

For each problem, show the details of your calculations (equations, units etc.).

Problem 1

- (a) Estimate the Henry's constant for benzene at 25°C from solubility and vapor pressure data. Please note that the solubility of benzene is incorrectly shown as 1.78×10^2 mg/L instead of the correct value of 1.78×10^3 mg/L in Appendix B.
- (b) Convert the Henry's constant for benzene to a dimensionless constant.

Problem 2

Estimate the diffusion coefficient for ethanol in water at 25°C.

Problem 3

- (a) Estimate the organic carbon partition coefficient K_{oc} of benzene from $\log K_{ow}$ data in Appendix B.
- (b) Determine if the estimated value that you obtained under part (a) is a good approximation by comparing your results to the measured value in Appendix B (calculate the percent difference between the two values).

Problem 4

Water enters a 5-L tank at a rate of 4 kg/s and it withdrawn from the tank at a rate of 6 kg/s. The tank is initially 4/5 full.

- (a) Write a mass balance for this process by assigning a variable function to the mass of water at time t . Describe which terms are present in the balance; give reason for deletion of any terms.
- (b) Solve the balance to find how long it will take the tank to drain completely.

Problem 5

An impoundment of 20 x 12 feet is contaminated by tetrachloroethylene. The contaminated liquid comes in contact with the groundwater and a concentration gradient of 1.3×10^{-6} (mol/cm³/cm) is established.

- (a) Use Fick's law to determine the diffusive flux.
- (b) Assuming diffusion is the only driving force, how many pounds of tetrachloroethylene will move toward the groundwater in one hour?