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

FINAL EXAMINATION PAPER: MAY 2016

TITLE OF PAPER	ENVIRONMENTAL ASSESSMENT
COURSE CODE	EHM 307
DURATION	2 HOURS
TOTAL NUMBER OF MARKS	75
INSTRUCTIONS	1. DO NOT OPEN THIS PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR. 2. QUESTION ONE IS COMPULSORY. CHOOSE TWO OTHER QUESTIONS IN ADDITION TO QUESTION ONE. 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 CORRECTLY. 4. POOR HANDWRITING AND CARELESSNESS IN ENGLISH LANGUAGE GRAMMAR SHALL RESULT IN LOSS OF MARKS. 5. NECESSARY PENALTIES SHALL BE APPLIED AGAINST ANY FORM OF MISCONDUCT DURING THE COURSE OF THE EXAMINATION.

QUESTION ONE [25 MARKS]

1. Most dry acid deposition (which occurs fairly near the industrial sources) takes place within;
   (a) 2–3 days of emission
   (b) 3–4 days of emission
   (c) 4–5 days of emission
   (d) 5–6 days of emission
2. The primary pollutants that are the main precursors of acid deposition are;
   (a) SO_2 and NO
   (b) CO and SO_2
   (c) NO_x and SO_2
   (d) SO_2 and SO
3. Secondary acid deposition pollutants do not include;
   (a) H_2SO_4
   (b) HNO_3
   (c) CO_2
   (d) SO_4^{-2}
4. Secondary acid deposition pollutants often remain in the atmosphere for;
   (a) 2–14 days depending mostly on prevailing winds
   (b) 4–16 days depending mostly on prevailing winds
   (c) 6–18 days depending mostly on prevailing winds
   (d) 8–20 days depending mostly on prevailing winds
5. Acid deposition has a pH of;
   (a) Less than 5.6
   (b) Less than 4.6
   (c) Less than 3.6
   (d) Less than 2.6
6. Unpolluted rain is mildly acid with a pH of;
   (a) About 5.6
   (b) About 4.6
   (c) About 3.6
   (d) About 2.6
7. Most wet acid deposition takes place within;
   (a) 4–14 days of emission
   (b) 6–16 days of emission
   (c) 8–18 days of emission
   (d) 10–20 days of emission

8. South Africa gets 80% of its energy from burning coal, Ghana gets 80% from hydroelectric power, China gets 80% from solar and Russia gets 80% from natural gas. The worst acid deposition must be occurring in;
   (a) South Africa
   (b) Russia
   (c) Ghana
   (d) China
9. In aquatic systems that experience acid deposition, fish cannot be found;
   (a) Below a pH of 4.5
   (b) Below a pH of 5.5
   (c) Below a pH of 6.5
   (d) Below a pH of 7.5
10. The destructive impacts of acid deposition on fish include,
   (a) Burns on their skin (especially since fish has soft skin)
   (b) Inhibition of diffusion of oxygen into the water body
   (c) Killing fish through excessive mucus formation
   (d) Killing fish by reducing the temperature of the water body below the tolerance level of fish
11. Chemicals or substances emitted directly into the air from natural processes and human activities, at concentrations high enough to cause harm are;
   (a) Primary pollutants
   (b) Secondary pollutants
   (c) Tertiary pollutants
   (d) Airborne pollutants
12. In the atmosphere, some pollutants react with one another and with other natural components of air to form new harmful chemicals, called;
   (a) Primary pollutants
   (b) Secondary pollutants
   (c) Tertiary pollutants
   (d) Airborne pollutants
13. One of the causes of indoor air pollution is the use of;
   (a) Batteries
   (b) Paints
   (c) Cow dung
   (d) Nail polish
14. One of the reasons why there may be less air pollution in rural areas compared to urban areas is linked with;
   (a) Education
   (b) HIV/AIDS
   (c) Vehicles
   (d) Health status

15. According to the WHO, each year indoor air pollution kills about';
    (a) 4.6 million people
    (b) 1.6 million people
    (c) 2.6 million people
    (d) 3.6 million people
16. Currently, there are about six to eight major categories of criteria pollutants. Use your knowledge of these pollutants to answer the questions below.

16.1 A colourless, odourless, and highly toxic gas that forms during the incomplete combustion of carbon-containing materials is
    (a) SO_2
    (b) O_3
    (c) CO_2
    (d) CO

16.2 A pollutant known to combine with haemoglobin in red blood cells, resulting in inhibition of normal binding of oxygen with haemoglobin molecules is
    (a) CO
    (b) NO
    (c) NO_2
    (d) SO_2

16.3 An air pollutant whose destructive effects include reduction of the ability of blood to transport oxygen to body cells and tissues is;
    (a) HNO_3
    (b) SO_2
    (c) CO
    (d) CO_2

16.4 About 93% of this pollutant in the atmosphere is the result of the natural carbon cycle. The rest comes from human activities, mostly the burning of fossil fuels and the clearing of forests and grasslands. This pollutant is;
    (a) NO
    (b) N_2
    (c) CO_2
    (d) NO_2

16.5 A colourless gas that forms when nitrogen and oxygen gas react under high-combustion temperatures in automobile engines and coal-burning power and industrial plants;
    (a) Nitric oxide
    (b) Sulfur dioxide
    (c) Carbon monoxide
    (d) Carbon dioxide

16.6 A greenhouse pollutant that is released from fertilizers and animal wastes, and also during the burning of fossil fuels is;
(a) Nitric oxide
(b) Nitrogen dioxide
(c) Nitrogen oxide
(d) Nitrous oxide

16.7 The irritation of eyes, nose, and throat, aggravation of lung ailments such as asthma and bronchitis, suppression of plant growth, and reduction of visibility are air pollution problems associated with;
(a) Nitrous oxide
(b) Nitric oxide
(c) Nitrogen dioxide
(d) Nitrogen oxides

16.8 Dust, wild fires, sea salt, coal-burning power and industrial plants, motor vehicles, and road construction are all sources of;
(a) Sulfur dioxide
(b) Suspended particulate matter
(c) Acid deposition
(d) Wet deposition

16.9 A colourless and highly reactive gas, which is a major ingredient of photochemical smog and also responsible for coughing and breathing problems, aggravation of lung and heart diseases, reduced resistance to colds and pneumonia, and irritation of eyes, nose, and throat is;
(a) CO
(b) O_2
(c) O_3
(d) CO_2

16.10 Damage to paints, paper, leather, and stone on buildings and statues is associated with;
(a) Sulfur dioxide
(b) Nitrous oxide
(c) Carbon monoxide
(d) Carbon dioxide

QUESTION TWO [25 MARKS]

1. It has been said that most of today's pesticides are 10 times more toxic than those used in the 1950s. However, according to **Figure 1** below, species of insects, plant pathogens and weeds are on the increase. Study the diagram carefully and answer the questions that follow.

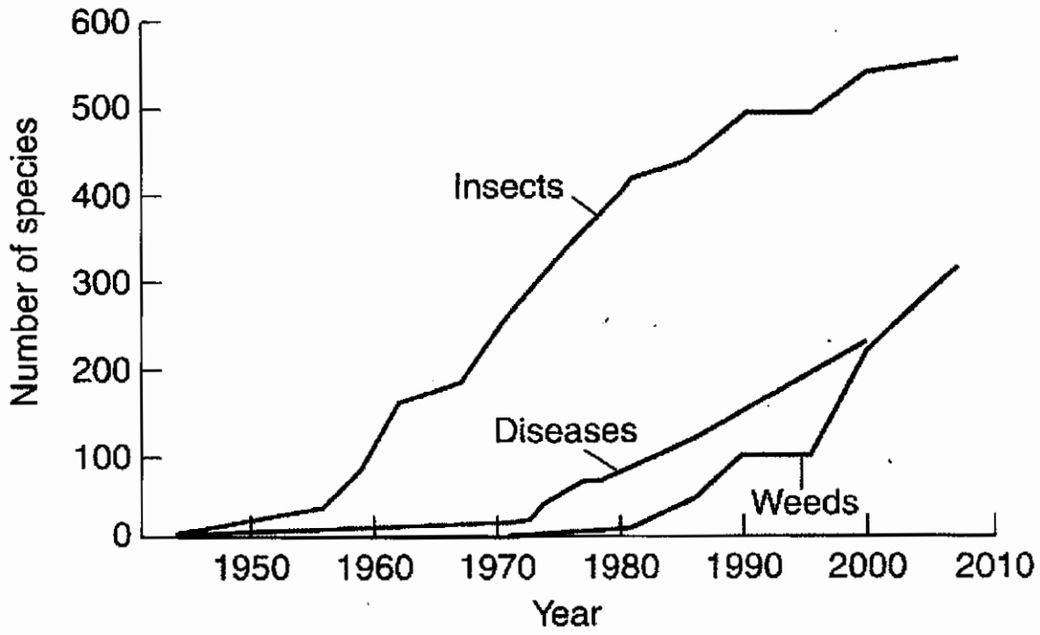

Figure 1: Species of insects, plant pathogen (disease organisms), and weeds that are resistant to at least one pesticide.

1.1 According to **Figure 1**, it is obvious that many pest species are now resistant to pesticides. How do pests develop resistance to pesticides? [6]

1.2 Due to what is shown in **Figure 1**, roughly how many times do farmers need to apply pesticides in one growing season? [2]

2. Describe one impact of broad-spectrum pesticides [2].
3. Discuss any two negative impacts of oil spills on aquatic birds [4].
4. The use of dispersing agents and fire are some of the easiest chemical methods that can be applied in cleaning oil spills. There is a catch, however, with each of these two. What is the catch? [4]
5. Discuss any two ways by which plastics are particularly lethal to marine animals [4].
6. Older ships were known to contribute to oil pollution in the seas through ballast tanks. Explain how this happened? [3]

QUESTION THREE [25 MARKS]

1. **Figure 2** shows some of the processes that are involved in photochemical smog, as a consequence of the action of sunlight on NO, NO_2 and O_3. Study the diagram carefully and answer the questions that follow.

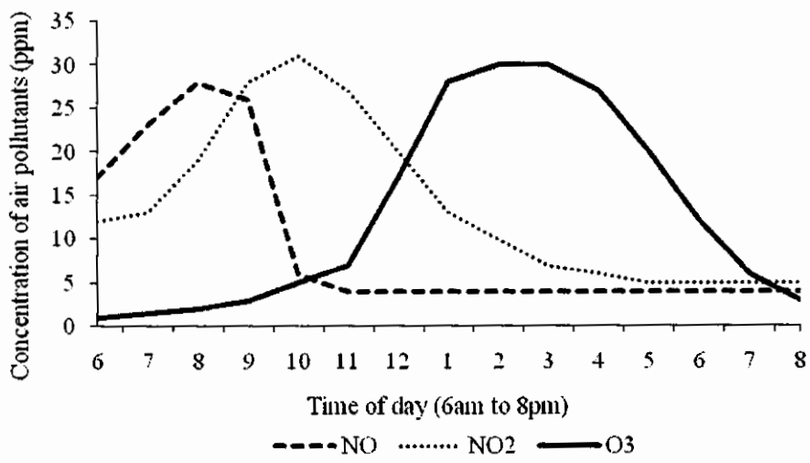

Figure 2: Typical daily changes in concentration of air pollutants that lead to development of photochemical smog.

1.1 What is photochemical smog? [2]
1.2 What is a photochemical reaction? [2]
1.3 As can be seen in **Figure 2**, NO concentrations are on the increase only from 6:00am to about 8:00am; thereafter, they drop sharply. What do you think is the cause of this pattern? [3]
1.4 The concentrations of NO_2 are much higher from around 9:00am to about 11:00am, after which they begin to drop sharply. What do you think is the cause of this pattern? [3]
1.5 O_3 concentrations remain at relatively lower concentration for up to about 11:00am; however, thereafter, O_3 builds up and remain at elevated concentrations for up to about 4:00pm. Why are O_3 levels higher at these times? [3]
1.6 Give one reason why suburbs and surrounding rural areas often have higher levels of photochemical smog than city centres [3].
1.7 State any three climatic characteristics of cities that are often plagued by photochemical smog [3]
1.8 Photochemical smog is a mixture of ozone, nitric acid, aldehydes, peroxyacyl nitrates (PANs), and other secondary pollutants. Which of these is more dominant? [2]
1.9 Why is photochemical smog also called brown-air smog? [2]
2. What is air pollution? [2]

QUESTION FOUR [25 MARKS]

1. **Figure 3** shows the impacts of one of the families of POPs in an aquatic food chain. Study the diagram carefully and use it (along with your knowledge of the three families of POPs) to answer the questions that follow.

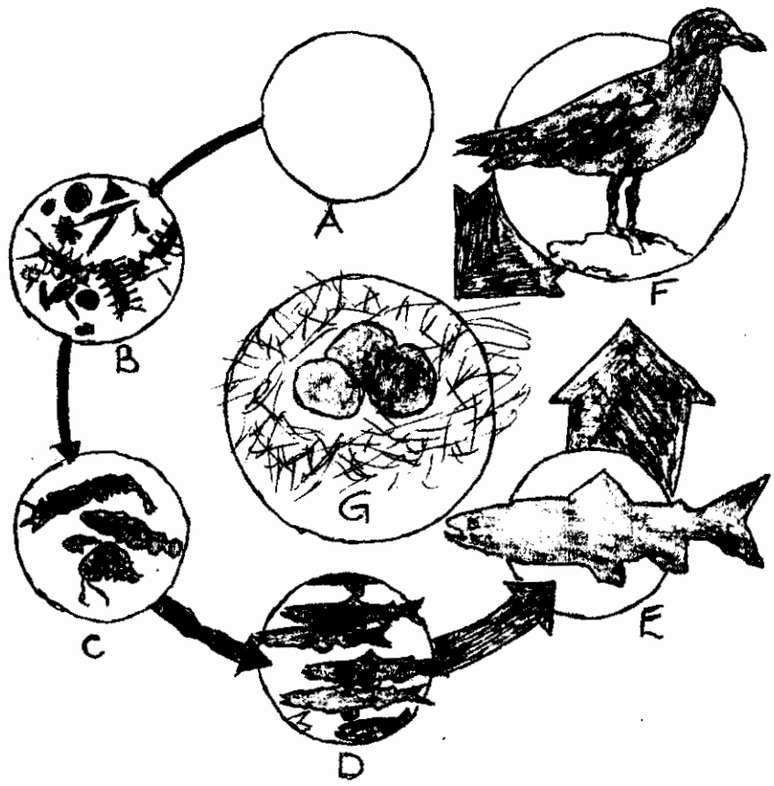

Figure 3: Impacts of one of the families of POPs in an aquatic food chain. Note: A – *water*; B – *phytoplankton*; C – *zooplankton*; D – *rainbow smelt*; E – *lake trout*; F – *herring gull (a fish-eating bird)*; and G – *herring gull eggs*; arrows – *concentration of POPs from one state to another*.

1.1 State the three main families of POPs are [3].

1.2 State POPs in full [1].

1.3 Which family of POPs is usually associated with problems shown in figure 3? [2]

1.4 What is the name of the process given to the phenomenon whereby the level of a chemical becomes progressively higher moving through the food web, as shown in figure 3? [1]

1.5 During the 1950s and 1960s, populations of fish- eating birds, such as osprey, cormorant, brown pelican and bald eagles plummeted. Research showed that a chemical derived from DDT was the major cause of this observation. Using figure 3, explain how DDT affected bird populations [3].

2. Discuss any two destructive impacts of algal blooms in coastal areas [4].

3. State any three sources of oil entering the oceans [3].

4. An oil spill in the ocean is known to result to significant negative environmental and economic impacts. Sometimes; however, the impacts can be minimal. Discuss any three factors that can lead to such variances [6].

5. State any two sources of plastics that end up in oceans [2].