Mark Scheme (Results)

Summer 2019

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

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Summer 2019
Publications Code 8BN0_02_1906_MS

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.
- In questions marked with an **asterisk** (*), marks will be awarded for the ability to structure answers logically showing how the points are related or follow on from each other where appropriate.

Question Number	Answer	Mark
1(a)(i)	**C** – the mode ***The only correct answer is C*** ***A*** *is not correct because the mean is a calculated value* ***B*** *is not correct because the median is the middle value on the x axis* ***D*** *is not correct because the standard deviation is a calculated value*	**(1)**

Question Number	Answer	Mark
1(a)(ii)	**B** – body mass ***The only correct answer is B*** ***A*** *is not correct because blood group is categoric* ***C*** *is not correct because eye colour is categoric* ***D*** *is not correct because gender is categoric*	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to the following • height is affected by the environment as well as genotype (1) • height is an example of polygenic inheritance (1) • (therefore) offspring can inherit a mixture of alleles from both parents (that increase height) (1) • description of a named environmental factor that can affect height (1)	e.g. higher protein diet, more calcium in diet, better healthcare ALLOW parents did not fulfil genetic potential due to a named environmental factor	**(4)**

Question Number	Answer	Mark
1(c)	**D -** two divisions to produce haploid cells ***The only correct answer is D*** ***A*** *is not correct because diploid cells are not produced* ***B*** *is not correct because there are two divisions not one* ***C*** *is not correct because diploid cells are not produced*	**(1)**

Question Number	Answer	Mark
2(a)	**B** – cannot produce fertile offspring ***The only correct answer is B*** ***A*** *is not correct because the populations of the same species can be geographically isolated* ***C*** *is not correct because individuals of the same species can have different coloured fur* ***D*** *is not correct because a species may occupy a different niche*	**(1)**

Question Number	Answer	Mark
2(b)(i)	**A** - They are also found in other locations ***The only correct answer is A*** ***B*** *is not correct because they are not at risk of extinction refers to endangered not endemic* ***C*** *is not correct because the term endemic is not related to competition* ***D*** *is not correct because the term endemic is not related to population size*	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	• natural selection (1)	ALLOW (allopatric) speciation or reproductive isolation.	**(1)**

Question Number	Answer	Mark
2(c)(i)	**C** – only Archaea and Bacteria ***The only correct answer is C*** ***A*** *is not correct because Eukaryota are not prokaryotic* ***B*** *is not correct because Bacteria are also prokaryotic* ***D*** *is not correct because Archaea are also prokaryotic*	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	A description that makes reference to four of the following: • presence of a cell wall (1) • circular DNA / plasmids (1) • {small / 70S} ribosomes (1) • pili / flagellum (1) • capsule / mesosome (1)		**(4)**

Question Number	Answer	Additional Guidance	Mark
3(a)	An answer that makes reference to the following: • mitosis	ALLOW cytokinesis	**(1)**

Question Number	Answer	Mark
3(b)(i)	***A*** *– anaphase* ***The only correct answer is A*** ***B*** *is not correct because chromosomes are not pulled apart in metaphase* ***C*** *is not correct because chromosomes are not pulled apart in prophase* ***D*** *is not correct because chromosomes are not pulled apart in telophase*	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	• correct conversion of units (1) • image size divided by magnification (1)	<u>Example of calculation</u> 15 (mm) x 1000 = 15000 (µm) 15000 ÷ 800 = 18.75 (µm) ALLOW 18.8 Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	An answer that makes reference to five of the following: • grow plant in a suitable range of temperatures (1) • description of a suitable named variable to be controlled when growing the plants(1) • sample meristem tissue from same area of plant (1) • an appropriately named stain (1) • details of root tip squash procedure (1) • detail of how to compare number of cells undergoing nuclear division / calculate mitotic index (1)	e.g. a range up to 40^{o}C e.g. plant {species / age } / growing conditions such as light, mineral ions, water, pH e.g. either root tips / shoot tips e.g. toluidine blue, (ethanoic) orcein e.g. use of hydrochloric acid to prepare tissue sample, maceration procedure, squashing under cover slip e.g. number of cells with {visible / condensed} chromosomes compared to the total	**(5)**

Question Number	Answer	Mark
4(a)	**A** – 15.9% ***The only correct answer is A*** ***B*** *is not correct because the value is incorrectly rounded* ***C*** *is not correct because the value is not converted to a percentage* ***D*** *is not correct because the value is incorrectly rounded and not converted to a percentage*	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following: 100 billion (US dollars) (1)	ALLOW a range of 98-102 billion, Or 100 000 000 000 (dollars)	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	An explanation that makes reference to the following: • extends storage time of the seeds (1) • because drying prevents {germination / decomposition} of seeds (1)	ALLOW drying {reduces enzyme activity / prevents growth of bacteria and fungi}	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	An answer that makes reference to three of the following: • prevent species from becoming extinct (1) • conserving species with (potential) medicinal properties (1) • safeguarding genes that may prove useful in the future (1) • allow for reintroduction of species (in the future) (1)	ALLOW conserve genetic diversity	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(d)	An answer that makes reference to the following: • (species richness) measures number of species (in a habitat) (1) • (heterozygosity index) is a measure of genetic diversity within a { species / population } (1)	ALLOW proportion of heterozygous individuals in a population / formula for heterozygosity index	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)	An explanation that makes reference to four of the following: • (many) cellulose molecules held together in microfibrils (1) • hydrogen bonds hold cellulose {molecules / chains} together (1) • criss cross arrangement of {cellulose / microfibrils} provide strength in {both / different} directions (1) • (cellulose/microfibrils) embedded in { a matrix / pectin / pectate / hemicellulose} (1) • (which prevents) {cellulose / microfibrils} from sliding over each other (1)	ALLOW which holds microfibrils in place	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(b)	An explanation that makes reference to two of the following: • available to future generations (1) • (because) bamboo is a renewable resource (1) • (because) more bamboo plants can be grown (1)	ALLOW bamboo { can be regrown / will grow back }	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(c)	An answer that makes reference to three of the following: • add {50g / 75g / 100g} bamboo fibre to (the same mass of) resin (1) • tensile strength tested by {adding masses / applying force} until the fibre breaks (1) • calculate tensile strength by dividing force by cross-sectional area (1) • relevant variable controlled (1)	e.g. temperature, humidity, age of bamboo fibre, length of fibre	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(a)	An explanation that makes reference to the following: • (presence of two flagella) would affect {motility / ability of sperm to propel itself} (1) • this may prevent sperm from reaching the egg (1) • preventing fertilisation (1)	ALLOW would affect ability of sperm to {swim / move} / affect direction of movement	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)	An answer that makes reference to the following: • MMS reduces {sperm count / number of sperm cells} (1) • MMS increases percentage of sperm cells with abnormalities (1) • (as the greatest effect is on percentage of sperm swimming normally) MMS is likely to affect production of {flagella / mitochondria} (1)		**(3)**

Question Number	Answer
6*(c)	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. • There is a positive effect of vitamin E shown from the trial on reducing number of abnormal sperm and improved motility • Reference to data from graphs to compare results with vitamin E and control groups • Increased motility will increase probability that sperm will reach the egg • Increases in sperm count will increase the chance of fertilisation • The low numbers of sperm may not be the reason for infertility • Trials conducted on rats not humans therefore results may not be the same in people • The trial only involved examples of teratozoospermia that are caused by MMS • Other causes of teratozoospermia may not respond to Vitamin E **(6)**

Level 0	**0**	No awardable content	
Level 1	**1-2**	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.	Description of positive effect of vitamin E e.g. reference to an improvement such as improved sperm motility, reduced abnormalities
Level 2	**3-4**	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.	Discussion of how specific effects of vitamin E treatment would improve fertility or analysis of data from graphs, e.g. comparing vitamin E treatment data with control groups. Reference to tests only being carried out on rats or results from trials on humans necessary. Other causes of teratozoospermia apart from MMS not considered.
Level 3	**5-6**	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Full discussion of evidence for potential use of vitamin E to treat infertility. Detailed discussion of limitations due to experimental design or other causes of infertility.

Question Number	Answer	Additional Guidance	Mark
7(a)	A description that makes reference to three of the following: • working near a Bunsen burner (to provide a convection current) (1) • sterilising work surfaces (1) • sterilising equipment with heat (1) • limiting time containers are open (1)	ALLOW using a laminar flow cabinet IGNORE Bunsen flame killing bacteria e.g. flaming of {forceps / bottle necks / inoculating loops} e.g. only partially lifting lids from Petri dishes	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	An explanation that makes reference to the following: • colonies present with a different {shape / size / colour} (1) • therefore {belonging to different species / contaminants} (1)	e.g. presence of 'darker spots' ALLOW other {microorganisms /bacteria} present or annotation of diagram to indicate other colonies	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	An explanation that makes reference to the following: • to allow bacteria to multiply (1) • without encouraging pathogenic organisms (1)	ALLOW growth of bacteria	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c)(i)	• maximum diameter for S calculated (1) • calculation of r^2 for S (1) • calculation of maximum area for S (1)	<u>Example of calculation</u> 22.9 + 1.28 = 24.18 $12.09^2 = 146.17$ $\prod \times 12.09^2 = 459.2 / 459$ (mm^2) ECF if maximum diameter not calculated - 2 marks for 412 / 411.9 / 411.87 ALLOW answers where value of ∏ is 3.14{ Correct answer without working gains full marks	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(c)(ii)	An answer that makes reference to the following: • extract P is the least effective (1) • all extracts { inhibit / prevent } growth of bacteria (1) • no significant differences between extracts Q, R and S due to overlap of ranges (1)		**(3)**

Question Number	Answer	Additional Guidance	Mark
8(a)	• correct values calculated for p and q (1) • correct calculation of proportion of heterozygotes (1) • correct calculation of number of heterozygotes in the population (1)	<u>Example of calculation</u> p= 0.99 q = 0.01 2pq = 2 × (0.99 × 0.01) = 0.0198 0.0198 × 17 020 000 = 336 996 carriers Correct answer with no working gains full marks	**(3)**

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	An answer that makes reference to two of the following: • (a disorder caused by) a {mutated / faulty } gene (1) • located on the { X / Y } chromosome (1) • therefore (the disorder) is more likely in one gender than another (1)	ALLOW allele for gene ALLOW located on sex chromosome	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	An explanation that makes reference to two of the following: • males only have one allele for this gene (1) • males cannot be heterozygous (1) • the Hardy-Weinberg equation assumes all individuals have two alleles for the gene (1)	 ALLOW males do not have two alleles for the gene ALLOW males cannot be carriers ALLOW 2pq cannot be calculated	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(b)(iii)	An explanation that makes reference to the following: • stem cells can differentiate into muscle cells (1) • these cells will not have the affected allele (1) • {the protein / dystrophin} will be produced (1)	 ALLOW 'specialise' instead of 'differentiate' ALLOW will have normal allele for dystrophin	**(3)**

Question Number	Answer	Additional Guidance	Mark
8(c)	An explanation that makes reference to the following: • genes {activated/ deactivated} (in stem cells) (1) • (because of) {methylation of DNA / histone binding} (1) • (therefore) the same genes will be activated in the daughter cells (1)	ALLOW genes switched on or off ALLOW acetylation of histones	**(3)**

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