Pearson Edexcel

Mark Scheme (Results)

Summer 2025

Pearson Edexcel A Level GCE
In Biology A Salters – Nuffield (9BN0)
Paper 01: The Natural Environment and Species Survive

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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)	A description that makes reference to the following: • fall in (body) temperature (1) • rigor mortis (1) • autolysis / bloating / fall in pH / discolouration of skin (1)	IGNORE any explanations ALLOW algor mortis / cooling ALLOW increase in temperature if qualified DO NOT ALLOW 'increase or decrease' without giving reason for possible increase ALLOW stiffening of the muscles IGNORE contraction of the muscles ALLOW description of autolysis as break down of the body by its own enzymes ALLOW livor mortis / hypostasis / blood pooling ALLOW ref to a named colour for discoloration	(3)

Question Number	Answer	Mark
1(b)(i)	The only correct answer is B *bacteria, flies, beetles* • A is incorrect because beetles do not colonise before flies • C is incorrect because fungi are not the first decomposers • D is incorrect because beetles do not colonise before flies	(1)

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation that makes reference to three of the following: • (an increase in temperature) will increase the rate of decomposition / increase rate that bacteria multiply (1) • enzymes will have more kinetic energy (1) • therefore {more frequent collisions between enzyme and substrate / enzyme-substrate complexes are formed more frequently} (1) • {at high temperatures / above the optimum temperature} the enzymes may denature and the rate decreases (1)	ALLOW KE for kinetic energy ALLOW more collisions / more enzyme substrate complexes formed ALLOW increased rate of collisions ALLOW ES for enzyme-substrate	(3)

Question Number	Answer	Mark
2(a)	The only correct answer is D *glucose molecules joined by glycosidic bonds* A is incorrect because starch does not contain amino acids B is incorrect because starch does not contain amino acids or peptide bonds C is incorrect because starch does not contain ester bonds	(1)

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to the following: • {global warming / climate change} can lead to {drought / high temperatures} (1) • (enset) {will survive / can grow / can provide food} and be available for future generations (1)	IGNORE an increase in average of Earth's surface IGNORE will not become extinct	(2)

Question Number	Answer	Additional guidance	Mark
2(c)	A description that makes reference to the following: • use fibres of the same {length/width} (1) • {add masses/use a force meter} until the fibre breaks (1) • repeats to calculate mean (1) • divide the force to break the fibre by the cross-sectional area (to calculate tensile strength) (1)	ALLOW weight if there is a reference to grams ALLOW weight as alternative to force	(4)

Question Number	Answer	Additional guidance	Mark
3(a)(i)	A description that makes reference to two of the following: • proteins are synthesised (1) • organelles are formed (1) • increase in size of {cell / cell membrane} / an increase in cytoplasm (1) • a relevant named function of the cell (1)	 e.g. enzymes ALLOW organelles duplicate ALLOW named examples ALLOW cell grows in size e.g. respiration, secretion, photosynthesis, contraction	(2)

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	An explanation that makes reference to the following: • the DNA increases because replication is taking place (1) • the quantity of DNA doubles (1) • the DNA halves when {cell division/cytokinesis} takes place (1)	IGNORE incorrect references to stages of cell cycle ALLOW DNA duplicated	(3)

Question Number	Answer	Mark
3(b)	The only correct answer is A *7* B is incorrect because 10 includes cells that are not in anaphase or metaphase C is incorrect because 21 includes cells that are not in anaphase or metaphase D is incorrect because 28 includes cells that are not in anaphase or metaphase	(1)

Question Number	Answer	Mark
3(c)(i)	The only correct answer is C *stem cells that can differentiate into some, but not all, cell types* A is incorrect because stem cells in the bone marrow do not just produce red blood cells B is incorrect because bone marrow stem cells cannot differentiate into all cell types D is incorrect because bone marrow cells are not totipotent	(1)

Question Number	Answer	Additional guidance	Mark
3(c)(ii)	A description that makes reference to two of the following: • {polypeptide / chain of amino acids} folded (1) • held together by {ionic / hydrogen / disulfide} bonds (1) • (bonds) between the R groups (1) • hydrophilic R groups arranged on the outside / hydrophobic R groups on the inside (1)	IGNORE ref to tertiary and quaternary structure throughout ALLOW 3D shape / spherical for folded ALLOW primary structure for polypeptide IGNORE {peptide / polypeptide} bonds ALLOW polar / non-polar for hydrophilic / hydrophobic	(2)

Question Number	Answer	Mark
4(a)(i)	The only correct answer is C *a group of similar organisms that interbreed to produce fertile offspring* A is incorrect because many different species live in the same habitat B is incorrect because members of the same species interbreed D is incorrect because offspring of the same species are fertile	(1)

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	A description that makes reference to three of the following:		
	• correct description of gel electrophoresis process (1)	e.g. putting samples into wells of gel, use of buffer, passing a current through the gel, use of dye to make bands visible, use of agarose gel	
	• analysis of DNA from both African and Asian cheetahs (1)	ALLOW use of DNA from both (cheetahs)	
	• compare the position of the bands (1)	ALLOW compare {distance bands have travelled / location of the bands / spacing of the bands}	
	• if the bands are similar, they are closely related (1)	ALLOW the more similar the bands, the more closely related	(3)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	An explanation that makes reference to three of the following: • (the two populations) will have different gene pools (1) • (therefore) genetic diversity is {maintained / increased} (1) • the new population is more likely to have alleles to adapt to a change in the environment (1) • it reduces inbreeding depression (1)	ALLOW introduces new alleles to the population ALLOW increases {size of gene pool / number of different alleles} ALLOW more chance of advantageous alleles ALLOW introduced cheetahs may have advantageous alleles ALLOW description of inbreeding depression e.g. breeding between siblings increases chance of genetic {condition / disease}	(3)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	An answer that makes reference to two of the following: • (animals born in the wild) know how to hunt (1) • therefore they will not starve (1) • leading to an increase in population (1)	ALLOW learning how to escape predators IGNORE reference to competing with other predators ALLOW less likely to be {killed /eaten} by predators	(2)

Question Number	Answer	Additional guidance	Mark
5(a)	A description that makes reference to the following: • phospholipid bilayer (1) • description of location of proteins in the membrane (1) • example of one other molecule present (1)	 e.g. spanning the membrane / extrinsic / intrinsic / embedded / transmembrane / peripheral / integral e.g. glycolipids / glycoproteins / cholesterol	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An explanation that makes reference to two of the following: • by osmosis (1) • because water molecules move from (an area of) low solute concentration to (an area of) high solute concentration (1) • through a partially permeable membrane (1)	 ALLOW correct reference to water concentration or from higher to lower water potential ALLOW through aquaporins or phospholipid bilayer ALLOW selectively permeable IGNORE semi-permeable membrane	(2)

Question Number	Answer	Mark
5(b)(ii)	The only correct answer is A *active transport through carrier proteins using energy from ATP* B is incorrect because active transport does not use channel proteins C is incorrect because mineral ions are not taken up by endocytosis D is incorrect because facilitated diffusion does not take place against the concentration gradient	(1)

Question Number	Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to four of the following • (water is transported through the stem) in the xylem (1) • walls contain lignin (1) • lignin provides waterproofing (1) • {little / less / reduced} resistance to water flow because there is no {cytoplasm / end walls} (1) • pits in the walls to allow lateral movement (of water) (1)	DO NOT ALLOW if both xylem and phloem referred to in context of just water ALLOW lignin provides strength ALLOW lignin withstands (water) pressure ALLOW {hollow / no organelles} instead of no cytoplasm	(4)

Question Number	Answer	Mark
6(a)	The only correct answer is D *2 and 3* A is incorrect because 1 is incorrect – acidic conditions on the skin that are the optimum for bacterial enzymes will not prevent entry of pathogens B is incorrect because 1 is incorrect – acidic conditions on the skin that are the optimum for bacterial enzymes will not prevent entry of pathogens C is incorrect because 1 is incorrect – acidic conditions on the skin that are the optimum for bacterial enzymes will not prevent entry of pathogens	(1)

Question Number	Answer	Additional guidance	Mark
6(b)	A description that makes reference to two of the following: • {hand washing stations / doctors and nurses to wash hands between patients} (1) • {doctors / nurses} do not wear {ties / watches / long sleeves} (1) • {beds / bedding} disinfected between patients (1) • {isolating / quarantining} patients (1)	ALLOW hand washing / reference to wearing {gloves / masks / PPE} / use of hand sanitizer or alcohol gel ALLOW {sterilisation of equipment / disinfection of surfaces} (between patients)	(2)

Question Number	Answer	Additional guidance	Mark
6(c)(i)	An explanation that makes reference to four of the following: • prepare agar plates spread with {antibiotic resistant bacteria / MRSA} (1) • use same concentrations of Seraticin and Reutericyclin (1) • place the antibiotic {in a well / on a (filter paper) disc} (1) • incubate {at a stated temperature / for a stated period of time} (1) • compare the {diameter / area} of the zone of inhibition (1)	ALLOW a bacterial lawn with agar / agar seeded with bacteria / agar spread with bacteria ALLOW same concentration of both antibiotics e.g. 20-40^{o}C OR 24-48 hours ALLOW one with larger {area / diameter} of zone of inhibition is most effective	(4)

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	An answer that makes reference to three of the following: Similarities • (peptidoglycan and cellulose) both have glycosidic bonds (1) • (peptidoglycan and cellulose) both have cross links between chains (1) Differences • peptidoglycan contains amino acids but cellulose does not (1) • the cross links in cellulose are hydrogen bonds whereas the cross links in peptidoglycan are peptide bonds (1)	ALLOW both are polymers of sugars ALLOW peptidoglycan contains nitrogen but cellulose does not	(3)

Question Number	Answer	Additional guidance	Mark
7(a)(i)	A description that makes reference to three of the following: • enzymes released by lysosomes (of the egg cell) / cortical granules release contents (1) • cause the zona pellucida to {thicken / harden} (1) • the sperm nucleus enters the {ovum / egg cell} (1) • sperm cell nucleus fuses with egg cell nucleus / the two nuclei fuse (1)	ALLOW cortical reaction IGNORE release of cortical granules ALLOW formation of fertilisation membrane ALLOW egg cell nucleus completes meiosis / zygote undergoes mitosis	(3)

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	A description that makes reference to two of the following: • a chemical {signal / stimulus} activates specific genes (1) • activated genes {transcribed / produce mRNA} (1) • this (mRNA) is translated to produce proteins which determine the {structure / function} of the cell (1)	ALLOW reference to genes being deactivated ALLOW transcription factor for {chemical signal / stimulus}	(2)

Question Number	Answer	Additional guidance	Mark
7(b)(i)	<table><tr><th>Year</th><th>Number of breeding females</th><th>Number of female offspring</th><th>Total number of offspring</th></tr><tr><td>1</td><td>1</td><td>6</td><td>12</td></tr><tr><td>2</td><td>1 + 6 = 7</td><td>42</td><td>84</td></tr><tr><td>3</td><td>7 + 42 = 49</td><td>294</td><td>588</td></tr><tr><td>4</td><td>343</td><td>2058</td><td>4116</td></tr></table> • two figures in Year 4 correct for 1 mark • all three figures correct for 2 marks		(2)

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that makes reference to four of the following: • due to genetic variation some (females) have the mutation / mutation (in some females) leads to genetic variation (1) • females with the mutation will reproduce at a younger age (1) • (advantage of breeding early being that) more offspring can be produced (1) • (because they mate earlier) more of the {offspring / population} will inherit the allele (1) • leading to an increase in frequency of the allele (1)	ALLOW it will pass on the allele to more offspring	(4)

Question Number	Answer	Additional guidance	Mark
8(a)(i)	• correct figures read from the graph (1) • correct calculation of percentage decrease to three significant figures (1)	<u>Example of calculation</u> 330 000 and 390 000 60 000 ÷ 330 000 = 18.1818 = 18.2% (3sf) ALLOW one mark for 18.18 Correct answer with no working gains full marks.	(2)

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	• 180 000 / 170 000 (in 2029)	160 000 to 170 000 from 2009 to 2019. Therefore, increase of 10000 per year to give 180 000 OR 170 000 (if no increase) If explanation given, must relate correctly to the value given	(1)

Question Number	Answer	Mark
8(b)	The only correct answer is B *a double blind trial on a large number of people with the condition* A is incorrect because phase III takes place on patients with the condition C is incorrect because testing for side effects is phase I D is incorrect because animal testing is not part of clinical trials	(1)

Question Number	Answer	Additional guidance	Mark
8(c)(i)	An explanation that makes reference to three of the following: • strand of mRNA has sequence of bases for the {antigen / protein} (1) • mRNA attaches to ribosome (of the host cell or macrophage) (1) • mRNA is translated (on ribosome) (1) • (therefore) tRNA with anticodon binding to codon on mRNA bring specific amino acids (1) • peptide bonds form between amino acids to form {protein / polypeptide / antigen} (1)		(3)

Question Number	Answer
*8(c)(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 **Biological knowledge applied to the context** • All types of immunotherapy activate the immune system to destroy cancer cells • All target the protein produced by the cancer cell and presented on its surface **Details of how each type of immunotherapy activates the immune system:** • Monoclonal antibodies - attach to antigens on surface of cancer cells in the same way as antibodies produced by the body – method of identifying cell (for destruction) e.g. agglutination, opsonisation • Checkpoint inhibitors-allow activation of T cells – bind to receptors on cancer cells and release cytokines, activating B cells and or T killer cells • mRNA vaccine-cell becomes APC- description of effects on all parts of the immune response in terms of activating immune response e.g. cytokine release by T helper cells, B cell activation, antibody production **Consequences** • cancer cells destroyed by phagocytosis, apoptosis or action of T killer cells • cancer cells cannot divide or spread • immunotherapy-targets body's own immune system so there should be fewer side effects (than chemotherapy) • more specific – targets cancer cells / results in less damage to other body tissues (so fewer side effects) (6)

Level	Marks		Additional Guidance
0	0	No awardable content	
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.	Activation of immune system generally described OR basic biological knowledge shown in describing how at least one of the methods affects cancer cells Consequences – e.g. cancer cells destroyed by immune system/ cancer does not spread
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.	Adequate biological knowledge and some links to context – activation of immune system Correct link made between at least two of the methods described and how the cancer cells will be destroyed. Consequences – cancer cells prevented from dividing and spreading. Cancer cells destroyed by immune system – e.g. apoptosis, killer T cells
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.	Comprehensive biological knowledge – activation of immune system – e.g. reference to two of: cytokines/ phagocytosis / apoptosis Correct links made between all three of the methods described and how the immune systems is activated to destroy the cancer cells Consequences –Fewer side effects than with chemotherapy or radiotherapy as using the body's own immune system. Targeted to cancer cells reduces damage to other body tissues.

Question Number	Answer	Additional guidance	Mark
9(a)	A description that makes reference to the following: • light independent reactions (of photosynthesis) / Calvin cycle (1) • (carbon dioxide) {combines with / fixes to} RuBP (1) • (carbon fixation) catalysed by the enzyme RUBISCO (1) • leading to the formation of {GP / GALP / organic molecules / glucose} (1)	ALLOW G3P, PGA, PG, TP, triose phosphate	(4)

Question Number	Answer	Additional guidance	Mark
9(b)	• correct calculation of the volume of the trunk (1) • multiply trunk volume by value for density (1) • correct value calculated and given to one decimal place (1)	<u>Example of calculation</u> $3.0 \times (0.6)^2 \times \pi =$ 3.392920065876976697539654853941 9 (m^3) $3.393 \times 720 =$ 2,442.902447431423222228551494838 1 =1221.5 ALLOW 1220.4 for 2 marks ALLOW 4885.8 for 2 marks Correct answer with no working gains full marks	(3)

Question Number	Answer	Additional guidance	Mark
9(c)	An answer that makes reference to three of the following: • the same size tree will store more carbon (1) • (therefore) causing greater reduction in {carbon dioxide / greenhouse gases} in the atmosphere (1) • (more species of plant growing under oak) will lead to more biodiversity (1) • more plant species will {increase variety of animal species / provide more sources of food for consumers / provide more habitats} (1)	ALLOW converse for Scots pine ALLOW oak stores more carbon ALLOW oak acts as larger carbon sinks	(3)

Question Number	Answer	Additional guidance	Mark
9(d)	An answer that makes reference to two of the following: • (microorganisms as) decomposers {break down / digest} organic matter (1) • carbon (from the products of digestion) assimilated into the microorganisms (1) • (some carbon used to) produce carbon dioxide in respiration (of microorganisms / decomposers) (1)	ALLOW biological molecules ALLOW carbon used to produce (named) organic molecules in the soil	(2)

Question Number	Answer	Mark
10(a)(i)	The only correct answer is D *starch is broken down by hydrolysis reactions to release glucose for respiration* A is incorrect because starch is not broken down by condensation B is incorrect because breakdown of starch does not release amino acids C is incorrect because glucose from starch is not used in photosynthesis	(1)

Question Number	Answer	Mark
10(a)(ii)	The only correct answer is B *a sequence of amino acids joined by peptide bonds* A is incorrect because amino acids are not joined by ester bonds C is incorrect because a polypeptide does not contain fatty acids or ester bonds D is incorrect because a polypeptide does not contain mononucleotides or phosphodiester bonds	(1)

Question Number	Answer	Additional guidance	Mark
10(b)(i)	• correct ratio of Spring to Autumn germination at 2500m (1) • correct ratio of Spring to Autumn germination at 2500m plus 4°C (1)	Example of calculation 3.75:1 (from 60 and 16 on graph) 0.089:1 (from 8 and 90 on graph) ALLOW 0.09:1 Correct answer with no working gains full marks	(2)

Question Number	Answer	Additional guidance	Mark
10(b)(ii)	An answer that makes reference to two of the following • reduced survival / decline in population (1) • as the temperature increases there will be more seeds germinating in the {autumn / colder months} (1) • they may not be able to survive the cold winter temperatures / unable to grow in the winter (1) • plant species cannot migrate any higher in altitude (1)	ALLOW seeds germinating in the {autumn / colder months} IGNORE better germination ALLOW idea of seeds being {transported / dispersed} further up the mountain to where it is cooler	(2)

Question Number	Answer	Mark
10(c)	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 **Generalised comments** • Seeds of plants germinated / at the same stage of germination • Same mass of seeds for both species • Same volume / concentration of amylase extract added to starch of the same concentration • Suitable range of temperatures for the reaction, NOT for germination • Use of water bath to control temperature for the reaction, NOT for germination **Explanation of how investigation modified** • Stated temperature values up to 50°C for the reaction, NOT for germination • Equilibrating both solutions separately before mixing • Use of pH buffer to maintain pH • Sensible time frame for initial rate of reaction (up to 10 minutes) • Method to determine break down of starch e.g. testing with iodine • Identification of end point • Repeat at each temperature to calculate mean initial rate **Scientific reasoning linked to determination of Q_{10}** • Rate of reaction calculated for each temperature • Graph plotted to support calculation of Q_{10}– temperature on x-axis, initial rate of reaction on y-axis • Calculation of Q_{10} by dividing rate at T+10 °C by rate at T °C	(6)

Level	Marks	
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.
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.
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.

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