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Activity Overview

A.

Title: Enzyme Kinetics, Part One

Possible Subject Area: Biochemistry, Cell Biology

Main Quantitative Skills:

- Calculation of rate of change
- Reading, interpreting, and creating graphs
- Solving equations, algebraic manipulations
- Creating formulas in Excel

B.

Overview: This activity is a self contained guided inquiry activity on enzyme kinetics. There are two subsections. The first part of the activity reviews the ideas of rate of change and reaction order associated with chemical kinetics. Using Excel, students graph velocity vs. reactant for zero, first, and second order reactions in order to be able to recognize these portions on the velocity curve of an enzyme catalyzed reaction. In the second part, the Michaelis Menton model of enzyme kinetics is derived, and students use the Michaelis Menton equation to generate a velocity vs. substrate concentration curve using an Excel spreadsheet. Through a series of questions, students learn the meaning of V_{\max} and K_m and how to determine them graphically.

At the completion of this activity, students will be able to:

- Calculate rate of change from graphical data
- Identify a plot of rate vs. reactant concentration as originating from a zero, first, or second order reaction
- Be able to enter rate data into a spreadsheet and produce graphs
- Be able to create spreadsheet formulas based on the Michaelis Menton equation
- Understand the meaning of and be able to evaluate V_{\max} and K_m from graphs

C. Activity and answers

D.

Notes to instructors: This activity requires that students have access to computers with Excel. Students could work alone or in a group of 2 to complete this activity. It should take approximately 50 – 75 minutes to complete the activity, depending on the students' comfort with and prior exposure to Excel. It is designed to introduce Michaelis Menton enzyme kinetics to upper level (junior/senior) science majors who have taken courses in Principles of Chemistry (through kinetics) and an introductory cell biology course.

Assessment: The pretest should take only a few minutes for students to complete prior to beginning the activity. Many students will not remember reaction order (question 1), and probably none will know how to calculate V_{\max} and K_m (question 3) prior to completing the activity. Question 2 assesses their comfort level with creating formulas and graphs using Excel. The pretest could be used unchanged as a posttest to assess student learning.