

$$\text{Rate} = k[A]^x[B]^y$$

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① Write the ratio of rate laws for 2 experiments

Find order in A: 1 and 2

$$\frac{\text{Rate}_2}{\text{Rate}_1} = \frac{6.14}{2.73} = \frac{k[A]^x[B]^y}{k[A]^x[B]^y}$$

② Plug in given concentrations

$$\frac{\text{Rate}_2}{\text{Rate}_1} = \frac{6.14}{2.73} = \frac{k[0.15]^x[0.1]^y}{k[0.1]^x[0.1]^y}$$

③ Cancel out like factors

$$2.25 = \frac{[0.15]^x}{[0.1]^x} = \left(\frac{0.15}{0.1}\right)^x$$

④ Take log of both sides of expression

$$\log(2.25) = \log(1.5)^x$$

$$\log(2.25) = x \log(1.5)$$

$$x = \frac{\log(2.25)}{\log(1.5)} = 2$$

$$\text{Rate} = k[A]^2[B]^y$$

Clicker:  $y=0$ , why?

$$\text{Rate} = k[A]^2[B]^0$$

$$\text{Rate} = k[A]^2$$

$$\frac{\text{Rate}_1}{\text{Rate}_3} = \frac{2.73}{2.74} = \frac{k[0.1]^2[0.1]^y}{k[0.1]^2[0.2]^y}$$

$$1 = \frac{[0.1]^y}{[0.2]^y} = \left(\frac{0.1}{0.2}\right)^y = (0.5)^y$$

$$\log(1) = \log(0.5)^y$$

↓  
0

$$0 = y \log(0.5)$$

$$y = 0$$

$$\text{Rate} = k[A]^2$$



$$k = \frac{\text{Rate}}{[A]^2} = \frac{\text{Ms}^{-1}}{\text{M}^2}$$

$$k = \frac{2.73}{(0.1)^2} = 273$$

$$\text{Rate} = \frac{\text{concentration}}{\text{s}} = \text{Ms}^{-1}$$

$$\text{Rate} = k[A]^2$$

$$k = \text{M}^{-1}\text{s}^{-1}$$

Half life  $t_{1/2}$  (half of initial concentration is "used up")

1st order reaction

s/w Integrated Rate Law (1st order)

$$\ln[A] = -kt + \ln[A]_0$$

$$k t_{1/2} = \ln(2)$$

$$\text{At } t_{1/2}: \frac{[A]_0}{2} = [A]$$

$$t_{1/2} = \frac{\ln(2)}{k} = \frac{0.693}{k}$$

Plug in to the IRL

$$\ln\left(\frac{[A]_0}{2}\right) = -k t_{1/2} + \ln[A]_0$$

$$k t_{1/2} = \ln[A]_0 - \ln\left(\frac{[A]_0}{2}\right)$$

$$k t_{1/2} = \ln\left(\frac{[A]_0}{\frac{[A]_0}{2}}\right) = \ln(2)$$