Alcohol oxidation

Introduction: The purpose of this experiment is to monitor the rate of alcohol oxidation and study the reaction rates that are involved in chemical kinetics. The kinetic rate constant and order of the reaction will be found through this study. One of the main objectives we attempt to accomplish will be determining the maximum light absorbance of K2Cr2O7. We will use a LoggerPro apparatus to determine the absorbance. We will utilize Beer's Law, which states that the absorbance is directly proportional to the concentration of a solution.

Also, after performing the experiment, four graphs will be constructed from the data we collect. These graphs are Beer's Law calibration curve, [K2Cr2O7] vs. time, Ln [K2Cr2O7] vs. time, and 1/[K2Cr2O7] vs. time. These graphs ought to show a trend relating to the concentration of the K2Cr2O7. By using a computer to plot and analyze the data, we will be more accurate and receive more information based on the reaction. Data: | Absorbance | [K2Cr2O7]| Ln[K2Cr2O7]| 1/[K2Cr2O7]| 30| 0. 583457| 0. 00229| -6. 07| 436. 7| 60| 0. 545668| 0. 00214| -6. 15| 467. 3| 90| 0. 51189| 0. 00201| -6. 2| 497. | 120| 0. 477355| 0. 00187| -6. 28| 534. 8| 150| 0. 447483| 0. 00175| -6. 35| 571. 4| 180| 0. 418738| 0. 00164| -6. 41| 609. 8| 210| 0. 394025| 0. 00155| -6. 47| 645. 2| 240| 0. 370999| 0. 00146| -6. 53| 684. 9| 270| 0. 350488| 0. 00138| -6. 59| 724. 6| 300| 0. 331227| 0. 0013| -6. 65| 769. 2| 330| 0. 313407| 0. 00123| -6. 7| 813| 360| 0. 29599| 0. 00116| -6. 76| 862. 1| 390| 0. 281267| 0. 0011| -6. 81| 909. 1| 420| 0. 266467| 0. 00104| -6. 87| 961. 5| 450| 0. 252696| 0. 00099| -6. 92| 1010| 480| 0. 239348| 0. 00093| -6. 98| 1075| 510| 0. 228189| 0. 00089| -7. 02| 1123| 540| 0. 217059| 0. 0085| -7. 07| 1176| 570| 0. 206938| 0. 00081| -7. 12| 1234| 600| 0. 198004| 0. 00078|

-7. 16| 1282| 630| 0. 189952| 0. 00075| -7. 2| 1333| 660| 0. 182047| 0. 00071| -7. 25| 1408| 690| 0. 17451| 0. 00068| -7. 29| 1471| 720| 0. 167993| 0. 00066| -7. 32| 1515| 750| 0. 162231| 0. 00064| -7. 35| 1562| 780| 0. 156546| 0. 00062| -7. 39| 1613| 810| 0. 152007| 0. 0006| -7. 42| 1667| 840| 0. 147515| 0. 00058| -7. 45| 1724| 870| 0. 143491| 0. 00056| -7. 49| 1786| 900| 0. 140131| 0. 00055| -7. 51| 1818| 930| 0. 136589| 0. 00054| -7. 52| 1852| 960| 0. 133488| 0. 00052| -7. 56| 1923| 990| 0. 130818| 0. 0051| -7. 58| 1961| 1020| 0. 128164| 0. 00050| -7. 6| 2000| 1050| 0. 126134| 0. 00049| -7. 62| 2041| 1080| 0. 124718| 0. 00049| -7. 62| 2041| 1110| 0. 123106| 0. 00048| -7. 64| 2083| 1140| 0. 122101| 0. 00048| -7. 64| 2083| 1170| 0. 1215| 0. 00048| -7. 64| 2083| 1200| 0. 120499| 0. 00047| -7. 66| 2128| From these graphs, it seems evident that the data corresponds to a second order reaction. Therefore, k’ being –slope, the pseudo rate constant would be equal to -1. 595. To find the true rate constant, divide this value by . 301, the initial concentration of ethanol in the solution.

This yields a k value of -5. 30. Furthermore, deriving the slope on the Beer’s Law Calibration curve shows a value of 202. 8 for ?. This value was used to create the other three graphs, by first finding the [K2Cr2O7] value by dividing the absorbance by this slope. Conclusion: In order to perform this experiment, one must be as careful and accurate as possible. The cells containing the water and other solutions must be placed in the colorimeter correctly with the mark facing the right way and all the air bubbles must be removed in order for the readings to be accurate.

Also, the cuvette must be thoroughly washed, rinsed, and wiped down before each separate test. During the lab, while searching for the better

wavelength, it was discovered that as we increased the wavelength the absorbance decreased. The wavelength that was chosen for our experiment was 430 nm and our concentration of stock ethanol solution was . 602 M. After the lab was completed, we graphed all the data collected in the lab. The Beer’s Law Calibration Curve was graphed in order to show the relationship between concentration and absorbance, namely that concentration and absorbance are related by a direct proportionality.

Also, the slope of this graph was used for ? , which was necessary to construct the other three graphs. Furthermore, the plot of [K2Cr2O7] vs. time, ln [K2Cr2O7] vs. time, and 1/[K2Cr2O7] vs. time were all graphed, for the purpose of determining what order the reaction was. Through the construction of these graphs, and subsequent analysis of the lines and R values, we were able to ascertain that the kinetics data fit best with a second order reaction.