L-Università ta' Malta

MATSEC
Examinations Board

Examiners' Report
AM Biology

First Session 2025

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A. STATISTICAL INFORMATION

The total number of candidates who registered to sit for Biology was 523, which is 2 candidates less than in 2024. Table 1 shows the distribution of grades for the First 2025 session examination.

GRADE	A	B	C	D	E	F	ABS	TOTAL
NUMBER	53	102	119	76	69	77	27	523
% OF TOTAL	10.1	19.5	22.8	14.7	13.0	14.7	5.2	100

Table 1: Distribution of grades for AM Biology 2025, Main Session

B. GENERAL REMARKS

The examination consisted of four papers. Paper I contained 8 compulsory structured questions. Paper II consisted of 3 sections, namely: section A – a compulsory comprehension exercise; section B – 4 essay type questions from which candidates were asked to choose 2; and section C – 2 structured questions from which candidates selected 1. Paper III consisted of 3 compulsory structured questions based on practical work, while Paper IV was a hands-on practical examination containing 1 compulsory question.

As a general observation, most candidates demonstrated a good understanding of the biology topics covered in the exam. However, many responses lacked the expected detail in explanations. Questions requiring simple recall were generally answered satisfactorily, but those demanding extended reasoning or higher-order skills were answered poorly. Some responses included material that did not address the question directly. In other responses, essential details and technical terms were omitted, or the question was rephrased instead of providing a proper answer. Explanatory responses often lacked logical sequence, further reducing their overall quality.

Inconsistencies were observed regarding the use of pen and pencil in diagrams. Ink was often incorrectly used for labelling and in some cases, even for drawing the diagrams themselves. To remove any uncertainty for candidates, the Examination Panel would like to clarify the rules on pen and pencil usage during the exam:

- all written text must be completed in pen, including labels when annotating a printed image;
- any diagrams or graphs drawn by the candidates, together with their labels, must be drawn or written with a sharp pencil to ensure clarity;
- drawings should not be small and should occupy at least half of the available space;
- lines must be clear and continuous;
- shading should be avoided;
- colouring is not permitted;
- all diagrams or graphs must include a title.

C. GENERAL COMMENTS

Paper I

Question 1 – Biomolecules

a. Many candidates answered this correctly, but a good number represented the molecule incorrectly with common errors such as representing the amino group with three hydrogens, and the carboxyl group with the oxygen and OH linked to the central carbon instead of a whole COOH. Some responses included a nucleotide or a completely unknown structure.
b. Candidates generally recognised the hydrophobic nature of the R group but the attempt to relate this to its interaction with water was poor.
c. Most candidates answered this question in very general terms, discussing secondary, tertiary and quaternary structures. When describing shape, many simply repeated the wording of the question rather than giving a meaningful explanation.
d. i. In general, this question was answered correctly with ionic bonds, H-bonds and hydrophobic interactions mentioned the most. Many also mentioned disulphide bonds.
   ii. Many candidates performed adequately but some responses were too short. pH or temperature on their own were not awarded full marks. Some responses just mentioned strong acids, forgetting that enzymes working in the stomach have their optimum pH which is very low. Enzymes in the small intestine work at a higher pH so mentioning high pH only is not enough.

Question 2– Classification

In general candidates gained most of the marks from examples rather than discussing the characteristics mentioned in the question.

a. The most common error was that chelicerae was associated with crabs or insects and not to modified mouth parts.
b. Many candidates referred to echinoderms as being sessile to justify their radial symmetry. Responses indicate that several candidates were not familiar with their mode of life.
c. Incorrect responses included misinformation that oligochaetes live in soil, or candidates who were aware that these organisms live in soil but were not aware what they feed on. Several candidates misunderstood the question and thought that oligochaetes had a pronounced head, indicating poor knowledge of 'reduced selective pressure'. Correct responses very often referred to the dark habitat as lacking the need for sensory structures concentrated in the head but very few referred to streamlining the body.
d. Responses indicate that candidates were familiar with the two stages and examples of cnidarians. Some responses were confusing, first referring to polyp and medusa stages, then describing competition between Hydra and jellyfish while incorrectly calling this intraspecific competition.
e. Responses indicate good knowledge that Platyhelminthes were parasitic. However, responses indicate poor knowledge about the role of the hooks, with some mentioning that they are structures used for feeding purposes.

Question 3– Digestive system

a. i. Most candidates performed adequately.
   ii. While many commented correctly on villi and microvilli in the ileum mucosa to increase surface area for absorption, they did not give the relevant information regarding the buccal cavity. A good number of candidates focused on the secretory role rather than relating structure to function.
b. i. In general, the performance was poor. Many referred to positive feedback due to gastrin causing an increase in HCl, ignoring the fact that the question was on the control of gastrin secretion in the stomach.
   ii. General performance was adequate.
c. Very few candidates performed adequately.
d. About half of the candidates gave an account on the function of bile but did not give an answer which specifically targets the question asked, namely why fat digestion is difficult if one has a blocked bile duct.

Question 4– Nervous system

a. In general, this part was answered correctly.
b. i. Responses indicate lack of coherence and logical sequence. Very few candidates referred to the steeper sodium ion concentration gradients in higher seawater percentages, or related this to sodium ion movement and consequent changes in membrane potential. Candidates also frequently referred to a higher sodium ion level giving rise to larger action potentials not distinguishing between membrane and action potentials.
   ii. In general responses were correct, though some incorrectly referred to myelin which was not relevant to the question.
   iii. There were several acceptable answers though very few went into the detail on the effect of temperature on enzyme activity and ion channel kinetics. Many responses were very poor, just explaining what endothermic and ectothermic means.
   iv. Several responses focused on myelin but not on what happens when it is lost. Some responses only mentioned slowing down of impulses.
   v. In general, this question was answered correctly.

Question 5– Function of the liver

a. Around half of the responses were correct. The other responses either confused the processes or provided completely unrelated processes.
b. Some answered 'hepatic artery'. While this vessel is not a major source of glucose transport, the response was accepted given the wording of the question, particularly as it was almost always mentioned alongside the hepatic portal vein.
c. i. While the majority answered this question correctly, several candidates did not realise that the carbohydrate-rich meal was consumed before the marathon, meaning glycogen reserves were being formed, not used up.
   ii. Most candidates answered this question correctly by explaining that the runner needs energy, so glycogen is broken down into glucose.

iii. Most responses did not identify that glycogen reserves had been depleted and that the body now needs to produce glucose from non-carbohydrate sources such as pyruvate. Some responses incorrectly explained that, since it is the end of the race, no more glucose is needed.

d. Most candidates correctly identified two functions of the liver. Incorrect responses included vague responses such as 'lipid metabolism' and 'protein metabolism'.

Question 6– DNA organisation and the genetic code

a. Most candidates correctly explained that histones are proteins around which DNA winds. However, only a small percentage noted that this arrangement compacts the DNA.
b. i. Most of the candidates answered this question correctly. Common errors included terms such as 'specific' and 'degenerate'.
   ii. Most candidates answered this question correctly.
c. Most candidates correctly concluded that the gene or protein would not function. However, only a small percentage explained that translation would either not occur or would occur at a different point in the sequence, altering protein structure and function.
d. Around half of the candidates correctly explained that different codons can code for the same amino acid, resulting in no change to protein structure or function. The most common error was stating that DNA is proofread and any 'mistakes' are automatically corrected.
e. Most candidates answered this question correctly.
f. A good number of candidates answered this question correctly. Most errors included switching the answers or describing the point mutation rather than identifying it.
g. Most candidates correctly identified that example 1 leads to a frameshift. Many also explained how this affects the reading of codons. However, only a small percentage described the impact on gene expression, specifically the production of a different amino acid sequence or a premature stop codon, possibly resulting in a non-functional protein.

Question 7– Biotechnology

a. i. Many candidates recognised that EcoRI would not function properly. However only a few candidates explained that EcoRI would not recognise the restriction site and therefore would not cleave the DNA.
   ii. The majority of candidates focused on the benefits of having multiple restriction sites. However, few explained that if the restriction enzyme produces multiple fragments, it may be difficult to ligate the plasmid with the correct one.
   iii. Most candidates correctly explained the role of complementary base pairing made possible by single-stranded sticky ends.
b. The majority of candidates correctly explained that DNA ligase joins the plasmid and donor DNA. However, only a small percentage mentioned that this involves the formation of phosphodiester bonds between the two.
c. Many candidates correctly listed the steps involved in PCR. The most common error was not mentioning that these steps are repeated.
d. Most candidates answered this question correctly.

Question 8– Environmental biology

a. i. The majority of candidates answered this question correctly. Marks were typically missed when the pyramid's shape was correct but the number of individuals at each trophic level was not specified.
   ii. The majority of candidates correctly performed the calculation and sketched the pyramid of biomass.
   iii. Many candidates answered correctly. A common error was applying the 10% rule to the first trophic level instead of starting with 10,000 kcal and decreasing up through the pyramid.
b. i. The majority answered this one correctly.
   ii. The majority of candidates correctly explained that energy decreases when moving from one trophic level to another and gave examples of energy loss.
c. i. About half of the candidates answered this question correctly. Common errors included stating that nitrogen-fixing bacteria release nitrogen into the air or giving vague answers about nutrient cycling without detailing specific roles in the nitrogen cycle.
   ii. The majority of candidates answered correctly. Common incorrect responses included naming molecules such as 'ammonia', 'nitrates' and 'nitrites', which are part of the nitrogen cycle but are not classified as biomolecules.

Paper II

Question 1 – Comprehension

As a general comment, several candidates demonstrated that their command of English was very poor. For example, many could not correctly write the terms 'predator' and 'prey', indicating gaps in literacy skills that affected their scientific expression. Candidates also confused inbreeding with interbreeding, leading to inaccurate responses for parts (c), (e), and (f). Additionally, concepts related to global warming were among those with the most misconceptions.

a. Though most candidates fared well in this question, many were unable to explain the actual benefit of being camouflaged.
b. The majority of candidates were unable to properly address this question as few responses linked the rate of reproduction with increased chance of gene mutation.
c. Most attempts linked the notion of decreasing habitable area increasing the chances of inbreeding.
d. Many candidates' attempt to provide a justification as to why reduction in genetic diversity is a negative consequence, was poor. A link to reduced heterozygosity was expected.
e. Most accounts were able to properly explain why habitat fragmentation and inbreeding led to an increase in incidence of the melanistic gene but very few accounts properly justified how the repetition of wildfires contributed to this phenomenon.
f. Even though the answer to this question was clearly provided in line 22 as 'isolated populations' the vast majority of candidates did not answer this question correctly.
g. Most candidates provided a clear explanation of how allopatric speciation occurs.
h. Most answers provided were correct.

i. Most candidates answered this question incorrectly.
j. Many candidates' attempt to define global warming was inadequate and frequently synonymized the notion with ozone depletion.
k. Most candidates provided a good example and/or reason of how sea snakes in New Caledonia benefit from the questioned phenomenon.
l. Human induced threats were mostly correctly identified.

Section B: Essays

Question 1– Plant cell and animal cell (chosen by 62% of the candidates)

This essay was popular amongst candidates. Most essays did not reach the expected level, with some essays being characterised by phrases such as the mitochondrion being "the powerhouse of the cell", and the nucleus being "the brain of the cell". In most essays, differences between plant and animal cells were limited to the presence of cell walls, chloroplasts and a large central vacuole in plant cells.

A number of common misconceptions emerged:

- endoplasmic reticula and golgi apparatus are found in animal cells only;
- mitochondria are lacking in plant cells with chloroplasts replacing their function.

Some essays further added that ATP generated by the light dependent reactions is used for metabolic reactions rather than channelled for use in the light independent reactions. Some essays also incorrectly stated that plants only respire during the night.

Although the majority of essays took a comparative approach, a considerable number of responses described the animal cell first, followed by the plant cell, failing to engage in direct comparison or providing only a brief summary of similarities and differences. Biological drawings were included in most essays. In many cases, however, the drawings were untitled, often untidy and very small. The use of pen was also common, despite the requirement that diagrams should be drawn in pencil.

Question 2– Population growth and size (chosen by 24% of the candidates)

Many replies were limited to a list of density-dependent and density-independent factors. Few essays discussed the impacts of these factors on population growth and size. In their discussion, some responses correctly included that density-dependent factors prevent populations from growing beyond the carrying capacity of the environment. Some essays discussed that density-independent factors can drastically alter the ecosystem's balance. Some essays correctly related density-dependent factors to a sigmoid population growth curve and density-independent factors to a boom and bust population growth curve. However, in most of the latter cases, there was no discussion on how the factors affect population growth and size, only a description of the different phases of the growth curves.

Question 3– Innate immune system (chosen by 64% of the candidates)

This question on the immune system was popular amongst candidates. Most responses showed a good understanding of the first and second line of defence. When describing the first line of defence, some incorrect terms like 'lysosomes', rather than 'lysozymes', and 'microvilli' or 'hairs' rather than 'cilia' were frequently encountered. When discussing blood clotting, most responses included the conversion of fibrinogen to fibrin but overlooked the role of platelets in blood clot formation. Furthermore, very few responses included that there is vasoconstriction to reduce initial blood loss. A common misconception was that natural killer cells directly target the pathogen rather than acting on virus infected cells or cancer cells.

Question 4– Circulation in animals (chosen by 50% of the candidates)

The responses to the question on mass flow systems showed a common misinterpretation, with many answers focusing on gaseous exchange rather than the circulatory system. A significant number of replies discussed respiratory mechanisms, such as the tracheal system in insects, gills in fish, and lungs in mammals, instead of addressing the transport of fluids driven by pressure differences. Some answers combined both circulatory and gaseous exchange systems. Most responses that focused on circulatory systems correctly stated that insects have an open circulatory system, fish have a single, closed circulatory system, and mammals have a double circulatory system and focused on differences in pressure in these three systems.

Section C: Structured Essays

Question 1(chosen by 55% of the candidates)

a. Most accounts provided a detailed account of the mechanics of circular vs longitudinal muscles and how their antagonistic nature enables locomotion in annelids. Accounts that were unable to clearly denote the type of musculature and types of body movements were not deemed sufficient to earn the full marks.
b. Though most candidates knew what the purpose of the exoskeleton is, many did not attribute its role in locomotion. Candidates were also expected to describe how flexor and extensor muscles work with the exoskeleton to bring about locomotion.
c. Only a handful of accounts properly addressed this question. Many accounts denoted how sarcomeres function, whereas the requested information pertained to the function of tendons to bring about locomotion.
d. Some of the accounts appropriately described the sequence observed during a cross bridge cycle and attributed how oxygen is necessary for such a cycle. The remainder of accounts focused on aerobic vs anaerobic respiration which was not within the scope of this question.
e. Candidates addressed this statement quite well as many were able to contrast compact with spongy bone. Some accounts focused more on compact bone histology and provided less information on spongy bone.

Question 2 (chosen by 45% of the candidates)

a. In general, this was the most well attempted question where candidates demonstrated good command of meiotic division knowledge. Though some confused the events of random alignment with random assortment, most attempts were awarded full marks.
b. Most accounts used examples seen in plants rather than those observed in humans.
c. Several answers properly addressed this statement and very few candidates were unable to link the events instigated by the hormones in question. Only a small number of candidates provided inaccurate accounts regarding the effects of FSH and LH in spermatogenesis.
d. A small number of candidates were able to determine that HCG is produced by the developing placenta and clearly denoted its site of production. Most accounts did supply a reason why progesterone isn't the hormone of choice and gave a good comparative account.
e. Only a few accounts properly addressed this question. Many attributed this phenomenon to sex-linked attributes forgetting that mitochondrial genome is independent of the nuclear genome. Relatively few accounts linked this phenomenon with the events that occur during the acrosome reaction and even fewer accounts explained why mitochondrial DNA is maternally inherited.

Paper III

Question 1– Plants and floral structures.

a. Most candidates correctly identified the bryophytes; however, there was some confusion regarding the identification of the other images. Also, some candidates used classification groupings different from those suggested in the syllabus, such as the use of other terms rather than 'Polypodiophyta' when referring to ferns.
b. i. Some candidates confused specific terminology (here mixing up 'monoecious' and 'dioecious'). Nevertheless, in most cases, the accompanying explanations aligned with the images and demonstrated a correct understanding.
   ii. The response here was similar to part (i), confusing the terms 'zygomorphic' with 'actinomorphic'.
   iii. A good number of candidates did not relate the flowering parts to the plant being a dicot.
   iv. Most candidates got most of the floral formula correct.

Question 2– Leaf modifications

a. i. The palisade parenchyma and aerenchyma were generally correctly identified. However, the upper and lower epidermis were rarely labelled accurately.
   ii. Most candidates demonstrated a clear understanding of the leaf adaptations associated with the structures in question.
b. i. Most candidates were able to accurately label the diagram.
   ii. Most candidates demonstrated a clear understanding of the leaf adaptations associated with the structures in question and provided well-reasoned explanations.
c. i. Most candidates got this one correct, including the explanation.

ii. A good number of candidates provided incorrect answers.
iii. Most candidates were able to interpret the results presented very well.
iv. Most candidates were able to elaborate on the results by providing a clear interpretation.
v. Several candidates did not provide a correct answer.

Question 3– Inheritance

a. i. Most candidates got the genotypes of the parents correct.
ii. Most candidates got the ratios correct.
iii. Most candidates got the expected values correct.
iv. Most candidates got the correct null hypothesis.
v. Most candidates were able to work out the chi-squared value.
vi. A number of candidates were unable to estimate the degrees of freedom associated with the chi-squared test presented here.
vii. A good number of candidates found it difficult to link the stated null hypothesis to the final outcome, specifically in determining whether to accept or reject the null hypothesis.
b. i. This part was generally well answered. However, some responses were off-topic or unnecessarily complex.
ii. Few candidates addressed all aspects comprehensively. While almost all students attempted an answer, justifications were occasionally weak.

Paper IV

Question 1– Different disaccharides and fermentation

a. Most candidates related the presence of foam to the production of carbon dioxide but the attempt to relate its amount to the rate of metabolic activity was poor.
b. Most candidates answered this question correctly.
c. Most answers were incomplete. Very few candidates referred to glycosidic bonds instead they attributed the need of different enzymes to the different monosaccharide composition.
d. Most of the candidates provided clear and scientific procedures.
e. Relevant precautions were generally given.
f. Most candidates presented organised tables showing the results obtained clearly.
g. Candidates opted for bar graph or line graphs. In most cases, appropriate scaling and labelling of all components was observed.
h. Very few candidates included the control in their observation.
i. Few candidates obtained marks in this question. The majority of candidates' attempt to relate the rates of fermentation to the presence/absence of the necessary enzymes was inadequate.
j. Few candidates obtained marks in this question. Many simply stated that sucrose fermentation would be faster. However, the attempt to link this to the transport of monosaccharides vs disaccharides was poor.
k. Majority gave at least one relevant source of error.

Chairperson
Examination Panel 2025