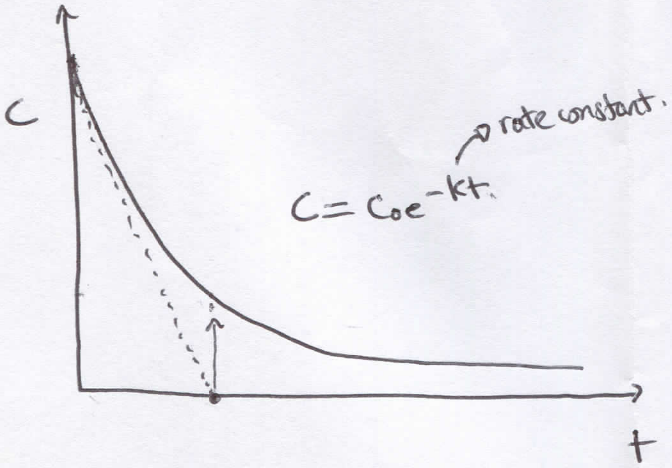

To find time constant:

Differentiate $C = C_0 e^{-kt}$.

$$\ln C = \ln C_0 - kt.$$

$$\frac{dC}{dt} \times \frac{1}{C} = -k.$$

$$\frac{dC}{dt} = -kC.$$

This gives gradient at any point on $C = C_0 e^{-kt}$.

The rate constant line equation is now:

$y = mx + c$.

$C = -kC_0 t + b$.

when $C = C_0$, $t = 0$ ∴

$C_0 = b$.

$C = C_0 - kC_0 t$

when $C = 0$:

$0 = C_0 - kC_0 t$

$-\cancel{C_0} = -k\cancel{C_0} t$

$t = 1/k$ → now input this in to $C = C_0 e^{-kt}$

$$C = C_0 e^{-kt}$$

$$C = C_0 e^{-k(1/k)}$$

$$C = \frac{C_0}{e}$$

When $C = \frac{C_0}{e}$, $t = T$:

$$\frac{\cancel{C_0}}{e} = \cancel{C_0} e^{-kT}$$

$$e^{-1} = e^{-kT}$$

$$-1 = -kT$$

$$T = 1/k.$$

↑ time constant.

→ Time constant = Resistance × Compliance

$$= \cancel{\frac{\text{Volume}}{\text{Flow}}} \times \cancel{\text{Vol/Pres}}$$

$$= \frac{\text{Pressure}}{\text{Flow}} \times \frac{\text{Volume}}{\text{Pressure}} = \frac{\text{Volume}}{\text{Flow}}.$$

→ ~~Equation~~

$$\frac{\cancel{C_0}}{2} = \cancel{C_0} e^{-kt_{1/2}}.$$

$$-\ln 2 = -kt_{1/2}$$

$$t_{1/2} = \frac{\ln 2}{k}.$$

$$k = 1/T \quad \therefore \quad t_{1/2} = \ln 2 \times T$$