**I. Conformation change kinetics**

**I.1** This will display first-order kinetics. This is because only one molecule of the protein is involved in each reaction, and the concentration of the closed-form protein will affect how much of it is converting to the open state in a given amount of time.

**I.2** d[closed]/dt = - kopen \* [closed] + kclose \* [open]

d[open]/dt = - kclose \* [open] + kopen \* [closed]

**I.3** [closed] = ([closed]o - [closed­]­eq­­) \* exp( - (kopen + k­close­) \* t) + [closed]eq­­

This means that [closed] is dependent on time in an *exponential* manner, and [closed] will exponentially decay to [closed]eq as time progresses.

**I.4** See image below for work. We know that for every molecule of closed-form that is lost, there is one molecule of open-formed gained, and vice versa, so we can say Δ[open] = - Δ[closed]. Additionally, because [open] starts at zero for time one, then however much [closed] is lost overall is equal to [open] at equilibrium, so we can also say [open]eq = Δ[closed]0. With this, we get the following equation:

[open] = - ([closed]0 - [closed­]­eq­­) \* exp( - (kopen + k­close­) \* t) + ([closed]0­ - [closed­]­eq)

**INSERT SCAN**

**I.5** Keq,22 / Keq,25 = (k­open,22 / kclose) / (k­open,25 / kclose)

Keq,22 / Keq,25 = k­open,22 / k­open,25

Keq,22 = Keq,25 \* (k­open,22 / k­open,25) = 0.2 \* (8.4E3 / 104) = **0.168**

**I.6** The system is at equilibrium, so the number of open🡪closed transitions is the same as the number of closed🡪open transitions. I calculate the number of closed🡪open transitions in the image below. My final answer is **2.108x1021 transitions/second** in one reaction volume.

**I.7** They do not change. The rate constants and equilibrium constant are independent of concentration. Typically, changing temperature is one of the only parameters that can result in a change of rate constants.

**I.8** At 22o, Keq = 0.168, while at 25o, Keq = 0.2. This means that the product (ie. the open state), becomes more favored when shifting from 22o to 25o. Since the open state has lower fluorescence than the closed state, this shift will result in an overall **decrease** in solution fluorescence.

**I.9** b

**II. Enzyme kineticws**

**II.1** b

**II.2** b

**II.3** b

**II.4** b

**II.5** b

**II.6** b