$$\ln\left(\frac{[S_2O_3^{2-}]_i}{2t_d[S_2O_8^{2-}]_i[I^-]_i}\right)=\left(\frac{-E_a}{R}\right)\left(\frac{1}{T}\right)+\ln A$$

or

$$\ln t_d=\left(\frac{E_a}{R}\right)\left(\frac{1}{T}\right)+\ln\left(\frac{[S_2O_3^{2-}]_i}{2[S_2O_8^{2-}]_i[I^-]_i A}\right) \qquad (2.6)$$

A plot of ln t_d against $1/T$ gives a straight line of slope $+E_a/R$ and intercept $\ln\left(\frac{[S_2O_3^{2-}]_i}{2[S_2O_8^{2-}]_i[I^-]_i A}\right)$.

In this experiment you will attempt to show that a plot of ln t_d (vertical axis) against $1/T$ (horizontal axis) does yield a straight line, and from the equation of that line you will calculate the activation energy and Arrhenius factor for the reaction. In addition you will plot a graph of $1/t_d$ (which is proportional to the initial rate of reaction) against T in order to illustrate better how the rate of the reaction varies with temperature.

METHOD

The reaction will be studied at a series of different temperatures between 0°C and 40°C, in order to give a measure of the initial rate of reaction at each of these temperatures. The temperatures should preferably be equally spaced over this interval, but it is not important (for example) if a temperature of 34, 35 or 36°C is used for one reading, ***so long as the exact temperature (e.g. 34.6°C) is noted in the results table.***

The reacting mixtures are those of system 4 in table 1, practical number 1. The procedure suggested below may be amended according to prevailing conditions.

1) Pipette 4 cm^3 of sodium peroxodisulfate solution into each of six clean test tubes. Add 6 cm^3 of water.
2) Into each of another six test tubes pipette 10 cm^3 of potassium iodide solution, 1 cm^3 of starch solution, and 1 cm^3 of sodium thiosulfate solution.
3) Separate the tubes into pairs so that each pair consists of one test tube containing sodium peroxodisulfate and one test tube containing potassium iodide.
4) Place three pairs of test tubes in a beaker of water containing a little ice so that they can cool to a suitable temperature (say 8°C lower than room temperature). Leave a second pair of test tubes in the test tube rack on the bench, so that the reaction can be studied at room temperature, and place another two pairs in a beaker of water on a tripod so that they can be warmed to suitable temperatures.
5) Place a thermometer in one test tube out of the pair in the test tube rack. Pour in the contents of the other tube and start a stop watch. Mix thoroughly with the thermometer and note the temperature. Stop the stop watch as soon as the first sign of colour develops. Note the temperature again. Reject the results and repeat the run if the initial and final temperature differ by more than 1°C. Record the darkening time (t_d seconds), and the average of the two temperatures in the results table.
6) Gradually warm the beaker of water on the tripod while stirring, keeping a check on the temperature of the water, and the contents of the tubes, until they are both steady at about 35°C. Be careful! It is easy to overheat. Sodium peroxodisulfate solution decomposes quite rapidly at temperatures above 50°C.
7) Stop heating and wait until the temperatures of the contents of two of the tubes and the bath have