteria / micro organisms} / warm water / salty water	(4)

Question Number	Answer	Additional guidance	Mark
8(a)(i)	A description that makes reference to two of the following: • can {differentiate / give rise} to all cell types (1) • capable of unlimited cell division (1) • can give rise to other totipotent stem cells (1)	ALLOW no Hayflick limit	(2)

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	An answer that makes reference to the following: Similarities • both contain a named organelle found in the cytoplasm other than the nucleus (1) • both possess {cell membrane / cytoplasm} (1) Differences • (unfertilised) egg cell has a haploid nucleus whereas the zygote has a diploid nucleus (1) • unfertilised egg cell contains cortical granules and the zygote does not (1)	e.g. rER, sER, Golgi apparatus, lysosomes, mitochondria ALLOW 23 chromosomes in egg cell compared to 46 chromosomes in zygote ALLOW idea of cortical granule enzymes not released from the unfertilised egg	(4)

Question Number	Answer	Mark
8(b)(i)	The only correct answer is – B the fetus contains genes from both parents A is incorrect because umbilical cells are not produced by meiosis and even if they were it is not the reason for them being genetically different to the cells of the mother C is incorrect because the presence of pluripotent stem cells does not explain why the cells are not genetically identical to those of the mother D is incorrect because the umbilical cord is not produced by the mother and if it was, the cells would be genetically identical to those of the mother	(1)

Question Number	Indicative content
8(b)(ii)	Answers will be credited according to candidate's 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 which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** All could be used to treat medical conditions and be used to replace tissues damaged by disease or faulty genes. **Embryos** • Stem cells are totipotent and have more potential • Use of embryonic stem cells destroys embryos • Embryos cannot give consent / have potential to become a human being **Bone marrow donors** • Stem cells are pluripotent – have less potential but still have potential to become all types of blood cell • May not match the recipient and be rejected • Bone marrow donor DNA will have a different genome **Umbilical cord tissue** • Stem cells are pluripotent – still have potential to become all types of blood cell • Will be genetically identical to the recipient • No chance of rejection / no need for immunosuppressant medication • May not be able to treat a genetic condition • Not all patients have umbilical cord tissue stored / storage issues such as cost (?) or degradation of tissue over time (6 marks)

Level	Marks		Additional guidance
0	0	No awardable content	
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information 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.	Basic points made. Some links made to either potential benefits or concerns, but not both.
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.	At least two sources of stem cell discussed. Some links made between sources of stem cells and their potential as well as practical or ethical concerns.
3	5-6	An explanation is made which 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 three sources of stem cells discussed. Issues discussed should consider the relative potential for each type of stem cell in therapeutic treatments as well as practical or ethical concerns.

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