Problem Set 2

Introduction to Bioengineering

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Problem 1

The formula describing the observed rate to equilibrium of a reaction of the type:

$$[A] + [B] \underset{k_2}{\overset{k_1}{\rightleftharpoons}} [C]$$

is given by:

$$k_{obs} = k_1[A] + k_2$$

Problem 1.1: In what equation covered in class have you seen k_{obs}?

Problem 1.2: Explain why the observed association rate k_{obs} depends not only on the association rate k_1, but depends also on the dissociation rate k_2. Why is k_{obs} also dependent on the concentration of A?

Problem 1.3: How long will it take to reach a concentration of [AB] equivalent to 50% of the equilibrium concentration of [AB] for a reaction with the following parameters:

$$k_{off} = 4.0x10^{-3}s^{-1}$$

$$[A] = 1nM$$

$$K_d = 11nM$$

Problem 1.4: Using the same parameters as given in problem 3, calculate how long it takes until 10% and 90% of the equilibrium concentration of [AB] has formed.

Problem 2

Above you used k_{obs} to calculate the time required for a reaction to reach equilibrium (50%, 10%, and 90%).

Problem 2.1: Will the time required to reach equilibrium increase or decrease for a reaction with a faster association rate constant k_1, and why?

Problem 2.2: Will the time required to reach equilibrium increase or decrease for a reaction with a faster dissociation rate constant k_2, and why?