

# **UNIVERSITY OF SWAZILAND**

**Faculty of Health Sciences**

**BSC IN ENVIRONMENTAL HEALTH SCIENCE**

**SECOND SEMESTER FINAL EXAMINATION PAPER MAY 2012**

**TITLE OF PAPER** : ENVIRONMENTAL CHEMISTRY 2

**COURSE CODE** : EHS 414

**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 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

This question consists of multiple choice questions that must be attempted. Write the number of the question and the letter of the correct answer besides it.

1. A chemical substance may be considered mutagenic because it
  - a. Is fatal to humans in low doses
  - b. Causes birth defects
  - c. Are harmful because it is flammable, explosive, irritating to the skin or lungs, or cause allergic reactions
  - d. Causes mutations
  
2. Which of the following anthropogenic compounds is teratogenic?
  - a. Dichlorodiphenyltetrachloromethane
  - b. Tetrachlorodibenzo-p-dioxin
  - c. Polychlorinatedbiphenyl
  - d. Polybrominatedbuphenyl
  
3. One can say a chemical is a tetrogen because it
  - a. Cause birth defects
  - b. Is fatal to humans in low doses
  - c. Is harmful because it is irritating to the skin or lungs
  - d. Cause mutations
  
4. A mutagen can directly change the molecules of
  - a. Protein
  - b. Carbohydrate
  - c. DNA
  - d. Fat
  
5. Of the following chemicals produced by our human activities, the least likely to cause birth defects is
  - a. Polychlorinatedbiphenyls
  - b. Thalidomide
  - c. Iodized sodium chloride
  - d. Steroid hormones
  
6. Which of the following chemicals is a carcinogen
  - a. Dichlorodiphenyltetrachloroethane
  - b. Xylene
  - c. Naphthalene
  - d. Polybrominatedbiphenyls

7. All of the following are photochemical oxidants except
  - a. Hydrogen peroxide
  - b. Peroxyacyl nitrates (PAN)
  - c. Dioxin
  - d. Ozone
  
8. Which of the following is not a suspended particulate matter?
  - a. Dust and soot
  - b. Pesticides
  - c. Sulfuric acid
  - d. Chlorofluorocarbons
  
9. Which of the following is NOT a function of a builder in a laundry detergent?
  - a. Adds fragrance to the fabrics
  - b. Enhances detergent activity by binding  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$
  - c. Increases the pH of the washing solution
  - d. Prevents redeposit ion of removed dirt
  
10. Which of the following is not a chemical substance used as a builder in detergents?
  - a. Phosphates (STPP)
  - b. Bleaching agent
  - c. Zeolites
  - d. Silicates
  
11. Which one of the following is NOT an advantage of using zeolites in laundry detergents?
  - a. Cannot serve as food for algae thus will not lead to eutrophication
  - b. They have an ability to bind to  $\text{Ca}^{2+}$  ions
  - c. Absorb (soak up) nonionic surfactants
  - d. Is not an effective builder
  
12. What function do bleaches, softeners and enzymes NOT serve in laundry detergents?
  - a. Impart an illusion of whiteness to fabric by absorbing uv light and emitting blue light in its place
  - b. Oxidizes dirt and stain to colorless form
  - c. Makes fabrics feel soft
  - d. Removes stain by hydrolysis reaction
  
13. Which of the following is NOT a function of optical brighteners, anti-redeposition agents, fragrances, and dyes in laundry detergents?
  - a. Prevent removed dirt from resettling back onto a surface
  - b. Impart pleasant odor and color
  - c. Oxidizes dirt and stain to colorless form
  - d. Impart an illusion of whiteness to fabrics

14. Organic chemistry is so diverse because of the ability of carbon atoms to bond to each other through
- Single, double, and triple bonding
  - Ionic bonding
  - Metallic bonding
  - Covalent bonding
15. The systematic name of an organic compound is based upon the ----- chain of carbon atoms
- Shortest continuous
  - Longest continuous
  - shortest continuous to a branch
  - longest continuous chain to a branch
16. Which of the following is the molecular formula for 1,2,3,5-tetramethylbenzene?
- $C_6H_6$
  - $C_6H_5CH_3$
  - $C_6H_2(CH_3)_4$
  - $C_6H_4(CH_3)_2$
17. Which of the following is the molecular formula for methylethylketone?
- $CH_3COCH_3$
  - $CH_3COC_2H_5$
  - $C_2H_5COC_2H_5$
  - $CH_3-CO-CH_2-CH_2-CH_3$
18. Synthetic polymers are formed when small ----- molecules join together
- Polymer
  - Isotope
  - Monomer
  - Isomer
19. Dichlorodifluoromethane is one of the chlorofluorocarbon compounds once widely manufactured as a -----and subsequently found to cause stratospheric ozone depletion.
- Refrigerant
  - Pesticide
  - Spray propellant
  - Fire extinguisher
20. Incineration of polyvinylchloride can result to the emission of
- Hydrogen chloride
  - Sodium chloride
  - Phosphorus chloride
  - Ammonium chloride
21. A potential air pollutant that reacts even with glass is

- a. HCl
  - b. H<sub>2</sub>S
  - c. HF
  - d. F<sub>2</sub>
22. The first poison gas used in world war II, a potentially deadly substance that can be an air pollutant in localized situations is
- a. F<sub>2</sub>
  - b. HCl
  - c. Cl<sub>2</sub>
  - d. NH<sub>3</sub>
23. Biogenic hydrogen sulfide is released to the environment by
- a. Burning of fossil fuels
  - b. Microbial decay of sulfur compounds and microbial reduction of sulfate
  - c. Incineration of medical waste
  - d. Incineration of pesticide
24. Some environmental hazards presented by plastics results from the presence of plasticizers added to provide essential properties such as flexibility. Which one of the following is not a hazard presented by plastics?
- a. Persistence
  - b. Resistance to treatment processes
  - c. Bioaccumulation
  - d. Biomagnification
25. Which one of the following is not a property of ethylene oxide?
- a. Toxic
  - b. Sweet-smelling
  - c. Persistent
  - d. Flammable

**TOTAL 25 MARKS**

## **QUESTION TWO**

For this question, copy the question number and write the correct answer besides the correct Roman numeral in your answer book. It must be attempted.

1. The atmospheric particles formed from gases are called (i)----- and those formed from breaking up larger masses of matter are called (ii)----- (2 marks)
2. What are the two very important factors in atmospheric chemistry that are the most important reactive intermediate species in atmospheric chemical processes? They are (i)-----and (ii) ----- (2 marks)
3. The chemical species in the lower atmosphere that is most likely to become excited by absorbing a photon of light is -----.(1 mark)

4. In photochemical reactions, an asterisk (\*) would indicate (i)-----  
whereas a dot (·) would denote (ii)----- (2 marks)
5. Both CO and CH<sub>4</sub> are eliminated from the atmosphere by reaction with -----  
(1 mark)
6. The most important basic species in the atmosphere is----- (1 mark)
7. A common process for the formation of acidic aerosol mist begins with -----  
(1 mark)
8. Si and Cl in atmospheric particles normally come from (i)-----, whereas,  
Pb and Zn are introduced by (ii)----- (2 marks)
9. The two metals normally of concern in polluted atmospheres are (i)-----  
and (ii)----- (2 marks)
10. Of the two oxides of carbon found in the atmosphere, the one of concern because of  
toxicity is (i)-----, whereas the other one is (ii)-----  
and is of concern because of (iii)----- (3 marks)
11. In the global sulfur cycle, a very large anthropogenic input is from (i)-----,  
and the largest natural source is (ii)-----released from marine organisms  
(2 marks).
12. The most abundant inorganic sulfur containing compound in the atmosphere is (i) -----  
, and a chemically related compound with a much shorter atmospheric lifetime is (ii)-----  
(2 marks)
13. The three major classes of hydrocarbons emitted to the atmosphere as pollutants are (i)---  
-----,(ii)-----, and (iii) ----- (3 marks)
14. The manufacture of PCBs has been banned because of (i)-----  
and(ii)----- (2 marks)

**TOTAL 25 MARKS**

### QUESTION THREE

1. Explain why photochemical smog is sometimes called oxidizing smog and sometimes  
reducing smog. (4 marks)
2. Describe any four environmental impacts of smog? 4 marks)
3. Draw and label a schematic representation of the formation of photochemical smog (17  
marks)

**TOTAL 25 MARKS**

### QUESTION FOUR

Mercury is one of the inorganic chemical substances found in the environment. It is a heavy metal that is regarded as an environmental and health hazard. You are appointed as an Environmental Health officer in charge of the City of Mbabane and it has been reported that there is an outbreak of Mercury pollution in the Mbabane River. Describe how you are going to

enlighten the affected communities about the dangers of using the water of this contaminated river under the following themes:

1. Nature and occurrence of mercury (6 marks)
2. Sources and uses of mercury (8 marks)
3. Effects on paths of entry into human body system (6 marks)
4. Control measures to safe guard human and environmental health (5 marks)

**TOTAL 25 MARKS**

### **QUESTION FIVE**

Polyvinyl chloride is one of the anthropogenic organic chemical substances that are of environmental concern. You are the Environmental Manager at the newly established Ezulwini Town Board and your Board wants to purchase various materials made of PVC for several development applications within the new town. As an environmentalist, you reject the proposal by your employer for the purchase of these materials. You decide to prepare a presentation to convince the Town Board to drop their option under the following themes:

1. What is Polyvinyl Chloride (PVC)? (5 marks)
2. The properties that makes PVC appropriate for several applications (9 marks)
3. Environmental impact and occupational health and safety aspects of PVC which forms the basis of your rejection to this option for the development (11 marks)

Give the details that you will include under the themes listed above.

**TOTAL 25 MARKS**