UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

BSC IN ENVIRONMENTAL HEALTH SCIENCE

FIRST SEMESTER FINAL EXAMINATION PAPER DECEMBER 2011

TITLE OF PAPER	:	ENVIRONMENTAL CHEMISTRY1
COURSE CODE	:	EHS 413
DURATION	:	TWO HOURS
MARKS	:	100
INSTRUCTIONS	:	ANSWER ONLY FOUR QUESTIONS
	:	EACH QUESTION CARRIES 25 MARKS
	:	QUESTIONS ONE, TWO AND THREE ARE COMPULSORY
	:	NO QUESTION PAPER SHOULD BE BROUGHT INTO NOR OUT OF THE EXAMINATION ROOM
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR

QUESTION ONE

For this question, copy the letter of the question on your answer book, and write the correct answer next to the letter.

a. Soil is the final product of ---------- (1 mark)
b. Mention five ecological roles of soil (5 marks)
c. When you look at the fine structure of the soil it shows you that soil consists of (i)---------- (ii)---------- (iii)----------, and (iv)---------- (4 marks
d. Typically, between bedrock and soil lies a layer called ---------- consisting of ---------- (2 marks)
e. In as far as plant life and growth is concerned, the most important layer of soil is the ---------- which consists of (i)----------(ii)---------- and (iii)---------- (4 marks)
f. The most common indicator of soil formation from parent rocks consists of ---------- (1 mark)
g. The reaction $MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$, indicates that the soil is --------- (1 mark)
h. The two most abundant elements in soil inorganic matter are (i) ---------- and (ii) ---------- (2 marks)
i. Organic matter in soil performs the following functions (i) ----------, (ii) ----------, and (iii) ---------- (3 marks).
j. Two complexing agents produced by fungi in soil are (i) ---------- and (ii) ---------- (2 marks)

TOTAL 25 MARKS

QUESTION TWO

a. The most important unique properties of water that largely determine its environmental chemical behaviour are (i) ----------, (ii) ----------, (iii) ----------, (iv) ----------, (v) ----------, (vi) ----------, (vii) ----------, (viii) ---------- (8 marks)
b. The thermal stratification of water bodies results from water's ---------- (1 mark)
c. The ability of solutes in water to neutralize added strong acids is called ---------- and water hardness is due mostly to the presence of ---------- while for water near neutral pH, the major contributor to alkalinity is ----------. (3 marks)
d. A major pollutant contributor to acidity in water is free mineral acid, manifested by the presence of ----------. (1 mark)
e. The chemical formula $H3O^+$ stands for ---------- and can be abbreviated simply as ----------. (2 marks)

f. A bare metal ion cannot exist as separate entity in water, but is present instead as ---------- (1 mark)
g. Calcium is present in water as a consequence of ---------- (1 mark)
h. The reaction $2C_{17}H_{35}COONa + Ca^{2+} \rightarrow Ca(C_{17}H_{33}CO_2)_{2(s)} + 2Na$ is a manifestation of ---------- (1 mark)
i. Oxidation-reduction reactions in water involve the transfer of ---------- and in natural water, wastewater, and soil are carried out by ---------- (2 mark)
j. The parameter pE is defined as ---------- and in a pE-pH diagram for iron in water, the species that predominates at low pE and low pH is --------- whereas at high pE and higher pH, it is ---------- (3 marks)
k. A ligand in water bodies bonds to a metal ion to form a ---------- (1 mark)
l. Most of the important chemical phenomena associated with water do not occur in solution, but rather through ---------- (1 mark)

TOTAL 25 MARKS

QUESTION THREE

a. The bottom layer of the atmosphere is the ----------, extending over an altitude of ----------, and the next layer up is the ----------, with an altitude range of approximately ----------. (4 marks)
b. The most significant feature of atmospheric chemistry is the occurrence of -------- ---------- resulting from the absorption by molecules of ----------, designated ----------. (3 marks)
c. Two vital protective functions of the atmosphere are ---------- and ----------, and it also serves as a source of ---------- for plants and ---------- for animals and other organisms. (4 marks)
d. In descending order, the five most abundant gases in the atmosphere are ----------, ----------, ----------, ----------, and ---------- (5 marks)
e. Why is it that at very high altitudes, normally reactive species such as atomic oxygen, O, persist for long periods of time? ---------- (1 mark).
f. The fact that hydrogen has not been lost to outer space from Earth's atmosphere is due to the existence of ---------- (1 mark)
g. The existence of the ionosphere is due to the action of ---------- under conditions of ----------. (2 marks)
h. Air masses move from regions of ---------- to regions of ---------- (2 marks)
i. An atmospheric condition that is particularly important for air pollution and sometimes affected by topography is that of ---------- (1 mark)
j. The values of the dry adiabatic laps rate and of moist adiabatic lapse rate are ------ ---------- and ---------- respectively (2 marks)

TOTAL 25 MARKS

QUESTION FOUR

a. Using illustrations, describe the energy budget. (13 marks)
b. Explain the global warming process with special reference to its causes. (5 marks)
c. Which types of problems will be the result of global warming? (7 marks)

TOTAL 25 MARRKS

QUESTION FIVE

a. Explain why atomic ions such as O^+ and N^+ predominate in the upper regions of the ionosphere whereas molecular ions such as O_2^+ and NO^+ predominate in the lower regions (5 marks).
b. Explain what the following two reactions show about oxidation – reduction phenomena in water
    i. $2H_2O + 2e^- \leftrightarrow H_{2(g)} + 2OH^-$ (5 marks)
    ii. $2H_2O \leftrightarrow O_{2(g)} + 4H^+ + 4e^-$ (5 marks)
    iii. How are they tied in with pE in water? (5 marks)

c. What is organic matter and what four important effects does it have in soil? (5 marks)

TOTAL 25 MARKS