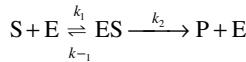


where  $K_m = \frac{k_{-1} + k_2}{k_1}$  and  $K_p = \frac{k_{-1} + k_2}{k_{-2}}$  and  $V_s = k_2 [E_0]$ ,  $V_p = k_{-1} [E_0]$ .

- 3.3.** The enzyme, fumarase, has the following kinetic constants:



where  $k_1 = 10^9 M^{-1} s^{-1}$

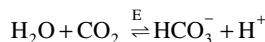
$$k_{-1} = 4.4 \times 10^4 s^{-1}$$

$$k_2 = 10^3 s^{-1}$$

- What is the value of the Michaelis constant for this enzyme?
- At an enzyme concentration of  $10^{-6} M$ , what will be the initial rate of product formation at a substrate concentration of  $10^{-3} M$ ?

[Courtesy of D. J. Kirwan from "Collected Coursework Problems in Biochemical Engineering" compiled by H. W. Blanch for 1977 Am. Soc. Eng. Educ. Summer School.]

- 3.4.** The hydration of  $\text{CO}_2$  is catalyzed by carbonic anhydrase as follows:



The following data were obtained for the forward and reverse reaction rates at pH 7.1 and an enzyme concentration of  $2.8 \times 10^{-9} M$ .

Hydration		Dehydration	
$1/v, M^{-1}$ ( $s \times 10^{-3}$ )	$[\text{CO}_2]$ ( $M \times 10^3$ )	$1/v, M^{-1}$ ( $s \times 10^{-3}$ )	$[\text{HCO}_3^-]$ ( $M \times 10^3$ )
36	1.25	95	2
20	2.5	45	5
12	5	29	10
6	20	25	15

$v$  is the *initial* reaction rate at the given substrate concentration. Calculate the forward and reverse catalytic and Michaelis constants.

[Courtesy of D. J. Kirwan from "Collected Coursework Problems in Biochemical Engineering" compiled by H. W. Blanch for 1977 Am. Soc. Eng. Educ. Summer School.]

- 3.5.** An inhibitor (I) is added to the enzymatic reaction at a level of 1.0 g/l. The following data were obtained for  $K_m = 9.2 \text{ g S/l}$ .

$v$	S
0.909	20
0.658	10
0.493	6.67
0.40	5
0.333	4
0.289	3.33
0.227	2.5