Transfer Phenomena

A Physics

There are many situations where "something" is being moved, under the influence of some "driving force."

3 key examples...

	Driving force...	transferring...	transfer rate.
1.	Pressure difference ΔP, N/m^2, Pa	liquid eg water	m^3/s or cm^3/s or kg/s.
2.	Temp. difference $\Delta\theta$, °C or K	heat energy (treated as a "thing"	J/s or W. (1 J/s = 1 W.)
3	Potential difference Voltage, V.	charge, electrons	C/s or A (1 C/s = 1 A.)

Transfer equations - all have the same basic pattern

flow rate $\propto$ driving force

flow rate = k × driving force

k ← constant for the system.

- Electricity

charge/sec = k × P.D

$I = 1/k \times V$ $\quad V = IR$

$I = A/\rho l \times V$ $\quad R = \rho l/A$

so $Q/t = I = \frac{\sigma A}{l} \times V$ (DS)

C/s, A

elec. conductivity

σ, $\Omega^{-1}m^{-1}$ $\quad \sigma = 1/\rho$ – resistivity Ωm.

- Heat

$Q/t = \frac{kA}{l} \times \Delta\theta$ (DS)

J/s

thermal conductivity of material

temp. diff.

↑ length: further for heat to travel ∴ slower flow rate.

↑ Area: faster heat flow

- Mass transfer

$m/t = \frac{C \times A^2}{\eta \times l} \times \Delta p$ (DS)

kg/s

constant for system.

pressure diff.

viscosity = stickiness < air – v.v. low; water – low; syrup, oil – high.