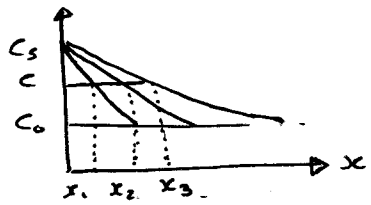
OCT. 31/18

Fick's Laws (where T = const.)

$$\frac{C(x_i, t_i) - C_o}{C_s - C_o} = 1 - \text{erf}\left(\frac{x_i}{2\sqrt{Dt_i}}\right)$$



$$\text{erf}\left(\frac{x_i}{2\sqrt{Dt_i}}\right) = \text{const.}$$

$$C(x_1, t_1) = C(x_2, t_2) = C(x_3, t_3) = C(x_i, t_i)$$

$$\frac{x_i}{2\sqrt{Dt_i}} = \text{const.}$$

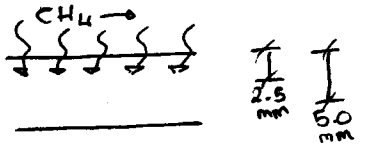
$$\frac{x_1}{\sqrt{D_1 t_1}} = \frac{x_2}{\sqrt{D_2 t_2}}$$

If T is constant,

↳ D is constant → $\frac{x_1}{\sqrt{t_1}} = \frac{x_2}{\sqrt{t_2}}$ → $\frac{x_1^2}{t_1} = \frac{x_2^2}{t_2}$

Example @ $x = 2.5$ mm, $t = 10$ hrs, $C(x,t) = 0.45$ wt%

@ $x = 5.0$ mm, $t = ?$, $C(x,t) = 0.45$ wt%



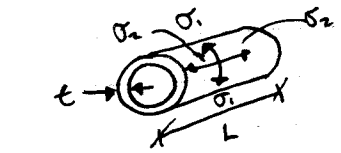
$$\frac{x_1}{\sqrt{D_1 t_1}} = \frac{x_2}{\sqrt{D_2 t_2}} \; ; \; \frac{x_1}{x_2} = \frac{\sqrt{t_1}}{\sqrt{t_2}}$$

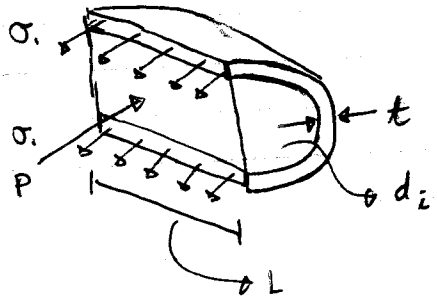
$\therefore t_2 = 40$ hours

→ need to use error packing function, interpolation

↳ basically, assignment questions.

Example (A)





σ_1 : circumfrential stress - makes the diameter bigger (hoop stress)

σ_2 : longitudinal stress - makes the length bigger

where $\sigma_1 = 2\sigma_2$

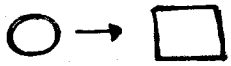
$$\sigma_1 = \frac{Pr_i}{2t}$$

$$\sigma_1 = \sigma_w = \frac{\sigma_y}{N} = \frac{r_i \Delta P}{t}$$

$$\sigma_y = \frac{N r_i \Delta P}{t} = 4 \times 50 \times 10^{-3}\,m \times (20 - 0.5) \times \frac{101 \times 10^3\ N/m^2}{1\ atm}$$

σ_y = 1907 MPa, (steel), copper, brass, titanium

→ Lecture 9: Example



$$\sigma_{fs} = \frac{F_s L}{\pi r^3} \Rightarrow \frac{(950\,N)(50 \times 10^{-3}\,m)}{\pi (3.5 \times 10^{-3}\,m)^3} = 352 \times 10^6\ N/m^2$$

$$\sigma_{fs} = \frac{3F_s L}{2bd^2} \Rightarrow F_s = \frac{2d^2 \sigma_{fs}}{3L} = \frac{2 \times (12 \times 10^{-3}\,m)^3 \times (352 \times 10^6\ N/m^2)}{3 \times (40 \times 10^{-3}\,m)}$$

$$= 10\,138\ N$$