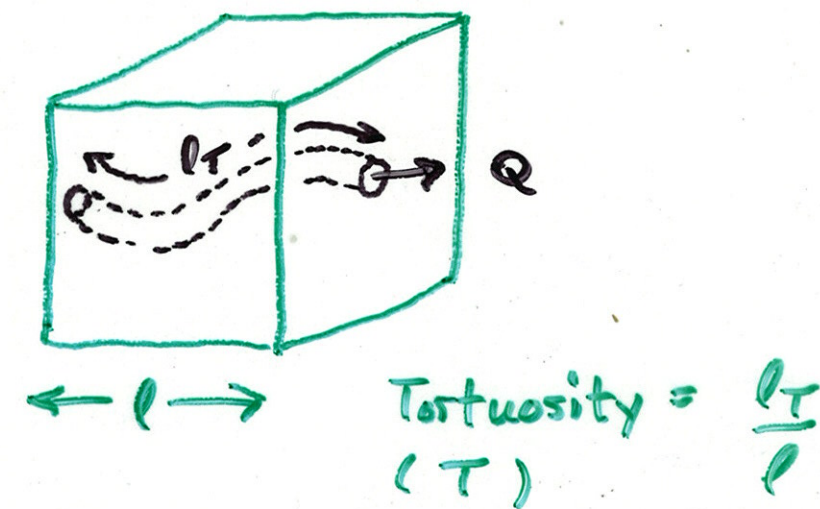


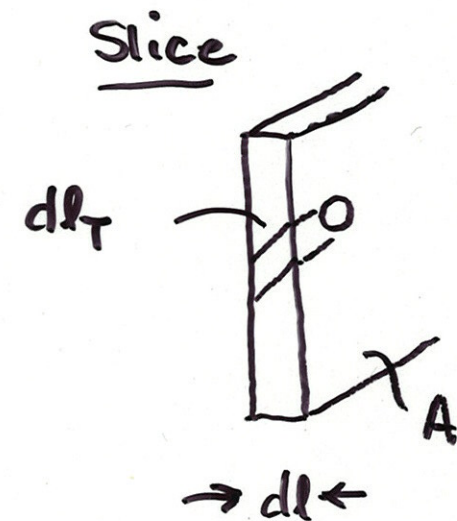
More General Case



$$q = \frac{Q}{A} = -\frac{A_c}{A} \frac{r^2}{8\eta} \left(\frac{\Delta P}{l_T} \right)$$

Comparing with Darcy's Law

$$k = \frac{A_c r^2}{A} \frac{1}{8T} = \frac{\phi r^2}{8T^2} \quad \text{units } m^2$$



$$\text{Volume of Pore} = A_c dl_T$$

$$\text{Total Volume} = A dl$$

$$\phi = \frac{A_c dl_T}{A dl} = \frac{A_c}{A} T$$

$$\therefore \frac{A_c}{A} = \frac{\phi}{T}$$

Further Generalizations

Kozeny - Carman Equation

$$k = \frac{1}{k_0 T^2} \frac{\phi^3}{S^2}$$

where

- $T \approx 2$ is tortuosity
- ϕ is porosity
- S is the specific surface area (surface area to volume ratio)
- $k_0 \approx 2.5$ is a constant

this relationship is commonly used in many applications

