1.

$d[E]/dt = (k2+k3)[ES] - k1[E][S]$

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

$d[ES]/dt = k1[E][S] - (k2+k3)[ES]$

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

2.Fail to get the answer.

3.

$V = d[P]/dt = k3[ES]$

$d[ES]/dt = k1[E][S] - (k2+k3)[ES]$

Assuming that it's in a steady state which means that the concentration of ES remains constant. E0 means the initial amount of E.

$k1[E][S] = (k2+k3)[ES]$

and $k1[E][S] = k1([E0]-[ES])[S]$

Thus $k1([E0]-[ES])[S] = (k2+k3)[ES]$

$[ES] = k1[E0][S]/(k1[S]+k2+k3)$

$V = d[P]/dt = k3k1[E0][S]/(k1[S]+k2+k3) = k3[E0][S]/([S]+(k2+k3)/k1)$

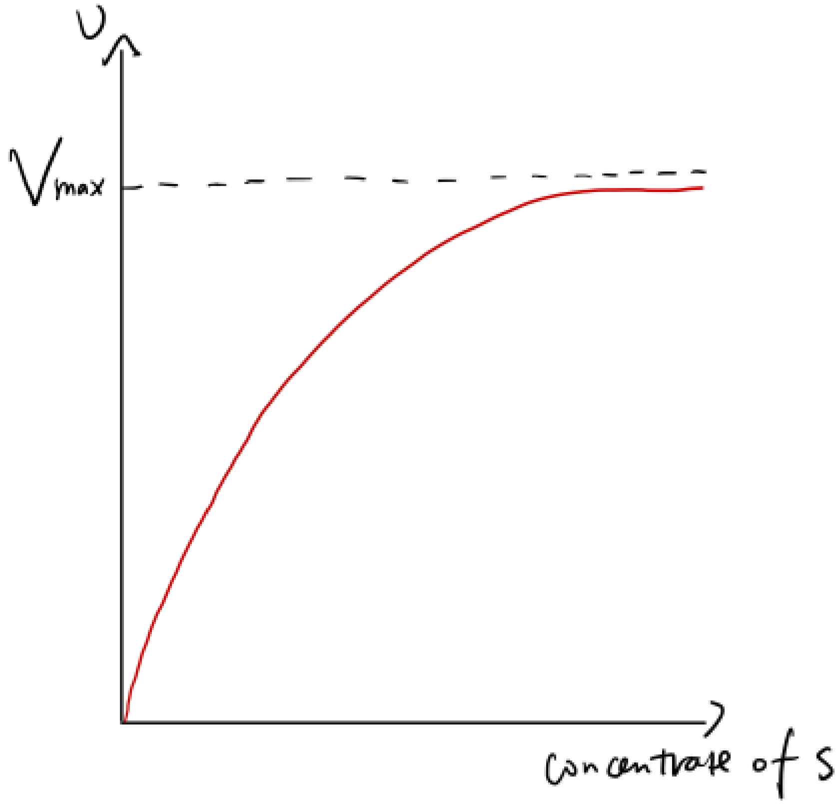
Suppose $km = (k2+k3)/k1$

$V = k3[E0][S]/([S]+km) = k3[E0]/(1+km/[S])$

When the concentrations of S are small, $[S] << km$, v increase approximately linearly, the gradient is about $k3[E0]/km$.

When concentrations of S become are very large, $[S] >> km$

$Vmax = k3[E0]$



v
Vmax
concentrate of S