UNIVERSITY OF MALTA

THE MATRICULATION CERTIFICATE EXAMINATION
ADVANCED LEVEL

BIOLOGY

May 2009

EXAMINERS’ REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD
AM EXAMINERS’ REPORT MAY 2009

AM Biology
MAY 2009 SESSION
EXAMINERS’ REPORT

1.0 General Remarks

The following report has been compiled from separate documents submitted by members of the Examination Board and by markers of the examination scripts in question. It represents an appraisal of the performance of candidates taking the Matriculation Certificate examination in biology (advanced level) in May 2009.

Comments on each of the questions set are given below. On a more general level, a number of points, many of which have already been expressed in analogous reports in previous years, should be stressed:

The level of English (both in terms of grammar and spelling) was poor and hardly up to the standard of an examination at Advanced Level. In a number of cases, the inability of candidates to express themselves made their answers unintelligible.

Most candidates are uncomfortable with questions that require some thought and there appears to be a general inability to apply learnt knowledge to novel situations. Candidates’ general performance in questions that required straightforward regurgitation of memorised facts was satisfactory.

Paper 2 Questions 1 and 2, involving the skills of application and analysis proved to be the major discriminators, however it was encouraging to see that yet again, this year, candidates seemed to find these questions more accessible than in past years.

The good practice of integrating diagrams in the answers was again evident. Attempts to use more specialist vocabulary were also noticeable.

The examiners were pleased to see that the majority of candidates made considerable effort to present their answers in a clear and legible manner.

2.0 Statistical Information

Table 1 below shows the distribution of grades for the May 2009 Session.

Table 1: Distribution of grades awarded in May 2009

<table>
<thead>
<tr>
<th>GRADE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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3.0 Comments regarding candidates’ performance

3.1 Comments regarding Paper 1

Question 1: Viruses

Overall candidates performed poorly for when answering this question, particularly when it is borne in mind that questions such as ‘what is a virus?’ are relatively simple to answer.

Q1.1 Several inaccuracies and misconceptions were evident in candidates’ answers to this basic question. Viruses were described as, amongst others, unicellular, prokaryotic and belonging to the kingdom Monera.

Q1.2 The majority of candidates only gave one correct answer, i.e. mutation. Recombination was only suggested by a few candidates.

Q1.3 Although the majority of candidates mentioned the immune system and its genetically driven differences, a number of them also mentioned lifestyle, age and hygiene levels, which may also contribute. In general, answers were acceptable.

Q1.4 Candidates also mentioned bacteriophage cycles, retrovirus cycles and a number of made-up terms for the lytic and lysogenic cycles. Although a number did give a correct answer for the first part, details were often missing, resulting in lack of
complete answers. In addition, several candidates listed budding, binary fission and other forms of cellular division as methods through which viruses reproduce.

**Question 2: Meiosis**

**Q2.1** In general, candidates performed well in this question, although a correct definition of meiosis was not always given (e.g. omitting to mention halving of the chromosome number). Some candidates also confused meiosis with fertilisation.

**Q2.2** The most common mistake was to give a general answer, e.g. genitalia, reproductive system, rather than specifying ovaries or testes. Several candidates also stated that this process occurs in the gametes.

**Q2.3** This question was probably the one that candidates found most difficulty with, in that it was difficult to describe the process of meiosis. In general, the key processes were identified by most candidates, however, several candidates thought that two diploid cells are produced after the first meiotic division, and there was also some confusion among candidates as regards terminology – e.g. chromosomes vs. chromatids. Also, several candidates confused the processes occurring in the first meiotic division with those occurring in the second (e.g. crossing over, pairing up of homologous chromosomes).

**Q2.4 and Q2.5** Most answers to these questions were awarded full marks, although the most common mistake was to list mutation, aneuploidy and polyploidy as answers, none of which may be regarded as a general consequence of meiosis.

**Q2.6** This was often not answered fully, in that candidates indicated genetic diversity as a reason, failing to explain the importance of natural selection, or that organisms with more suitable characteristics produce more offspring.

**Question 3: Evolutionary change**

**Q3.1** This was often answered correctly; however, several candidates could not distinguish between evolution and speciation and so lost marks.

**Q3.2** This was almost always answered correctly.

**Q3.3 to Q3.5** These presented a problem to candidates and were answered incorrectly in several cases. Incorrect answers included directional vs stabilising or disruptive selection, natural selection, homologous vs analogous evolution, divergent vs convergent evolution, allopatric vs sympatric evolution.

**Question 4: Amino acids**

**Q4.1 to 4.3** These were answered correctly by most candidates. The most common mistake in Q4.1 was to identify an amino acid as a protein.

**Q4.4** Most candidates gave the correct answer, although these were not always sufficiently detailed.

**Q4.5** This was problematic for many candidates and irrelevant answers were often given, e.g. the ability of proteins to denature or how an enzyme works by lowering the activation energy.

**Question 5: Cell membranes**

**Q5.1** Most candidates had little difficulty with this question, however a substantial number did not mention the fact that the cell membrane is the outer part of the cell or that it is a barrier for the cell contents.

**Q5.2** This was answered correctly by most candidates, although some confused the terms hydrophobic and hydrophilic.

**Q5.3** This was often answered correctly, however several candidates did not obtain full marks either because of improperly labelled structures or not enough structures identified. A small number of candidates drew a whole animal cell rather than the cell membrane.
Q5.4 This presented little difficulty to candidates, although some did not give the required details and merely glossed over the process.

Q5.5 This presented the most difficulty – the technique was often not known, and a large number of candidates gave techniques which would be more appropriate for light microscopy (several even followed up their instructions with a note that the sample should be viewed under a light microscope). Quite a few candidates also indicated ultracentrifugation as a technique, while others left this question unanswered. However, it should be noted that most of the candidates who could name the technique expected were then able to provide an adequate description.

Question 6: Transpiration

Q6.1 Candidates provided a complete definition of transpiration in general although a few considered this as gaseous exchange through stomata.

Q6.2 Most candidates gave two out of three correct answers.

Q6.3 Overall candidates gave correct answers although details such as H bonding may have been missing from some answers. A few candidates explained the symplast, apoplast pathways instead.

Q6.4 Although this question may have been tricky since stomatal and not plant or leaf adaptations were requested, most candidates gave correct answers.

Q6.5 A correct answer was given by the majority of candidates. In the second explanation, some candidates argued that water may actually enter the stomata.

Question 7: Glycolysis

Most answers were satisfactory, in particular answers to Q7.2, Q7.3 and Q7.4.

Q7.1 Candidates largely gave correct answers although variants such as Glucose-3-phosphate, fructose, glycogen and G-3-P were mentioned.

Q7.5 A number of candidates missed a step such as formation of acetyl group, or joining to coA or the cycle. Some different cycles such as the Calvin Benson cycle were mentioned.

Question 8: Parasitism

The majority of candidates answered Q8.1 and Q8.4 incorrectly. In Q8.1 the majority of candidates failed to identify what a parasitoid is or confused it with other organisms, whereas in Q8.4, few identified the role of increasing competitiveness. In fact, the majority stated that since parasites are present in each trophic level, they themselves increase the number of species.

Question 9: Environmental degradation

Q9.1 The majority of candidates answered by noting that decrease in ozone will cause global warming due to passage of UV. This is essentially incorrect. They proceeded to note that this will cause organisms to adapt to these changes, or else become extinct. Therefore, the mutagenic properties of UV were not mentioned by most candidates.

Q9.2 A number of candidates mentioned a decrease in pH without specifying the possible effects on wildlife.

Q9.3 This was largely answered in correctly. However, some candidates confused halophytes with hydrophytes.

Q9.4 This was mainly answered correctly although the term eutrophication was only mentioned by a few candidates. Some candidates argued that bacteria grow in polluted waters and algae would feed on them, causing a bloom. This shows a lack of basic appreciation that algae are photosynthetic.
Several candidates argued that acid rain acts as a preservative for organic matter. A number argued that acid rain degrades organic matter rapidly, thus not allowing decomposers to work or contradicted the statement by saying that rates of decomposition actually increase.

3.2 Comments regarding Paper 2

Section A

Question 1: comprehension exercise

Q1.1 The majority of candidates were able to adequately distinguish between white matter and grey matter. Full marks could not be awarded, however, when candidates limited themselves to stating the composition of the tissues, with no reference being made to function; or vice-versa.

Q1.2 An appreciable number of candidates were able to clearly state that the myelin sheath consists of fatty tissue, however, only candidates who gave specialist answers, namely, that myelin consists of ‘membraneous phospholipids wrappings produced by specialized glial cells called Schwann cells’ were awarded full marks.

Q1.3 Although this question was very straightforward, the number of incomplete answers was disappointing. Candidates had to mention that identical twins result from the division of the zygote post-fertilisation, resulting in genetically identical offspring. Fraternal twins result from two separate fertilisation events, resulting in offspring that are genetically different, and perhaps of different gender.

Q1.4 Few candidates specified that fraternal twins share half their genes, and that therefore by comparing to identical twins who have identical genes, one can determine how much brain function can be truly attributed to inheritance or to nurture/ the environment.

Q1.5 A number of candidates could not identify the correct function and location of the corpus callosum.

Q1.6 An appreciable number of candidates answered this question correctly.

Q1.7 Answers to this question were rather poor. But a few realised that proteins the genes code for could be artificially synthesized and added, leading to high integrity myelin, and hence boost IQ.

Q1.8 A surprising number of candidates did not realise that such work could also be used in medical research. Fewer still were able to correctly mention disorders related to myelin degradation, such as autism, ADD, and multiple sclerosis.

Q1.9 Only a small number of candidates mentioned genes and their interaction with the environment. Frequent answers related to the fact that identifying genes is a very long and laborious process and that experimenting with the brain is very tricky.

Q1.10 Few candidates were capable of giving a correct answer to this question.

Question 2: Analysis of data

Q2.1 It was pleasing to see that several candidates found this question rather accessible and that they could identify at least 3 general trends. The word trends was the keyword to answering this question. No numerical details were required.

Q2.2 The vast majority of candidates answered this question correctly.

Q2.3 Again, most candidates answered this question correctly.

Q2.4 The answers to this question were variable. Very few came up with the proposal that albatrosses regurgitate indigestible swallowed items.

Q2.5 An appreciable number of candidates were capable of identifying two ways in which plastics negatively affects birds.
Q2.6 Most candidates gave correct suggestions to this question. Over fishing and marine pollution were the commonest answers.

Q2.7 Few candidates realised what was being asked of them in this question, with a consequent loss of the available marks.

Section B

As in previous years, candidates fared best in this section, where straightforward recollection of facts was mainly being tested. Lack of detail and poor organisation in essay writing, and lack of clarity in diagram drawing were the major reasons for loss of marks.

Question 3: skeletal muscle

An average performance on this question was observed. A significant number of candidates did not write a proper introduction, and plunged directly into describing the fine structure of skeletal muscle without qualifying its position in the body. Variable answers were seen in the second part of the essay were candidates were asked to describe the mechanism of skeletal muscle contraction. Here answers ranged from either extremely detailed to rather skimpy.

Question 4: protein synthesis

It was pleasing to see that a large number of candidates performed satisfactorily well in this slightly more challenging essay. Drawings relating to the text were the major setback in this essay.

Question 5: thermoregulation

This essay was rather straightforward, and candidates who chose to answer it performed adequately. Most candidates failed to gain maximum credit due omission of certain facts; this being attributed to improper organisation in their essay writing.

Question 6: biomolecules

This essay proved to be the most challenging one. Candidates who attempted this question showed lack of organisation in essay writing. They wrote liberally without much structure, with the consequence of omitting important facts, lack of detail, and poor molecular drawings, if at all drawn. The term ‘discuss’ still needs proper qualification with A-level candidates.

Section C

Question 7: General

Q7.1 Most candidates correctly identified phototropism in plant shoots and describing importance to plants, in general. Few, on the other hand, included the roots in their answers; hence forfeiting marks.

Q7.2 Again, most candidates were correctly identified the main benefit reaped from having resident micro-organisms in the gut.

Q7.3 On the one hand, some very detailed and correct answers were seen here. On the other hand, some candidates were completely ignorant of the meaning of CAM photosynthesis and its selective advantage.

Q7.4 Most candidates were capable of identifying at least one selective advantage related to a closed circulatory system. Most answers were however incomplete.

Question 8: General

Q8.1 A large number of candidates gave detailed answers about the advantages of cross-pollination vs self-pollination. These were irrelevant, given that insect pollination is not the only method of cross-fertilisation. Quite a number mixed up pollination with seed dispersal. Many identified insects as being direct agents of pollen with therefore less wastage of pollen. Few candidates, however managed to mention that another advantage lies in the fact that genes are spread over a wide area by means of insects.

Q8.2 Candidates were capable of adequately answering this question.
Q8.3 Some candidates have very vague notions of the tissues that arise from the various dermal tissues. It is clear that very few fully comprehend the embryological details involved.

Q8.4 A large number of candidates were not familiar with the term vegetative propagation. Those who were often limited themselves to stating how it occurs through buds and corms and runners, omitting the essential part of its selective advantage over sexual reproduction.

3.3 Comments regarding Paper 3

Question 1: Vegetation surveys

Q1.1 A substantial number of candidates gave the correct answer, however a number of candidates gave a quadrat technique for sampling of rats, or indicated that all the rats should be captured and marked, showing a basic lack of understanding on how to sample for motile animals.

Q1.2 It seems that most candidates had an idea of what is meant by a random sample, but failed to describe it correctly. For instance, several candidates gave as an answer “a sample that is taken at random from the area”, which describes nothing new other than what was given in the question, but then answered Q1.3 correctly, which shows that they know what a random sample is. Candidates sometimes made reference to a random “throw” in Q1.2 and in Q1.3, which led to a reduction in marks.

Q1.4 The most common two mistakes were giving 125 m$^2$ as the answer (rather than the proportion) or to express the proportion with units (when proportion should be unit-less).

Q1.5 Candidates who scored full marks were a minority and it seemed that most candidates could not differentiate between when a transect or when a quadrat is required. Candidates also often lost sight of the fact that a transect did not need to be a line transect but could be a belt transect.

Q1.6 This was often answered correctly.

Q1.7 A number of candidates answered this question incorrectly.

Q1.8 Candidates performed well although a small amount of marks were sometimes deducted for failing to describe the main trends and instead focusing only on the details. A large number of candidates did not represent scientific names (binomial nomenclature) in the correct format.

Q1.9 This was correctly answered by about half the candidates, with the most common wrong answer being the chi-squared test.

Q1.10 This was generally answered correctly.

Question 2: Stomatal density

Overall candidates performed poorly in this question. In general answers referred to the statistical test required or else lacked necessary detail.

In general candidates gave a correct answer for Q2.1. Some candidates answered by saying ‘Chi square’ or any other test. Few defined the alternate hypothesis instead. Q2.3 was answered in a correct way in the majority of cases although details were often missing. In a number of candidates, instead of referring to the eye piece graticule, the haemocytometer was referred to. This is incorrect for measuring distances on slides. In the case of Q2.4 a number of candidates failed to give replicate readings. In Q2.5, reference should have been made to the statistical test which should be used to accept or refute the null hypothesis. A number of candidates described data analysis through comparison rather than statistical tests.

Question 3: Taxonomy

The table was generally filled in correctly. There were a number of common mistakes including:
- Referring to the phylum by mentioning ‘echinoderms’ rather than ‘Echinodermata’;
- Incorrect class of Cnidarians (Hydrozoa instead of Schyphozoa);
As regards to the characteristics feature of each class, some candidates referred to features which are characteristic of the phylum rather than the class. The most common mistake was reference to stinging cells in the jellyfish.

Most candidates found little difficulty with Q3.2. However, a number of candidates showed lack of familiarity with scientific terms (e.g. calling chaetae “legs”), and a substantial number of candidates did not use binomial nomenclature correctly.

Q3.3 was answered correctly by most candidates.

3.4 Comments regarding Paper 4

General Comment

In question 1.1 of all three options, there was usually a lack of structure in the answer, with steps being mentioned haphazardly, rather than in any sort of order.

Option 1 – Activity of Catalase

1.1. All parts of this question were generally well-answered, including the choice of controls and dilutions.
1.2. Mostly correct, although some confusion in wording sometimes led to the opposite meaning being implied.
1.3. Mostly correct.
1.4. Most of the time, the correct explanation was given.
1.5. The answer did not always reflect the actual results obtained, as listed in the table. Rather, very often, the candidates simply described the results expected, based on the underlying theory.
1.6. Sometimes, the precautions mentioned referred to actions that would have been taken before the actual exam session (e.g. catalase must be freshly-prepared). The candidates should list precautions that they have taken themselves.
1.7. Generally correct, although sometimes these contradicted a listed precaution.
1.8. Most candidates answered this correctly.

Option 2 – Photosynthesis

1.1. It was obvious that most candidates had previously carried out this experiment, but with a different experimental set-up. The problem is that most of them tried to replicate it with the materials provided, e.g. trying to insert the pond-weed into the capillary tube, rather than the syringe. Also, some candidates did not correlate the movement of the meniscus in the capillary with the volume of oxygen produced. The conclusion from this is that apparently more emphasis is being placed on replicating what has been done previously, rather than on problem-solving, and devising a good experimental procedure based on the materials provided.

In the case of the control, very few candidates answered correctly that no pond-weed should be used, and suggested covering the syringe with brown paper instead. This was actually meant to be one of the experimental conditions tested, not a control.
1.2. Mostly correct, although some confusion in wording sometimes led to the opposite meaning being implied.
1.3. Mostly correct.
1.4. The answer did not always reflect the actual results obtained, as listed in the table. Rather, very often, the candidates simply described the results expected, based on the underlying theory.
1.5. Sometimes, the precautions mentioned referred to actions that would have been taken before the actual exam session (e.g. pond-weed must be freshly-cut). The candidates should list precautions that they have taken themselves.
1.6. Generally correct, although sometimes these contradicted a listed precaution.
1.7. There was sometimes some confusion with the word “wavelength”. Some candidates interpreted this as “light intensity” and made no mention of different-coloured lights.

Option 3 – Transpiration

1.1. Mostly correct, except that for the control, very few candidates used the set-up without the plant, and instead mentioned factors that should have been part of the environmental conditions being tested, e.g. removal of leaves, or smearing with petroleum jelly.
1.2. Mostly correct, although some confusion in wording sometimes led to the opposite meaning being implied.
1.3. Mostly correct.
1.4. The answer did not always reflect the actual results obtained, as listed in the table. Rather, very often, the candidates simply described the results expected, based on the underlying theory.

1.5. Sometimes, the precautions mentioned referred to actions that would have been taken before the actual exam session (e.g. pond-weed must be freshly-cut). The candidates should list precautions that they have taken themselves.

1.6. Generally correct, although sometimes these contradicted a listed precaution.

Chairperson
Board of Examiners
July 2009