

Name \_\_\_\_\_

CE 326 Principles of Environmental Engineering  
First Exam - Fall 1997

Defendable True/False. If the statement is true as stated, mark it OK. If it is false, correct by changing the underlined word or words in the sentence so that it will be true. 3 points each.

1. In general, a warm, moist environment will tend to diminish the effects of air pollutants on material surfaces compared to a cool, dry environment.
2. Ozone depletion in the upper atmosphere is predominantly caused by the accumulation of greenhouse gases like methane, carbon dioxide, and CFCs.
3. The majority of sulfur dioxide emissions in the U.S. are from stationary sources, and the majority of carbon monoxide emissions are from mobile sources.
4. A venturi scrubber utilizes a high voltage direct current to impart an electrical voltage on particulate matter, which is subsequently collected on oppositely charged plates.
5. Adjusting the air-fuel ratio in automobiles to minimize overall automotive emissions, necessitates a trade-off between fuel economy and vehicle performance (power).
6. Flue gas desulfurization involves the use of an alkaline compound, such as limestone, to react with the sulfur oxides, forming a precipitate which is subsequently removed in downstream air pollution control devices.
7. A land breeze occurs during the night when land cools more rapidly than the adjacent water.
8. As a percentage of the overall solid waste constituents, plastics are by far the largest portion.
9. In a landfill, the daily cover refers to the tarp placed over a solid waste cell at the end of the day to keep out flies, rodents, etc.

10. If a waste has a pH of 2.0 or less it is classified as hazardous under the characteristic of reactivity.

Short Answer Problems - 10 points each:

11. Draw a sketch of an electrostatic precipitator, identify key components, and describe how it functions and what type of pollutants it removes.

12. Briefly discuss what constitutes an integrated approach to solid waste management? Include in your discussion EPA's hierarchy of solid waste management.

13. Define and explain the significance of the following terms:

target risk \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

manifest system \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

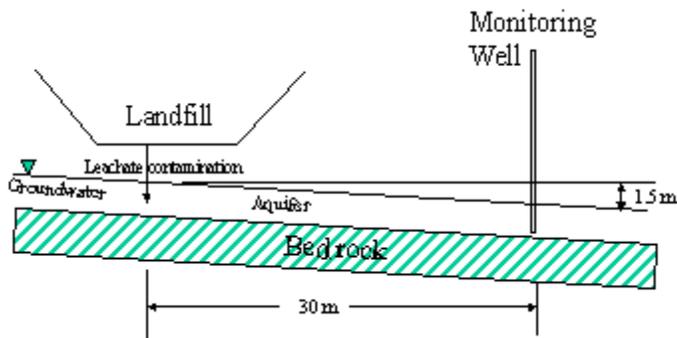
PM-10 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Numerical Problems - 20 points each

14. Leachate leaked through a composite liner system at a municipal solid waste landfill contaminating the aquifer below. After the leachate migrates to the monitoring well, what volume of leachate will travel past the monitoring well in a year. The monitoring well is located 30 m away, the hydraulic conductivity of the soil in the aquifer is  $5 \times 10^{-4}$  cm/s, and the groundwater elevation at the monitoring well is 1.5 m below the elevation at the landfill? (Note:  $v = K \, dH/dL$ )



17. A electric utility wants to build a new coal fired power plant in an urban setting. The regulatory agency has determined that in order for the plant to be permitted it must limit its emissions to prevent the ground level SO<sub>2</sub> concentration from exceeding 0.015 g/m<sup>3</sup> at the site fence line 0.5 km directly downwind (y = 0) from the stack. What is the maximum SO<sub>2</sub> discharge rate (g/s) the plant can emit? Use the following:

Effective stack height = 50 m

Wind speed = 1 m/s

Stability Class C, using Martin's equation:  $s_y = 104.0X^{0.894}$  and  $s_z = 61.0X^{0.911}$   
where the dispersion coefficient is in meters and the X distance is in km

$$\chi = \left( \frac{Q}{\pi s_y s_z u} \right) \exp\left( -\frac{1}{2} \left( \frac{y}{s_y} \right)^2 \right) \exp\left( -\frac{1}{2} \left( \frac{H}{s_z} \right)^2 \right)$$