Enzyme inhibition calculations

1. An enzyme that follows Michaelis-Menten kinetics has V_{max} = 400 μmol/sec and a K_M = 3.0 mM. What will be the velocity of the reaction when the substrate concentration is 26 mM?

2. An enzyme-catalyzed reaction has a K_M of 1 mM and a V_{max} of 5 nM.S^{-1}. Calculate the reaction velocity when the substrate concentration is

   a) 0.25 mM
   b) 1.5 mM
   c) 10 mM

3. An enzyme catalyzes the reaction A → B. The initial rate of the reaction was measured as a function of the concentration of A. The following data were obtained:

[A], micromolar	**V_0, nmoles/min**
0.05	0.08
0.1	0.16
0.5	0.79
1	1.6
5	7.3
10	13
50	40
100	53
500	73
1000	76
5000	79
10,000	80
20,000	80

On a graph paper, plot the above data using Lineweaver-Burk plot (1/ V_0 vs 1/[A]).

Using your plot, calculate

a) The K_m of the enzyme for the substrate A?
b) The value of the V_{max} of the enzyme?
c) The value of V_0 when [A] = 43 µM?

4. The initial velocities of an enzyme-catalysed reaction were measured in the presence and absence of an inhibitor. The data for these measurements are given below.

[S] (mM)	**Initial velocity (mmol min-1)**	
	No inhibitor	With inhibitor (10 mM)
5	27	20
10	40	32
15	48	40
20	53	46
30	60	53

Graphically determine the type of inhibition

4. The kinetic data given in the following table is for the reaction catalysed by the enzyme prostaglandin endoperoxide synthase.

[Arachidonic acid] (mM)	**Rate of formation of PGG2 (mM/min)**	**Rate of formation of PGG2 with 10 mg/mL Ibuprofen (mM/min)**
0.5	23.5	16.67
1	32.2	25.27
1.5	36.9	30.49
2.5	41.8	37.04
3.5	44.0	38.91

(a) Focusing here on the first two columns, determine the $\boldsymbol{V}_{\mathbf{max}}$ and $\boldsymbol{K}_{\mathbf{m}}$ of the enzyme.

(b) Ibuprofen is an inhibitor of prostaglandin endoperoxide synthase. By inhibiting the synthesis of prostaglandins, ibuprofen reduces inflammation and pain. Using the data in the first and third columns of the table, determine graphically the type of inhibition that ibuprofen exerts on prostaglandin endoperoxide synthase.