



UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

DEGREE IN ENVIRONMENTAL HEALTH SCIENCE, AND
FINAL EXAMINATION PAPER 2016

TITLE OF PAPER : ENVIRONMENTAL CHEMISTRY
COURSE CODE : EHM 104
DURATION : 2 HOURS
MARKS : 100

INSTRUCTIONS : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
: ANSWER **ANY FOUR** QUESTIONS
: EACH QUESTION **CARRIES 25** MARKS.
: WRITE NEATLY & CLEARLY
: NO PAPER SHOULD BE BROUGHT INTO 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. One of the sources of carbon monoxide is smoking tobacco. Which one of the following suggestions would least likely reduce the health risks of smoking?

- A. Legalize the sale of tobacco products to all age groups
 - B. Ban cigarette vending machines
 - C. Eliminate subsidies to tobacco farmers and companies
 - D. Ban cigarette advertising
2. Which of the following elements constitutes the highest percentage of mass in Earth's crust?
- A. Oxygen
 - B. Aluminium
 - C. Carbon
 - D. Potassium
3. All of the following gases have been implicated in contributing to the increase in global temperatures via the greenhouse effect except;
- A. O₂
 - B. CH₄
 - C. N₂O
 - D. CO₂
4. The most abundant gas in the Earth's atmosphere is;
- A. Oxygen
 - B. Nitrogen
 - C. Water vapor
 - D. Carbon dioxide
5. All of the following substances are derived from petroleum except;
- A. Asphalt
 - B. Dichlorodiphenyltetrachloroethane
 - C. Cellulose
 - D. Polystyrene
6. Which of the following substances is released by chlorofluorocarbons and catalyzes a chain reaction that breaks down ozone in the upper atmosphere?
- A. Carbon monoxide
 - B. Carbon dioxide
 - C. Chlorine
 - D. Sulfur dioxide
7. The major biological source of dissolved oxygen in water bodies is
- A. Decomposition of organic sediments in the water floor

- B. Metabolic processes of organisms
 - C. Oxidation of sulfur by bacteria
 - D. Photosynthesis
8. The main environmental effects of ozone depletion could include all of the following except;
- A. Lower food crop production
 - B. Decreased concentration of CO₂ in the atmosphere
 - C. Disruption of food chains
 - D. Increased incidence of skin cancer
9. The primary cause of earth's seasons is the;
- A. Constant tilt of earth's rotational axis with respect to the plane of its orbit around the sun
 - B. Changing distance of earth from the sun at different times of the year
 - C. Periodic wobbling of earth on its axis of rotation
 - D. Periodic changes in solar energy output
10. The element that cycles in the environment and also has a gaseous phase at some point in its cycle is;
- A. Carbon
 - B. Sulfur
 - C. Carbon and phosphorus
 - D. Carbon and sulfur
11. Although ozone in the stratosphere has been decreasing in recent years, ozone near the earth's surface is on the increase. This ozone near the surface is undesirable because it;
- A. Absorbs ultraviolet light
 - B. Has a different chemical structure than stratospheric ozone
 - C. Is a strong oxidant and a respiratory irritant
 - D. Reacts with hydrocarbons to form chlorofluorocarbons
12. In models of global warming, the most important factor contributing to an increase in sea level is;
- A. Thermal expansion of the oceans
 - B. Increased precipitation

- C. Decreased evaporation
 - D. Growth of the polar ice caps
13. Which of the following best explains why Dichlorodiphenyltetrachloroethane (DDT) has been found in human breast milk?
- A. Chemicals used in one region of earth can circulate in the biosphere and affect organisms in a distant region
 - B. The large number of penguins in Antarctica has resulted in a depletion of their preferred foods
 - C. Chemicals like DDT are volatile and eventually make their way to the ozone layer
 - D. Because penguins incubate their eggs on land, the eggs are exposed to DDT
14. Approximately what is the percentage of freshwater on earth?
- A. 75%
 - B. 25%
 - C. 0.25%
 - D. 0.025%
15. Which of the following best describes the mechanism of the greenhouse effect in earth's atmosphere?
- A. Ultraviolet radiation from the sun is absorbed by ozone gas in the stratosphere
 - B. Cosmic radiation from deep space is absorbed by gases in the atmosphere
 - C. Gamma radiation from the sun is absorbed at ground level by dust particles in the atmosphere
 - D. Infrared radiation from earth's surface is absorbed by gases in the atmosphere
16. *El Nino*, a periodic warming of ocean surface waters, occurs in which of the following regions?
- A. Tropical East Pacific Ocean
 - B. Gulf of Mexico
 - C. Tropical Indian Ocean
 - D. Temperate West Atlantic Ocean
17. Which of the following procedures would be best for remediating the effects of soil salinization?
- A. Application of broad-spectrum biocides to kill microorganisms

- B. Application of clay to increase soil water-holding capacity
 - C. Addition of large amounts of water to leach out salts
 - D. Addition of lime to raise soil pH
18. Which of the following chemical substance can cause a decrease in the penis size and the opposite in females?
- A. Dichlorodiphenyltetrachloroethane
 - B. Tetrachlorodibenzo-p-dioxin
 - C. Polybrominatedbiphenyls
 - D. Polychlorinatedbiphenyls
19. All of the following are petrochemical oxidants except;
- A. Dioxin
 - B. Hydrogen peroxide
 - C. Peroxyacyl nitrates (PANs)
 - D. Aldehydes such as formaldehyde
20. All of the following are volatile organic compounds (VOCs) except;
- A. methane
 - B. chlorofluorocarbon
 - C. carbon monoxide
 - D. benzene
21. All of the following are suspended particles except;
- A. dust and soot
 - B. pesticides
 - C. sulfuric acid
 - D. chlorofluorocarbons
22. Thermal inversion is a 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
23. Gray-air smog comes from suspended particles of;
- A. carbon dioxide
 - B. ammonium salts
 - C. carbonic acid
 - D. soot
24. Exposure to indoor formaldehyde pollution is likely to cause;
- A. ulcers
 - B. Headaches
 - C. Chronic breathing problems
 - D. Dizziness

25. Furniture stuffing, paneling, particle board, and foam insulation may be sources of;

- A. Chloroform
- B. Formaldehyde
- C. Carbon monoxide
- D. Asbestos

TOTAL 25 MARKS

QUESTION TWO

Discuss how soil is formed detailing the **five** factors that are responsible for its formation.

TOTAL 25 MARKS

QUESTION THREE

Describe the chemistry of water (detailing how the reactions influence the dissolved chemical substances in the water) under the following themes:

- A. Acid-base reactions. (5 marks)
- B. REDOX reactions. (5 marks)
- C. Precipitation reactions, (5 marks)
- D. Photosynthesis. (5 marks)
- E. Gaseous exchange. (5 marks)

TOTAL 25 MARKS

QUESTION FOUR

Discuss Polychlorinatedbiphenyls (PCB) under the following sub-themes:

- 1. Its origin. (5 marks).
- 2. Its manufacture and molecular structure (draw). (8 marks).
- 3. Its health effects. (6 marks).
- 4. Its environmental effects. (6 marks).

TOTAL 25 MARKS

QUESTION FIVE

- 1. Briefly describe the composition of soil highlighting the different constituents. (13 marks).
- 2. Give two reasons why clay particles stick together. (2 marks).

3. Name four most important elements in the earth's crust. (4 marks).
4. Match the names of the following soil minerals with their correct chemical formulae.

Names: Albite, Orthoclase, Quartz, Epidote, Goethite and Magnetite

Formulae: $\text{NaAlSi}_3\text{O}_8$, KAlSi_3O_8 , $4\text{CaO} \cdot 3(\text{AlFe})_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot \text{H}_2\text{O}$, Fe_3O_4 , SiO_2 , and $\text{FeO}(\text{OH})$. (6 marks).

TOTAL 25 MARKS