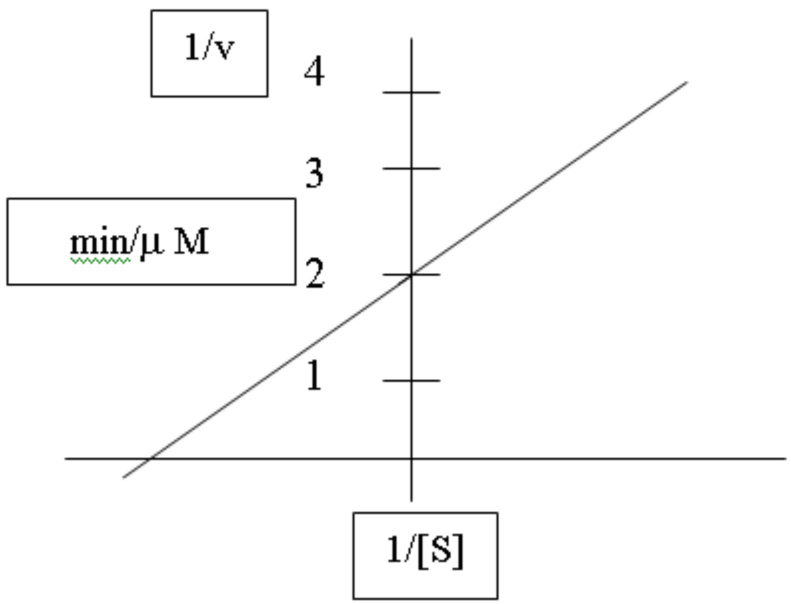
1. The reaction A $\rightarrow$ B is catalyzed by an enzyme that follows Michaelis-Menton kinetics. If the initial rate of the reaction is measured under conditions where [A] = 2/3Km, at what percentage of Vmax will the velocity of the reaction be?

When [A] = 2/3Km,
v = Vmax(2/3Km)/Km + 2/3Km or v = 2/5Vmax.
As a percentage this would be 40% of Vmax.

2. For the reaction above, when [A] = Km and the enzyme concentration is 3×10^{-8} M (**3 x 10-2μM**), the velocity of the reaction is 15 μM per min. At saturating [A], each molecule of enzyme can catalyze how many reactions in one minute?

When [A] = Km, v = 1/2Vmax or Vmax = 2v.
If Kcat = Vmax/[E] then Kcat = 2v/[E]
Kcat= 2(15μM min^{-1})/3 x 10^{-2}μM = 1,000 min^{-1}.

3. The reaction S → P is catalyzed by an enzyme that follows Michaelis-Menton kinetics. From the following graph determine Kcat. [E] = 2×10^{-6} M (or 2µM)



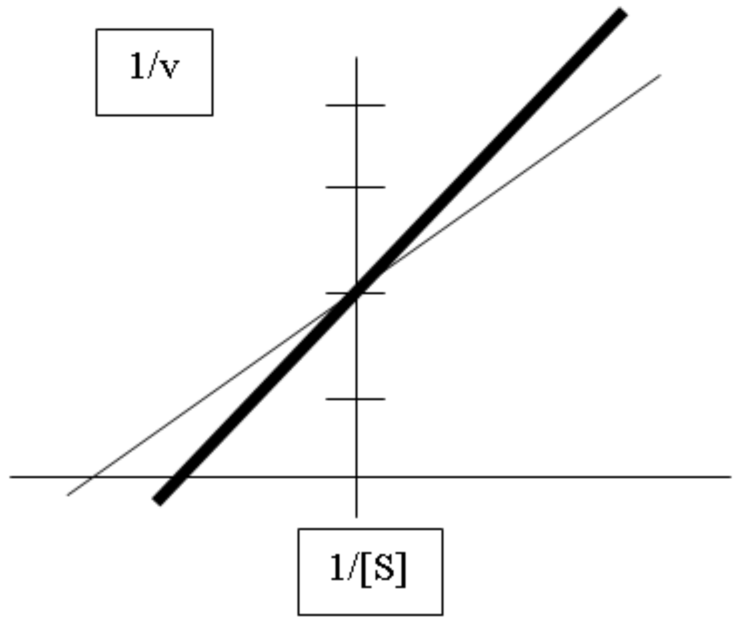
From the graph we find that 1/Vmax is 2min/µM

So Vmax is 0.5µM/min. (1/ 2min/µM)

If Kcat = Vmax/[E] then

Kcat = 0.5 M min^{-1}/ 2µM = 0.25 min^{-1}.

4. Draw a line on the following graph to demonstrate how a competitive inhibitor would affect the curve. Label clearly which line is with inhibitor. **Bolder line**



#5. Rhinoceros myoglobin has a P_{50} for O_2 of 40mmHg. What PO_2 is needed to saturate 60% of myoglobin?

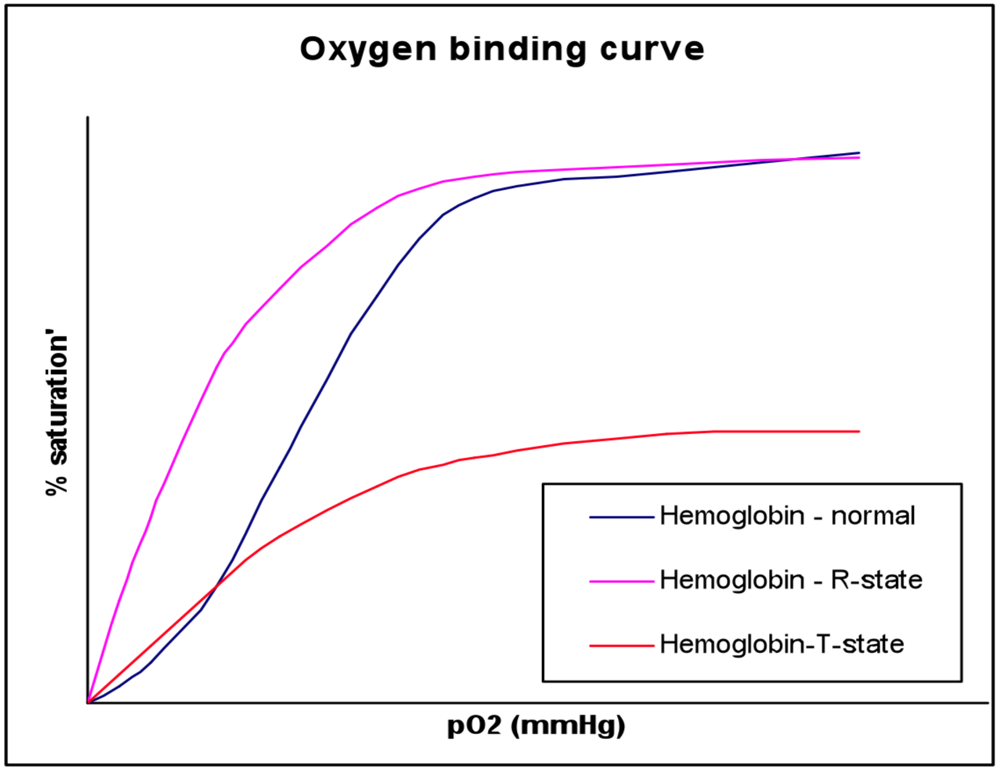
$$Y = pO2 / (p50+pO2)$$

$$0.6 = pO2 / (40 + pO2)$$

$$0.6(40) + 0.6(pO2) = pO2$$

$$pO2 = 60mmHg$$

#6. Draw the oxygen binding curve of hemoglobin. Then draw in the two curves of hemoglobin if it is stuck at the T state and R state. Explain why and how hemoglobin achieve sigmoidal oxygen binding properties.



- Why: Because hemoglobin is an oxygen transport protein. This means that it needs to be able to drop off oxygen efficiently when oxygen level is low (i.e. at tissue) and pick up oxygen efficiently at high oxygen level (i.e. at lung). Therefore, at lower oxygen hemoglobin is at T-state – in order to drop off oxygen; and it would transition to R-state in order to bind more oxygen at higher oxygen level.
- How: Cooperativity. This property allows hemoglobin to have increasing oxygen binding affinity at increasing oxygen level. Basically it is achieved by the binding to oxygen of one subunit raises the binding affinity of the other unbound subunits.

7.

A) . True/False. Only hemoglobin contains the heme group.

a. true b. false

B) True/False. The structure of myoglobin prevents it from transporting oxygen like hemoglobin does.

a. true b. false

C) True/False. The R-state of hemoglobin has higher oxygen affinity than the T-state

a. true b. false

D) True/False. The activation energy, G‡, can be lowered by an enzyme.

a. true b. false