

Homework 1A – DUE MONDAY 4/18

1. Assuming that the total product does not depend on any other quantities and that the rate of formation of product is proportional to the amount of product available, i.e., we have

$$\frac{dp}{dt} = k_2 p$$

Integrate the equation to find $p(t)$

2. The limit in equation (1.12) is bounded, find

$$\lim_{s \rightarrow 0} \frac{V_{\max} s}{K_s + s}$$

$$\lim_{s \rightarrow \infty} \frac{V_{\max} s}{K_s + s}$$

3. Show that at $s = K_s$ the reaction rate is half of the max rate.
4. Use the non-dimensional quantities

$$\sigma = \frac{s}{s_0}, \quad x = \frac{c}{e_0}, \quad \tau = k_1 e_0 t$$

and constants

$$\kappa = \frac{k_{-1} + k_2}{k_1 s_0}, \quad \varepsilon = \frac{e_0}{s_0}, \quad \alpha = \frac{k_{-1}}{k_1 s_0}$$

to show that

$$\frac{dc}{dt} = -(k_{-1} + k_2)c + k_1 s e$$

can be rewritten as

$$\varepsilon \frac{dx}{d\tau} = \sigma - x(\sigma + \kappa)$$