

UNIVERSITY OF MALTA

**SECONDARY EDUCATION CERTIFICATE
SEC**

BIOLOGY

May 2009

EXAMINERS' REPORT

**MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD**

**SEC Biology
May 2009 Session
Examiners' Report**

Part 1: Statistical Information**General Performance**

A total of 1677 candidates sat for the Biology SEC examination in May 2009. The Table below shows the distribution of grades for the May 2009 session.

Table 1: Distribution of the candidates' grades for SEC Biology May 2009

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	79	139	241	274	173			177	3	1086
PAPER B				59	79	83	85	256	29	591
TOTAL	79	139	241	333	252	83	85	433	32	1677
% OF TOTAL	4.71	8.29	14.37	19.86	15.03	4.95	5.07	25.82	1.91	100

Part 2: Comments regarding the candidates' performance**2.1 General Comments**

- Knowledge of and use of biological terms was highly lacking – students' often used layman's language to explain/describe biological principles
- Definitions of a number of simple biological terms often lacked the necessary detail
- A number of common misconceptions were evident across scripts: the use of pesticides and that of fertilisers ; seed dispersal and pollination together with the consideration of yeast as a bacterium were amongst the most frequent
- A number of replies (especially in paper II) included large chunks of irrelevant information that students have studied by heart
- Whenever diagrams were presented their presentation was often poor – lacking the necessary details and labels. This trend seems to reflect a general lack in the practice of this skill in the biology class
- The plotting of bar graphs seemed challenging to the majority of students
- Poor understanding of the key terms used in questions such as *describe*, *explain* and *give differences* often resulted in irrelevant answers
- Questions focusing on practical/experimental investigations remained highly unpopular among students. Students often scored poorly in such questions. This often contrasted with the relatively high marks, students attained in the practical component

2.2 Comments regarding Paper 1**Question 1**

This was a straightforward recall question. All students attempted this question and the majority of students scored high marks. Some candidates confused the descriptions of sucrose with that of starch and of lactic acid with that of glucose.

Question 2

In part 'a' of the question most students did not refer to the temperature as a variable that needs to be kept constant. Furthermore while many candidates linked the temperature to human body temperature, few students mentioned that this temperature is the *optimum* temperature for the action of pepsin. Most students answered part 'b' of the question fairly correctly, however students generally failed to mention that enzymes are pH specific. In a number of scripts hydrochloric acid was incorrectly written as hydrolic or hydrologic acid, notwithstanding that the proper term was used in the question itself.

Most candidates failed to understand part 'c' of the question – while a small number of candidates showed evidence that they know NaOH is alkaline and thus pepsin is inactive in it, many students referred to the Biuret test in their replies. In fact many candidates mentioned the purple colouration typical of this test in their prediction. A number of other incorrect answers included: *NaOH is very reactive, corrosive and kills enzymes*. The last part of the question was generally answered incorrectly – Many candidates drew diagrams of single or double units representing amino acids or dipeptides respectively.

Question 3

Parts 'a' 'b' and 'c' were generally correctly answered, however the spelling of technical terms such as palisade mesophyll and epidermis was incorrect in many scripts. In part 'c ii' it was evident that few students know of the *compensation point* – indeed a number of students described what takes place at that point well but avoided the use of the proper term. In a number of scripts other incorrect terms such as neutral point, limiting factor, equilibrium point were used. Most students did not attain any mark in part 'd' of this question - failed to understand that products of respiration are used in photosynthesis.

Question 4

The answers to this question provide evidence that many students are still unable to differentiate between *changes observed* and *conclusions*. Furthermore students failed to use the terms given in the diagrams to substantiate their replies. Students lost marks since they wrote their answers out of place. As regards part 'a' of the question there was correct reference to osmosis in the conclusion however students failed to explain the process clearly. The terms *concentration* and *concentration gradient* were used interchangeably in a number of answers.

In part 'b' a similar pattern was observed – students often gave conclusions in place of observations. The conclusions in most scripts were mostly incorrect since students did not refer to the absence of oxygen in jar A but to the presence of carbon dioxide within the jar. Although candidates showed understanding that germinating peas respire, the presence of carbon dioxide does not affect a lighted splint.

Question 5

Generally candidates wrote incorrect definitions to the simple term allele - indeed it seems that students are totally unaware of the term. A number of students gave definitions of the terms gene and chromosome instead. Parts 'b' and 'c' were adequately answered by most candidates. Some candidates lost marks because they failed to write the gametes in their genetic diagrams and/or because they failed to explain the offspring resulting from the genetic cross. In isolated cases students lost all marks for parts 'b' and 'c' because they presented a sex-linked answer.

Question 6

Most students identified the part labelled A correctly as the sweat gland. In part 'b' some students describe that the hair erector muscle contracts to trap heat rather than to trap air and often failed to indicate that air, being an insulator (or a bad conductor of heat) prevents heat loss. In a number of cases students confused the role of the hair erector muscle with other mechanisms involved in temperature control such as vasodilation, sweating or shivering.

In part 'c' most students were aware that the blubber served for insulation. Some candidates failed to explain that the blubber is effective since it is made up of fat. Most students erroneously described that blubber served as a food store. Few students showed evidence that the blubber is an energy store and rarely did students describe its importance for buoyancy.

Question 7

In part 'a' most candidates were aware of the differences between the nervous and the hormonal systems. However some candidates associated the hormonal system solely with the male and female reproductive systems – with no reference to other hormones present in the human body. Some students failed to compare the two control systems but simply wrote information about each system separately. This was considered incorrect since the question specifically asked for differences between the two.

In part 'b' of the question the terms cerebrum, cerebral hemispheres and cerebellum were frequently spelled incorrectly. Sometimes the medulla oblongata was confused with the spinal cord. Some students incorrectly labelled part D as medulla. This showed evidence of confusion between the part of the brain called medulla oblongata and that part of the kidney called medulla.

Question 8

Most students correctly used the term flatworms; few students referred to the phylum as Platyhelminthes. With regards to the jellyfish most students mentioned the typical; sac-like body with stinging tentacles. The crab was often classified as a crustacean; students failed to recognise that they were specifically asked to mention the phylum (in this case Arthropods). Most students mentioned the jointed appendages and exoskeleton as typical characteristics of arthropods. Students lost marks when they only mentioned a hard shell.

As regards angiosperms most students simply mentioned that they are flowering plants and failed to indicate that angiosperms produce seeds enclosed in an ovary. Some students showed awareness that angiosperms produce fruit. Most students were aware of the term gymnosperms or conifers, even though the spelling was frequently incorrect. A common spelling mistake observed was *coniferns*. The characteristics mentioned by most candidates included the presence of needle-like leaves and the wooden cones. Only very few students listed that naked seeds are enclosed within the cones. A number of students only mentioned very general features such as *conifers are evergreen or they produce acorns* showing a general lack of sound biological concepts.

Question 9

For the first poster it was evident that students are aware of extinction however they found difficulty to define it. Sometimes extinction was confused with organisms that are few in number and are thus endangered species.

The idea of carbon footprint is not clear to most students. Most students referred to mentioned carbon rather than to carbon dioxide in their explanations. Students discussed the importance of planting more trees however failed to give biological reasons for it. The replies to this question gave evidence that most students do not distinguish well between global warming and the greenhouse effect. There was hardly any mention of carbon dioxide as a main greenhouse gas. The majority of candidates wrote that the excess carbon dioxide is causing global warming; they failed to explain that due to the greenhouse effect created by excess carbon dioxide (and other greenhouse gases) the temperature of the earth is increasing thus leading to global warming.

For the third poster most replies centred around general water pollution problems such as dumping of rubbish, water bottles and plastic bags in the water. Most students focused their explanation on the effect of such rubbish on organisms like turtles. Students' replies also described the causes and effects of eutrophication. Some of the candidates' replies indicate that some students mistake the effect of pesticides with that of fertilisers when they leach out of the soil.

Question 10

In this question a small number of students mentioned barnacles, sea urchins and starfish as molluscs. Students often failed to predict the immediate effect/s of the fact that starfish lay millions of eggs.

Students often gave the following reasons why starfish lay millions of eggs such as indicated in these replies: 'so that at least some of them survive' or 'some may be eaten by predators'.

Part 'c' of this question was correctly answered by the majority of candidates, however in part'd' students often failed to write the proper scientific names of the sea star and the ciliate – confusing the genus *amurensis* with the genus *stellarum*.

2.3 Comments regarding Paper 2A

Section A

Question 1

Part 'a' of this question was generally answered incorrectly. Many candidates did not mention that the researcher included both biotic and abiotic factors in the study. This reflected common misconceptions regarding the term ecosystem. Indeed most candidates lifted information straight out of the text and suggested that the text refers to *the study concerning the ecology of the...*

Many candidates correctly identified one abiotic factor, generally temperature however then included other irrelevant abiotic factors such as humidity. Some candidates referred to biotic factors in their answers.

In parts 'c' and 'd' only a small number of students attained full marks. The vast majority of students failed to realise that the absence/abundance of water changes the salinity levels. Only few candidates mentioned that rainfall or water evaporation change the water levels throughout the year. Furthermore candidates did not refer to the movement of water out of organisms and just suggested that the water would be too concentrated to survive in it. Parts 'e' and 'g' were generally answered correctly, however part 'f' was often incompletely answered. Candidates failed to make the link between algae acting as producers, photosynthesis and the introduction of food in the ecosystem. The variety of answers to part 'e' ranging from nets, jars and sieves reflect applied knowledge of situations encountered in fieldwork activities.

Question 2

Most candidates drew histograms instead of bar graphs. A significant number of candidates superimposed the bars instead of drawing them next to each other as instructed in the question. Whenever bar graphs were presented they were often not up to standard – inadequate scale and incorrect plotting of the bars were two major and common faults. The remaining parts of the question were generally correctly answered although in part'd' some students listed symptoms related to smoking instead of lung diseases. Emphysema and bronchitis were the two lung diseases frequently cited.

Section B

Question 3

This question was chosen by a very limited number of candidates and the general performance was overall poor. In part 'a' of the question students were generally unable to list the apparatus required for the investigation, many omitted the clinostat. A number of candidates presented experiments related to phototropism rather than focusing on the plan's response to gravity. The answers to this part of the question indicated that candidates were generally unaware of control measures in experimental investigations. Candidates generally concluded that roots bend towards gravity yet some interpreted this response in terms of light. Students also lost marks in the last part of the question. Indeed students failed to realise the symptoms of etiolation and that a plant growing in the dark strives to find light and hence grows longer. Reference to auxin effects leading to apical dominance was also highly lacking.

Question 4

This question was popular with candidates. The definitions of osmoregulation and excretion were generally very poor. For osmoregulation most students only referred to the control of water content in the body but ignored the control of salt concentration in the body. Excretion was generally defined as the *removal of waste/toxic products* however no reference was made to metabolic waste. Some students still fail to distinguish between excretion and egestion.

The description of the process of ultrafiltration in part 'b' was poor. Students generally failed to explain how an increase in pressure is brought about. However the majority of candidates were able to distinguish between the substances that pass into the glomerular filtrate and those which cannot pass.

The majority of students scored well in part 'c'. Some marks were lost when students mentioned uric acid and glucose as components of urine. Students generally indicated the pathway through which urine passes well. Diagrams were often used to complement the answers given too. Students were aware that the concentration of urine increases after heavy exercise. Only few students made reference to the fact that the volume of urine decreases. In part 'd' of the question most students fared badly since they failed to explain that the difference in concentration gradients affected the time taken to fill up the contractile vacuole.

Question 5

In general the discussion related to the environmental benefits of the statements put forward was poor. Answers were generally incomplete and lacking detail. Often students explained each phenomenon in simple everyday terms and failed to make links to biological concepts. The benefit of nature reserves was generally associated solely with the protection of birds; the issue of biodiversity that is conserved within nature reserves was generally ignored. When discussing the part related to sewage treatment many students were generally aware of the issue of eutrophication and its negative effects on the water ecosystem. However students rarely listed the phosphates and nitrates present in sewage. The spread of disease was only mentioned in isolated cases. Some students wrote detailed paragraphs to explain how sewage treatment takes place however this was not necessary to answer the question. Many students showed awareness that heavy fines related to oil spillage make industrialists aware of the need to prevent accidents. Students outlined that birds and fish can be killed and harmed however they rarely described how oil damages the birds' feathers and thus reduce their insulation properties. The damage caused to beaches and the effects on the tourism industry were rarely outlined. A number of students included irrelevant material in their replies such as burning fossil fuels and issues related to air pollution.

The majority of students were unable to explain strip cropping – although most linked it to soil erosion. A number of students mistook strip cropping for crop rotation or terraced fields.

Students discussed the disadvantages of pesticides in a general manner but failed to outline the proper meaning of the term *persistent*. Reference to bioaccumulation and biomagnification were often ignored. Notwithstanding that many students referred to the leaching of pesticides causing water pollution some confused this process with eutrophication.

Students listed the destruction of habitats, increase in atmospheric carbon dioxide concentration and soil erosion as the main effects of deforestation. Only a limited number of students mentioned flooding, species extinction and climatic changes as other effects related to deforestation.

Students were generally aware of the effects of dumping rubbish. Most discussed issues related to foul smells and rapid spread of disease through vectors such as rats and insects. Some students explained that gases are emitted from rubbish but failed to explain that gases are emitted if the rubbish is burned.

Question 6

In part 'a' students generally described the importance of wings and feathers, hollow bones and streamlined body however failed to include the powerful flight muscles in birds.

Similarly in part 'b' students identified the streamlined body, presence of a tail and presence of fins as important adaptations of fish to live in water. The lateral line was often lacking.

Students explained that conifers have seeds enclosed in cones – a detail that was not relevant to the question. Very often students failed to focus on the xerophytic properties of gymnosperms.

Most candidates referred to the absence of chlorophyll in *Mucor* and linked this to lack of photosynthesis. However only few students mentioned the saprophytic nature of *Mucor*.

In part 'e' students generally mentioned that reptiles lay eggs on land but did not explain that the leathery shell protects the offspring inside. Students often referred to the hard skin with scales as an

important adaptation to prevent water loss. In a number of scripts students lost marks as they focused their answer on the characteristics that classify reptiles as vertebrates rather than on their adaptations to a terrestrial mode of life.

Students generally found difficulty to distinguish between saprophytic and mutualistic bacteria.

The last statement of this question was well explained by most students.

Question 7

Most students were able to describe the processes listed in this question however they often failed to explain the benefits of each process – this resulted in the deduction of several marks.

In part 'a' some students confused the process of vasodilation with piloerection. Many students described gamete formation in great detail giving excess details of meiosis. The idea of variation was often cited however students generally failed to explain that gametes carry genetic information.

Most students showed awareness that vasectomy is a relatively permanent birth control mechanism. However some erroneously pointed out that after this process no sperms are produced. In a number of cases students described referred to vasoconstriction and tubal ligation.

Students showed good understanding of the different types of seed dispersal mechanisms. Some scripts included unnecessary lengthy paragraphs about the different types of seed dispersal methods. Most students were aware that seed dispersal is needed to avoid competition, but only very few students explained that seed dispersal helps plants to colonise new areas. A number of students mixed up the terms seed dispersal with pollination.

Vegetative propagation was well explained as a kind of asexual reproduction in plants. Students mentioned cuttings, runners, tubers and tissue cultures and explained that through this process positive plant characteristics are maintained. A number of students did not attempt this part of the question altogether.

Most students were unable to describe the process of nitrogen fixation and many students interchanged nitrogen fixing bacteria in root nodules with nitrifying bacteria present in soil.

Most students were aware of the role of yeast in fermentation in a bakery; however some students described the yeast as a bacterium or as an enzyme. Students referred to the rising of the dough but many failed to outline the role of carbon dioxide.

2.4 Comments regarding Paper 2B

Question 1

A significant number of students did not manage to give concise and valid definitions of the terms habitat and ecosystem. A number of students still defined the term habitat as *the place where an animal lives* instead of *the place where an organism lives*. Very often students were unable to distinguish between biotic and abiotic factors. Furthermore students managed to describe the increase/decrease in salinity however they failed to explain the changes in salinity. The definition of osmosis was generally incorrect – students often failed to specify that it involves the movement of water. Instead students merely mentioned the movement of *molecules* or *substances*. Definitions of osmosis often lacked reference to the presence of a selectively permeable membrane. A significant number of incorrect answers were noticed in part 'd'. Students often referred to algae as plants or fungi. Students listed several structural characteristics of the named organisms. In part 'f' students often failed to give comparative differences. Parts 'g' and 'h' were generally incorrect or left incomplete. Most students were not aware that algae are producers. Some common incorrect replies included *algae purify the water; algae eat bacteria*.

Question 2

The bar graphs presented by a significant number of students were not up to standard. Very often the titles, labels, scale and plotting were inadequate. The bars were not presented separately from each other as instructed in the question. The simple calculations in part 'b' proved difficult for a significant number of students. Students often cited exhaust fumes and toxic gases as the main culprits of lung cancer. Reference to passive smoking was sparse. The diagrams presented by most students were of a very poor quality. Labels were often incorrect or completely missing. Parts 'e' and 'f' were generally incorrect or left out. Students' answers show a general misunderstanding of the biological concept related to gas exchange surfaces.

Question 3

This question was only attempted by a limited number of students. Students' replies often showed misunderstanding of biological concepts related to plant biology. Most students described the function of water in very generic terms such as *to stay alive*; *to grow*; or *not to dry out*. The functions of nitrates and magnesium were generally unknown. Students knew that magnesium is obtained from soil however many failed to refer to active transport for its uptake. Similarly for carbon dioxide – most students mentioned that it is taken up from the air but failed to describe the role of diffusion and stomata. Parts 'c', 'd' and 'e' were generally answered incorrectly. Students failed to outline how osmosis is involved in the uptake of water by the roots while most were unable to explain the adaptation of the rolling of leaves. As in paper 1 many students did not distinguish between pesticides and fertilisers.

Question 4

This question was popular among students. The definition of osmoregulation often lacked reference to the control of salt concentrations in the body. Excretion was often defined as the removal of waste from the body with no reference to metabolic waste. A number of students still cannot differentiate between excretion and egestion indeed a number of students defined excretion as the *removal of undigested material*. On the other hand a number of students gave specific examples of excreted waste such as sweat or carbon dioxide, thus giving evidence of adequate understanding of the term. The diagram of the kidney was not presented in a number of scripts. Whenever diagrams were presented they lacked the necessary detail (such as relative thickness of renal artery and vein) and labels. In isolated cases the nephron diagram was presented instead of the kidney. The description of the ultrafiltration process in part 'c' of the question was often inadequate. Students were generally aware that ultrafiltration takes place in the glomerulus but generally failed to explain how high pressure brings about this process. Part 'd' was generally answered correctly however a number of students still exchanged the ureter and the urethra. Some students presented a simple diagram to explain the pathway better. The last part of the question was often left unattempted; whenever answered students failed to explain the decrease in urine output and there was absolutely no mention of increased water reabsorption in the nephron.

Question 5

This question was not very popular amongst candidates. Students often failed to design an adequate experimental investigation. The use of the clinostat for a control experiment was generally ignored. A significant number of students were unable to distinguish between shoots and roots.

Question 6

In part 'a' of this question students demonstrated sound knowledge of gills, fins, and waterproof scales. Some misconceptions were still evident such as the function of gills *to take oxygen from the water* (without any reference to the gas exchange process) or *gills needed for respiration*. Similarly in part 'b' students were generally aware of the importance of dry scales. The behavioural characteristics of lizards (e.g. hiding under stones) were often not associated with the ectothermic nature of reptiles. A significant number of students still use the inadequate term *cold blooded* when referring to ectotherms. The last part of the question was generally correct.

Question 7

In this question students presented generic answers such as *chimney filters reduce air pollution*. Only a relatively small number of students mentioned that less smoke is emitted from filtered chimneys; reference to less sulphur dioxide emission was very limited. Students generally mentioned that sewage treatment helps to reduce unpleasant odours and the risk of diseases/infections. Reference to

eutrophication was very sporadic. Nature reserves were generally associated with the protection of birds – the importance of nature reserves as conservation areas was highly lacking.

In part 'c' students stated that sea levels rose because of ice melting, however failed to explain that global warming is causing a rise in temperature. Students also showed awareness that oil pollution is harmful to birds as their wings are impaired however the insulating properties of the feathers were never mentioned. In the discussion related to pesticides the term *persistent* was ignored by most students; furthermore the issue of bioaccumulation of the chemicals in the pesticide, along the food chain was hardly ever mentioned.

Students often gave definitions of monocultures without referring to the effects on soil. In the last part of this question students showed awareness of the importance of recycling to reduce land pollution, to reduce waste or to conserve natural resources. Students often cited examples of good practice such as recycling papers to reduce the destruction of trees.

Question 8

The term vasodilation was often confused with other temperature control mechanisms such as sweat formation and contractions of the hair erector muscles. A significant number of students named the male and female gametes correctly however failed to mention their site of production and the process of cell division. Detailed accounts of how the sperm reached the egg were unnecessary. The role of gametes in carrying genetic information of both parents was often overlooked.

Vasectomy was well defined as a birth control method preventing pregnancy, however students often failed to mention that it is a practically permanent contraception method. Students' answers highlighted the common misconception that males who underwent vasectomy produce no sperms.

Seed dispersal was often confused with pollination – students mentioned that *seeds pass from plant to plant with the help of insects or wind*. Whenever seed dispersal was mentioned in the correct context students only linked it to its use in reducing competition but failed to mention the benefit of seed dispersal in the colonisation of new areas.

Students generally showed a general lack of understanding of the process of alcoholic fermentation; most answers did not include any reference to the role of carbon dioxide in making the dough rise. Furthermore a number of students referred to yeast as a bacterium.

Part 3: General comments about Coursework

- The feedback sheet related to coursework that was introduced last year generally served to improve the overall quality of the practical component.
- In the majority of the moderated schools the practical reports presented ranged over a variety of topics from the syllabus and the level was adequate to SEC.
- Most of the students presented their practical work in neat ring-files with a front sheet listing all the practical reports. However in a number of schools students failed to separate the five different sections (as specified in the syllabus). It is recommended that students use dividers to distinguish clearly between the different sections.
- The precautions and sources of error were conspicuously absent in the vast majority of reports.
- In a small number of schools no fieldwork report was presented – the syllabus stipulates the inclusion of at least one fieldwork activity.
- In the large majority of moderated schools three problem solving investigations were presented. In some schools two or three students failed to present three such practicals; then the average was worked out incorrectly. It is worth pointing out that in such situations the missing problem solving report cannot be replaced by other 'normal' lab reports.
- In some schools the problem solving investigations were presented in the normal layout (aim, apparatus, method etc.) The SEC syllabus outlines clearly the format to be used for problem solving reports. Such reports should include the following sections:

Identifying the problem

Experimental design

Evaluation of the investigation

- The problem solving reports very often lack adequate information related to the changes from the original plan of the investigation. This is an essential step of the analysis as students may vary their approach, alter parts of the investigation and add on missing steps or request additional apparatus as they proceed.

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- An increasing variety of problem solving investigations attempted in schools was observed. However in a particular school the investigation involved the extraction of DNA that was performed as a demonstration by the tutor – this practice is not commendable.
- In isolated cases a small number of experiments lacked the correct ethical hygienic professional procedures: one such case involved the use of saliva for experiments related to the action of the enzyme amylase.
- In general the site visit reports were lengthy and including a lot of downloaded material not related to the biological concept/s. The syllabus specifies that the site visit report should approximately consist of 1500-2000 words. In isolated practices students presented the site visit report as a group. Notwithstanding the fact that students are encouraged to work in groups, each and every student must present his/her own report.
- In most of the schools moderated, teachers marked the reports rigorously with clearly set criteria in mind. In one particular school students were provided with a mark allocation sheet for each experiment. This is a highly recommended practice as students gain direct feedback about their work. However in a limited number of schools, teachers assigned high marks to all students notwithstanding big discrepancies in the level of work presented by the different students.
- A number of private candidates were called for an interview about the practical reports they presented. From the interviews it was evident that a number of private candidates presented reports of practicals that they had not performed. Indeed the interviewees were unable to discuss the methods or equipment they wrote about in their practical reports.

Chairperson
Board of Examiners
July 2009