Mark Scheme (Results)

October 2020

Pearson Edexcel GCE In Biology A Salters Nuffiled (9BN0) Paper 1: The Natural Environment and Species Survival

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Autumn 2020
Publications Code 9BN0_01_2010_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.

Question Number	Answer	Mark
1(a)	The only correct answer is D – 80S ribosomes on the endoplasmic reticulum *A is incorrect because the ribosomes are not 70S* *B is incorrect because the ribosomes are not 70S* *C is incorrect because protein synthesis does not occur in the nucleus*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	A description that makes reference to three of the following • the proteins are folded in the rough endoplasmic reticulum (RER) (1) • the proteins are {packaged into/transported in} vesicles (1) • the protein is modified in the Golgi apparatus (1) • exocytosis (1)	ALLOW processed/description of modification ALLOW description of exocytosis	**(3)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation that makes reference to the following • (if the protein is not folded correctly) the {tertiary structure / 3D shape} would be different (1) • therefore the active site of the enzyme would not { fit / bind with } the substrate / it would not be able to form an enzyme substrate complex (1) • therefore it would not be able to catalyse the reaction (1)	ALLOW not complementary	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)	• found only in one geographical location (1)	ALLOW one area of the world	**(1)**

Question Number	Answer	Mark
2(b)(i)	The only correct answer is C - an increase in carbon dioxide and methane in the atmosphere that trap infrared radiation *A is incorrect because carbon dioxide and methane are increasing* *B is incorrect because carbon dioxide and methane are increasing and they do not trap ultraviolet radiation* *D is incorrect because carbon dioxide and methane do not trap ultraviolet radiation*	**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	The only correct answer is A - dendrochronology, peat bog pollen and ice cores *B is incorrect because classification does not provide evidence* *C is incorrect because niche and classification do not provide evidence* *D is incorrect because niche does not provide evidence*		**(1)**

Question Number	Answer	Additional guidance	Mark
2(c)	An answer that makes reference to four of the following • fewer seeds will lead to a decrease in the plant population(1) • fewer seeds means that there is less {food / energy} (1) • lipids and carbohydrates contain (large amounts) of stored energy(1) • the monkeys will not be able to generate enough heat to survive the cold winters (1) • the monkey population will decrease in size (1)	ALLOW lipids needed for insulation/less respiration to generate heat	**(4)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><td></td><td>Keratin in the skin</td><td>Lysozyme in mucus</td><td>Hydrochloric acid in the stomach</td></tr>
<tr><td>Physical barrier</td><td>✓</td><td>x</td><td>x</td></tr>
<tr><td>Chemical barrier</td><td>x</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>3 correct answers 1 mark
All correct 2 marks</td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that makes reference to the following • flora in the gut and skin are better adapted to the conditions (1) • therefore they can outcompete pathogenic organisms (1) • bacteria in the gut secrete {chemicals /lactic acid} which help to destroy pathogens (1)	ALLOW details of competition for space or nutrients ALLOW enzymes	**(3)**

Question Number	Answer	Additional guidance	Mark
3(c)	An explanation that makes reference to two of the following • because the pH inside the stomach is too low for the enzymes of most bacteria to function (1) • bacteria that live in the stomach have adaptations that enable them to survive (1)	ALLOW reference to bacterial enzymes being denatured ALLOW (some) bacteria have evolved specifically to withstand the conditions	**(2)**

Question Number	Answer	Mark
4(a)	The only correct answer is A - DNA which codes for a different amino acid *B is incorrect because DNA does not code for monosaccharides* *C is incorrect because the change is not in RNA* *D is incorrect because the change is not in RNA and it does not code for monosaccharides*	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)	An explanation that makes reference to three of the following • (because) { one triplet is affected / a different triplet code is produced } (1) • (the mutation) could change one of the amino acids (1) • this would {change the bonds formed between the R groups / cause a change in the tertiary structure} (1) • the haemoglobin would no longer be able to bind to oxygen (1)	ALLOW produce a stop codon IGNORE reference to secondary or quaternary structure	**(3)**

Question Number	Answer	Additional guidance	Mark
4(c)(i)	A description that makes reference to the following • pre mRNA contains exons and introns (1) • introns are removed and exons are spliced together (to produce a strand of mRNA) (1)	ALLOW reference to introns and exons in the correct context i.e. exons are coding and introns are non-coding regions ALLOW 'joined together' for 'spliced'	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An explanation that makes reference to the following • the {exons can be spliced together in a different order / different exons can be removed } (1) • therefore producing different sequences of amino acids (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	A description that makes reference to the following • it fuses with the cell (surface) membrane of the sperm cell (1) • (digestive) enzymes are released (1) • to break down the zona pellucida (1)	DO NOT ALLOW lysozyme	**(3)**

Question Number	Answer	Mark
5(a)(ii)	The only correct answer is C- mitosis to produce diploid cells *A is incorrect because the division is not meiosis* *B is incorrect because meiosis does not produce diploid cells* *D is incorrect because mitosis does not produce haploid cells*	**(1)**

Question Number	Answer	Mark
5(b)(i)	The only correct answer is C – R *A is not correct because P is the site of the acrosome* *B is not correct because Q is the nucleus* *D is not correct because S is the flagellum*	**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	• correct calculation of difference (1) • correct calculation of % decrease (1)	<u>Example of calculation</u> 37-28=9 (9÷37)x100=24.32 ALLOW 24 24.3 Correct answer without working gains full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)(iii)	An answer that makes reference to two of the following • PCBs reduce (aerobic) respiration (1) • therefore less ATP is produced (1) • sperm need ATP to move the flagellum (1)	ALLOW energy for ATP ALLOW tail for flagellum	**(2)**

Question Number	Answer	Additional guidance	Mark
6(a)	A answer that makes reference to four of the following • succession has occurred (1) • alder and spruce were the first species of tree to colonise (1) • slowest increase in abundance was spruce (1) • (interspecific) competition occurs between the three species (1) • example of resources competed for (1)	IGNORE primary or secondary ALLOW either alder or spruce ALLOW description of increase and decrease of abundance of each species over time ALLOW spruce and hemlock compete with alder / hemlock competes with spruce and alder e.g. water, mineral ions, light, etc.	**(4)**

Question Number	Answer	Additional guidance	Mark
6(b)	An explanation that makes reference to the following • the bare rock was colonised by pioneer species (1) • (these pioneer species) break up the rock (1) • dead plants add {humus / organic matter} (as they decompose) (1) • (eventually trees will be able to grow) as the soil { becomes deeper / can retain more water } (1)	ALLOW algae or lichen	**(3)**

Question Number	Answer	Additional guidance	Mark
6(c)	An explanation that makes reference to the following • (in the early stages of glacial retreat) the soil may lack nitrates (1) • (however) lupin plants can use the { ammonium ions / source of nitrogen } produced by the bacteria (1) • (therefore can) synthesise { amino acids / chlorophyll / nucleic acids / nitrogenous bases } (1)	ALLOW other sources of nitrogen lacking ALLOW produce for synthesise ALLOW protein	**(3)**

Question Number	Answer	Additional guidance	Mark
7(a)(i)	Correct completion of the table n(n-1) 2 56 0 72 6	All figures need to be correct	**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	• correct calculation of N(N-1) (1) • correct calculation of D (1)	<u>Example of calculation</u> N(N-1) =23 x 22 = 506 Σn(n-1) = 136 506 ÷ 136 D = 3.72 ALLOW 3.7 ALLOW ecf from 7(a)(i) Correct answer without working gains full marks	**(2)**

Question Number	Answer	Mark
7(b)(i)	The only correct answer is B the number of different species in one area *A is incorrect because species richness does not measure alleles* *C is incorrect because it is not the number of individuals of one species* *D is incorrect because it is not the number of individuals of one species and it is not different habitats*	**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An answer that makes reference to five of the following • random sampling in each woodland using suitable method of generating co-ordinates (1) • use of a quadrat to sample at least 10 times in each woodland (1) • count the number of different species in each quadrat (1) • take measures to ensure validity of investigation / measure named abiotic variables (1) • for each woodland, calculate { the total number of species present / number of species / given area} (1) • use a suitable statistical test to compare the data from the two woodlands (1)	e.g. random number tables e.g. carry out the investigation at the same time of year / forests in similar locations / same climate /measure temperature/pH e.g. mean and standard deviation for each woodland / t-test ALLOW Mann-Whitney U test DO NOT ALLOW diversity index	**(5)**

Question Number	Answer	Additional guidance	Mark
7(c)	An answer that makes reference to four of the following points • (difference in number of species) not due to temperature and soil moisture content as they are the {same/similar} in the two woodlands (1) • the light intensity is the most likely reason for the greater number of species as it is higher in the deciduous woodland (1) • description of the effect of light intensity on plant growth (1) • the pH of the soil in the coniferous woodland is acidic so this may also reduce the number of species found (1) • only plant species considered and not other organisms (1)	e.g. high light intensity allows a greater rate of photosynthesis / more photosynthesis or plants need to be adapted to low light intensities	**(4)**

Question Number	Answer	Additional guidance	Mark
8(a)	A description that makes reference to three of the following • animals are selected to prevent { breeding between closely related individuals / inbreeding depression } (1) • a stud book is used to { select individuals for mating / keep a record of all breeding events } (1) • exchange of { animals / gametes } between zoos (1)	ALLOW use of studbook to prevent inbreeding	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	• correct calculation of loss of area from 2010 to 2012 (1) • correct calculation of rate with relevant units (1)	Example of calculation 1160 - 700 = 460 (460÷2) x 1000 = 230 000 Ha yr^{-1} ALLOW Ha per year Correct answer without working gains full marks ALLOW ECF(1) eg 1160-680=240000 Ha yr^{-1} (1) 1160-690=235000 Ha yr^{-1} (1) 1160-710=225000 Ha yr^{-1} (1) 1160-720=240000 Ha yr^{-1}(1) 220 000 to 240 000 Ha yr^{-1} with no working gains 1 mark	**(2)**

Question number	Answer	Mark
***8(b)(ii)**	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 which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content Basic information • captive breeding will increase population size • deforestation is reducing the habitat • captive animals will be protected from hunters Evidence of linkages • orangutan numbers are declining and captive breeding will increase population size • as loss of habitat is a major reason for the decline, animals should be released into areas of forest in protected areas • more of the forest needs to be protected to reduce the rate at which habitat is being lost • captive bred animals show behaviour that may make them unable to compete in the wild • loss of habitat would lead to increased competition due to reduced food availability Evidence of sustained scientific reasoning • it is important to restrict passage of disease from humans to the wild population by minimising contact and releasing animals away from wild populations • if deforestation is not reduced – or protected areas increased – there will not be enough habitat left in which to release captive-bred orangutans • judgement on relative importance of captive breeding and habitat protection taking into account rate of deforestation and loss of suitable habitat • releasing animals if there is insufficient habitat could lead to an increased vulnerability to predation and poaching	**(6)**

Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	Captive breeding will increase numbers of orangutans Habitat loss is increasing
Level 2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.	Discussion of benefits of both captive breeding and habitat protection. Separate discussions of habitat loss and captive breeding. Linkages made for each aspect but not compared.
Level 3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.	Conclusion that without habitat protection, captive breeding is limited as there is less suitable habitat in which to release the animals Comparative evaluation of the benefits of habitat protection and captive breeding. Reference made to the data.

Question Number	Answer	Additional guidance	Mark
9(a)	An answer that makes reference to three of the following Similarities • both contain RNA (1) • both have {a (protein) capsid / glycoproteins} (1) Differences • Ebola contains one strand of RNA but HIV contains two strands of RNA (1) • HIV is spherical, Ebola virus is elongated (1)	IGNORE retrovirus ALLOW protein coat ALLOW HIV is icosahedral / Ebola is filamentous ALLOW HIV is round ALLOW HIV has a lipid layer/envelope and Ebola does not (acceptable on basis of diagram provided)	**(3)**

Question Number	Answer	Mark
9(b)(i)	The only correct answer is A artificial active immunity *B is incorrect because the immunity is not passive* *C is incorrect because the immunity is not natural* *D is incorrect because the immunity is not natural or passive*	**(1)**

Question Number	Answer	Additional guidance	Mark
9(b)(ii)	An explanation that makes reference to three of the following • T helper cells bind to { protein / antigen } the APC (1) • (therefore) leading to the production of {active T helper cells / T memory cells} (1) • the T helper cells activate the B cells to { divide / become } cells capable of producing antibodies (1) • The memory cells remain in the body so antibodies can be produced quickly (on re-infection) (1)	ALLOW B cells develop into B effector cells or plasma cells	**(3)**

Question Number	Answer	Additional guidance	Mark
9(c)(i)	A description that makes reference to three of the following • (small groups of) healthy volunteers are given the vaccine to test for side effects (1) • (healthy volunteers) tested for presence of antibodies to the virus (following vaccination) (1) • a group of people at risk of contracting the disease is given the vaccine (1) • the number of people who develop the viral disease (following vaccination) are monitored (1)		**(3)**

Question Number	Answer	Additional guidance	Mark
9(c)(ii)	An answer that makes reference to four of the following • large numbers of people died from the disease (1) • health workers are in close contact with people suffering from the disease (1) • the side effects of the vaccine will not be worse than contracting Ebola(1) • vaccinating immediate family will help to reduce the spread of disease(1) • if health workers were vaccinated they could care for more people (1)	ALLOW disease is (usually) fatal ALLOW health workers and family most likely to be exposed to the virus ALLOW risk from the disease is much greater than the risk from the vaccine	**(4)**

Question Number	Answer	Additional guidance	Mark
10(a)(i)	The only correct answer is C – no correlation *A is incorrect because it is not inverse* *B is incorrect because it is not negative* *D is incorrect because it is not positive*		**(1)**

Question Number	Answer	Additional guidance	Mark
10(a)(ii)	• correct calculation of $\sum(x-\bar{x})^2$(1) • value divided by n-1 (1) • correct calculation of SD (1)	<u>Example of calculation</u> $\sum(x-\bar{x})^2 = 31.49$ ÷9 = 3.499 Answer= (±) 1.87 Correct answer without working gains full marks	**(3)**

Question Number	Answer	Mark
10(b)(i)	The only correct answer is C – polynucleotides and phospholipids *A is incorrect because phosphate is not in cellulose* *B is incorrect because polysaccharides do not contain phosphate* *D is incorrect because phosphate is not in polysaccharides*	**(1)**

Question Number	Answer	Additional guidance	Mark
10(b)(ii)	An explanation that makes reference to three of the following • the stems contain starch or cellulose (1) • enzymes are { secreted / released } by the microorganisms (1) • which break down the glycosidic bonds (1) • which releases glucose that is used by the microorganisms in respiration (1)	ALLOW lignin ALLOW enzymes from microorganisms digest (starch / cellulose)	**(3)**

Question Number	Answer	
***10(c) expert**	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 which is indicated as relevant. Additional content included in the response must be scientific and relevant. Basic information • measure growth of plants e.g. length of leaves, mass of plants, etc. • grow wheat seedlings with either biological farming product or chemical fertiliser, several plants in each. • Control of one relevant abiotic variable e.g. temperature, soil and light. Evidence of linkages • measure growth of plants at standardised time intervals. • measure after growing the plants for a sensible period of time- reference to rate of growth • grow wheat seedlings from the same batch of seed. • same mass / volume / concentration of chemical fertiliser and biological farming product • plants grown in standardised conditions, e.g light / humidity / temperature Evidence of sustained scientific reasoning • compare health of plants e.g. development of disease • calculate mean and SD to compare the results • statistical comparison of results • use of sterilised soil so that there are no fungi in the soil for the chemical fertiliser • analyse the soil at the end of the experiment to determine moisture and mineral content	**(6)**

Level	Marks		Additional Guidance ?
0	0	No awardable content	
1	1-2	An explanation of how the investigation should be modified may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.	Use of chemical fertiliser and biological farming product A number of seedlings used Growth of plants measured Control of one abiotic variable
2	3-4	An explanation of how the investigation should be modified will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.	Description of how growth will be measured eg height of plant, number of leaves Measured at regular intervals/after a specific time interval Wheat seedlings from the same batch of seeds Explanation of control of abiotic variables Same volume/concentration of chemical fertiliser and biological farming product
3	5-6	An explanation of how the investigation should be modified is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.	Named statistical analysis of results Consideration of health of plants/soil analysis

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