



SUBJECT: **Environmental Science**  
 DATE: 28<sup>th</sup> May 2022  
 TIME: 9:00 a.m. to 12:05 p.m.

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. (a) Briefly explain the following processes.

(i) Nitrogen fixation: \_\_\_\_\_  
 \_\_\_\_\_ (2)

(ii) Denitrification: \_\_\_\_\_  
 \_\_\_\_\_ (2)

(b) Complete the table by selecting the appropriate term from the list below. Each term may be used once, more than once or not at all. (5)

<b>A Horizon</b>	<b>O Horizon</b>	<b>Infiltration</b>
<b>B Horizon</b>	<b>Humus</b>	<b>Biological Weathering</b>
<b>C Horizon</b>	<b>Leaching</b>	<b>Physical Weathering</b>

Definition	Term
The breakdown of rock with no change in the rock's chemical composition.	
This soil layer is usually referred to as topsoil.	
The name given to the decomposed organic matter present in soil.	
The loss of soluble materials from a soil due to water flowing through the soil.	
This soil layer is mainly weathered bedrock and inorganic material.	

***This question continues on the next page.***

(c) List **THREE** advantages of organic fertilisers.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (3)

**(Total: 12 marks)**

2. (a) State whether each of the following statements is **TRUE** or **FALSE**.

	<b>Statement</b>	<b>True or False</b>
(i)	Insolation is the amount of incoming solar radiation that reaches the Earth's surface.	
(ii)	Ferrel Cells are convection cells that develop at the Equator due to intense heating.	
(iii)	The mesosphere is the layer of the Earth's atmosphere where most of the Earth's weather occurs.	
(iv)	The global energy budget stays in balance as outgoing earth radiation equals incoming solar radiation.	
(v)	Milankovitch cycles affect the amount of solar heat that's incident on the Earth's surface and subsequently influence climatic patterns over thousands of years.	
(vi)	The oceans are the best surface for albedo to occur.	

(3)

(b) Choose **TWO** false statements and give a reason why each statement is false.

(i) Statement number: \_\_\_\_\_

Reason: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (2)

(ii) Statement number \_\_\_\_\_

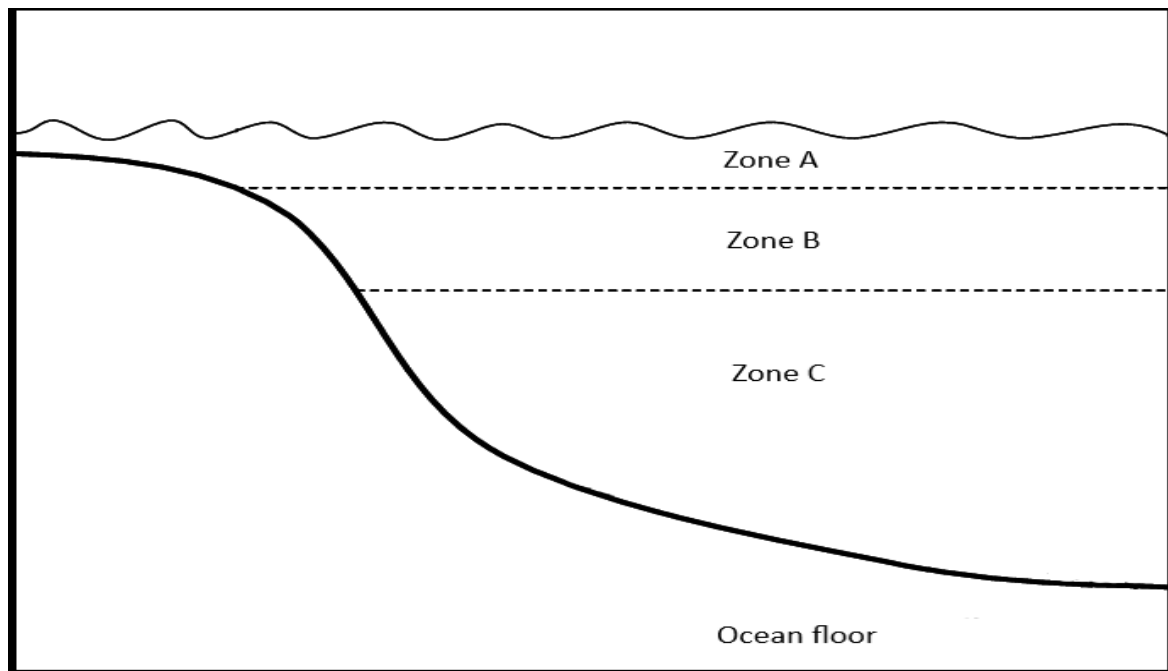
Reason: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (2)

**(Total: 7 marks)**

3. The open sea is characterized by three main zones as shown in the diagram below.



(a) Fill in the table below:

	<b>Name</b>	<b>Degree of illumination</b>	<b>Principal living organisms and their characteristic feature</b>
<b>Zone A</b>			
<b>Zone B</b>			
<b>Zone C</b>			

(9)

(b) What are tides and what causes them?

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(3)

**(Total: 12 marks)**  
**Please turn the page.**

4. Briefly describe each of the following different measures used to control the effects of atmospheric and water pollution.

(a) Electrostatic precipitator: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(b) Catalytic converter: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(c) Flue gas desulfurisation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(d) Primary sewage treatment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(e) Secondary sewage treatment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(f) Tertiary sewage treatment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

**(Total: 12 marks)**

5. (a) Briefly explain the difference between the term greenhouse effect and global warming.

Greenhouse effect: \_\_\_\_\_  
\_\_\_\_\_ (2)

Global warming: \_\_\_\_\_  
\_\_\_\_\_ (2)

(b) Name **TWO** oxygen-containing greenhouse gases.

\_\_\_\_\_  
\_\_\_\_\_ (2)

(c) List **FOUR** possible consequences of an enhanced greenhouse effect over the next century.

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(4)

**(Total: 10 marks)**

6. Each row in the table below represents a different ecological relationship, its definition and one example. Complete the missing information. *The first row is given as an example.*

Ecological relationship	Definition	Example
<i>Mutualism</i>	<i>When two different species interact with each other, and both are benefitting from the relationship.</i>	<i>Honeybees and flowers</i>
Intraspecific competition		
		Ticks attached to the dogs' fur.
	A relationship where one species is harmed, and the other species is unaffected.	
Commensalism		
Interspecific competition		

**(Total: 10 marks)**

***Please turn the page.***

7. Read the passage below and answer the questions that follow it.

There are several policies aimed at protecting habitats that are critical for commercial species and identify measures to decrease the negative impacts of fishing in areas where juveniles of commercial species gather.

Most of the Mediterranean fisheries target overfished stocks. Besides the biological impacts of their activity, this unsustainable practice also means that fishermen cannot maximise their income. To increase the productivity of the fished species, a key requirement is to shift the size of the first capture to larger sizes. Decreasing small individuals in catches ensures that more fish and shrimp survive to reproduce. Establishing and implementing marine protected areas will control fishing activities in these areas ensuring the protection of habitats that are essential for species to complete their life cycles.

*(Adapted from: <https://timesofmalta.com>)*

(a) Find the term in the passage that matches each statement below:

- (i) An activity that cannot continue at its current level or rate:  
\_\_\_\_\_ (1)
- (ii) A population of fish whose numbers are so low due to excessive fishing:  
\_\_\_\_\_ (1)
- (iii) A geographical location which receives protection because of its recognized natural, ecological, or cultural values: \_\_\_\_\_ (1)
- (iv) The environment where the organism lives:  
\_\_\_\_\_ (1)

(b) Define the term biotic factor and mention **ONE** example from the passage above.

- (i) Definition: \_\_\_\_\_ (2)
- (ii) Example: \_\_\_\_\_ (1)

(c) Describe **ONE** alternative and more sustainable way of managing biotic resources in the Mediterranean Sea that is **not** mentioned in the passage above.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(d) Define the term conservation biology.

\_\_\_\_\_  
\_\_\_\_\_ (2)

(e) Name **ONE** marine protected area in the Maltese shores.

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\_\_\_\_\_ (1)

(f) Wildlife reserves are also established to protect flora and fauna on land. Name **ONE** example of a wildlife reserve.

\_\_\_\_\_ (1)

(g) Briefly describe **TWO** legislative tools used in conservation biology.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (4)

**(Total: 17 marks)**

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**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. (a) With the aid of a diagram, describe how solar radiation and gravity drive the different processes of the water cycle. (14)

(b) Briefly explain **THREE** strategies employed in Malta for providing adequate freshwater supplies. (6)

**(Total: 20 marks)**

2. (a) What is the main difference between renewable and non-renewable energy sources? (2)

(b) Name:

(i) **FOUR** types of renewable energy. (2)

(ii) **FOUR** types of non-renewable energy sources. (2)

(c) Describe **TWO** renewable sources of energy that can be used in Malta. Discuss the advantages and disadvantages for **each** source chosen. (8)

(d) List and explain **THREE** ways how the environment is negatively impacted when minerals and non-minerals are extracted. (6)

**(Total: 20 marks)**

3. The three Rs of waste management (reduce, reuse and recycle) are widely considered as the most effective way of dealing with solid waste for a more sustainable environment.

(a) Briefly explain **THREE** benefits of reducing waste and reusing resources. (6)

(b) List **FIVE** different actions that we can take to reduce waste and reuse materials. (5)

(c) Briefly explain **THREE** important advantages of recycling, over other means of waste disposal such as landfills and incinerators. (6)

(d) List **THREE** commonly used products that can be produced out of recycled material. (3)

**(Total: 20 marks)**

***Please turn the page.***

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4. (a) Explain the origin of photochemical smog, referring to primary and secondary atmospheric pollutants involved and typical climatic conditions for its formation. (8)
- (b) Explain how the condition known as temperature or thermal inversion, favours the formation of photochemical smog. (3)
- (c) Write suitable word equations or symbol equations to summarize the following chemical reactions which give rise to photochemical smog.
- (i) Nitrogen dioxide gas ( $\text{NO}_2$ ) breaking down by sunlight to form nitrogen monoxide gas ( $\text{NO}$ ) and an oxygen radical ( $\text{O}\bullet$ ). (1)
- (ii) The formation of ozone molecules ( $\text{O}_3$ ) from atmospheric oxygen ( $\text{O}_2$ ). (1)
- (iii) Reaction of ozone with nitrogen monoxide gas to produce a brown gas mentioned in reaction (i) above and atmospheric oxygen. (1)
- (d) Name **TWO** effects of photochemical smog on human health and another **TWO** effects on the environment. (4)
- (e) Mention **TWO** measures that are used to prevent the formation of photochemical smog. (2)

**(Total: 20 marks)**

5. (a) Draw a food chain made of **THREE** trophic levels. Use organisms that are present in the Maltese environment. (4)
- (b) Explain what will happen if the population of the producer included in your food chain dies out. (2)
- (c) Briefly explain the following statements.
- (i) Energy flow in a food chain always decreases along the food chain. (3)
- (ii) The primary consumer is in the second trophic level of the food chain. (3)
- (iii) The producer is not always a plant. (3)
- (iv) Food webs portray a more realistic understanding of ecosystems when compared to food chains. (3)
- (d) Identify the major terrestrial biome dominating the Mediterranean region, which is also present in the Maltese Islands. Describe **ONE** characteristic of this biome. (2)

**(Total: 20 marks)**

6. (a) Sketch a clearly labelled demographic transition graph of the total human population. Label the **FIVE** main phases. (8)
- (b) Distinguish between populations growth in more-developed countries (MDCs) and less-developed countries (LDCs). (8)
- (c) Define the term population density and explain why Malta is currently one of the top countries in Europe with a high population density even though it has a low fertility rate. (4)

**(Total: 20 marks)**

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