8.1

① E forms a complex with S to form an intermediate species ES in a reversible manner at forward rate k_1 and reverse rate k_2.

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

② The intermediate ES breaks down into product P at a rate k_3, thereby releasing E.

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

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

③ The change in the concentration of substrate S can be expressed as follows

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

④ The change in the concentration of enzyme E' can be expressed as follows

$$\frac{d[E']}{dt} = k_3 \cdot [ES]$$

$$\Rightarrow \quad \frac{d[E]}{dt} = -k_1 \cdot [E] \cdot [S] + k_2 \cdot [ES] + k_3 \cdot [ES]$$

In this process, the rate of change of the mass of E, S, ES and P should be equal to zero. Therefore, the above equations are effective in describing this process.