

**UNIVERSITY OF SWAZILAND  
DEPARTMENT OF GEOGRAPHY, ENVIRONMENTAL SCIENCE AND  
PLANNING  
FINAL EXAMINATION, MAY 2006  
B.A., B.Ed., B.S., B.A.S.S.**

**TITLE OF PAPER: INTRODUCTION TO THE NATURAL ENVIRONMENT**

**COURSE NUMBER: GEP 111**

**TIME ALLOWED: THREE (3) HOURS**

**INSTRUCTIONS: THIS PAPER IS DIVIDED INTO THREE SECTIONS**

**SECTION A: MULTIPLE CHOICE**

- (i) ANSWER ALL QUESTIONS ON THE ANSWER SHEET PROVIDED. PUT A CROSS ON THE CORRECT ANSWER**
- (ii) THIS SECTION CARRIES 30 MARKS**

**SECTION B: SHORT ESSAY**

- (i) ANSWER ANY TWO QUESTIONS ONLY**
- (ii) EACH QUESTION CARRIES 15 MARKS**

**SECTION C: TECHNIQUES AND SKILLS**

- (i) ANSWER ANY ONE QUESTION ONLY**
- (ii) YOU ARE PROVIDED WITH A TOPOGRAPHIC MAP, TRACING PAPER AND GRAPH PAPER**
- (iii) EACH QUESTION CARRIES 40 MARKS**

**THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR**

**SECTION A: MULTIPLE CHOICE QUESTIONS**  
**ANSWER ALL QUESTIONS**

1. The law which explains the differences in the rate of movement around the earth's orbit during aphelion and perihelion is known as:
  - A. Law of equal areas
  - B. Law of universal gravitation
  - C. Harmonic law
  - D. Elliptic law
2. Changes in the position and arrangement of the planet earth, moon and sun have an influence on:
  - A. Incoming solar radiation
  - B. Oceanic tides
  - C. Rotation period
  - D. Revolution period
3. Plants and algae exit in an ecosystem as:
  - A. Detritus
  - B. Primary consumers
  - C. Biomass
  - D. Primary producers
4. Among the factors of soil formation, topography influences:
  - A. Mineralogy of soil
  - B. Nutrient status of soil
  - C. Movement and depth of soil
  - D. Degree of soil development
5. Large-scale movement of lithospheric plates cause either a convergence or divergence of plates. Which of the following is associated with plate convergence?
  - A. Shallow focus earthquakes
  - B. Andesitic volcanoes
  - C. Basaltic volcanoes
  - D. Oceanic ridge
6. The movement of material down-slope under the influence of gravity is known as:
  - A. Erosion
  - B. Weathering
  - C. Mass wasting
  - D. Denudation
7. One important component of the oxygen cycle involves:
  - A. Oxygen and ammonia
  - B. Photosynthesis and respiration
  - C. Atmospheric fixation
  - D. Oxidation and respiration
8. The organisms that produce their foods from inorganic substances through the use of sunlight or chemical energy are known as:
  - A. Heterotrophs
  - B. Oxidation
  - C. Autotrophs

D. Respiration

9. Potential evapotranspiration and water balance are mainly determined by the relationship between:

- A. Trophic level
- B. Primary productivity
- C. Herbivores and light
- D. Temperature and moisture

10. Phosphorous is available to plants directly from the soil which also supplies other major nutrients such as:

- A. Calcium, magnesium, potassium and sulphur
- B. Oxygen, carbon dioxide and carbohydrates
- C. Nitrogen, ammonia and nuclear acids
- D. Sugars, carbon dioxide and sulphur dioxide

11. Nitrogen gas is converted into forms that plants can use by two processes:

- A. Fossil fuels and energy
- B. Biological fixation and atmospheric fixation
- C. Animal wastes and ammonia
- D. Lithification and carbon dioxide

12. Denitrification is a process carried out by other specialised group of bacteria which convert:

- A. Proteins into urea
- B. Ammonia into nitrate
- C. Nitrate into sugars
- D. Nitrate into nitrogen gas

13. Which of the following is a dry climatic region?

- A. Am
- B. ET
- C. Bsh
- D. Cwb

14. The critical temperature at which saturation occurs as a consequence of cooling is known as:

- A. Relative temperature
- B. Dew-point temperature
- C. Adiabatic temperature
- D. Saturation temperature

15. Energy transformations in the ecosystem occur by means of a series of steps/levels referred to as:

- A. Decomposers
- B. Amino acids
- C. Biological oxidation
- D. Food chain

16. The driving force of an ecosystem is known as:

- A. Predator
- B. Biomes
- C. Solar energy
- D. Equilibrium

17. The scientific study that examines the differences in average weather conditions of various places is called:
- A. Meteorology
  - B. Climatology
  - C. Hydrology
  - D. Seismology
18. There are different forms of parent material from which soils develop. However, rock debris deposited under the influence of gravity lead to:
- A. Alluvium
  - B. Colluvium
  - C. Loess
  - D. Glacial uplift
19. The cementation of sediments by a solution of iron, silica and calcium to form sedimentary rock is known as:
- A. Oxidation
  - B. Frost wedging
  - C. Hydrolysis
  - D. None of the above
20. The increase in temperature with increasing height within the troposphere is known as:
- A. Pollution
  - B. Albedo
  - C. Temperature inversion
  - D. Temperature subsidence
21. Which of the following is an igneous rock?
- A. Shale
  - B. Gneiss
  - C. Gabbro
  - D. Marble
22. Organisms that eat either plants or other animals are called:
- A. Herbivores
  - B. Omnivores
  - C. Carnivores
  - D. Heterotrophs
23. The lowest part of the troposphere has the highest concentration of:
- A. Dust
  - B. Smoke
  - C. Water vapour and ozone
  - D. Moisture
24. Which of the following does not all belong to the group?
- A. Olivine
  - B. Carbonates
  - C. Sulphides
  - D. Phosphates

25. Rainfall may occur in the eastern slopes and not in the western part of the Lubombo mountain ranges in the Kingdom of Swaziland due to:
- A. Frontal uplift
  - B. Convectional uplift
  - C. Depression force
  - D. Orographic force
26. In which month is the sub-polar point directly over the Tropic of Capricorn?
- A. September
  - B. June
  - C. March
  - D. December
27. Which of the following is associated with the movement of air masses?
- A. Convectional rainfall
  - B. Relief rainfall
  - C. Cyclonic rainfall
  - D. Adiabatic cooling
28. The hydrological cycle involves a number of key concepts or phrases. Which of the following does not belong to the group?
- A. Interception
  - B. Overland flow
  - C. Infiltration
  - D. Soil creep
29. Which of the following involves possible adjustment to floods?
- A. Regulation of land use
  - B. Soil moisture
  - C. Storm runoff
  - D. Evaporation
30. The O, A and B horizons together constitute what is known as:
- A. Zone of accumulation of soil
  - B. Subsoil
  - C. Solum
  - D. Hardpan

**SECTION B: SHORT ESSAYS**  
**ANSWER ANY TWO QUESTIONS**

**QUESTION 1**

With illustrations, discuss the heating and cooling of the earth-atmosphere system. (15 marks)

**QUESTION 2**

'There are possible courses of action that can be undertaken to reduce the impending toll of floods'. Discuss. (15 marks)

**QUESTION 3**

Examine the major processes involved in mechanical weathering. (15 marks)

**SECTION C: TECHNIQUES AND SKILLS**  
**CHOOSE AND ANSWER ONE QUESTION ONLY**

**QUESTION 1**

a) Define the following: (10 marks)

- i) Principal Point
- ii) Aerial photograph
- iii) Meridian
- iv) Electromagnetic spectrum
- v) Contour line

b) With reference to topographical map of Swaziland (PWD 12), state how far are the following features from the Equator in kilometres? (8 marks)

- i) Logobisa dipping tank
- ii) Phowe dipping tank

c) With reference to topographical map of Swaziland (PWD 12), state the distance from the meridian of origin to the following locations in kilometres. (8 marks)

- i) Mampondweni dipping tank
- ii) Commissie Nek dipping tank

d) If the time at Greenwich is 12:00 midnight, at what longitude will the time be: (10 marks)

- i) 5:25pm
- ii) 11:05 pm
- iii) 12:00 noon
- iv) 9:52 am
- v) 8: 15 pm

e) Calculate the Noon Solar Angle on December 21<sup>st</sup> at the following locations. (4 marks)

- (i) 28.51°S
- (ii) 17.37°N

## QUESTION 2

- a) Explain three main ways in which incoming radiation is lost as it penetrates the atmosphere. (9 marks)
- b) What are the characteristics of contour lines? (6 marks)
- c) Given the following hypothetical conditions calculate the amount of incoming, outgoing and net solar radiation for the month of July. Refer to tables 1, 2 and 3. (20 marks)

Location	es	T <sup>0</sup> C	n(hours)	R <sub>i</sub>	R <sub>o</sub>	H
45 <sup>0</sup> N	18	18	8.5			
22 <sup>0</sup> N	14	21	10.5			
0 <sup>0</sup>	16	27	12			
13 <sup>0</sup> S	12	15	8			

- d) With reference to topographical map of Swaziland (PWD 12), use the six-figure grid reference system to state the location of the following places/features: (5 marks)
- i) New Mbuluzi school
  - ii) Blue Hills dipping tank
  - iii) Nyakeni dipping tank
  - iv) Kwaluseni Trigonometrical station
  - v) Saddle Trigonometrical station

**TABLE 1: SOLAR RADIATION (R<sub>s</sub>) EXPRESSED IN EQUIVALENT EVAPORATION (MM/DAY)**

Latitude	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
60°N	1.4	3.6	7.0	11.1	14.6	16.4	15.6	12.6	8.5	4.7	2.0	0.9
50°N	3.7	6.0	9.2	12.7	15.5	16.6	16.1	13.7	10.4	7.1	4.4	3.1
40°N	6.2	8.0	11.1	13.8	15.9	16.7	16.3	14.7	12.1	9.3	6.8	5.6
30°N	8.1	10.5	12.8	14.7	16.1	16.5	16.2	15.2	13.5	11.2	9.1	7.9
20°N	10.8	12.4	14.0	15.2	15.7	15.8	15.8	15.4	14.4	12.9	11.3	10.4
10°N	12.8	13.9	14.8	15.2	15.0	14.8	14.9	15.0	14.8	14.2	13.1	12.5
Equator	14.6	15.0	15.2	14.7	13.9	13.4	13.6	14.3	14.9	15.0	14.6	14.3
10°S	14.6	15.0	15.2	14.7	13.9	13.4	13.6	14.3	14.9	15.0	14.6	14.3
20°S	16.8	15.7	15.1	13.9	12.5	11.7	12.0	13.1	14.4	15.4	15.7	15.8
30°S	17.2	15.8	13.5	10.9	8.6	7.5	7.9	9.7	12.3	14.8	16.7	17.5
40°S	17.3	15.1	12.2	8.9	6.4	5.2	5.6	7.6	10.7	13.8	16.5	17.8
50°S	16.9	14.1	10.4	6.7	4.1	2.9	3.4	5.4	8.7	12.5	16.0	17.6
60°S	16.5	12.6	8.3	4.3	1.8	0.9	1.3	3.1	6.5	10.8	15.1	17.5

Source: Shaw, 1983. *Hydrology in Practice*.

**TABLE 2: MEAN DAILY DURATION OF MAXIMUM POSSIBLE SUNSHINE HOURS (H)**

North Lat.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
South Lat.	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
60°N/S	6.7	9.0	11.7	14.5	17.1	18.6	17.9	15.5	12.9	10.1	7.5	5.9
58°N/S	7.2	9.3	11.7	14.3	16.6	17.9	17.3	15.3	12.8	10.3	7.9	6.5
56°N/S	7.6	9.5	11.7	14.1	16.2	17.4	16.9	15.0	12.7	10.4	8.3	7.0
54°N/S	7.9	9.75	11.7	13.9	15.9	16.9	16.5	14.8	12.7	10.5	8.5	7.4
52°N/S	8.38	9.94	11.8	13.8	15.6	16.5	16.1	14.6	12.7	10.6	8.8	7.8
50°N/S	8.58	10.0	11.8	13.7	15.3	16.3	15.9	14.4	12.6	10.7	9.0	8.1
48°N/S	8.8	10.2	11.8	13.6	15.2	16.0	15.6	14.3	12.6	10.9	9.36	8.3
46°N/S	9.1	10.4	11.9	13.5	14.9	15.7	15.4	14.2	12.6	10.9	9.5	8.7
44°N/S	9.3	10.5	11.9	13.4	14.7	15.4	15.2	14.0	12.6	11.0	9.7	8.9
42°N/S	9.4	10.6	11.9	13.4	14.6	15.2	14.9	13.9	12.6	11.1	9.8	9.1
40°N/S	9.63	10.7	11.9	13.3	14.4	15.0	14.7	13.7	12.5	11.2	10.0	9.3
35°N/S	10.1	11.0	11.9	13.1	14.0	14.5	14.3	13.5	12.4	11.3	10.3	9.86
30°N/S	10.4	11.1	12.0	12.9	13.6	14.0	13.9	13.2	12.4	11.5	10.6	10.2
25°N/S	10.7	11.3	12.0	12.7	13.3	13.7	13.5	13.0	12.3	11.6	10.9	10.6
20°N/S	11.0	11.5	12.0	12.6	13.1	13.3	13.2	12.8	12.3	11.7	11.2	10.9
15°N/S	11.3	11.6	12.0	12.5	12.8	13.0	12.9	12.6	12.2	11.8	11.4	11.2
10°N/S	11.6	11.8	12.0	12.3	12.6	12.7	12.6	12.4	12.1	11.8	11.6	11.5
5°N/S	11.8	11.9	12.0	12.2	12.3	12.4	12.3	12.3	12.1	12.0	11.9	11.8
Equator	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0

Source: Shaw, 1983. *Hydrology in Practice*.



**TABLE 3: VALUES OF  $\sigma_T^2$**

°F	0	1	2	3	4	5	6	7	8	9
30	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.6	11.7	11.87
40	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8
50	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.9
60	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.5	14.8	14.9
°C										
-0	11.2	11.0								
0	11.2	11.4	11.5	11.7	11.9	12.0	12.2	12.3	12.5	12.7
10	12.9	13.1	13.3	13.5	13.7	13.9	14.0	14.2	14.4	14.6
20	14.8	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6

Source: Shaw, 1983. *Hydrology in Practice*.