Environmental Engineering

Event Structure:
The event will consist of a written test and will last for 50 minutes. Participants will work in teams of two, and each team will turn in a single answer sheet. The first half of the test will be multiple-choice and the second half will be free response (worth slightly more per question). For all questions it is important to show working to receive full credit.

Description:
This event is centered on a written test in which participants will be tested on the fundamental concepts in environmental engineering. Questions will be predominantly quantitative, and are designed such that participants will be required to demonstrate analytical problem-solving skills as well as conceptual understanding of the subjects. Fundamental topics from hydrology, chemistry, and mass balance will be covered. Calculators are allowed during this event.

Topics:
Participants should be able to:

- Understand how to use common equations in hydrology (Manning's, Hazen Williams etc.)
- Calculate mass balances for closed and open systems
- Solve problems in chemistry including molarity, solubility, and equilibrium
- Understand basic concepts about landfill and wastewater treatment plants
- Understand equations of energy for kinetic, thermal, nuclear, solar and wind sources
- Analyze basic problems in thermodynamics, diffusion, convection and radiation

Sample Problem:
Fresh air flows into an air shed of 100 km by 100 km in area and 1 km in height at a speed of 4 m/s. In this air shed a source emits 10 kg/s of pollution. What is the concentration of pollution that flows out of the air shed (mg/m3 per second)?

Provided Equations/Conversions:
1 foot = 0.3048 meters
1 cubic feet = 7.48052 gallons
1 gallon = 3.7854 liters
Manning's Equation: $v = \frac{R^{2/3}S^{1/2}}{n}$
Hazen-Williams Equation: $v = 0.849CR^{0.63}S^{0.54}$
Material Balance Equation: $V\frac{dC}{dt} = vAC_{in} - vAC_{out} + source - sink$
Specific heat of water: 4.186 kJ/kg°C
Specific heat of vaporization of water: 2406 kJ/kg @ 40°C
Density of water: 1000 kg/m^3
Density of air: 1.2 kg/m^3
Gas constant: $R = 0.0821\frac{L \cdot atm}{mol \cdot K}$
Gas equation: PV = nRT
Stefan-Boltzmann Law: $P = \varepsilon\sigma AT^4$ where $\sigma = 5.67(10^{-8})$ W/m^{2}K^4
EROI = energy produced by system/energy to produce system

Contact:
This event is designed by ASCE Princeton (email contact: setung@princeton.edu).
All email inquiries about the event should have the subject line: "PEO Event Inquiry- Environmental Engineering."