How does the iodine clock reaction work?

The iodine clock reaction times how long it takes for a fixed amount of thiosulphate ions to be used up, i.e. the time taken for the iodide ions to reach a fixed number of moles produced in the reaction between potassium iodide and an oxidising agent (usually hydrogen peroxide, or sodium peroxodisulphate).

The system is as follows:

The oxidising agent reacts with the iodide ions (usually introduced in the form of potassium iodide).

$H_2O_2 + 2I^- + 2H+ \longrightarrow 2H_2O + I_2$

The iodine produced is then absorbed by reaction with a fixed amount of thiosulphate ions:

$2S_2O_3^{2-} + I_2 \longrightarrow S_4O_6^{2-} + 2I^-$

As soon as the thiosulphate ions are used up the free iodine then reacts with some starch indicator that is added right at the beginning. The reaction produces an almost instantaneous blue/black colour. Thus it is possible to time fairly accurately the time taken for a fixed amount of iodine to be produced (from the thiosulphate moles present initially)

If the oxidising agent concentration is kept constant and all other factors are constant except the iodine concentration then the rate equation simplifies to:

Rate = k[iodide]x

where x is the order of the reaction with respect to [iodide], and k is a kind of super constant combining all of the other constant factors, the rate constant and the other components of the reaction.

So, as rate is porportional to 1/time taken then

$1/t = k[\text{iodide}]^x$

if you take logs throughout

$\log(1/t) = x\log[\text{iodide}] + \log k$

This now has the form y=mx+c (a straight line graph)

So a plot of log(1/t) on the y-axis against log[iodide] on the x-axis gives a straight line of gradient x and intercept k (although k is pretty useless