UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

(BSC) IN ENVIRONMENTAL HEALTH

FIRST SEMESTER FINAL EXAMINATION PAPER 2008

TITLE OF PAPER	:	ENVIRONMENTAL CHEMISTRY 1
COURSE CODE	:	EHS 413
DURATION	:	TWO HOURS
MARKS	:	100
INSTRUCTIONS	:	ANSWER ONLY FOUR QUESTIONS
	:	EACH QUESTION CARRIES 25 MARKS
	:	QUESTIONS ONE AND TWO ARE COMPULSARY
	:	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

1. The surface litter horizon of soil is described by the letter
    a. A.
    b. B.
    c. C.
    d. O.

2. As it is weathered, ---------- gives rise to the C-horizon.
    a. Parent material.
    b. Leaching.
    c. Subsoil.
    d. Bed rock.

3. The dissolving of material from the upper layers of the soil and its movement to lower horizons is called
    a. Percolation.
    b. Weathering.
    c. Accumulation
    d. Leaching.

4. Soil texture most directly determines
    a. Porosity.
    b. pH.
    c. Color.
    d. Nutrient content

5. Most soil erosion is caused by
    a. Moving water.
    b. Wind.
    c. Earthquakes.
    d. Volcanoes.

6. Salt build up in soils may
    a. Increase crop growth.
    b. Increase yields.
    c. Eventually kill weeds.
    d. Eventually make the land unproductive.

7. In addition to solid mineral and organic matter and water, roughly 35% of the volume of typical soil is composed of
    a. Pore spaces.
    b. Moisture.
    c. Organic matter.
    d. Clay minerals.

8. An important property of soil abbreviated CEC expresses its capacity to
    a. Exchange cations.
    b. Exchange anions.
    c. Adsorb cations.
    d. Adsorb anions.

9. A thermal inversion is the result of
    a. Precipitation.
    b. Cold air drainage.
    c. A lid of warm air on top of cooler, stagnant air.
    d. A cold blanket of air that prevents warm air from rising.

10. Photochemical smog is characteristic of urban areas with many vehicles and a climate that is
    a. Cool, wet and cloudy.
    b. Cool, dry, and sunny.
    c. Warm, dry, and sunny.
    d. Warm, wet, and cloudy.

11. The major greenhouse gases include all of the following except
    a. Chlorofluorocarbons (CFCs).
    b. Carbon dioxide and water vapor.
    c. Sulfur dioxide.
    d. Ozone and nitrous oxide.

12. All of the following greenhouse gases have increased in recent decades except
    a. Carbon dioxide.
    b. Methane.
    c. Water vapor.
    d. Nitrous oxide.

13. As global warming progresses, methane
    a. Might be absorbed as permafrost melts in the arctic tundra.
    b. Might be absorbed from natural wetlands with rising carbon dioxide.
    c. May be released from oceanic mud as ocean waters warm.
    d. May be reduced by bacteria in tundra soils.

14. Which of the following statements is false?
    a. The formation of ozone layer enabled life on land to evolve.
    b. CFCs are odorless and stable.
    c. CFCs are nonflammable, nontoxic, and noncorrosive.
    d. Fluorine atoms are responsible for the breakdown of ozone to molecular oxygen.

15. The ozone layer is most effective in blocking
    a. UV-C, the highest-energy UV band.
    b. UV-B, the middle-energy UV band.
    c. UV-A, the lowest-energy UV band.
    d. CFCs.

16. The most significant feature of the atmospheric chemistry is the occurrence of ---- ----- resulting from the absorption by molecules of light photons.
    a. Oxidation reactions.
    b. Reduction reactions.
    c. Photochemical reactions.
    d. Acid-base reactions.

17. Albedo refers to
    a. Reflective index of the earth.
    b. The absorptive index of the earth.
    c. Positive lapse rate.
    d. Negative lapse rate.

18. Thermal stratification of bodies of water results from water's
    a. Unique temperature-density relationship.
    b. Unique temperature-pressure relationship.
    c. High surface tension.
    d. Unique water solubility property.

19. The ability of solutes in water to neutralize added strong acids is called
    a. Neutralization
    b. Alkalinity
    c. Acidity
    d. Oxidation

20. In water near neutral pH the major contributor to alkalinity is
    a. HCO_3^-
    b. Ca^{2+}
    c. PO_4^{3-}
    d. CO_3^{2-}

21. The reaction $2C_{17}H_{33}COO^-Na^+ + Ca^{2+} \rightarrow Ca(C_{17}H_{33}CO_2)_{2(s)} + 2Na^+$ is a manifestation of
    a. Saponification.
    b. Complexation.
    c. Water hardness.
    d. Esterification.

22. The relative oxidation-reduction tendencies of a chemical system depends upon
    a. The activity of the electron e^-.
    b. The pH.
    c. Bacterial activity.
    d. Acid-base reactions.

23. In the pE-pH diagram for iron in water, the species that predominates at low pE and low pH is
    a. Fe^{3+}.
    b. Fe^{2+}.
    c. $Fe(OH)_3$.
    d. $Fe(OH)_2$.

24. The most important class of complexing agents that occur naturally are
    a. Colloids.
    b. Humic substances.
    c. Fulvic acid.
    d. Humic.

25. Complexing agents in wastewater are of concern primarily because of
    a. Their ability to solubilize heavy metals.
    b. Their ability to adsorb heavy metals.
    c. Their ability to immobilize metals.
    d. Their ability to detoxify heavy metals.

TOTAL 25 MARKS

QUESTION TWO

1. What do you understand by the term weathering? (2 marks)
2. Name three types of weathering. (3 marks)
3. Discuss the process of weathering through the following:
    a. Oxidation (5 marks).
    b. Hydrolysis (5 marks).
4. Explain how parent material influence soil formation (10 marks)

TOTAL 25 MARKS

QUESTION THREE

1. Briefly explain the chemistry of the stratosphere (5 marks)
2. With the aid of balanced chemical equations, describe the processes of
    a. stratospheric ozone formation (10 marks)
    b. stratospheric ozone destruction (10 marks)

TOTAL 25 MARKS

QUESTION FOUR

1. Draw the Lewis-Dot diagram of the water molecule (1 mark).
2. In a tabular, list the eight unique properties of water that you know and explain their effects and significance (24 marks).

Property	Effects	Significance
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

TOTAL 25 MARKS

QUESTION FIVE

1. Name six trace constituents of the atmosphere (6 marks).
2. In a tabular form, how would you broadly divide the major regions of the atmosphere? (19 marks).

Region	Altitude	Temperature range ^{0}c	Important chemical species.
1.			
2.			
3.			
4.			

TOTAL 25 MARKS