Question 8

8.1

According to the law of mass action.

d[ES] / dt = k1 * [E] * [S] - k2 * [ES] - k3 * [ES]

d[E] / dt = k2 * [ES] + k3 * [ES] – k1 * [E] * [S]

d[S] / dt = k2 * [ES] – k1 * [E] * [S]

d[P] / dt = k3 * [ES]

8.2

When the reaction comes to a balance, we can get

k1 * [E] * [S] – k2 * [ES] – k3 * [ES] = 0 = d[ES] / dt = d[E] / dt

E + ES = 1

S + ES +P = 10

But I really don't know how to solve this because I have never heard of fourth-order Runge Kutta method before.

8.3

According what I have learned from the biochemistry course. This question is about Michaelis equation, which is $V = Vmax \frac{[S]}{Km+[S]}$ $Vmax = k3 * [E]$

So theoretically, at large concentrations of substrate, V = Vmax = 150 μM/min