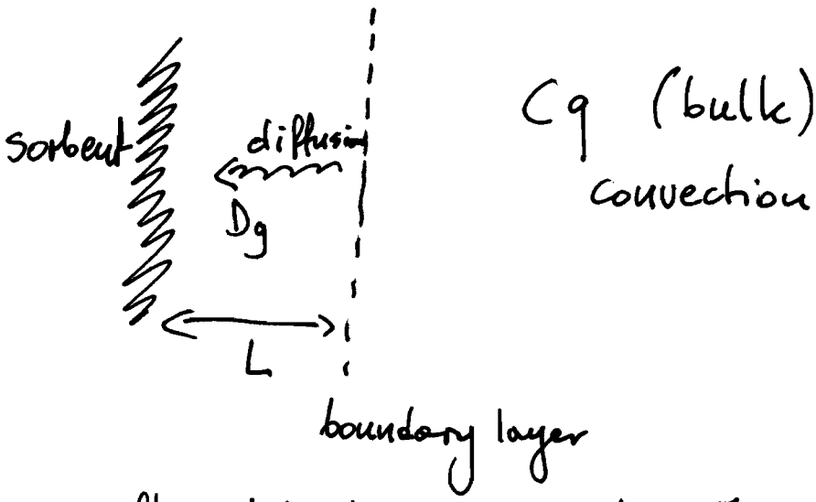
Homework on passive samplers



where: flux into the sorbent $J = \frac{n}{At}$

n (mass)
A (surface area of the sorbent face)
t (time)

assumption

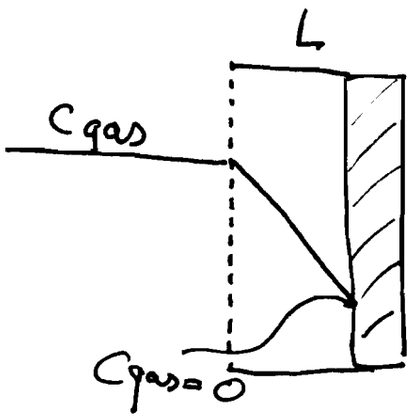
- sorbent surface serves as zero sink for sample/gas
- no competitive adsorption
- Fick's law describes the sampling process

$$J = -D_g \frac{dC_g}{dx}$$ D_g - gas-phase diffusion coeff.

$$J\,dx = -D_g\,dC_g$$

$$J\int_0^L dx = -D_g \int_{C_g}^{0} dC_g$$

$$JL = D_g C_g \rightarrow \bar{C_g} = \frac{JL}{D_g} = \boxed{\frac{nL}{AD_g t}}$$



linear process

$$C_g = \left(\frac{n}{A D_g t}\right) L$$

Problem 2

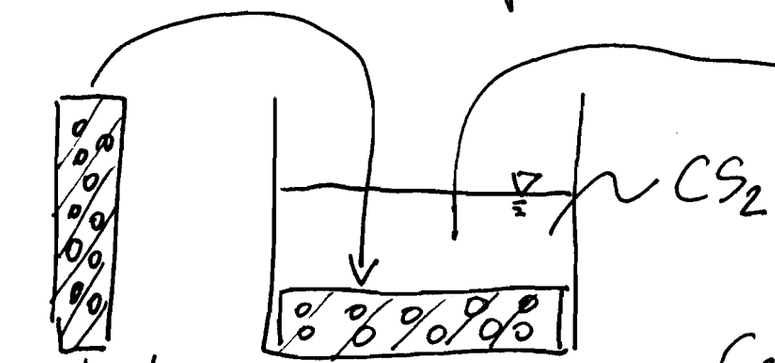
$t = 8\ hrs = 28,800 s$ D_g for benzene @ room temp $\approx 0.09 \frac{cm^2}{s}$

$L = 1\ cm$

$D = 5\ cm$ $A = \pi\left(\frac{5\ cm}{2}\right)^2 = 19.6\ cm^2$

$n = 100\ \mu g$

10% contribution of benzene from the solvent



sorbent from the badge is transfered to a beaker

solvent is poured. Solvent extraction occurs.

$$C_g = 0.9 \frac{n}{A D_g t} L$$

$$C_g = 0.9 \frac{100\ \mu g \times 1\ cm}{19.6\ cm^2 \times 0.09 \frac{cm^2}{s} \times 28,800 s}$$

$$C_g = 1.77 \times 10^{-3} \frac{\mu g}{cm^3} \times \frac{10^6\ cm^3}{m^3}$$

$$\boxed{C_g = 1.77 \times 10^3 \frac{\mu g}{m^3}} \approx 0.554\ ppm$$