



L-Università
ta' Malta

MATSEC
Examinations Board



Examiners' Report

AM Biology

First Session 2021

Examiners' Report (2021): AM Biology

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A. STATISTICAL INFORMATION

The total number of candidates who registered to sit for Biology was **594**, which is **7** candidates more than in 2020. Table 1 shows the distribution of grades for the Main 2021 session of the examination.

GRADE	A	B	C	D	E	F	ABS	TOTAL
NUMBER	71	114	153	90	70	47	49	594
% OF TOTAL	12.0	19.2	25.8	15.2	11.8	7.9	8.2	100.0

Table 1: Distribution of grades for AM Biology 2021, First Session

B. GENERAL REMARKS

General Remarks on the Written Examination

The examination consisted of three papers. Paper I contained 9 compulsory, structured questions. Paper II consisted of 3 sections, namely: section A which was a compulsory comprehension exercise; section B which contained 4 essay type questions from which students choose 2 and section C which consisted of 2 structured questions from which candidates select 1. Paper III comprised of Section A with 3 compulsory structured questions based on practical work and Section B which was a written exercise instead of the usual Paper 4 hands-on practical.

As a general note, responses indicate that most candidates were knowledgeable about the various biological topics. However, it was often noted that the details expected at this level were lacking. Whilst satisfactory responses were given to questions involving recall of biological facts, responses to questions entailing higher order skills were generally poor. Various responses indicate lack of understanding of terms "interpret" and "deduce". In general, the candidates fared better in the paper related to practical aspects (Paper III) than in the theoretical papers (Papers I and II).

C. COMMENTS ON PAPER I, PAPER II, and PAPER III

Paper I

Note: Average Marks obtained per question are shown below.

Question 1- Biochemistry

Average mark: 3.8/8

Q1.a. Identification of the type of the bonding involved was answered correctly but the attempt to explain was often very weak.

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- Q1.b. The attempt to identify the type of bonds/forces involved was adequate. However, the attempt to define the latter was very poor. In some responses, the terminology used for proteins was confused with that used for nucleic acids and referred to H-bonding between nucleotides/nitrogen bases.

Question 2- DNA replication

Average mark: 9.0/14

- Q2.a. In part a. ii., candidates were compensated since a mistake was noted in the figure provided.
- Q2.b. Many responses were correct.
- Q2.c. Most candidates were able to identify and explain the semi-conservative model. In a number of responses, the terminology/process used in DNA replication was confused with that of protein synthesis or nuclear division referring to transcription and translation when describing semi-conservative replication.
- Q2.d. The performance in this question was adequate with the correct identification of the name and roles of the enzymes involved in DNA replication.

Question 3- Nervous system

Average mark: 4.6/8

- Q3.a. The attempt of various responses to give the 'main function' of the brain structure was inadequate. In some responses, there was reference to structure instead of function. In general, responses indicate familiarity with the functions of the cerebrum and cerebellum was observed. However, the functions of the pons and the thalamus were often confused with the functions of the hypothalamus.
- Q3.b. Most responses show a correct identification of the differences between the SNS and the PSNS. However, difficulty identifying the similarities was observed. There was reference to hormones rather than specifying the differences and some replies did not distinguish between a hormone and a neurotransmitter.

Question 4- Biotechnology

Average mark: 6.2/12

- Q4.a. The attempt to define a vector was inadequate as in a number of cases, the vector was thought to be the required genetic material itself rather than a means of carrying it.
- Q4.b. Very few responses included the correct diagrams, and a substantial amount were a copy of the diagrams given in the next part of the question on antibiotic resistance.

- Q4.c. In general, the question on antibiotic resistance was well answered. However, some marks were lost as the connection between gene functionality and antibiotic resistance was insufficient and the responses did not mention that the gene is used to produce a protein giving resistance.
- Q4.d. Very few responses were correct. Common errors included giving the vector itself, for example, virus or bacteriophage.

Question 5- Transport in animals

Average mark: 5.1/13

- Q5.a. The majority of the candidates answered this correctly by stating that plasma is the blood component responsible for carrying wastes and dissolved substances. However, the attempt to explain that plasma is made up largely of water and so substances are dissolved and carried in blood in solution was inadequate.
- Q5.b.i. Most of the responses were incorrect as most replies included the function of mitochondria rather than answering why mitochondria are not found in red blood cells.
- Q5.b.ii. Most of the responses were incorrect since they included the function of the rough endoplasmic reticulum rather than why this organelle should not be found in red blood cells.
- Q5.c. Most of the responses were incorrect.
- Q5.d.i. Most of the candidates answered correctly by stating that the pulmonary artery carries deoxygenated blood from the heart to the lungs and the aorta carries oxygenated blood from the heart to the rest of the body. Thus, less pressure is needed by the pulmonary artery as there is a shorter distance for blood to travel when compared to the aorta.
- Q5.d.ii. Most replies failed to mention that the tissue fluid forms, thus leading to a decrease in blood volume and consequently a decrease in pressure.
- Q5.d.iii. The majority of the responses were incorrect as they stated that the veins need to be in close proximity to muscles because muscles are metabolically active and need a nearby supply of oxygen and a means to remove waste products quickly.
- Q5.e. Several candidates answered with both 'vasoconstriction' and 'vasodilation' whereby the question asked for the mechanism employed by the blood vessels to decrease the blood pressure, which is 'vasodilation'.

Question 6 - Immune system

Average mark: 6.0/10

- Q6.a. Many incorrect responses stated that antibodies have a tertiary structure instead of quaternary.
- Q6.b. About half of the responses were correct, whilst the other half did not specify that this was a humoral response.
- Q6.c. The majority of the candidates correctly deduced that IgM and IgG served different functions due to a concentration difference or time of onset difference.
- Q6.d. Most candidates correctly reasoned out that, the duration of the response will be longer and that the memory cells will not recognise the changed antigen. However, very few candidates mentioned that new antibodies will need to be synthesised.
- Q6.e. The majority of the candidates identified the possibility of there being incompatibility between the blood group of the mother and that of the baby. Several candidates also mentioned the mother being rhesus positive and the baby being rhesus negative. However, very few candidates explained further that this can lead to haemolytic disease or agglutination of red blood cells in the baby.
- Q6.f. This question was answered correctly by the majority of the candidates. The most common mistake was referring to vaccines as 'injections', since not all vaccines are injected in the body and not all injections are vaccines.

Question 7- Reabsorption of biomolecules

Average mark: 5.4/10

- Q7.a.i. The majority of the candidates correctly stated that plasma proteins are too large to pass through the Bowman's capsule and into the glomerular filtrate during ultrafiltration.
- Q7.a.ii. Most candidates correctly mentioned that glucose is small enough to pass through the glomerulus. However, the fact that glucose is not a charged molecule and thus can pass unhindered through the basement membrane was not mentioned.
- Q7.a.iii. The majority of the candidates correctly noticed that the urea concentration increases from the descending limb to the ascending limb. Several candidates also explained that this increase in concentration is due to water being reabsorbed in the descending limb. The most common error was stating that water was reabsorbed in the ascending limb, which is impermeable to water.
- Q7.a.iv. Responses indicate that most candidates were aware of the function of ADH, how it operates and in the presence of ADH, the concentration of urea would be higher.

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- Q7.b. The majority of the candidates recognised that the readings were taken from an unhealthy person. However, not all candidates explained that they made this decision due to glucose in the urine. A common error included there being excess urea in the urine.

Question 8 - Environmental Biology

Average mark: 5.0/8

- Q8.a. The majority of the candidates correctly identified this graph as showing a mutualistic relationship with both parties benefitting and increasing in population size.
- Q8.b. Several candidates' responses included amensalism instead of commensalism. However, most candidates gave the correct interpretation of the graph and included correct explanation of commensalism.
- Q8.c. Most candidates correctly identified the graph as showing a parasitic relationship in which the parasite is benefitting, and its population size increases whereas the host is harmed, and its population size slowly decreases.
- Q8.d. The predator-prey relationship was mostly identified correctly. However, full explanations were only occasionally given. Marks were deducted when the prey and predator species were not identified.

Question 9 - Evolution

Average mark: 8.5/14

- Q9.a.i. The majority of the candidates' attempt to differentiate between allopatric and sympatric speciation was adequate.
- Q9.a.ii. Most candidates correctly stated that pre-zygotic reproductive isolation mechanisms prevent the formation of the zygote and post-zygotic reproductive isolation mechanisms come into play after the formation of the zygote.
- Q9.b. The majority of the candidates correctly identified which examples were pre-zygotic reproduction isolation and which examples were post-zygotic reproductive isolation.
- Q9.c.i. In the first part of this question, most candidates mentioned the geographical isolation/barrier, mutations/variation and selection. However, very few candidates mentioned that these reptiles became different because there was no possibility of interbreeding between the different groups. In some responses, candidates did not emphasise that the lizards were isolated and just referred to them as living in different regions. There was no indication that there was no possibility of them going from one region to the other.

Q9.c.ii. This question was very often answered correctly.

Q9.c.iii. Most responses correctly identified the type of speciation.

Paper II

Note: The Average Marks obtained per question, are shown below. All marks are out of 25 marks.

Section A: Comprehension Exercise

Question 1

Average mark: 14.9/25

Q1.a. Many responses indicate a misunderstanding between the definition of 'biological diversity' and 'community'.

Q1.b. Many candidates answered this question correctly.

Q1.c. The majority of the responses were correct.

Q1.d. Confusion between immigration and emigration was noted. Several incorrect references were made to illegal immigration of humans.

Q1.e. Many candidates answered part (i) with the responses required for part (iii) by giving examples rather than explaining what density-dependent and density-independent factors are.

Q1.f. Many candidates answered this question correctly.

Q1.g. Many candidates answered this question correctly.

Q1.h. Many candidates answered this question correctly.

Q1.i. The deceleration phase of the graph was either incorrectly labelled or unattempted.

Section B: Essays

Question 1 – Liver (response rate: 52.11%)

Average mark: 11.6/25

The performance of the candidates who attempted this question was adequate. Most candidates produced in-depth accounts of how the liver metabolizes the biomolecules in question. The main difficulty encountered by the majority of the candidates was to name properly the carbohydrate metabolism mechanisms mainly confusing the term glycogenolysis with glycogenesis.

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Question 2 – Photosynthesis and reproduction (response rate: 62.42%)

Average mark: 8.5/25

Most of the candidates who attempted this question did not present comparative and/or contrasting accounts. Rather, most essays lacked the analytical aspects that contrast both processes. Though most responses indicate that candidates were aware of the basic constituents and occurrences of both respiration and photosynthesis, the attempt to highlight key processes that occur similarly in both or otherwise was inadequate. Apart from such, misconceptions that were present in several accounts include: the confusion between photosystems and photorespiration, the false inclusion of the Calvin Benson cycle as part of respiration, the notion that no ATP is generated through light dependent reactions and accounts synonymizing breathing with respiration.

Question 3 – Sexual reproduction (response rate: 53.03%)

Average mark: 7.1/25

The major notable limitation that most accounts exhibited was that candidates went into detail in explaining gametogenesis and less so on fertilization. Most of the accounts lacked a thorough discussion element that contrasted external fertilization with internal one. Some accounts also included plant fertilization and prokaryotic reproductive techniques when the question did not ask for such. Candidates who did present an in-depth account included to mention the following: both the advantages and the disadvantages of external and internal fertilization, included the dependency of water or lack therefore exhibited during fertilization and supported their argument with ample examples to better illustrate the necessitated physiological and morphological changes that occurred to accommodate the transition from heavily reliance of water bodies to being less dependent on such.

Question 4 – Expression of gene sequences (response rate: 26.06%)

Average mark: 10.8/25

Many candidates who attempted this question performed well. Most accounts presented a thorough rendition of protein synthesis, starting from transcription, and ending with translation. Though so, many responses did not explain how tRNA molecules are charged. Some accounts did mention the *lac operon* yet did not disclose how *lacZ*, *lacY* and *lacA* are expressed. Only a few candidates confused protein synthesis with DNA replication.

Section C - Structured Essay

Question 1 (response rate: 10.8%)

Average mark: 11.3/25

Q1.a. Most responses did explain the evolutionary importance of the cleidoic egg by mentioning not only its biological constituents but also the limitations that such mode of fertilization poses on the organism. However, some candidates did not mention that this is a product of internal fertilization

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with a minor percentage of the answers disclosed that this is a result of an external fertilization process.

- Q1.b. Although most responses did give the backstory of how endosymbiosis came to be, many lacked to substantiate their argument with the evidence that such organelles exhibit that support such a theory. Most accounts provided a basic diagram of both organelles yet did not highlight the structures and features that act as proof.
- Q1.c. Many accounts focused on tagmatization rather than metamerism with many of them detailing the features of tagmatization and labelling them as features of metamerism. This was further exemplified by the statement that insects and not annelids exhibit metamerism.
- Q1.d. Few candidates explained the ancestral origin of the pentadactyl limb. Some candidates did not include its origin from a common ancestor, and most did not mention that it is a homologous structure. Some candidates focused more on the term tetrapod than the whole phrase.
- Q1.e. Most candidates presented detailed responses explaining what compartmentalization is. Candidates who included several examples of organelles that exhibit such along with an explanation of its importance through an evolutionary perspective performed inadequately.

Question 2 (response rate: 89.2%)

Average mark: 10.8/25

- Q2.a. Though most candidates denoted the difference between positive and negative feedback, many were unable to substantiate their responses with an explanation as to why in certain cases, positive feedback is preferred over negative one. This could have been further elaborated upon, by the use of examples.
- Q2.b. Most candidates who attempted this question correctly deduced that these frequencies are influenced by the parameters proposed by the Hardy-Weinberg equilibrium. However, some accounts skewed by giving thorough explanation of dominant and recessive alleles.
- Q2.c. Many candidates gave good representation of the differences between homosporous and heterosporous plants. However, some responses denoted that Polypodiophyta exhibited gametophyte dominant life cycles, which is incorrect. Some candidates omitted to mention the presence and/or absence of male and female reproductive organs during the sporophyte stage.
- Q2.d. The majority of responses gave clear explanation of channel and carrier proteins. This was further consolidated with the addition of several examples that contrasts both types of proteins.

- Q2.e. The attempt of several candidates to explain the plant structures in depth was adequate but in explaining animal structures was inadequate. The inclusion of tissue that grant both support and flexibility was expected.

Paper III

Note: Average Marks obtained per question are shown below.

Section A

Question 1 - Classification

Average mark: 10.2/12

- Q1.a. Most candidates answered this question successfully.
- Q1.b. Most candidates answered this question satisfactorily. In a number of responses, the structure of the dichotomous key was incorrect, while in some others non-morphological features were used in the key.

Question 2 - transpiration in plants

Average mark: 12.3/20

- Q2.a. Almost all candidates answered this question successfully.
- Q2.b. The attempt of several candidates to explain or mention the step where the air bubble is introduced in the set-up was inadequate. A significant number of candidates performed poorly especially in mentioning the recording of time (required to calculate the rate) as part of the procedure.
- Q2.c. A significant number of candidates answered this question successfully, including the correct units. The units mm^3/s or mm^3/h , when correctly derived, were also considered correct.
- Q2.d. Most candidates managed to get the relationship between light intensity (i.e., distance from lamp) and rate of transpiration correctly, but a significant number of responses did not relate that to stomatal opening correctly.
- Q2.e.i. A significant number of candidates answered these questions satisfactorily. A number of responses mistook the factor or variable being tested as O_2 or CO_2 availability.
- Q2.e.ii. A significant number of candidates answered this question satisfactorily.
- Q2.f.i. Most candidates answered this question successfully.
- Q2.f.ii. Most candidates answered this question successfully.

Q2.g. Most candidates answered this question successfully.

Question 3 - Animal histology

Average mark: 9.1/18

Q3.a.i. Most candidates answered this question successfully.

Q3.a.ii. Most candidates answered this question satisfactorily.

Q3.b.i. Many candidates' attempt to draw and label the goblet cell was insufficient. A number of responses included a longitudinal section of a villus instead of the simple columnar cells provided in Figure 10.

Q3.b.ii. Many responses did not describe the goblet cell as a structural modification. In a number of responses, the microvilli were referred to as villi.

Q3.c.i. These cells were identified correctly in a very few responses.

Q3.c.ii. A significant number of candidates answered this question satisfactorily.

Q3.c.iii. Most candidates answered this question successfully.

Q3.c.iv. Most candidates answered this question successfully.

Section B - Written Experimental Design

Average mark: 30.2/40

Q.1.a. The majority of candidates stated clearly the aim of this investigation, as it was also indicated in the introductory text of the experiment.

Q.1.b. In several responses, the null and alternative hypotheses were confused. Some candidates' attempt to distinguish between the two and provided one typical hypothesis was inadequate.

Q.1.c. Most precautions were correct but the justification was inadequate.

Q.1.d. A common misconception noted in several candidates' responses was that a buffer is used to allow the introduction of another variable.

Q.1.e. Most candidates gave a correct and detailed method. In a number of cases, the use of the pH buffer and acclimatisation were either incorrect or omitted. A number of responses ignored the volumes suggested. The control was at times incorrect as a control without the milk was suggested instead of removing the enzyme trypsin.

- Q.1.f. The average time was easily worked out by counting all three values and divide the total by three (the total number of samples). The rate of reaction is meant to be worked out $1/\text{average}$. Several candidates' workings were incorrect.
- Q.1.g. In general, the graph was plotted successfully according to the data in the table and included the title, axis titles and units, and using appropriate scales.
- Q.1.h. Candidates were expected to provide a brief description of the graph plotted in the previous question. Most responses were correct including the increase in rate of reaction along an increase in temperature up to an optimum activity at 40°C.
- Q.1.i. Several marks were lost in this question as most responses were unable to provide biological knowledge to explain the trend discussed above.
- Q.1.j. Some responses were unable to distinguish between an error and a precaution. Some of the errors provided were completely irrelevant to the experiment. Since this experiment relied on a final colour change, it was very difficult to identify the correct end-point, even by means of a colour standard.

D. CONCLUDING COMMENTS

It was noted that whenever the questions entailed recall of biological facts, the performance of the candidates was satisfactory. Generally, the responses given indicated difficulty when it comes to higher order skills, where candidates encounter difficulty when applying biological knowledge to new situations. Furthermore, it was noted that some responses, especially the essay-type, were not properly planned. In many cases, the specificity of the question was overlooked. In a vast number of cases, the details required at this level were missing. Most essays lacked a cohesive argument and at times lacked a definite conclusion. It is to be noted that whilst candidates were not assessed on their grammar, many accounts lacked the necessary linguistic level to explain themselves coherently. This inadvertently influenced how they described and/or explained the scientific phenomena being asked for. It is also worthy to note that most essays aimed for length rather than being accurate in their accounts. Responses indicate a lack of proper understanding of the questions being asked and the instructions for each question. Some responses lacked the use of technical and biological terms expected at this level.

Chairperson
Examiners Panel 2021