

**UNIVERSITY OF SWAZILAND**  
**FACULTY OF HEALTH SCIENCES**  
**DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE**  
**FINAL EXAMINATION [MAY 2012]**

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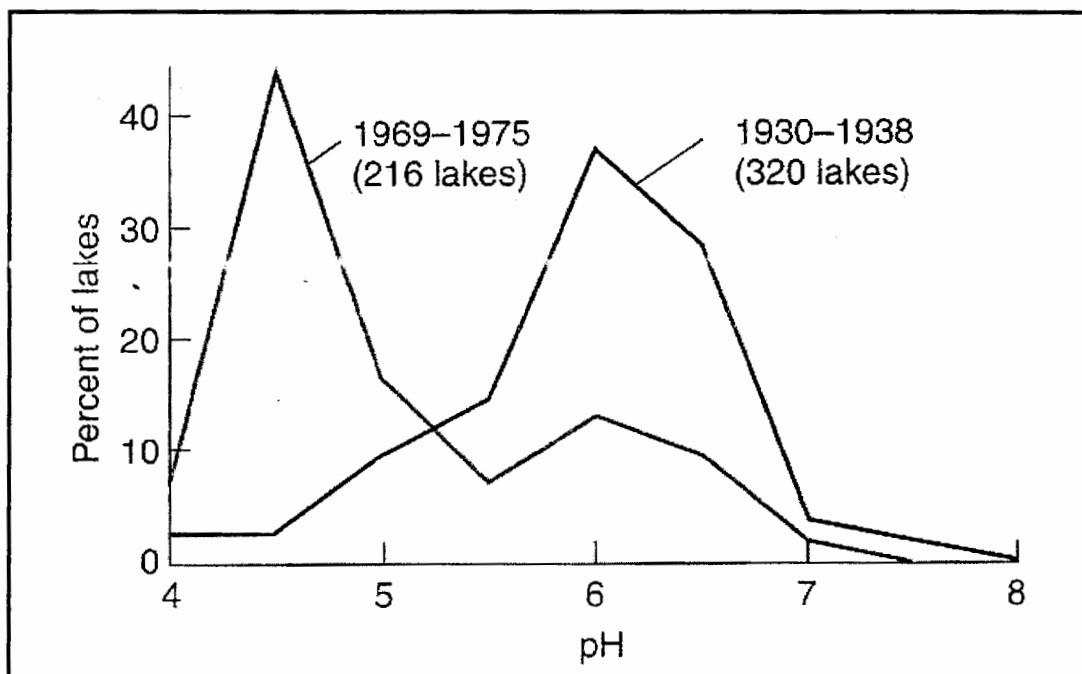
TITLE OF PAPER : ENVIRONMENTAL PHYSICS TWO  
COURSE CODE : EHS 412  
ACADEMIC YEAR : 2011/2012  
TIME : 2 HOURS  
MARKS : 75

**INSTRUCTIONS**

1. DO NOT OPEN THIS EXAMINATION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR.
2. CHOOSE AND ANSWER THREE QUESTIONS ONLY, OUT OF THE FOUR QUESTIONS PRESENTED IN THIS PAPER.
3. NO FORM OF PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
4. BEGIN YOUR ANSWERS TO EACH QUESTION ON A FRESH PAGE OF THE ANSWER BOOKLET. ENSURE THAT ALL PAGES OF THE ANSWER BOOKLET ARE NUMBERED ACCORDINGLY.
5. WRITE CLEARLY; MARKS WILL NOT BE AWARDED WHERE HANDWRITING IS NOT POSSIBLE TO READ.
6. USE PROPER ENGLISH LANGUAGE GRAMMAR; POOR ENGLISH GRAMMAR SHALL RESULT IN LOSS OF MARKS.

## QUESTION ONE

- a) You are an environmental manager responsible for all environmental management issues for the proposed nuclear power plant in Matsapha. At a top management meeting, why are you bent on convincing your senior managers that they must use the nuclear fission technique and not nuclear fusion? [3]
- b) Distinguish between primary and secondary oil recovery. [4]
- c) What are isotopes? [2]
- d) In not more than two points, discuss the two main mechanisms by which deforestation contributes to atmospheric CO<sub>2</sub> inputs. [4]
- e) Discuss one possible fate of N<sub>2</sub>O. [2]
- f) Study the diagram presented in Figure 1 and answer the questions presented below it;



**Figure 1: Changing pH In Swaziland lakes.**

1. In 1969-1975 there were more fish populations in Swaziland lakes than in 1930-1938. True or false? [2]
2. In 1969-1975 there were more mosses and less desirable species of plankton than in 1930-1938. True or false? [2]

3. There were more levels of toxic metals, such as aluminum, in 1930-1938 than in 1969-1979. True or false? [2]
  4. There were more songbirds living close to Swaziland lakes in 1930-1938 than in 1969-1979. True or false? [2]
  5. The rate of decay of organic material, such as dead plants, leaves, etc, was higher in 1969-1979 than in 1930-1938. True or false? [2]
- TOTAL NUMBER OF MARKS IN QUESTION ONE [25]

## QUESTION TWO

- a) The mining of tar sand, from which oil is extracted, is known to be expensive particularly with regard to damage on equipment. In what ways do tar sands affect mining equipment? [3]
- b) In natural gas production, what is flaring? [2]
- c) State any three air pollutants that are often released during flaring. [3]
- d) In nuclear energy production and nuclear waste management;
  1. What is yellow cake? [2]
  2. What are fuel rods [2]
  3. Fuel pellets are very small (slightly thicker than a pencil and about 1.5cm long); however in terms of energy release, each pellet is equivalent to a ton of coal. True or false? [1.5]
  4. From the list below chose the media by which heat is transferred to the turbines; [1.5]
    - a. Sand
    - b. CO<sub>2</sub>
    - c. Water
    - d. Fuel rods
    - e. Nuclear pump stations
  5. From the list below, chose the best statement that describes the present status with regard to nuclear waste management; [1.5]
    - a. The best way to permanently deal with nuclear waste is to shoot it into space.
    - b. The best way to deal with nuclear waste is to bury it in state of the art landfills, equipped with multiple layers of concrete liners.

- c. Presently, there is no permanent way to deal with nuclear waste worldwide.
  - d. The best way to deal with nuclear waste is to take it to nuclear waste processing plants because nuclear waste can be recycled endlessly.
  - e. The best way to deal with nuclear waste is to dump it abandoned underground mines. This would actually solve the problem of acid mine drainage.
6. Inside a reactor, what are the two functions of the control rods? [4]
- e) State the three main types of coal. [3]
- f) The concentration of CH<sub>4</sub> is lower in the atmosphere than CO<sub>2</sub>, but molecule for molecule, methane has  $\approx$  25 times greater global warming potential than does CO<sub>2</sub>. True or false? [1.5]
- g) There are four main greenhouse gases, namely; CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>, CFCs. Arrange these gases in order of their atmospheric residence times, from the one with the longest residence time to the one with the least. [1]
- TOTAL NUMBER OF MARKS IN QUESTION TWO [25]**

### QUESTION THREE

- a) State five strategies that have been proposed as the best means to deal with nuclear waste. [5]
- b) The useful operating life of a nuclear power plant is estimated to be 30-40 years; however, 81 reactors worldwide have been shut down after being operational for an average of 17 years. True or false? [1]
- c) Setting up a nuclear power plant can cost up to billions of Emalangeni; however in terms of air pollution, why would you prefer a nuclear power station over a coal power plant? [4]
- d) What is the greenhouse effect? [2]
- e) One of the environmental impacts associated with coal mining is acid mine drainage. Discuss two impacts of acid on water, soil or infrastructure. [4]
- f) Air pollutants released during coal combustion are responsible for two of the world's most significant environmental problems. State the two problems. [2]
- g) State any three symptoms of radiation sickness. [3]

- h) State three acid pollutants that react with  $O_2$  in the atmosphere to form acid chemicals. [3]
- i) The liming of lakes, as practiced in Some Scandinavian countries, usually cleans off the acid permanently. True or false? [1]
- TOTAL NUMBER OF MARKS IN QUESTION THREE [25]

#### QUESTION FOUR

- a) For each of the two scenarios presented below, explain the causes of the effects stated;
1. Ozone depletion  $\Rightarrow$  fish populations in seas decline due to starvation. [2]
  2. Ozone depletion  $\Rightarrow$  less atmospheric  $CO_2$  is absorbed by oceans and as a result, global climate change increases. [2]
- b) State three sources of ozone depleting chemicals in the stratosphere. [3]
- c) State any three health effects that could be experienced as a result of exposure to ultraviolet radiation. [3]
- d) In energy efficiency, no matter how hard people try to use energy efficient appliances and systems, some wastage is inevitable. Using one of the laws of energy, explain why it is impossible to achieve 100% energy efficiency. [4]
- e) What is energy efficiency? [2]
- f) You are an environmental management officer in a huge power company. Your 10-storey head office consumes up to E15000.00/month in heating bills during the winter months. At the meeting of the management, you convinced your top managers that it is possible to spend only E7500.00/month. How are you going to achieve this? [3]
- g) State four examples that can be used to avoid wastage of energy in transportation. [4]
- h) In energy efficiency, discuss one example that illustrates cogeneration. [2]
- TOTAL NUMBER OF MARKS IN QUESTION FOUR [25]