【1】

Q2

(1) according to Michaelis equation $v = \frac{V_{max}[S]}{K_m + [S]}$

$$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_3} E + P$$

ES generation rate $= k_1([E_1] - [ES])[S]$ ESCG)

ES decomposition rate $k_2[ES] + k_3[ES]$ ESCD)

E_1 is total enzyme concentration $[E_1] - [ES]$ is free enzyme concentration

when the reaction system is in the steady state, ESCG) = ESCD)

$$k_1([E_1] - [ES])[S] = k_2[ES] + k_3[ES] \quad ①$$

then $\frac{([E_1] - [ES])[S]}{[ES]} = \frac{k_2 + k_3}{k_1}$

We assume $K_m = \frac{k_2 + k_3}{k_1}$ ②

from ① and ② $[ES] = \frac{[E_1][S]}{K_m + [S]}$

Because in the range of initial rate, the concentration of the remaining substrate (>95%) in the reaction system is much higher than that of the product.

inverse reaction can be ignored the rate of whole reaction is directly proportional to the concentration of ES

$v = k_3[ES]$ ③

from ② and ③ $v = \frac{k_3[E_1][S]}{K_m + [S]}$ ④

when all enzymes form ES, the reaction rate reaches the maximum

$V_{max} = k_3[E_1]$ ⑤

from ④ and ⑤ $v = \frac{V_{max}[S]}{K_m + [S]}$

【2】【3】

I'm sorry, I really can't answer the other two questions.