Mark Scheme (Results)

Summer 2024

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

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General Marking Guidance

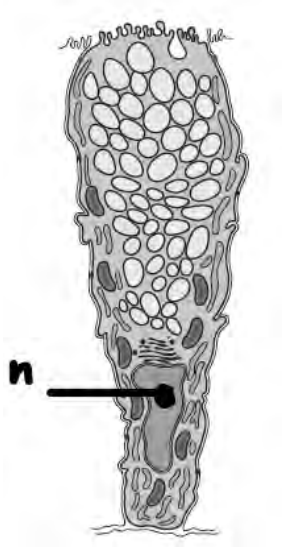
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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)(i)	The only correct answer is – C – R • A is incorrect because P is sclerenchyma • B is incorrect because Q is phloem • D is incorrect because S is not xylem	(1)

Question number	Answer	Mark
1(a)(ii)	The only correct answer is – B • A is incorrect because organic solutes are not transported through xylem vessels. • C is incorrect because organic solutes are not transported through xylem vessels. • D is incorrect because organic solutes are not transported through xylem vessels.	(1)

Question number	Answer	Mark
1(a)(iii)	The only correct answer is – B • A is incorrect because sieve tubes are not found in epidermal tissue • C is incorrect because sieve tubes are not found in sclerenchyma tissue • D is incorrect because sieve tubes are not found in xylem tissue	(1)

Question number	Answer	Additional guidance	Mark
1(b)	An explanation that makes reference to three of the following: • used in calcium pectate (1) • found in the middle lamella (1) • needed to connect cell walls of neighbouring cells (1) • supports cellulose microfibrils in cell wall (1)	ALLOW pectin ALLOW holds cells together	(3)

Question number	Answer	Additional guidance	Mark
2(a)(i)	• discrete ovoid drawn within boundary of nucleus and labelled 'nucleolus'		(1)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	• mitochondrion / mitochondria/ chloroplast		(1)

Question number	Answer	Additional guidance	Mark
2(a)(iii)	An answer that makes reference to the following: • in chromosomes / as chromatin (1) • wrapped around histone (proteins) (1)		(2)

Question number	Answer	Additional guidance	Mark
2(b)(i)	An answer that makes reference to three of the following: Similarity • both are composed of (flattened) stacks of membranes / both are composed of {cisternae / membrane bound sacs } (1) • both have vesicles (1) Difference • only the rER has ribosomes attached (1) • rER has interconnected sacs whereas these are separated in the Golgi apparatus (1) • the membranes of the rER are connected to the nuclear membrane (1)	For full marks must have at least one similarity ALLOW both are made of flattened sacs	(3)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An answer that makes reference to the following: • proteins are folded in the rER (1) • proteins are modified within the Golgi apparatus (1) • proteins are packaged into {transport vesicles by rER / secretory vesicles by Golgi apparatus } (1)	ALLOW {secondary / tertiary} structure of proteins ALLOW description of transport or secretory function of vesicle IGNORE proteins forming vesicles	(3)

Question number	Answer	Additional guidance	Mark
3(a)	• locus / loci		(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	An explanation that makes reference to three of the following: • mother is {heterozygous / $X^B X^b$} (1) • (to pass on red green colour deficiency) the child must inherit the recessive allele from its mother (1) • if father has {recessive allele / genotype $X^b Y$} can produce a daughter with { red green colour deficiency / genotype $X^b X^b$} (1) • a son (with red green colour deficiency) would have the genotype $X^b Y$ (1)	Marks can be awarded from correct genetic cross diagrams ALLOW mother has a dominant allele and a recessive allele/ mother is a carrier	(3)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer that makes reference to two of the following: • the mother has one dominant allele / recessive allele not expressed due to presence of dominant allele (1) • the dominant allele is expressed (1) • therefore the correct protein is produced (1)		(2)

Question number	Answer	Mark
3(b)(iii)	The only correct answer is – B 0.25 • A is incorrect because the answer is not 0.00 • C is incorrect because the answer is not 0.50 • D is incorrect because the answer is not 0.75	(1)

Question number	Answer	Mark
4(a)(i)	The only correct answer is – A capsule • B is incorrect because Y is not labelling a mesosome • C is incorrect because Y is not labelling a plasmid • D is incorrect because Y is not labelling a ribosome	(1)

Question number	Answer	Mark
4(a)(ii)	The only correct answer is – B smaller than in eukaryotes • A is incorrect because ribosomes in bacteria are not larger than in eukaryotes • C is incorrect because ribosomes in bacteria are the same size as in eukaryotes • D is incorrect because ribosomes in bacteria are not variable in size	(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	An answer that makes reference to the following: • a cell that can differentiate (1) • into any type of (specialised) cell (1)	ALLOW a cell that can specialise	(2)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation that makes reference to four of the following: • cell receives a stimulus (1) • some genes are activated / differential gene expression (1) • leading to transcription of genes / production of mRNA from genes (1) • translation to produce protein (1) • protein determines {structure / function} of the cell (1)	ALLOW reference to transcription factors /regulator proteins	(4)

Question number	Answer	Additional guidance	Mark
5(a)(i)	• correct value for p^2 (1) • correct value for 2pq (1) • correct number of individuals (whole number) (1)	<u>Example of calculation</u> 0.64 0.32 (ALLOW 2 marks for 0.96 if answer is incorrect for using correct values to determine $p^2 + 2pq$) 19 Correct answer with no working gains full marks	(3)

Question number	Answer	Mark
5(a)(ii)	The only correct answer is – C • A is incorrect because two statements are correct • B is incorrect because two statements are correct • D is incorrect because two statements are correct	(1)

Question number	Answer	Additional guidance	Mark
5(b)(i)	• niche		(1)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation that makes reference to the following: • more genetic variation (within the population) / increases genetic diversity (1) • due to different alleles being present / more alleles in the gene pool (1) • therefore more likely to have individuals suited to the environment / capable of {adapting/surviving} (1)	ALLOW larger gene pool ALLOW description of an example	(3)

Question number	Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to the following: • use of stud books to select individuals to breed from (1) • therefore preventing closely related individuals breeding / to avoid {inbreeding depression /genetic drift } (1) • exchange of {individuals/gametes} between zoos (1)	ALLOW (genetic) testing of potential parents	(3)

Question number	Answer	Additional guidance	Mark
6(a)	An answer that makes reference to four of the following: Similarities • both are {polysaccharides / chains of glucose} (1) • both contain (1-4) glycosidic bonds (1) Differences • starch is made of alpha-glucose and cellulose is made of beta-glucose (1) • (only) {starch /amylopectin} contains 1-6 glycosidic bonds (1) • {starch /amylopectin} is branched and cellulose is not (1)	ALLOW polymer made of glucose monomers	(4)

Question number	Answer	Additional guidance	Mark
6(b)	A description that makes reference to the following: • jute has a higher tensile strength when not mixed with other materials /mixing jute with other materials reduces its tensile strength (1) • calculated effect on tensile strength (1) • adding polypropylene reduces tensile strength to a much greater extent than adding epoxy (1)	e.g. epoxy reduces tensile strength by 50 MPa/ 8.9% OR Polypropylene reduces tensile strength by 519 MPa/ 92%	(3)

Question number	Answer	Additional guidance	Mark
6(c)	An answer that makes reference to the following: • treat fibres with a range of sodium hydroxide concentrations (1) • control a variable concerning the plant fibre (1) • control an environmental variable / same length of time in sodium hydroxide (1) • add masses to fibre in increments until fibre breaks (1) • calculate tensile strength as force divided by cross sectional area (of fibre) (1)	e.g. between 0 and 10% E.g. species of plant, age of fibre, length and width of fibre. E.g. temperature or humidity. ALLOW use of forcemeter to measure force needed to break fibre	(5)

Question number	Answer	Additional guidance	Mark
7(a)(i)	• 1:4.25	ALLOW 4:17	(1)

Question number	Answer	Additional guidance	Mark
7(a)(ii)	A description that makes reference to three of the following: • greater genetic variation in gametes (1) • (active MSH4 gene) increases number of recombinants (1) • due to more crossing over (1) • (MSH4 has) a greater effect on longer chromosomes (1)	ALLOW less effect on shorter chromosomes ALLOW decreased effect as chromosome number increases	(3)

Question number	Answer	Additional guidance	Mark
7(b)	An explanation that makes reference to the following: • the zygote may not contain { homologous pairs of chromosomes / diploid nucleus } / zygote not diploid (1) • because gametes can be produced with incorrect number of chromosomes / haploid gametes not produced (1)	ALLOW odd numbers of chromosomes {in zygote/ when egg fertilised/ at fertilisation} ALLOW some gametes have extra chromosomes ALLOW daughter cell for gamete	(2)

Question number	Answer	Additional guidance	Mark
7(c)	• number of cells in mitosis identified (1) • correct calculation of mitotic index (1)	<u>Example of calculation</u> 11 – 14 (out of 22-24 cells) ALLOW one mark ECF for correct calculation using other numbers of cells	(2)

	11	12	13	14
22	50.0	54.5	59.1	63.6
23	47.8	52.1	56.5	60.9
24	45.8	50.0	54.2	58.3

Question number	Answer	Additional guidance	Mark
7(d)	A description that makes reference to five of the following: • strawberry plants of different species grown in same conditions (1) • (standardised) sample of root tips (1) • soften tissue with hydrochloric acid / tease tissue with mounted needle to separate cells / maceration of tissue (1) • use of named stain (to make chromosomes more visible) (1) • count number of cells visible under microscope and number of cells undergoing mitosis (1) • {calculate/compare} mitotic index for each species (1)	e.g 5mm in length e.g. toluidine blue, (acetic) orcein	(5)

Question number	Answer	Additional guidance	Mark
8(a)	An answer that makes reference to the following: • species richness / index of biodiversity (1) • genetic diversity / heterozygosity index (1)	ALLOW counting of number of species in an area	(2)

Question number	Answer	Mark
8(b)	The only correct answer is – D – they can reproduce asexually • A is incorrect because A is a behavioural adaptation • B is incorrect because B is an anatomical adaptation • C is incorrect because C is an anatomical adaptation	(1)

Question number	Answer	Additional guidance	Mark
8(c)	An explanation that makes reference to the following: • more cotton plants can be grown / cotton is renewable (1) • therefore { does not run out / is available to future generations} (1)		(2)

Question number	Answer	Additional guidance	Mark
8(d)(i)	• correct values used to calculate change (1) • percentage calculated to 3sf (1)	<u>Example of calculation</u> 15 470 - 8 184 = 7286 (7 286 ÷ 15 470) x 100 = 47.0976 Answer = 47.1 (%) ALLOW 1 mark for 47 (%) Correct answer with no working scores full marks	(2)

Question Number	Indicative content
* 8(d)(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. Basic information • Greater number of insect species of all groups with agroforestry • More farms with mammals with agroforestry • More plant species with agroforestry • Agroforestry has greater biodiversity / species richness Linkages • Reference to data in table of insects – more species for each type of insect and greater numbers of each, except the Diptera (flies) where there were more in monoculture • Reference to data on mammals –percentage of farms with each group of mammals higher for agroforestry • Reference to different number of plant species in agroforestry from box plots mean is 6.4 compared with 2.4, median 5 compared to 2 Sustained reasoning • Agroforestry provides more {habitats / niches} • Different types of plant – trees, shrubs and grasses provide more habitats • Monoculture with non-native plants not suitable habitat for native insect species • Greater range of plant species provides more food for animals • More smaller mammals allows more feeding opportunities for carnivores • Monoculture – non-native plants, not suitable for native insects 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 observation on agroforestry: more insects / mammals / animals / plants Greater biodiversity / species richness with agroforestry
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of all pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.	Linkage to at least one source of data:– • Table of data on insects e.g. more species of all groups of insects • Mean number of species of plants higher with agroforestry • Greater percentage of farms with mammals More habitats / more niches / reference to feeding relationships
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of all pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Analysis of all three sets of data on insects, mammals and plants. Link made between: species richness of plants with greater variety of habitats /niches leading to more insect species / greater percentage of farms with mammals.

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