**UNIVERSITY OF SWAZILAND**
**FACULTY OF HEALTH SCIENCES**
**DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE**

| | | |
|---|---|---|
| TITLE OF PAPER | : | FINAL EXAMINATION [ENVIRONMENTAL POLLUTION] |
| COURSE CODE | : | EHS 550 |
| ACADEMIC YEAR | : | 2013/2014 |
| DATE | : | 12/2013 |
| ALLOCATED TIME | : | 2 HOURS |
| NO. OF MARKS | : | 75 |

**INSTRUCTIONS**

1. QUESTION ONE IS COMPULSORY. CHOOSE ANY OTHER TWO QUESTIONS IN ADDITION TO QUESTION ONE [THREE QUESTIONS IN TOTAL].

2. NO FORM OF PAPER, OR ANY OTHER UNAUTHORIZED MATERIAL, SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.

3. 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.

4. WRITE CLEARLY AND USE PROPER ENGLISH LANGUAGE GRAMMAR, OTHERWISE MARKS SHALL BE DEDUCTED FOR CARELESSNESS IN THESE ASPECTS.

DO NOT OPEN THIS EXAMINATION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR.

**QUESTION ONE [25 MARKS]**

1. The following statement, "they are found mostly in products used by homeowners, but less useful to farmers" is more applicable to;
   a. Carbamates
   b. Organochlorines
   c. Fumigants
   d. Inorganic pesticides
2. A good example of first generation pesticides is;
   a. Dichlorodiphenyltrichloroethane (DDT)
   b. Organochlorines
   c. Hydrogen cyanide
   d. Carbamates
3. DDT, aldrin, dieldrin, endrin, lindane are good examples of;
   a. Organochlorines
   b. Carbamates
   c. Fumigants
   d. Inorganic pesticides
4. Organophosphates are;
   a. Extremely resistant to breakdown, persist in the environment, highly toxic to sensitive organisms, are passed up the food chain (biomagnified).
   b. Not fat soluble, and so, they do not bioaccumulate to high levels in fat
   c. Have high solubility in lipid materials, including animal fat.
   d. Found mostly in products used by homeowners, but less useful to farmers
5. The following pesticides, "nicotine, nicotinoid alkaloids and pyrethrum", are good examples of;
   a. Natural organic pesticides
   b. Carbamates
   c. Organophosphates
   d. Microbial agents and biological controls
6. Bacillus thuringiensis, parasitic wasps such as the tiny *Trichogramma* genus, lacewings and ladybugs are good examples of;
   a. Microbial agents and biological controls
   b. Fumigants
   c. First generation pesticides
   d. Organochlorines
7. During the application of herbicides and insecticides, large areas of agricultural fields and forests are sprayed. Regarding the amount of the chemicals that that reach the targeted insects, it can be concluded that;
   a. All the chemicals sprayed reach the targeted insects
   b. Half the chemicals sprayed reach the targeted insects

c. Less than half of the chemicals sprayed reach the targeted insects
d. The amount of chemicals reaching the targeted insects cannot be estimated.

8. The use of certain types of pesticides is associated with the loss of beneficial insects (predators), resulting in proliferation of pest species. This is a particular concern with regard to the use of;
   a. Broad-spectrum pesticides
   b. Powerful pesticides by people who are illiterate
   c. *Chrysanthemum cinerariaefolium* pesticides
   d. The use of pesticides in developing countries where application rates are often not adhered to.
9. A dramatic increase in genetically resistant insects is another unintended result of pesticide use. This is as a result of;
   a. Genetic diversity
   b. Application rates
   c. Application times
   d. Pesticide treadmill
10. In using pesticides, the pest that a farmer wants to kill (i.e. the pest that he is concerned with), is also known as;
   a. The primary pest
   b. The secondary pest
   c. The tertiary pest
   d. The top level pest
11. The central goal of integrated pest management (IPM) is;
   a. To reduce pest populations to levels that do not cause economic damage, while protecting human health and the environment.
   b. To eliminate pest species entirely
   c. To use only environmental controls when dealing with pests
   d. To use biological controls (like it was done in Australia) when dealing with pests
12. In dealing with pests, environmental control refers to;
   a. Techniques that alter the biotic and abiotic conditions in crops, making them inhospitable to pests.
   b. Natural controls exerted by predators, diseases and parasites.
   c. Developing resistant crops and animals.
   d. Sterilizing male pests in order to ensure that they do not reproduce.
13. A farmer who plants several crops in his field side by side, rather than huge expanses of one crop, is controlling pests using;
   a. Environmental controls
   b. Biological controls

c. Genetic controls
d. Third generation controls

14. Some plants naturally escape insect pests by sprouting early or late in the growing season. Agriculturalists can use their knowledge of an insect's life cycle to their advantage by coordinating plantings with the expected date of hatching. This strategy is one example of;
    a. Environmental controls
    b. Biological controls
    c. Genetic controls
    d. Third generation controls
15. In the early 80s in sub-Saharan Africa, the mealy bug insect became a pest, attacking cassava plants. Scientists brought in (from the mealy bug's South American homeland) a small parasitic wasp, which injects its eggs into the larvae of the mealy bug. This strategy is a good example of;
    a. Environmental controls
    b. Biological controls
    c. Genetic controls
    d. Third generation controls
16. In sterile male technique, males are sterilized rather than females, and this is because;
    a. Male insects mate several times, whereas the females mate only once, and thus eggs produced by such a union are infertile.
    b. Sterilizing females damages the eggs, which could render the whole process useless.
    c. Female insects spend less time feeding compared to males, and so, sterilizing them may not achieve the desired results.
    d. Males live longer, which ensures the control of pest populations for a longer period of time.
17. In pest control, scientists have discovered that insects and other animals release chemicals that provide a chemical means of communication. These chemicals are called;
    a. Pheromones
    b. Ephemerals
    c. Phemorones
    d. Ephemeral diversity
18. Substances that are fatal to more than 50% of the test animals ($LD_{50}$) at given concentrations are;
    a. Toxic chemicals
    b. Carcinogens
    c. Mutagens
    d. Teratogens
19. Chemicals, types of radiation, or certain viruses that cause cells to multiply uncontrollably are;
    a. Carcinogens

b. Teratogens
c. Mutagens
d. Toxic chemicals

20. Chemicals or forms of radiation that cause changes in the DNA molecules found in cells are;
    a. Mutagens
    b. Toxic chemicals
    c. Carcinogens
    d. Teratogens
21. Chemicals, radiation or viruses that cause birth defects while the human embryo is growing and developing during pregnancy, especially during the first three months, are;
    a. Teratogens
    b. Carcinogens
    c. Mutagens
    d. Toxic chemicals

22. Depending on dose and particular type of these chemicals, they can damage the nervous and immune systems, the liver and thyroid gland. They also profoundly affect foetal brain development. these effects are closely associated with;
    a. Polychlorinated biphenyls
    b. Polybrominated fire retardants
    c. Perfluorooctane sulfonates
    d. DDT
23. The major use of these chemicals was in insulation of electric equipment, due to non-flammability even at high temps. These are;
    a. Polychlorinated biphenyls
    b. Polybrominated fire retardants
    c. Perfluorooctane sulfonates
    d. PBDEs
24. The most persistent (i.e. extremely difficult for living organisms to degrade) category of POPs are;
    a. PFOS
    b. DDT
    c. PCBs
    d. PBDEs
25. The type of POPs that are often found in high levels in cats and children are;
    a. PFOS
    b. DDT
    c. PCBs
    d. PBDEs

**QUESTION TWO [25 MARKS]**

1. In describing the characteristics of persistent organic pollutants (POPs), it is said that many of these chemicals act as environmental hormones.
   a. Naturally, what are hormones in the endocrine system? [2]
   b. Why are some POPs referred to as environmental hormones? [3]
2. Figure 1 shows bioaccumulation and biomagnification of many types of persistent organic pollutants (POPs) in an aquatic food chain. Study the diagram carefully and answer the questions that follow.
   a. When does a chemical bioaccumulate? [2]
   b. When does a chemical undergo biomagnification? [2]
3. Describe the common observation when studying chemicals like polychlorinated biphenyls (PCBs) in the laboratory, regarding solubility [2].

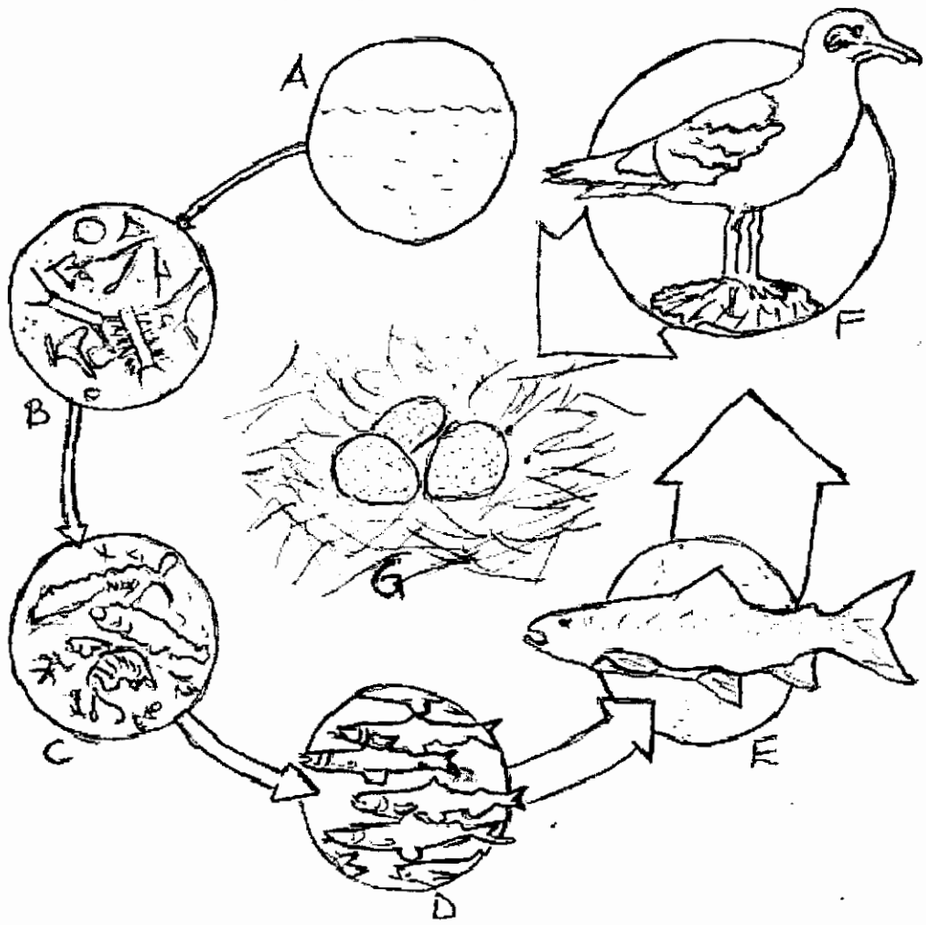


Figure 1: Bioaccumulation and biomagnification of polychlorinated biphenyls in an aquatic food chain (PCBs) [Miller 2002]

a. In aquatic environments, PCBs are said to concentrate in sediment at the bottom of water bodies. Describe two ways by which PCBs attached to sediment at the bottom can move into water above [2].
b. State any two impacts of PCBs on fish [2].
c. If you were asked to label figure 1, where would you place zooplankton and phytoplankton? [2]
d. Where are PCBs currently being used? [2]
e. Describe any two problems of dichlorodiphenyltrichloroethane (DDT) on the eggs of birds feeding in POPs – contaminated lakes, like the one shown in figure 2 [4].
f. Chemicals that end up causing problems like the ones shown in figure 1 above are known to have special uses industrially. State any two uses of these chemicals [2].

**QUESTION THREE [25 MARKS]**

1. Figure 2 shows conditions that often occur after introduction of pollution in aquatic environments. Study the diagram carefully and answer the questions that follow.

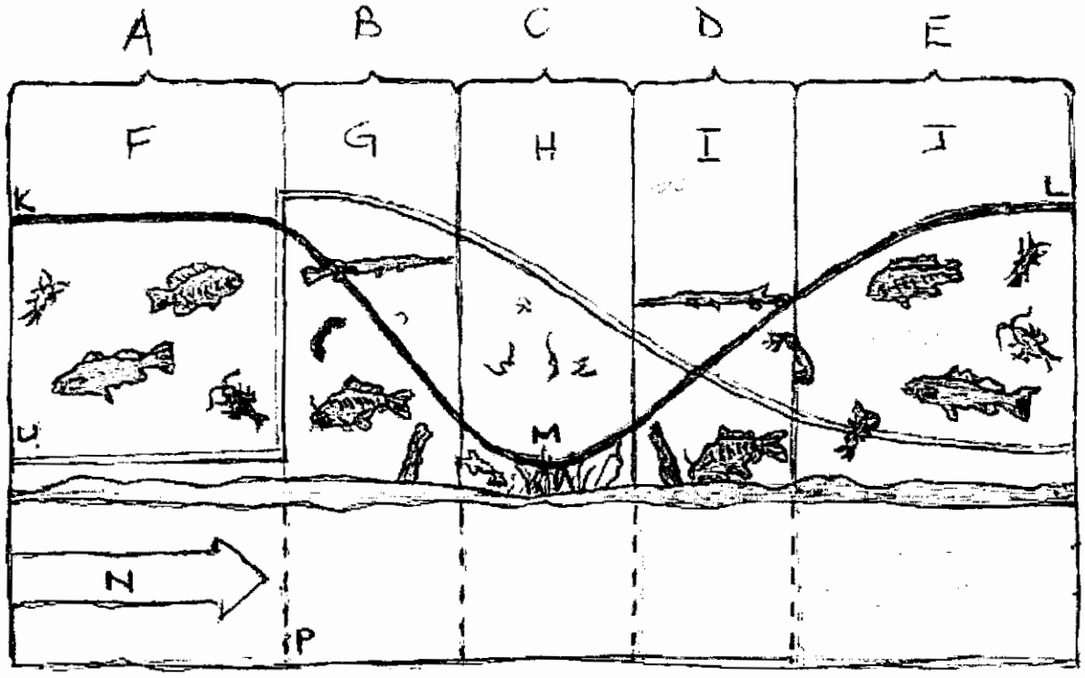


Figure 2: Typical conditions occurring after the introduction of pollutants in aquatic environments [Miller and Spoolman 2012]

1.1 State any three examples of pollutants that can cause the conditions that are shown in figure 2 above [3].
1.2 State the names of the five zones shown in A to E [5].
   a. A _____
   b. B _____

c. C _____
d. D _____
e. E _____

1.3 Describe one significant impact of the type of pollutants that you have stated in question 1.1 above [2].

1.4 State the types of organisms that are represented by F to J [5]

a. F _____
b. G _____
c. H _____
d. I _____
e. J _____

2. One of the most important types of waste is nuclear wastes. State the two main categories of nuclear waste? [2]
3. For each of the categories of nuclear waste that you have stated above, state two examples [4].
4. Acid runoff from mine wastes can result to significant impacts on soil. Describe (in full) two problems of acids in soil [4].

**QUESTION FOUR [25 MAKS]**

1. You are an Environmental Management Officer working at the National Air Pollution Monitoring Laboratory in Matsapha. Due to the on-going financial problems affecting Swaziland, many of the damaged equipment in your laboratory has not been replaced. In order to monitor levels of air pollution, you decide to rely on your knowledge of the impacts of air pollution on vegetation. Luckily for you, within and around Matsapha, the following plant species and other organisms are found; apple trees, alfalfa, lichens, conifers and Chinese apricot.
   a. Which plant species are you going to use to carry out your analysis? [2]
   b. Explain how you can use the plant you have stated in question 1 (a) above to draw a conclusion whether air pollution is increasing or decreasing in Matsapha, without using chemical analysis [4].
   c. Describe one property of the species you have stated in question 1 (a), which makes them particularly useful in air quality and air pollution monitoring [3].
2. The following five radioisotopes are found in indoor air; plutonium (radiation half-life = 24000 years), uranium-235 (radiation half-life = 710 million years), polonium-218 (radiation half-life = 3 minutes), uranium-238 (radiation half-life = 4.5 billion years) and polonium-214 (radiation half-life = 1 second). Using your knowledge of the negative health impacts of indoor air pollutants, answer the following questions;
   a. If you happen to inhale indoor air containing all of the above isotopes in microscopic dust particles, state two isotopes that are not likely to immediately cause any harm to your health [4].

b. If you happen to inhale indoor air containing all of the above isotopes in microscopic dust particles, state two isotopes that are likely to cause harm to your health within a very short time [4].
c. State one factor that has guided you in answering questions 2 (a) and (b) above [2].
d. Using your knowledge of the factor that you stated in question 2 (c) above, explain your reasons for the choices you have made in question 2 (a) and (b) [4].
e. What is meant by half-life? [2]