Name _____

Chem 352 - Fall 2018
Quiz 2

$R = 8.314\ J/(mol \cdot K) = 0.08206\ (L \cdot atm)/(mol \cdot K)$

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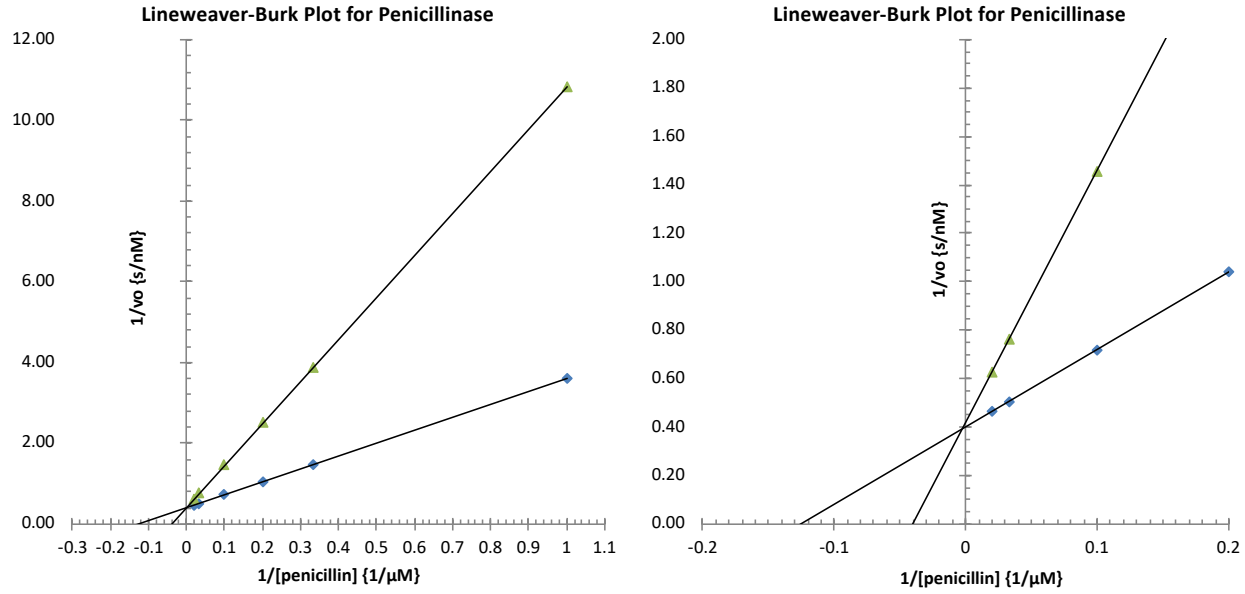
1. Penicillin-resistant bacteria produce an enzyme called *penicillinase*, which is able to chemically inactivate the antibiotic *amoxicillin*, a member of the penicillin class of antibiotics. When bacterial infections are treated with amoxicillin, the drug is often augmented with an inhibitor of penicillinase called *clavulanic* acid. Below are graphs showing kinetics data for the penicillinase reaction in the presence and absence of 10 µM clavulanic acid. These data were collected using a penicillinase concentration of 50 pM. The graph on the right is an expansion of the one shown on the left.



a. Is the affinity of the penicillinase enzyme for its substrate penicillin affected by the presence of the clavulanic acid (Y/N)? _____
Describe your evidence for this claim:

b. On average, how many reactions does each penicilinase enzyme molecule catalyze each second when saturated with the substrate in the absence of clavulanic acid? (Assume that each enzyme molecule has only one active site.)

c. Is the number you calculated for part b. affected by the presence of clavulanic acid (Y/N)?_____
Describe your evidence for this claim:

d. Is it possible for the penicillin-resistant bacterium, which produced the penicillinase that was studied above, to improve on the enzyme's efficiency (Y/N) _____?
Describe your evidence for this claim:

e. The follow reaction equation is used to describe enzyme-catalyzed reactions that adhere to the Michaelis-Menton model for enzyme kinetics. Using the letter "I" to represent the inhibitor clavulanic acid, modify this reaction equation to show what happens when clavulanic acid is present.

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P$$