UNIVERSITY OF MALTA

THE MATRICULATION CERTIFICATE EXAMINATION
INTERMEDIATE LEVEL

ENVIRONMENTAL SCIENCE
May 2014

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD

Environmental Science
Intermediate Level
May 2014

Introduction

A total of 424 candidates applied for the examination. The table below shows the distribution of grades for this session as compared with the results of the previous year:

Grade	No. of Candidates	% of sample	% of May '13 sample
A	20	4.7	4.1
B	41	9.7	9.8
C	92	21.7	22.0
D	116	27.4	27.5
E	68	16.0	16.7
F	58	13.7	14.9
Absent	29	6.8	5.1

Comments on the individual questions

Section A

Q1. Most candidates answered part (a) correctly. A few candidates confused the inner with the outer core. Only a handful of candidates gave the correct reason for parts (b) and (c), i.e. the convective currents in the mantle and what the composition of the lithosphere.

Q2. Most candidates answered parts (a) and (b) correctly. However, some candidates failed to realize that the human practices requested in part (a) had to be related to the Maltese context and consequently erroneously referred to *deforestation* and *oil exploration*. In part (c) only a few candidates replied with the correct type of soil horizon that matches the description given in the table. The vast majority of the candidates had no problems with part (d).

Q3. This question was correctly answered by most candidates. In part (a) many candidates repeated their answers in different forms so as to give three benefits. The three benefits being sought should have been distinct biodiversity benefits. Most candidates were aware of 'monocropping' and its effects. Answers revealed many misconceptions related to genetically modified crops such as that these crops have toxic chemicals injected in them. Few candidates gave two correct effects of land clearing – the rest just elaborated on a single effect.

Q4. Many candidates performed rather badly in this question showing distorted ideas on the issue of ozone depletion. A common mistake was the confusion between the ability of stratospheric ozone to filter off harmful UV radiation and the ability of greenhouse gases to absorb and radiate heat and hence warm up the lower atmosphere. In part (a) candidates were quite confident in describing the ozone layer although some thought it was entirely made up of ozone gas. Many responses in part (b) focused on differentiating between the troposphere and stratosphere without distinguishing between the formation of naturally occurring ozone in the upper atmosphere and ground level ozone resulting from pollution. In part (c), the majority of candidates indicated correctly CFCs (chlorofluorocarbons) as substances with a high ozone depleting potential. However there were several responses making the wrong connection with greenhouse gases such as CO_2. Only a minority of responses to part (d) described the correct mechanism through which CFCs interact with ozone molecules in the stratosphere converting them to diatomic oxygen molecules. Indeed there were very few references to the catalytic role of the chlorine free radicals in the conversion between the two allotropes of oxygen. Many of the responses to part (e) confirmed that some of the candidates confused the concept of ozone depletion with that of the enhanced greenhouse effect. In fact typical responses referred to melting of glaciers and of polar ice caps, increase in sea levels and global climate change as consequences to ozone depletion, rather than problems related to human health (e.g. skin cancers, eye cataracts) and the environment (e.g. destruction of phytoplankton, effect on crop yield).

Q5. Candidates generally did well in this question although only a few secured a high mark. Some of the responses to part (a) were general, making reference to biological, physical, chemical or industrial pollutants without giving any specific examples. Others mentioned solid waste such as plastic and

dead organisms, or referred to air pollutants such as oxides of nitrogen and sulfur. In part (b), a good number of candidates could not distinguish clearly between point sources and diffuse sources of water pollution, relating the latter to dilution effects of water soluble pollutants rather than untraceable sources of pollution. Candidates in general gave a good description of the term eutrophication in part (c) but a minority was completely out of point, indicating processes such as water purification or salinization. Part (d) was also generally well answered with typical responses referring to nutrient enrichment deriving from agricultural practices such as excessive use of fertilisers (nitrates and phosphates) and discharge or organic matter in closed water bodies, leading to cloudy waters and algal blooms. Part (e) was also generally well tackled with most candidates citing both lack of direct sunlight and oxygen as the consequence of eutrophication which has a negative impact on aquatic life. In part (f), only few candidates could figure out that the offensive smell linked with polluted water originates from bacterial decay of organic matter which occurs under anaerobic conditions and releases pungent smelling gases such as hydrogen sulfide (which smells of rotten eggs).

Q6. Approximately 15% of candidates did not even attempt to answer this question. It was also noted that there were many candidates whose answers showed that they did have any knowledge about this part of the syllabus. The majority of candidates did not obtain any marks in part (a). Many candidates said that succession can be of two types, but failed to define succession. Part (b) was also answered wrongly by most of the candidates who attempted it, if answered at all. Many candidates gave the definition of a sere rather than a seral stage. On the other hand, a good number of candidates obtained full or half marks for part (c). Most candidates who answered correctly part (c), could also explain the characteristics of a climax community in part (d).

Q7. Many candidates identified the biomes correctly and listed correctly the characteristic desert vegetation. Less correct answers were provided for the nutrient content of soil in the different biomes with the most common misconception being that tropical rainforests contain nutrient rich soils.

Q8. The majority of candidates were awarded half the marks for their answer to part (a) because, while describing that it is a growth that is increasing constantly, they failed to explain that it occurs by a fixed percentage. Wrong answers mostly referred to the J-shaped growth curve. Half of the candidates obtained full marks for parts (aii) and (aiii). Parts (bi) and (bii) were correctly answered by the majority of candidates. Most candidates answered part (biii) wrongly with the most common answers being *China*, *Malta*, a European country like *Italy* or *England*. Many candidates also gave a general answer such as a *developing country* or *Africa*.

Section B

Q1. Most candidates gave correct replies for part (a), including some very good chemical equations for the three processes. The Carbon Cycle was drawn correctly by most of the candidates. However, the formation of acid rain and the sources of methane were less known by the candidates. Many candidates confused the formation of acid rain from carbon dioxide with other gases present in air or with the pollution present in air. A number of other acids (other than carbonic acid) were mentioned even though they were irrelevant to the answer requested. Candidates indicated a general lack of awareness about methane gas and its role as a pollutant.

Q2. This was the second most attempted question. Nevertheless, most candidates fared badly in this question, especially in part (b). Even though candidates demonstrated a high degree of general knowledge about recycling of materials, this question asked for specific knowledge about the issues related to the recycling of the four different waste fractions mentioned in part (b) of the question. Part (c) was correctly answered by the majority of the candidates.

Q3. Only a few candidates who attempted this question scored a high mark as most of the answers given lacked important details or were completely irrelevant. In part (a), few responses made a clear distinction between primary, secondary and tertiary treatments of sewage / wastewater. However, the best accounts included very well-labelled diagrams which helped summarize the most important details of the techniques and features described. Candidates were more confident answering part (b) whereby they were asked to distinguish between the 3 main types of waste disposal, i.e. the use of open dumps, incinerators and engineered landfills. Many of them even referred to the local context by citing the various waste management facilities in our country. There were also some excellent diagrams to explain the main features of a sanitary landfill. Candidates found it hard to explain the difference between primary and secondary air pollutants in part (c) and many gave the wrong examples. Some candidates also found it hard to distinguish between hazardous and inert waste. Household waste was frequently associated with inert waste without realizing that this includes organic matter which is biodegradable and cannot therefore be classified as such. The most commonly mentioned hazardous waste was 'used batteries' and only few referred to flammable solvents, reactive chemicals, heavy metals and radioactive waste as typical examples of hazardous and toxic waste.

Q4. This turned out to be the least attempted question in section B, indicating that candidates avoided answering questions requiring a good background of environmental chemistry. Those candidates attempting this question gave a good account of the origin and toxicity of the common atmospheric pollutants, but were less successful in highlighting specific methods of pollution control such as the catalytic converter (for carbon monoxide, oxides of nitrogen and certain VOCs), the flue desulfurization process (to remove oxides of sulfur), electrostatic precipitators (to reduce particulate matter) and other alternative techniques. Candidates however correctly indicated the use of alternative / renewable sources of energy as one of the effective and practical measures which could be taken to reduce pollution and particularly the carbon footprint representing the impact of carbon dioxide on global warming.

Q5. Around 80% of the candidates chose to answer this question making it the most popular question with the candidates. Most candidates obtained full marks for part a. In part (b), many candidates only proposed two or three reasons why forests are important. Candidates should match their answer to the number of marks given. Also many candidates used rather immature scientific language in their answer such as *forests are the lungs of the earth* or *trees take in bad air and release good air*. This is not acceptable at this level. In part (c) many candidates did not obtain full marks in their answer because they did not provide enough reasons for deforestation. A number of candidates also have the wrong impression that it is important to cut down forests to prevent the spread of diseases and to fertilise the land. Many candidates did not obtain full marks for their answer to part (d) because they did not mention enough impacts of deforestation. Many candidates also used incorrect scientific language and expressed misconceptions such as that deforestation leads to more carbon dioxide in the atmosphere which causes ozone layer depletion.

Q6. This was the third most attempted question. Candidates generally performed well in this question, with most of them securing a high mark. It is clear that candidates were prepared well in this area and found themselves confident explaining terminology such as ecosystem, abiotic versus biotic components, trophic levels and food chains. Diagrams given were not always clearly labelled and some of the food chains included inverted direction of arrows between organisms cited. There were also some incorrect references to amounts of energy transferred between successive trophic levels of a typical food chain.

General comments

The examiners would like to highlight the following common issues:

1. It was again noted that some candidates found it really hard to express themselves in good English, although on a positive note, there were also some very excellent presentations.

2. Examiners found it hard to read and mark scripts with crammed calligraphy and irrelevant responses. Candidates are reminded that illegible handwriting and poor presentation of work are always penalized in written examinations.

3. A good number of responses to section A questions were very long and exceeded the space provided. Candidates are reminded to keep as concise as possible when tackling this section as extra details cannot be rewarded with extra marks.

4. Section B questions were sometimes attempted without any necessary planning, resulting in long and winding paragraphs with disorganized or illogical sequence of concepts. It is important to devote some minutes to planning and keep always straight to the point.

5. Some candidates preferred to answer the long questions in the form of an essay, ignoring the fact that questions were mostly structured and divided into sub-questions requiring separate answers. Answers to section B questions are preferably divided into shorter paragraphs, underlining key terms and illustrating descriptions with the use of simple (well-labelled) diagrams, where necessary.

Chairperson
2014 Examination Panel