

NATIONAL UNIVERSITY OF LESOTHO
BSc. EXAMINATIONS
ESC 1311: INTRODUCTION TO THE PHYSICAL ENVIRONMENTAL

DECEMBER 2018

MARKS: 100

DURATION: 3 HOURS

This question paper consists of **TWO** pages; please see that you have **BOTH**

Answer **FOUR** questions. Answer one question from each section. Use **CLEAR** sketches and diagrams where appropriate.

SECTION A: LITHOSPHERE & BIOSPHERE

Question 1

- a) Provide a fully labelled diagram of the internal structure of the earth. Your diagram should show layers based on both the chemical composition and physical properties. (15)
- b) List the soil forming factors, and write short notes on any two of these (10)
- [25]**

Question 2

Explain, with the aid of a fully labelled diagram, the components of the ecosystem. **[25]**

SECTION B: ATMOSPHERE & HYDROSPHERE

Question 3

- a) Explain how and why the wet adiabatic lapse differs from the dry adiabatic lapse rate. Magnitude of the wet adiabatic lapse rate is less than that of the dry adiabatic lapse rate. Rate of cooling of dry air is greater than that of moist air due to the fact that as moist air cools, water vapour condenses. As water vapour condenses latent heat of condensation is released and that has a warming effect, thus reducing the net cooling. (5)
- b) The normal lapse rate is $6.5\text{ }^{\circ}\text{C}/\text{km}$. If the surface temperature is $24\text{ }^{\circ}\text{C}$, what is the air temperature at $12,000\text{ m}$ above Earth's surface? In your answer also indicate whether the atmosphere is stable or unstable.
Note that the condensation level is at $4,000\text{ m}$ above the surface. The saturated and dry adiabatic lapse rates are $5.5\text{ }^{\circ}\text{C}/\text{km}$ and $9.8\text{ }^{\circ}\text{C}/\text{km}$.

For the environment:

At $4,000\text{m}$ temperature is $24 - 26 = -2\text{ }^{\circ}\text{C}$

Change in temperature: $6.5 \times 4 = 26\text{ }^{\circ}\text{C}$

For the environment:

At $12,000\text{m}$ temperature is $-2 - 52 = -54\text{ }^{\circ}\text{C}$

Change in temperature: $6.5 \times 8 = 52\text{ }^{\circ}\text{C}$

For dry air

At $4,000\text{m}$ temperature is $24 - 39.2 = -15.2\text{ }^{\circ}\text{C}$

Change in temperature: $9.8 \times 4 = 39.2\text{ }^{\circ}\text{C}$

For dry air

At $12,000\text{m}$ temperature is $-15.2 - 44 = -59.2\text{ }^{\circ}\text{C}$

Change in temperature: $5.5 \times 8 = 44\text{ }^{\circ}\text{C}$

- (8)
- c) Briefly describe any **three** processes by which the Earth's atmosphere is heated. (12)
- Through latent heat of condensation: when latent heat of condensation is released, the atmosphere is heated.
- Through convection: when warm air rises
- Through advection: horizontal flow of air.

[25]

Question 4

- a) What are the necessary conditions for precipitation to occur? Discuss. (10)
- b) Describe the processes by which water is transferred between the Earth's surface and the atmosphere. (15)

[25]

SECTION C: MAPPING

Question 5

- a) Differentiate between the database and toolbox based definitions of Geographic Information systems (GIS) (5)
- b) Define the term remote sensing (2)
- c) Outline the importance of converting geographic coordinates to Decimal Degrees in mapping (3)
- d) Draw the following polygons:
- i) 1 ha/ 10000m² at the scale of 1: 2000 (5)
- ii) 3 ha /30000m² scale of 1: 3000 (5)
- e) Differentiate between aeronautical and synoptic charts (5)

[25]

Question 6

- a) Briefly, discuss all elements of an ideal remote sensing system and indicate what each element entails (20)
- b) Discuss the importance of Broadened Spectral Sensitivity in aerial photography (5)

[25]