

UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE
FINAL EXAMINATION [MAY 2013]

TITLE OF PAPER : ENVIRONMENTAL PHYSICS
COURSE CODE : EHM 103
ACADEMIC YEAR : 2012/2013
TIME : 2 HOURS
MARKS : 75

INSTRUCTIONS

1. DO NOT OPEN THIS EXAMINATION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR.
2. QUESTION ONE IS COMPULSORY. CHOOSE ANY OTHER TWO QUESTIONS IN ADDITION TO QUESTION ONE [THREE QUESTIONS IN TOTAL].
3. NECESSARY PENALTIES SHALL BE APPLIED FOR ANY UNACCEPTABLE BEHAVIOUR DURING THE COURSE OF THIS EXAMINATION.
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. NO MARKS SHALL BE AWARDED FOR POOR HANDWRITING AND POOR ENGLISH LANGUAGE GRAMMAR.

QUESTION ONE [TOTAL NUMBER OF MARKS = 25]

1. The fermentation of sugar and certain crops (such as sugarcane, sugar beets, sorghum, sunflowers and corn) would enable the production of;
 - a. Methanol
 - b. Gasohol
 - c. Biogas
 - d. Ethanol
2. Biogas is a mixture of;
 - a. 60% CH₄ and 40% CO₂
 - b. Liquid ethanol and liquid methanol
 - c. Wood alcohol and liquid ethanol
 - d. 50% CH₄ and 50% CO₂
3. Gasohol is obtained by mixing;
 - a. Ethanol and biogas
 - b. Gasoline and ethanol
 - c. Biogas and methanol
 - d. Gasoline and diesel
4. The ultimate answer to the world's energy problems is;
 - a. Nuclear energy
 - b. Electric energy
 - c. Solar energy
 - d. Wind energy
5. The main impacts of acid deposition on aquatic species are particularly noticeable on;
 - a. Whales, dolphins and aquatic birds
 - b. Aquatic insects, fish and mink whales
 - c. Aquatic insects, fish and birds
 - d. Fish, whales and aquatic birds
6. In acid affected lakes, species of fish often disappear when the pH drops below;
 - a. 5.5
 - b. 4.5
 - c. 3.5
 - d. 2.5
7. The capture of solar energy within a structure and its subsequent use directly for space heating, at the site where it is collected is common in;
 - a. Active solar systems
 - b. Passive solar systems
 - c. Solar power towers
 - d. Solar thermal plants

8. An example of subatomic particles is;
 - a. Alpha particles
 - b. Beta particles
 - c. Neutrons
 - d. Atoms
9. Acid deposition that affects forests on mountain slopes in snow regions may increase the likelihood of;
 - a. Flooding
 - b. Volcanic activity
 - c. Avalanches
 - d. Earthquakes
10. In order of their importance (i.e. the heating potential), the correct order of the main GHGs is;
 - a. CFCs, N₂O, CH₄, CO₂
 - b. N₂O, CH₄, CO₂, CFCs
 - c. CH₄, CO₂, CFCs, N₂O
 - d. CO₂, CH₄, N₂O, CFCs
11. One of the major contributing factors to global climate change is;
 - a. The use of fossil fuel-driven machinery in agriculture
 - b. Industrial revolution
 - c. Coal burning for electricity generation
 - d. Fossil fuel burning in transportation (cars, trucks, buses, trains and aircrafts).
12. Choose the correct statement from below.
 - a. Gases that are involved in the greenhouse effect [GE] are not the same as those that are involved in global climate change [GCC].
 - b. The atmospheric concentration of GE gases is slightly higher than the concentration of GCC gases.
 - c. Molecules of the gases that drive the GE are the same molecules that drive the GCC process, except that in the latter, the process is largely enhanced.
 - d. GE is not beneficial to life whereas GCC is beneficial. Actually, without GCC, the earth would be a lifeless planet.
13. Amongst the main fossil fuels, the one that contributes to the most important greenhouse gas is;
 - a. Processed oil [diesel, petrol/gasoline, paraffin]
 - b. Natural gas
 - c. Coal
 - d. Crude oil

14. Neutrons are;
- Positively charged
 - Negatively charged
 - Neutral
 - Positively charged only when heated
15. The mass of an atom is made up of;
- Electrons and protons
 - Protons and the electron cloud
 - The electron cloud and electrons
 - The nucleus
16. The atomic number;
- Tells us the number of positively charged protons and the equal number of negatively charged electrons outside its nucleus.
 - Tells us the number of positively charged neutrons and the equal number of negatively charged electrons outside its nucleus.
 - Tells us the number of positively charged atoms in the periodic table
 - Tells us the number of neutrons that are released during fission reactions in a nuclear power plant.
17. The number of electrons is provided by;
- The mass number
 - The atomic number
 - The charge number
 - The Avogadro's Number
18. Amongst the major anthropogenic sources of CO₂, the greatest is;
- Deforestation
 - Electricity generation in coal-driven power plants
 - Transportation (the use of diesel, petrol and aviation fuel in internal combustion engines).
 - Volcanic eruptions
19. Oceans are known to absorb huge amounts of atmospheric CO₂; however, lately scientists have realized that oceans are increasingly becoming less able to absorb CO₂ due to;
- The melting of glaciers
 - The saline nature of sea water
 - Increasing acidity
 - The increased demand of fish products, which has led to the increase of fishing vessels on the earth's oceans.

20. Ozone is known to have harmful effects in the;
- Mesosphere
 - Thermosphere
 - Troposphere
 - Stratosphere
21. Every time a reaction releases an alpha particle;
- The atomic charge decreases by 4 and the atomic mass by two
 - The atomic mass value decreases by 4 and the atomic valence by two
 - The atomic number decreases by 4 and the atomic mass by two
 - The atomic mass value decreases by 4 and the atomic number by two
22. Half-life is affected by;
- Temperature
 - Pressure
 - Chemical reactions
 - None of the above
23. An isotope that has a half-life equivalent to two-thirds of a day would only be considered safe to handle after;
- 9600 days
 - 9600 hours
 - 9600 minutes
 - 9600 years
24. Common nuclear power plants are based on;
- Natural radioactivity
 - Nuclear fusion
 - Nuclear fission
 - Both nuclear fusion and natural radioactivity
25. The source of energy that powers the sun is based on;
- Natural radioactivity
 - Nuclear fusion
 - Nuclear fission
 - Both nuclear fusion and natural radioactivity

QUESTION TWO [TOTAL NUMBER OF MARKS = 25]

1. Discuss any two impacts of acid deposition on soils [4].
2. In the last 50 years, there has been an increase of acid deposition in the highveld of Swaziland. Consequently, there has been a significant decline in a number of aquatic species in many lakes around the highveld.
 - a. In these lakes, what are the main causes of the decline in fish species with regard to leaching of soils? [3]
 - b. Apart from impacts on fish, explain why eggs of many bird species are failing to hatch or are crushed during incubation periods [5].
3. In many countries, CFCs are no longer manufactured; however, during the days when CFCs were produced, they were useful in many things. State any three such uses [3].
4. Beginning in the 1930s CFCs were considered as marvelous chemicals, and as a result, they found their way into many uses. State any five factors that led to mass production of CFCs [5].
5. What is the greenhouse effect? [3]
6. State two important factors that determine the amount of heat trapped in the troposphere during the greenhouse effect process [2].

QUESTION THREE [TOTAL NUMBER OF MARKS = 25]

1. Discuss any two factors that hinder the re-establishment of vegetation in former mine sites [5].
2. Three mining companies are located in the Piggs Peak Mountains. Company [A] is a gold mining company using the placer mining technique, company [B] is a coal mining company using the subsurface technique and company [C] is an asbestos mining company using the open pit technique. Sediment deposition on the Nkomazi River, which is about 500m below the Piggs Peak Mountains, has increased in recent years and the mining companies are thought to have contributed to this problem. From this statement, answer the following questions;
 - 2.1 Which company is more responsible for the increased deposition on the Nkomazi River? [2]
 - 2.2 Describe your reasons for your answer in question 2.1 above [4].
 - 2.3 Which two companies are more likely to result in acid mine drainage [4].
 - 2.4 What do you understand by acid mine drainage? [3]
 - 2.5 Close to each of these three companies (about 1.5km away from each), there are three camps where gold miners, coal miners and asbestos miners live respectively. In one of these camps, miners have recently been complaining of sewage that is often seen welling up from the ground.
 - a. Which camp is affected by the sewage problem? [2]
 - b. Describe your reasons for your answer in question 2.5 [a] above [3].

3. Recent research demonstrates that globally, sea levels rose by 4-8 inches (10-20cm) in the 20th century. State the two main factors that contribute to the rising of the sea level [2].

QUESTION FOUR [TOTAL NUMBER OF MARKS = 25]

1. What is the main global climate change effect on permafrost in areas such as Alaska, Siberia, etc? [2]
2. The effect you have stated in question one above, is linked to a number of problems on infrastructure and trees. Briefly discuss the observed problems on infrastructure and trees [4].
3. What is permafrost? [2]
4. Discuss one health benefit of the ozone layer [2].
5. State the two main sinks of CO₂ [2].
6. Of the two types of CO₂ sinks, which you have stated above, which one is reportedly showing some signs of slowing down? [2].
7. Briefly describe two reasons why the CO₂ sink you have stated in question six above is reportedly slowing down in its function [4].
8. Ruminant animals, such as cattle, are said to be contributing to the release of methane to the atmosphere. How does this happen? [2]
9. State any three constituents of natural gas [3].
10. Describe one important benefit of solar radiation from the sun [2].