

FATE AND TRANSPORT
CE/ESM 4/579
PROBLEM SET 6 - 2016

1. [2 pts.] A stoppered flask at 25°C contains 500 ml of water, 230 ml of octanol, and 70 ml of air. An unknown amount of toluene is added to the flask and allowed to partition among the phases. After equilibrium has been established, 20.0 mg/L of toluene is measured in the water.
 - a. What is the **total mass** of toluene present in the flask?
 - b. In which phase is most of the toluene found?

2. [3 pts.] A leaking tank drips trichloroethene (TCE) into a small stream at a rate of 13.0 g/hr. Stream discharge is 8.2 m³/hr, and the stream depth is 130 cm.
 - a. What is the maximum concentration of TCE in water downstream of the tank, assuming the dissolved TCE fully mixes with the stream? [2 pts.]

 - b. Does any DNAPL accumulate on the stream bottom? Why or why not? [1 pt.]

3. [3 pts.] The suspended solids content of a 1-liter lake water sample is 135 mg/L. Analysis reveals this solid material contains 55% organic carbon. The lake is suspected of being contaminated with atrazine, a widely used member of the triazine family of herbicides, as well as phenanthrene, a polynuclear aromatic compound.

For both compounds, an analytical laboratory offers to analyze the total concentration in the whole, unfiltered water (compound in water plus in suspended solids), and for an additional fee, in water passed through a 0.20 μm filter, which removes all of the particles (compound only in the water).

Your boss asks you if filtration makes much difference; should you pay for the extra step?

- a. What is the difference in the expected concentration of each compound in unfiltered water compared to filtered water? Express in terms of the measured concentration C_w , (mg/L) of the filtered sample. You do **not** need a particular concentration (numerical) to answer this. The answer is of the form $C_T = XC_w$ where X is the factor that express the difference in concentration between unfiltered and filtered samples. (E.g., $X = 1.00$ means *no* difference, $X = 1.60$ means the unfiltered has 60% more compound, etc. X must be greater or equal to 1.00.) [2 pts.]

- b. What will you tell your boss? Is the answer the same for both compounds? [1 pt.]