

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION CERTIFICATE EXAMINATION
INTERMEDIATE LEVEL
SEPTEMBER 2013

SUBJECT: ENVIRONMENTAL SCIENCE
DATE: 7th September 2013
TIME: 9.00 a.m. to 12.00 noon

Answer ALL questions in Section A and any TWO questions from Section B.

Section A carries 80 marks and Section B carries 40 marks. You are advised to spend about two hours on Section A and one hour on Section B.

Section A

Answer all questions from this section.

1. The graph on the right shows how the temperature of an ocean varies with increasing depth of the ocean.

(a) Briefly explain the relationship indicated by the graph.

(2 marks)

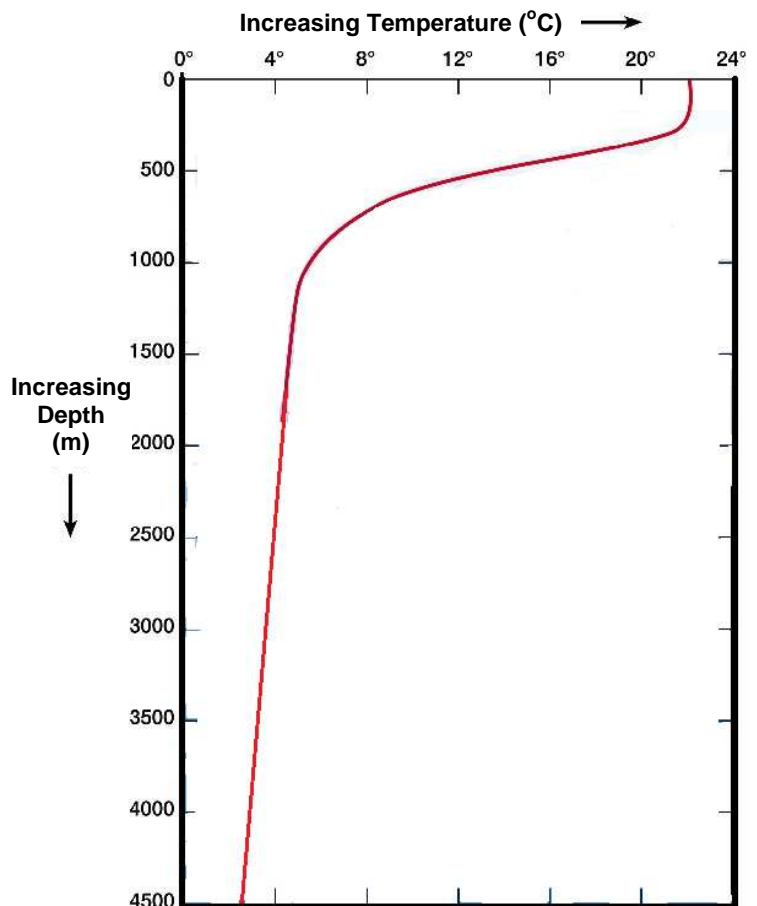
(b) (i) Define the term *thermocline*.

(ii) On the graph, draw a circle to mark the region on the curve representing a *thermocline*.

(2, 1 marks)

(c) On the graph label (i) the photic zone and (ii) the abyssal zone.

(1, 1 marks)



DO NOT WRITE ABOVE THIS LINE

(d) Underline the correct word in the following sentences:

- (i) About 90% of all marine life can be found in the (photic / abyssal) zone.
- (ii) The greater the water depth the (less / more) light will be available to organisms living in water.
- (iii) The (temperature / transparency / density) of the water determines the depth of the photic zone.
- (iv) The (photic / abyssal) zone is characterized by a lack of nutrients.

(4 marks)

(Total: 11 marks)

2. Complete the following passage on Tanzania's mineral resources by choosing the best term from the following list. Each term may only be used **once** BUT not all terms are required.

toxic

river

health

degradation

deforestation

pollution

environment

sulfide

mercury

The exploitation of mineral resources is considered to be one of the main causes of _____ in Tanzania. Mineral extraction involves the excavation of underground pits and the breaking up of rocks using explosives, which causes regional land _____. Some of the typical environmental impacts caused by mining activities include diversion of rivers, water siltation, _____, destruction of aquatic life habitat, and widespread mercury pollution. The wastes contain _____ elements and minerals, which may interact with water to contaminate the soil and the _____. Gold extraction causes chemical alteration of _____ minerals which process releases acid in water bodies. Such acidic water can contaminate nearby streams and ground water for centuries after a mine has closed. The use of mercury in gold mining causes the liquid element to vaporize to the atmosphere to contaminate the _____. This can pose a serious _____ threat to the communities surrounding mining regions.

(Total: 8 marks)

DO NOT WRITE ABOVE THIS LINE

3. Agenda 21 of the UN lays out what needs to be done to reduce wasteful and inefficient consumption patterns in some parts of the world while encouraging increased but sustainable development in others.

(a) From the following list, underline the practices that encourage sustainable development.

Using disposable plastic cups because they can be recycled

Polluter pays for pollution caused

Completely switching off appliances that are on standby mode

Environment assessments are carried out after new projects are undertaken

Using stones from demolished buildings to build new ones

Abiotic resources such as land and water are used extensively by developed countries

Ensuring rainwater catchment measures in building designs

(4 marks)

(b) Briefly explain **one** example to show how **resource substitution** can be applied in practice.

(2 marks)

(c) Name **two** advantages of using a *named* renewable source of energy compared to using a non-renewable source.

(i) _____

(ii) _____

(2 marks)

(Total: 8 marks)

DO NOT WRITE ABOVE THIS LINE

4. From the following list, choose the term which best fits the description given in the table provided. Each term can be used once, more than once or not at all.

carbon dioxide**chlorofluorocarbons****fatty acids****carbon monoxide****particulate matter****oxides of nitrogen****ozone****volatile organic compounds****sulfur dioxide**

Description	Term
A gas produced by burning coal in power plants or by some industrial processes such as extraction of metals and manufacture of paper. Contributes to acid rain.	
Substances once used in great quantities for refrigeration and air-conditioning. Damage the stratospheric ozone layer.	
A colourless odourless greenhouse gas that occurs naturally in air. Also emitted in significant quantities by fossil fuel combustion.	
A colourless odourless toxic gas produced by incomplete combustion of fossil fuels. Combines with red blood cells preventing blood from carrying oxygen to cells, tissues and vital organs.	
An air pollutant produced by sources involving burning of fuels as well as by other sources such as road construction and stockpiling of sand.	
A pollutant produced by lightning and burning of fossil fuels. Plays an important part in the formation of smog and acid rain.	
A sharp smelling gas which reacts with other substances and forms photochemical smog. It is undesirable in the troposphere but desirable in the stratosphere because it absorbs harmful radiation which would otherwise reach the earth's surface.	
Substances used as solvents and dry cleaning agents that are synthesized by chemists in laboratories. Vaporise readily at room temperature and pressure.	
Substances that are released into the atmosphere by natural sources such as trees, by vaporisation of fuel and through the use of solvents. Contribute to smog formation.	

(Total: 9 marks)

DO NOT WRITE ABOVE THIS LINE

5. Complete the following account by choosing the appropriate term from the following list of terms. *Each term may be chosen once, more than once or not at all.*

aerobic	carbon monoxide	nitrifying
algal	dissolved oxygen	organic matter
anaerobic	eutrophication	phosphates
aquatic	sulfates	phytoplankton
hydrogen sulfide	methane	salmonella
carbon dioxide	nitrates	biological oxygen demand

The reduction in concentration of oxygen (in ppm) caused by the natural decomposition of _____ in lakes and rivers is known as the _____. Microorganisms such as _____ bacteria make use of _____. These organisms break down _____ releasing a range of plant nutrients such as _____, _____ and _____. They also oxidise carbon into _____. If excessive amounts of nutrients are dumped into the water, this results in a population explosion of _____ known as _____ bloom. This may result in the depletion of _____ in water which kills fish and other _____ organisms. This process is known as _____. In the absence of oxygen, _____ decay occurs and this results in the release of a greenhouse gas called _____ and the poisonous gas _____ which smells of rotten eggs.

(Total: 17 marks)

DO NOT WRITE ABOVE THIS LINE

6. Forests are essential to the survival of life on Earth, providing oxygen, clean water, shelter, fuel, and food. Illegal logging has put a heavy strain on these important resources. These ecosystems are protected if logging is conducted responsibly.

(a) What is logging?

_____ (1 mark)

(b) Give **three** reasons why logging occurs.

 _____ (3 marks)

(c) Give **two** examples of sustainable forestry practice.

 _____ (2 marks)
 (Total: 6 marks)

7. The figure below shows a human population growth curve showing how the human population has grown from 0.5 billion in 1650 to 6.5 billion by the end of 2010.



(a) What population growth model best represents the graph shown here?

_____ (1 mark)

DO NOT WRITE ABOVE THIS LINE

- (b) Give **three** consequences of the continuation of the trend shown in the graph.

(3 marks)

- (c) Define **birth rate**.

(2 marks)

- (d) The decision to keep families small is directly related to the gross national income of a country. The fertility rate in less developed countries is much higher than the rate in more developed countries. Give **three** reasons why this is so.

(3 marks)

- (e) Faced with poverty and hardship in the countryside, hundreds of millions of people in the developing world are moving to cities in search of employment and a better life. Give **one** reason why this urbanization increases child mortality?

*(2 mark)***(Total: 11 marks)**

8. Scientists recorded the data below that shows populations of snake and mice found in an experimental field. Mice were introduced to the field and their numbers allowed to stabilize, and to reach their carrying capacity with no predation. A breeding pair of snakes was introduced in 1960. No immigration or emigration occurred.

Year	No. of Snakes	Mice born per 1000	Mice died per 1000
1960	2	1000	200
1970	10	8000	300
1980	30	400	400
1990	15	600	550
2000	14	620	600
2010	15	640	580
$(r) = \frac{(\text{Birth rate} + \text{Immigration}) - (\text{Death rate} + \text{Emmigration})}{10}$			

DO NOT WRITE ABOVE THIS LINE

(a) Distinguish between immigration and emigration.

(2 marks)

(b) Give **three** factors that may have limited the growth of the mice population and stabilised it.

(3 marks)

(c) During which year was the mouse population experiencing zero population growth?

(1 mark)

(d) Give an estimate for the carrying capacity of the field for the **snake** population based on this data.

(1 mark)

(e) What is the rate of growth (r) for the mouse population in 2000? Show your working.

(3 marks)

(Total: 10 marks)

DO NOT WRITE ABOVE THIS LINE

Section B

Answer any TWO questions from this section.

Write your answers in the space provided in THIS booklet. If you need more space to continue your answers you may request another booklet from your invigilator.

1. Explain the main processes involved in the Hydrologic Cycle (Water Cycle). In your account:
 - (a) use a well labelled diagram to illustrate the cycle **(6 marks)**
 - (b) ensure that you explain the following terms:
 - Evaporation
 - Condensation
 - Precipitation
 - Interception
 - Run-off
 - Percolation
 - Ground water **(14 marks)**

2.
 - (a) Define the following terms: Solar System, Galaxy and the Universe. **(6 marks)**
 - (b) Describe the position of the Earth in the Universe. **(4 marks)**
 - (c) Draw the main features of the internal structure of the Earth. **(4 marks)**
 - (d) Distinguish between: converging, diverging and conservative plate boundaries. **(6 marks)**

3.
 - (a) Distinguish between **first class water** and **second class water**. **(2 marks)**
 - (b) Explain the main aim of sewage treatment. **(2 marks)**
 - (c) Outline the **primary** and **secondary** stages of sewage treatment, stating clearly what substances are removed during each stage and referring to techniques involved such as filtration, sedimentation, flocculation, aeration, activated sludge, and disinfection. Your explanation may include a simple labelled diagram summarising methods used in every stage. **(12 marks)**
 - (d) There is an increasing demand for sewage to be subjected also to a **tertiary** treatment. Describe **two** techniques which may be employed in such an advanced method of wastewater treatment. **(4 marks)**

4.
 - (a) Define succession and climax community. **(4 marks)**
 - (b) Give **five** characteristics of a climax community. **(5 marks)**
 - (c) Name a pioneer species. **(1 mark)**
 - (d) Make a list of **five** characteristics that a coloniser would probably have. **(5 marks)**
 - (e) Create a flow chart showing the different seral stages in a primary succession. **(5 marks)**

DO NOT WRITE ABOVE THIS LINE

5. (a) Certain chemical elements can exist in two or more different forms, known as allotropes. Each allotrope has atoms of the element that are bonded together in a different manner. Oxygen (O) has two naturally occurring allotropes. Distinguish between these two forms of oxygen, stating the molecular formula, physical state and any other physical or chemical property of each allotrope. **(4 marks)**
- (b) It is believed that the levels of stratospheric ozone have recently fallen due to increased levels of CFC molecules which change in the presence of UV light producing free chlorine radicals, which in turn react with and destroy ozone.
- (i) Explain the term 'CFC' and give the molecular formula or structural formula of a typical CFC.
- (ii) Explain the origin of CFC molecules in the atmosphere.
- (iii) CFCs have been completely banned and replaced by compounds referred to as HFCs. Explain the difference between CFCs and HFCs and explain also why the latter compounds have no ozone depletion potential. **(2, 2, 3 marks)**
- (c) Give the name and chemical formula of another gas that reacts with ozone in the upper atmosphere. **(2 marks)**
- (d) Name **two** harmful effects of stratospheric ozone layer depletion. **(4 marks)**
- (e) Explain why ozone is considered as a **secondary pollutant** in the troposphere and name **one** undesirable effect of ozone on humankind. **(3 marks)**
6. (a) Sketch a graph showing sigmoid population growth and label the different phases. **(6 marks)**
- (b) Explain **three** of the phases you labelled in (a). **(6 marks)**
- (c) Explain **environmental resistance** and list **three** factors that can contribute to it. **(4 marks)**
- (d) Distinguish between **density dependent** and **density independent** factors. **(2 marks)**
- (e) Distinguish between **intraspecific** and **interspecific** competition. **(2 marks)**
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