



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

FINAL EXAMINATION PAPER: MAY 2017

TITLE OF PAPER	ENVIRONMENTAL POLLUTION MANAGEMENT
COURSE CODE	EHM 307
DURATION	2 HOURS
TOTAL NUMBER OF MARKS	100
INSTRUCTIONS	<ol style="list-style-type: none">1. DO NOT OPEN THIS PAPER UNTIL YOU ARE INSTRUCTED TO DO SO.2. QUESTION ONE IS COMPULSORY. CHOOSE THREE OTHER QUESTIONS IN ADDITION TO QUESTION ONE.3. BEGIN EACH QUESTION ON A FRESH PAGE OF THE ANSWER BOOKLET. ENSURE THAT ALL PAGES ARE NUMBERED CORRECTLY.4. POOR HANDWRITING AND CARELESSNESS IN ENGLISH LANGUAGE GRAMMAR SHALL RESULT IN LOSS OF MARKS.5. NECESSARY STEPS SHALL BE TAKEN AGAINST ANY FORM OF MISCONDUCT DURING THE EXAMINATION.6. MARKS FOR EACH QUESTION (SECTION) ARE SHOWN IN BRACKETS.

QUESTION ONE [25 MARKS]

1. The diagram below (Fig 1) is an illustration of one of the two major outdoor air pollution problems. Study the diagram carefully and answer the questions that follow below.

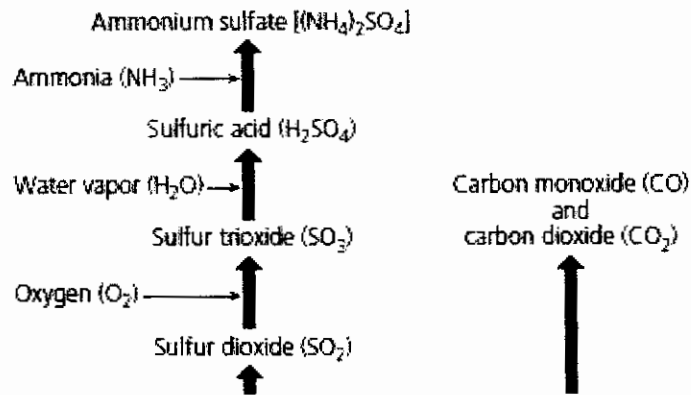


Figure 1: Pollutants that contribute to one of the major outdoor air pollution problems.

- 1.1 The problem shown in Fig 1 is known as;
 - (a) Brown-air smog
 - (b) Photochemical smog
 - (c) Both (b) and (d) are correct
 - (d) Gray-air smog
- 1.2 The problem shown in Fig 1 is very common in;
 - (a) Residential areas in moist and hot climates
 - (b) Industrial cities in moist and hot climates
 - (c) Warm, wet and cloudy cities
 - (d) Industrial cities in moist and cold cities
- 1.3 The name of the problem shown in Fig 1 is associated with;
 - (a) CO
 - (b) CO₂
 - (c) H₂SO₄
 - (d) H₂O
- 1.4 Amongst the following pollutants, a product of incomplete combustion is;
 - (a) CO₂
 - (b) H₂SO₄
 - (c) CO
 - (d) SO₃
- 1.5 Amongst the following pollutants, a primary pollutant is;
 - (a) CO₂
 - (b) NH₃
 - (c) H₂SO₄
 - (d) H₂O
- 1.6 Amongst pollutants shown in Fig 1, the major acid deposition problems are associated with;
 - (a) NH₃
 - (b) H₂SO₄
 - (c) CO₂
 - (d) H₂O

- 1.7 Amongst pollutants shown in **Fig 1**, drivers stalled in traffic or driving in highly congested areas are particularly affected by;
- (a) CO
 - (b) SO₃
 - (c) H₂SO₄
 - (d) (NH₄)₂SO₄
- 1.8 Amongst pollutants shown in **Fig 1**, a corrosive acid gas, colourless with a sharp irritating odour is;
- (a) CO
 - (b) (NH₄)₂SO₄
 - (c) H₂SO₄
 - (d) SO₂
2. The Love Canal case study is one of the many examples that illustrate the fact that poor management of hazardous waste can often lead to major health impacts. Using your knowledge of this case study, answer the questions below.
- 2.1 The Love Canal, built in the 1890s, was never used as a canal. Then, starting in 1942, Hooker Chemicals Co. disposed of;
- (a) 22 000 tons of hazardous waste
 - (b) 32 000 tons of hazardous waste
 - (c) 42 000 tons of hazardous waste
 - (d) 52 000 tons of hazardous waste
- 2.2 The more than 200 hazardous chemicals that were dumped in the canal included;
- (a) Oxygen-demanding waste
 - (b) Pesticides
 - (c) Plant nutrients
 - (d) Sediment contaminated with salts
- 2.3 The Love Canal site was capped with clay and topsoil, and sold to Niagara Falls school board. Between 1954 and 1959, the site was developed. Amongst these developments, were;
- (a) Car manufacturing factories
 - (b) Fish hatcheries
 - (c) Schools
 - (d) Shopping malls
- 2.4 In the 1960s, the dumped hazardous waste began to affect residents within the vicinity of the site by;
- (a) Weakening concrete walls affect maize yield
 - (b) Overflowing into fields where it began to yields of crops like maize, lettuce, potatoes, animal feed, etc.
 - (c) Corroding underground electricity cables
 - (d) Overflowing into the basements and back yards
- 2.5 The extent of the impact of hazardous waste from the Love Canal site was such that city authorities ended up;
- (a) Destroying homes closest to the canal
 - (b) Banning the consumption of vegetables grown within the vicinity of the affected site
 - (c) Banning the use of boreholes for 25 years
 - (d) Conducting tests to determine health impacts on all residents within the vicinity of the affected site.

3. The environmental persistence of four types of chemicals, which are used in farming in Swaziland, is shown in Fig 2. Study the diagram carefully and use it (along with your knowledge of pesticides) to answer the questions below.

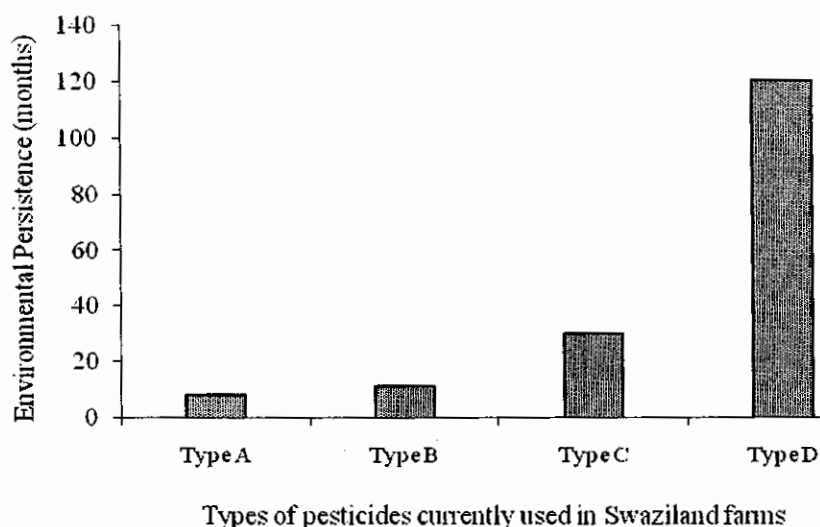


Figure 2: Environmental persistence of four types of chemicals used in farming activities in Swaziland

- 3.1 The chemical that is likely to be easily broken down once it is released into the environment is;
- Type B
 - Type A
 - Type C
 - Type D
- 3.2 The chemical that might cause the highest fatalities in bird species like peregrine falcons, bald eagles, brown pelicans, cormorants, gulls, ospreys, which feed on fish and of other smaller birds is;
- Type A
 - Type B
 - Type D
 - Type C
- 3.3 The chemical that is likely to have the lowest biomagnification rates as it moves along the food chain is;
- Type B
 - Type C
 - Type D
 - Type A
- 3.4 The chemical that is more likely to have the highest solubility in lipid materials, including animal fat is;
- Type A
 - Type B
 - Type C
 - Type D

- 3.5 The chemical that is likely to have the lowest water solubility is;
- (a) Type A
 - (b) Type B
 - (c) Type C
 - (d) Type D
- 3.6 The chemical that is likely to have the highest water solubility is;
- (a) Type B
 - (b) Type A
 - (c) Type C
 - (d) Type D
- 3.7 The chemical that is likely to be detected in high quantities in the fat of animals found in Arctic regions is;
- (a) Type A
 - (b) Type D
 - (c) Type B
 - (d) Type C
- 3.8 The chemical that is likely to be less useful to farmers but more famous to homeowners is;
- (a) Type A
 - (b) Type B
 - (c) Type C
 - (d) Type D
- 3.9 Insecticides that are short-lived in the environment bioaccumulate to high levels in fat;
- (a) False
 - (b) True
 - (c) Only broad spectrum insecticides
 - (d) Only target-specific insecticides
- 3.10 Insecticides with an LD₅₀ of 113 mg/kg are more toxic than those with an LD₅₀ of 3.6 mg/kg;
- (a) False
 - (b) Only target-specific insecticides
 - (c) True
 - (d) Only broad spectrum insecticides
4. Most dry acid deposition (which occurs fairly near the industrial sources) takes place within;
- (a) 3–4 days of emission
 - (b) 4–5 days of emission
 - (c) 2–3 days of emission
 - (d) 5–6 days of emission
5. The primary pollutants that are the main precursors of acid deposition are;
- (a) SO₂ and NO
 - (b) CO and SO₂
 - (c) NO_x and SO₂
 - (d) SO₂ and SO

QUESTION TWO [25 MARKS]

1. The following statements relate to water pollution problems. In each case, determine whether the statement is true (T) or false (F) [10].
- (a) Problems relating to oxygen sag curve and the curve of oxygen demand are associated with lakes or reservoirs.
 - (b) In an unpolluted water body, dissolved oxygen is higher than biochemical oxygen demand.
 - (c) Dissolved oxygen levels often begin to fall immediately below the source of pollution.

- (d) Low dissolved oxygen levels causes more mass fish deaths than any other single agent, including oil spills.
 - (e) Eutrophication is mainly a problem that is encountered in streams/rivers.
 - (f) Point sources of water pollution are harder to control than nonpoint sources.
 - (g) High BOD in a water body often indicates human activity; however, naturally water contains some BOD.
 - (h) More than a quarter of the world's population depends on groundwater for drinking water.
 - (i) The effects of oxygen demanding wastes are always the same, regardless of volume of water polluted, flow and temperature.
 - (j) Rivers and lakes that have clear water and low biological productivity are said to be oligotrophic.
2. State any;
 - (a) Two examples of carbon oxides [2]
 - (b) Two examples of volatile organic compounds [2]
 - (c) Two examples of nitrogen oxides [2]
 - (d) Two health impacts of ozone [2]
 - (e) Two non-health impacts of ozone [2]
 3. Explain why CO is especially dangerous to people with existing heart diseases [5].

QUESTION THREE [25 MARKS]

1. The impacts of acid deposition were recently studied on soils and aquatic ecosystems. In both systems, the average acidity levels are shown in **Fig 3**. Using your knowledge of the impacts of acid deposition, determine whether each statement below is true (T) or false (F) [15]:

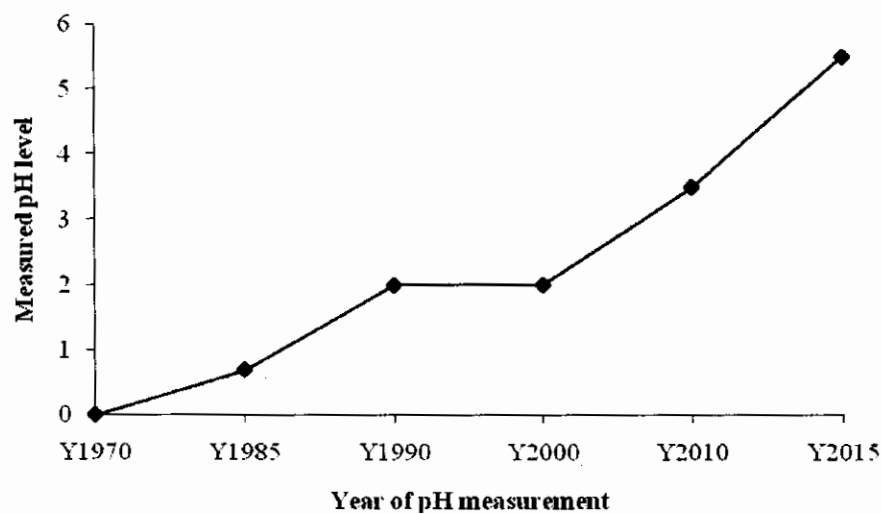


Figure 3: Acidity levels in soil and aquatic ecosystems of Swaziland (1970–2015)

- (a) Acid deposition has been on the increase in Swaziland from 1970 to 2015.
- (b) The populations of song birds living in aquatic environments have been on the increase from 1970 to 2015.
- (c) From 1970 to 2010, there were no species of fish in many lakes in Swaziland.

- (d) The growth of acid loving plants, known as mosses, has been on the decline ever since the 1970s.
 - (e) The highest number of bird mortalities was observed between 1970 and 1985.
 - (f) The largest loss of soil buffering capacity was observed after 2010.
 - (g) At the bottom of many lakes, the amount of undecayed organic material has been increasing since 1970.
 - (h) The populations of aquatic insects were higher in year 2000 than in 1990.
 - (i) The clarity (clearness of water) of many lakes in Swaziland has been decreasing since 1970.
 - (j) The levels of heavy metals (e.g., cadmium, mercury, lead, etc) have been decreasing in many lakes since 1970.
2. The amount of pollution that reaches groundwater is said to be dependent on a number of factors. State any three such factors [3].
 3. State any three sources of groundwater pollution [3].
 4. When groundwater becomes contaminated, it cannot cleanse itself of degradable wastes as quickly as flowing surface water. Why? [4]

QUESTION FOUR [25 MARKS]

1. The diagram shown below (Fig 4) is a chemical illustration of one of the major outdoor air pollution problems. Study the diagram carefully and answer the questions that follow.

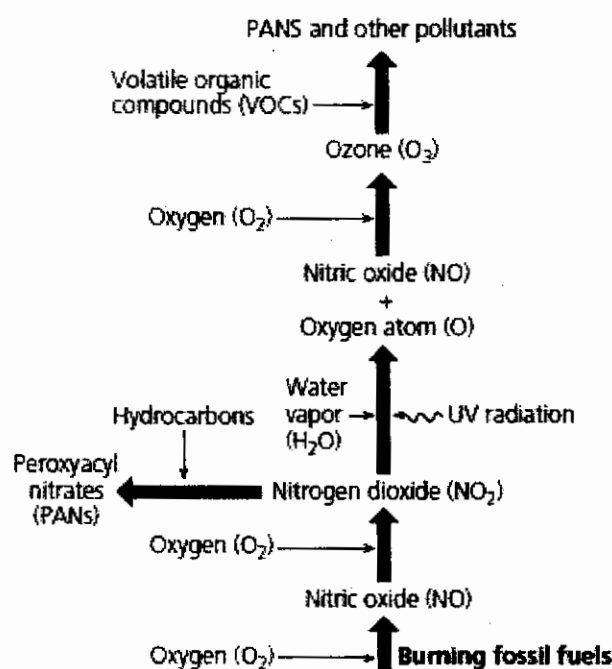


Figure 4: Pollutants that contribute to one of the major outdoor air pollution problems.

- 1.1 State any two major pollution sources that are associated with problems shown in Fig 4 [2].
- 1.2 State any two primary pollutants that are associated with problems shown in Fig 4 [2].
- 1.3 What is the difference between primary and secondary pollutants? [2]
- 1.4 State any two primary pollutants and two secondary pollutants shown in Fig 4 [4].
- 1.5 State any three major climatic characteristics of cities in which Fig 4 problems are common [3].

- 1.6 State the most dominant pollutant in the problem shown in **Fig 4** [2].
- 1.7 Between city centres and surrounding suburbs, where would you expect to find the highest concentrations of the dominant pollutant (you have stated in 1.7 above)? [2]
- 1.8 The problem shown in **Fig 4** is also associated with a particular colour. State the pollutant that is responsible for this colour [2].
- 1.9 At what time and type of day is **Fig 4** likely to occur? [2]
- 1.10 Using **Fig 4**, write balanced equations that lead to the formation of NO and NO₂ [4].

QUESTION FIVE [25 MARKS]

- 1 The following statements (1.1–1.9) relate to three types of insecticides, namely polychlorinated insecticides, organophosphates and carbamates. Study each statement and match it with the appropriate insecticide, i.e., state the correct insecticide/insecticides in each case.
 - 1.1 Because of their lower toxicity, they are often found in products used by homeowners but are less useful to farmers [1.5].
 - 1.2 They have high solubility in lipid materials, including animal fat [1.5].
 - 1.3 They are short-lived in the environment [3].
 - 1.4 These can reach Arctic regions where low temperatures prevent their degradation [1.5].
 - 1.5 After application to a field, they can runoff in rainwater readily or percolate into groundwater [3].
 - 1.6 Some of these have an LD₅₀ of 113mg/kg [1.5].
 - 1.7 Some of these have an LD₅₀ of 3.6 mg/kg [1.5].
 - 1.8 They do not bioaccumulate to high levels in fat [3].
 - 1.9 They have low water solubility and cling to soil particles; thus little is lost to rainwater [1.5].
- 2 What are pesticides? [2]
- 3 State any three examples of first generation pesticides [3].
- 4 State one of the reasons that prompted farmers to abandon some of the first generation pesticides [2].