



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

FINAL EXAMINATION PAPER: MAY 2016

TITLE OF PAPER	ENVIRONMENTAL ASSESSMENT
COURSE CODE	EHS 551
DURATION	2 HOURS
TOTAL NUMBER OF MARKS	75
INSTRUCTIONS	<ol style="list-style-type: none">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. The collection of plastics by communities and the return of these to the manufacturing sector for the manufacture of plastic mats is a good example of;
 - (a) Open-loop recycling
 - (b) Closed-loop recycling
 - (c) Primary recycling
 - (d) Tertiary recycling
2. The manufacture of lower quality products is usually associated with;
 - (a) Primary recycling
 - (b) Secondary recycling
 - (c) Tertiary recycling
 - (d) None of the above
3. An air pollution device that is known to remove over 99% of the particulates and 80-95% of sulfur oxide gases is
 - (a) The scrubber
 - (b) The cyclone
 - (c) Catalytic converters
 - (d) FBC
4. The main principle of operation of the device you have chosen in question one above is;
 - (a) Pollutant-laden air is passed through bag filters
 - (b) Pollutant-laden air is passed through an electric field
 - (c) Pollutant-laden air is passed through a fine mist of water and lime
 - (d) Pollutant-laden air is passed through a fluidized bed
5. The use of pollution control devices is tremendously desirable in reducing the impacts of air pollution from either stationary or mobile sources. However, some of these devices can result to the worsening of other environmental problems. A pollution control device that is more relevant to this statement is;
 - (a) The wet scrubber
 - (b) The catalytic converter
 - (c) The bag filter
 - (d) The cyclone
6. The device you have chosen in question 3 above is often used in;
 - (a) Stationary sources
 - (b) Both stationary and mobile sources
 - (c) Mobile sources
 - (d) Coal burning sources only

7. The most problematic pollutant in mobile devices is;
 - (a) CO
 - (b) HNO₃
 - (c) CO₂
 - (d) SO₂
8. The two types of pollutants that almost all control devices fail to remove from stationary combustion sources are;
 - (a) NO_x and CO₂
 - (b) CO₂ and CO
 - (c) PANs and CO
 - (d) N₂O and CO₂
9. The main environmental problems associated with the gases that you have chosen in question 6 above are;
 - (a) Stratospheric ozone depletion and acid deposition
 - (b) Acid deposition and the greenhouse effect
 - (c) The greenhouse effect and ozone depletion
 - (d) Acid deposition and global climate change
10. The use of electric current in removing particulates is associated with;
 - (a) Fluidized bed combustion systems
 - (b) Magnetohydrodynamics
 - (c) Precipitators
 - (d) Cyclones
11. Hot air, fed from underneath, suspends the mixture while it burns, thus increasing the efficiency of combustion. This is the description of the operational principle of;
 - (a) MHD
 - (b) FBC
 - (c) Scrubbers
 - (d) Cyclones
12. The allocation of E5 million Emalangeni for the compensation of former asbestos miners of Bulembu, is a good example of;
 - (a) The polluter pay principle
 - (b) The taxpayer pay principle
 - (c) The consumer pay principle
 - (d) The precautionary principle
13. Microbial breakdown of wastes in extremely hypoxic conditions result in production of;
 - (a) CO
 - (b) CO₂
 - (c) CH₃
 - (d) CH₄

14. One of the main factors contributing to the accumulation of POPs in remote areas in the Arctic is;
- (a) Humidity
 - (b) Acidity
 - (c) Temperature
 - (d) Light
15. According to the theory of the transport fate of pollutants, you would expect to find dioxins;
- (a) Highly concentrated in areas that are far from the source (due to air transport)
 - (b) Moderately concentrated at the source of pollution
 - (c) Highly concentrated around the source of pollution
 - (d) Evenly distributed everywhere
16. Living organisms exposed to DDT are likely to show signs of poisoning;
- (a) Any time after a year
 - (b) Towards the end of winter
 - (c) Towards the end of summer
 - (d) Any time of the year
17. One of the products of microbial degradation in aerobic conditions is;
- (a) HNO_3
 - (b) H_2O
 - (c) H_2SO_4
 - (d) H_2O_2
18. Potentiation can be mathematically expressed as;
- (a) $8-2 = 6$
 - (b) $3+3 = 6$
 - (c) $5+1 = 6$
 - (d) $0+2 = 6$
19. The correct relationship between bioaccumulation and biomagnification is that;
- (a) Bioaccumulation cannot occur without biomagnification
 - (b) Biomagnification depends on bioaccumulation
 - (c) Organisms affected by biomagnification often survive, whereas those that are affected by bioaccumulation always perish
 - (d) Bioaccumulation is more fatal than biomagnification
20. As far as waste management strategies, composting is a good example of;
- (a) Input strategies
 - (b) Output strategies
 - (c) Throughput strategies
 - (d) End of pipe strategies

21. The use of green plants and their associated microorganisms, soil amendments, and agronomic techniques to remove, contain, or render harmless environmental pollutants is;
- (a) Rhizofiltration
 - (b) Phytoremediation
 - (c) Phytostabilization
 - (d) Phytotransformation
22. The release of plant exudates/enzymes into the root zone (rhizosphere) to stimulate the microbial and fungal degradation of organic pollutants is;
- (a) Phytoextraction
 - (b) Rhizofiltration
 - (c) Phytostimulation
 - (d) Phytostabilization
23. In composting, one of the purposes for the use of amendments (such as straw, alfalfa, manure, agricultural wastes and wood chips) is;
- (a) For the provision of carbon
 - (b) To ensure that the compost can be used in agricultural activities
 - (c) To control bad smell (composts are particularly known for their nose wrenching stench)
 - (d) To ensure that the compost pile has an adequate amount of moisture (these amendments are good in retaining moisture).
24. In phytoremediation of petroleum hydrocarbons, the accumulation of contaminants within the plants, adsorption of contaminants onto roots and binding of contaminants in the rhizosphere through enzymatic activities is;
- (a) Direct containment
 - (b) Indirect containment
 - (c) Phytostabilization
 - (d) Bioventing
25. The degradation of contaminants whereby plants supply enzymes that bind contaminants into soil organic matter (or humus) in a process called humification is;
- (a) Direct containment
 - (b) Indirect containment
 - (c) Phytostabilization
 - (d) Bioventing

QUESTION TWO [25 MARKS]

1. **Figure 1** is a graphical representation of the main strategies that may be employed to deal with waste and pollution. Study the diagram carefully and answer the questions that follow.
- 1.1 State the strategies represented by A to G [7 marks].

- 1.2 The seven strategies shown in **Figure 1** can be grouped in to three main categories. State the three categories [3 marks].
- 1.3 Briefly state the purpose of each of the three main categories of waste reduction strategies you have stated in question 1.2 above [3 marks].
- 1.4 Amongst the seven strategies shown in **Figure 1**, select one that is associated with the following phrases: “job creation, provision of inexpensive products, and savings on energy” [1 mark].
- 1.5 Select one strategy that fits the following description: “Many large newspaper manufacturers have gone for an economical design that has cut the use of print paper by up to 5%” [1 mark].
- 1.6 Select one strategy that is associated with the emission of dioxins and toxic metals such as Pb, Hg [1 mark].
- 1.7 Select one strategy fitting the following description: “the fashion industry thrives on its ability to convince the public that new fashions are in and that anyone wearing the old is out of fashion” [1 mark].
- 1.8 Select one strategy that is associated with the following: “ Matsapha, Mbabane and Pigs’ Peak have passed ordinances to ban the use of plastics in supermarket” [1 mark]
2. The use of incinerators is associated with the release of two types of solid waste. What are these wastes? [2 marks]
3. Microbial breakdown of pollutants can occur in conditions that have abundant oxygen levels and also in conditions that have very low oxygen. How does microbial breakdown of wastes in these two conditions differ? [3 marks]
4. What is swamp gas? [1 mark]
5. State two examples of areas where you would expect to find production of higher quantities of swamp gas [1 mark].

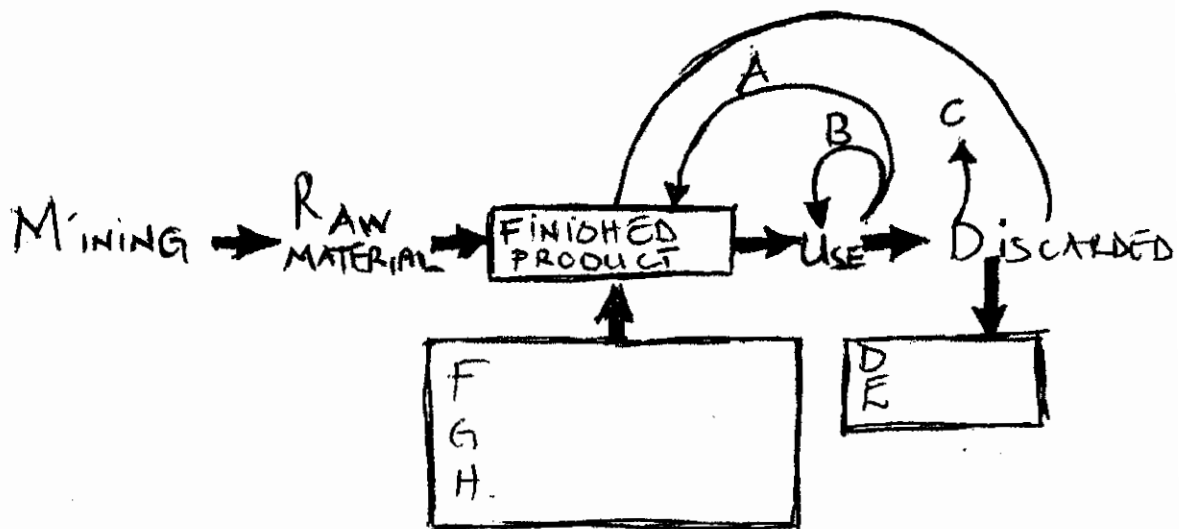


Figure 1: Strategies used to deal with waste and pollution.

QUESTION THREE [25 MARKS]

1. **Figure 2** shows the concentrations of DDT in fatty tissues of animals (mink whales, snow bears, Arctic foxes and lion seals) caught in Northern Norway. Study the diagram carefully and answer the questions that follow.
- 1.1 DDT has never been imported into or ever used in Norway and surrounding areas (Iceland, Finland, Denmark, Sweden, etc.). In fact, ever since the discovery of DDT in 1875, it has only been used in South America and Southern Africa. However, as shown in **Figure 2**, animals in the seas surrounding Norway have consistently shown higher levels of DDT from the 1880s to 1955. Is this possible? [2 marks]
- a) Yes
b) No

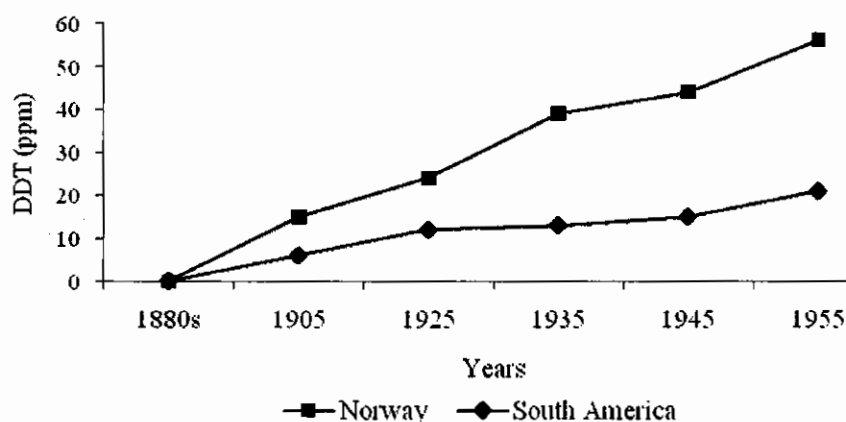


Figure 1: DDT concentrations (in ppm) in fatty tissues of Arctic animals from 1880s to 1955

- 1.2 Describe any reasons that influenced your choice in question 1.1 above [6 marks].
- 1.3 Studies that were conducted from 1935 to 1955 showed that while DDT poisoned all the four types of animals, more toxicity was observed amongst bears and foxes towards the end of the winter season and not in summer. What explanation can you give for this observation? [6 marks].
2. A portion of a xenobiotic distributed in the bloodstream around the body may be stored for short or long periods. As long as a chemical remains bound, it does not exert adverse effects. However, there are instances where stored chemicals are released and symptoms of poisoning may be observed. In the case of animals, state any two such instances [4 marks].
3. With regard to pollutant fate and transport, it has been stated that pollutants move through air, water, soil, and sediments. Sometimes, however, biotransport occurs. What do you understand by biotransport? [2 marks]

4. Microbial breakdown of pollutants is a vital natural service which helps to ensure that wastes and chemical pollutants do not build up to intolerable levels in the environment. Some synthetic organic chemicals have structures that make it very difficult for microbes to degrade them. State any two examples of such chemicals [2 marks].
5. State any three factors that contribute to microbial breakdown of organic substances [3 marks].

QUESTION FOUR [25 MARKS]

1. Despite the scarcity of fresh water (due to the prevailing draught in Swaziland), Matsapha is a fast growing industrial town with many industries including a power plant that produces electricity by burning both coal and natural gas to heat water, a pharmaceutical company, a sulphuric acid manufacturing company, a petroleum refinery, and a cement and road building company. Not far from this industrial complex there are a lot of staff houses and small organic farms. Since there are no wastewater treatment plants, no landfills and no incinerators, this industrial complex relies on industrial symbiosis, a process whereby a waste product can be fed into the production process of another system. Using your knowledge of this process, give one option that can be used to deal with the following waste products;
 - 1.1 Hot liquid sulfur captured during the burning of natural gas at the coal and gas power plant [2 marks].
 - 1.2 Ash and clinker released during coal combustion at the coal and gas power plant [2 marks]
 - 1.3 Natural gas captured (instead of being burned off as usual) during petroleum refining processes [2 marks].
 - 1.4 Lower temperature steam released by the coal and gas power plant during electricity production processes [2 marks].
 - 1.5 Nutrient-rich sludge produced by the pharmaceutical company in its processes involving the fermentation of food-grade material into usable products [2 marks].
 - 1.6 Used water from the petroleum refinery company [2 marks].
2. How do discarded newspapers result into groundwater pollution? [2 marks]
3. Describe any two problems that were more experienced during the open dumps era, which are now largely under control in the age of sanitary landfills [4 marks].
4. Discuss any two strategies that can be used to reduce water pollution threats from sanitary landfills [4 marks].
5. Describe one reason why it is practically impossible for a huge city like Johannesburg to have a perfectly functioning recycling program simultaneously with a perfectly functioning waste-to-energy facility [3 marks].