

## MIDTERM 1

**1) Which is the role of engineering in relationship with the environmental stewardship concept?**

Engineers are primarily involved in problems related to technology development and deployment. Simultaneously, engineers design and build all the manufacturing processes, industrial technology, and transportation infrastructure needed to extract, transport, and refine raw materials; fabricate products and distribute the goods and services

Engineers are involved in the study of how pollutants are transported and transformed in the environment. Engineers are concerned and responsible for a wide range of activities that directly or indirectly contribute to environmental change.

Engineers have responsibilities for both types of impacts:

- 1) Changes associated with land use
- 2) Changes induced by emissions or residues from products and industrial processes

**2) Name three activities that impact air quality:**

- Fuel combustion (coal and oil), industrial and manufacturing processes produce → Particulate Matter (PM)
- The combustion of coal and oil/ Metal smelting and other industrial processes generates → Sulfur Dioxide (SO<sub>2</sub>)
- Transportation (mainly automobiles) are the dominant source of → CO emissions
- Fuel combustion/Transportation sector → Nitrogen Dioxide (NO<sub>2</sub>)

**3) Name three activities that impact soil quality:**

- Deforestation
- Agriculture (pesticides, herbicides)
- Landfills that do not have impenetrable barriers
- Housing and infrastructure

**4) If the equivalent CO<sub>2</sub> emissions are reduced from  $1.26 \times 10^5$  tonnes per year to  $7.6 \times 10^4$  by replacing coal with natural gas, what is the % reduction in emission?**

39%

**5) What is the difference between primary and secondary water quality standards?**

**Primary:** Designed to protect public health

**Secondary:** Non-enforceable guidelines related to public welfare criteria such as water taste, color and odor.

**6) What is the difference between smoke and smog?**

**Smoke:** Gases from burning of carbon matter, organic matter, wood, coal.

**Smog:** Produced from the NO<sub>x</sub> and hydrocarbons put into the atmosphere by automobiles, power plants, factories and other sources.

**7) What do the following acronyms stand for: EPA, PM, NAAQS and IPCC?**

**EPA:** Environmental Protection Agency

**PM:** Particulate Matter

**NAAQS:** National Ambient Air Quality Standards

**IPCC:** Intergovernmental Panel on Climate Change

**8) Which are the four characteristics that define hazardous wastes?**

**Ignitability:** An ability to burn easily or cause or enhance fires.

**Corrosivity:** Strong acids and bases, or substances able to corrode metal.

**Reactivity:** An ability to react violently or cause explosions, including reactions with water.

**Toxicity:** An ability to threaten water supplies and health, as determined by a laboratory test of leach ability.

**9) Specify the wavelength of Ultra-Violet and Infra-Red radiation?**

**Ultra-Violet:** Below 3 MM

**Infra-Red:** Above 3 MM

**10) What is the average production of solid wastes per capita/per day?**

100 Kg per person per day

**11) Explain in your own words:**

- One successful story which shows that as global community we did what was necessary to address an environmental problem or concern.

**EPA's Brownfields initiative.** Program that stimulate the redevelopment of abandoned industrial sites in ways that are environmentally popular, but without the rigid requirements imposed by CERCLA.

- Another not successful story that our reaction and action as global community was not as drastic and appropriate as the scientific evidence indicates.

Historically, an environmental catastrophe that occurred in 1978 attracted the public attention and political support. The incident occurred at Love Canal near Niagara Falls and New York. Toxic chemicals from abandoned industrial waste dump were leaked into homes, soils became contaminated and children were exposed to carcinogens. In 1980, Congress responded to the environmental problem with the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**. It is said that under CERCLA too much money has been spent on legal proceedings and studies than on actual cleanup.

### **12) What is the atmospheric window?**

Is one small region of the spectrum, where relatively little absorption occurs. This is a region between about 8 micro m and 12 micro m, where terrestrial radiation passes directly through the atmosphere to space.

### **13) Which is the typical test developed to evaluate toxicity?**

**TCLP:** Toxicity Characteristics Leaching Procedure

## **BONUS**

### **14) What do we mean, when we refer to Low Level Radioactive Wastes?**

Consists of low levels of radioactivity spread across large volumes of materials. About 80% of such wastes come from sources in the civilian sector and 20 % from the government sector.

## **MIDTERM 2**

### **1. What is green engineering?**

### **2. Name 3 activities that impact groundwater quality:**

- Petroleum compounds (Oil Manufactures)→ Leaking organic chemicals underground storage tanks.
- Agricultural Fertilizers → high levels of nitrates in drinking water
- Abandoned chemical waste dumps → major source of the toxic metals and organic compounds

**3. Explain the main results of the tests done in the test station in Vostok, Antarctica:**

They drilled 3.3 km deep ice core from Vostok, Antarctica which allows them to examine trends over the past 420,000. Scientists measured the concentrations of atmospheric CO<sub>2</sub> and methane trapped air bubbles inside the ice, and their corresponding variations.

**4. If the equivalent CO<sub>2</sub> emissions are reduced from 1.26x10<sup>5</sup> tonnes per year to 7.6x10<sup>4</sup> by replacing coal with natural gas, what is the % reduction in emission?**  
39%

**5. What is the difference between primary and secondary air quality standards?**

**Primary Standard:** Designed to protect human health.

**Secondary Standard:** Related to human welfare.

**6. Define acid rain by describing how it is formed:**

Gaseous sulfur dioxide emitted from chimneys of coal-burning plants is partially converted to fine sulfate particles by chemical processes in the atmosphere. This mix of sulfurous gases and particles leads to acid rain, which can damage lakes and forests hundreds of miles away.

**7. What do the following acronyms stand for?**

**CFCs:** Chlorofluorocarbons

**CAA:** Clean Air Act

**TRI:** Toxics Release Inventory

**IPCC:** Intergovernmental Panel on Climate Change

**8. Which are the four characteristics that define hazardous wastes?**

**Ignitability:** An ability to burn easily or cause or enhance fires.

**Corrosivity:** Strong acids and bases, or substances able to corrode metal.

**Reactivity:** An ability to react violently or cause explosions, including reactions with water.

**Toxicity:** An ability to threaten water supplies and health, as determined by a laboratory test of leach ability.

- 9. Name an environmental impact and benefit for each of the following energy sources:  
a) solar, b) wind**

SOLAR BENEFIT → renewable

ENVIRONMENTAL IMPACT → the massive amount of electricity used in solar plants causes some harmful emissions in the air

WIND BENEFIT → renewable, clean

ENVIRONMENTAL IMPACT → wind plants can be dangerous for wild animals (birds)

- 10. Which are the two modes of Radiative Forcing?**

- 11. Name some of the less important greenhouse gases:**

- 12. Define the climate sensitivity factor**

- 13. What is Carbon Sequestration?**

The natural ability of biomass to absorb CO<sub>2</sub> from the atmosphere represents a well-known method of limiting or offsetting anthropogenic CO<sub>2</sub> emissions from fossil fuel combustion.

## **BONUS**

- 1) What do you mean by Stratospheric Ozone Depletion?**