Question 2

8.1)

$$E+S \stackrel{k_1}{\underset{k_2}{\rightleftharpoons}} ES \stackrel{k_3}{\rightarrow} E+P$$

$$\begin{array}{c} k_1 \\ E+S \, \rightarrow \, ES \end{array}$$

$$\begin{array}{c} k_2 \\ \text{ES} \, \rightarrow \, \text{E} + \text{S} \end{array}$$

$$\begin{array}{c} k_3 \\ \text{ES} \, \rightarrow \, \text{E} + \text{P} \end{array}$$

According to the law of mass action,

$$\frac{d[E]}{dt} = (k_2 + k_3)[ES] - k_1[E][S]$$

$$\frac{d[S]}{dt} = k_2[ES] - k_1[E][S]$$

$$\frac{d[ES]}{dt} = k_1[E][S] - (k_2 + k_3)[ES]$$

$$\frac{d[P]}{dt} = k_3[ES]$$