

Chemical Engineering 4310

Fall Semester, 2005

**Homework Assignment #3**

Chapters 4 and 5

(For return in marked box in hall of 2nd floor

Chemical Sciences by noon on Friday, October 13 )

Work problems 4-12, 4-13, 4-15, 4-33, 5-4, and 5-12 in the text

1. A tank truck hauling liquid benzene ( $C_6H_6$ ) has overturned on I-94 in Detroit and a pool of benzene 30 m in diameter has formed. The terrain is fairly flat. It is 1-pm in the afternoon on a clear, sunny day. The wind is blowing at 7 m/s. The ambient temperature is 30°C.
  - a. Estimate the evaporation rate of the benzene in kg/s.
  - b. Use a dispersion model to estimate the downwind distance, in meters, to the ERPG-1 concentration.

All physical properties required are contained within the textbook.

2. Liquid chlorine is supplied to a process from a regulated pressure source at 20 barg and supplied through 300 m of horizontal commercial steel pipe of actual inside diameter of 0.02 m. The ambient pressure is 1 atm and the ambient temperature is 30°C.
  - A. If the pipe breaks off at the regulated source, estimate the flow rate through the leak, in kg/s.
  - B. If the pipe breaks off at the end of the 300 m length, estimate the flow in kg/s.

For liquid chlorine, the following properties are available at these conditions:

Density:	1380 kg/m <sup>3</sup>
Viscosity:	$0.328 \times 10^{-3}$ Pa·s