Kinetics Practice Problems

A bottle of hydrogen peroxide, H_2O_2, slowly decomposes to produce water and oxygen

$$H_2O_2(aq) \rightarrow H_2O(aq) + \tfrac{1}{2}O_2(g)$$

The following data were recorded in an experimental study of the kinetics of this decomposition reaction (a small amount of I^- was added as a catalyst to make the reaction go faster).

Time (s)	$[H_2O_2]$ (M)	Time (s)	$[H_2O_2]$ (M)	Time (s)	$[H_2O_2]$ (M)
0	0.882	240	0.372	480	0.152
60	0.697	300	0.298	540	0.120
120	0.566	360	0.236	600	0.094
180	0.458	420	0.188	660	???

A graph of $[H_2O_2]$ vs. time is shown on the back of this page.

1. What is the average rate for the period in which the reaction is monitored?
2. Estimate the instantaneous rate at $t = 60$ s?
3. What is the rate law for this reaction, including the value of the rate constant?
4. The table shows ??? as the concentration of H_2O_2 at 660 s. What is the missing value?
5. Suppose you have a solution of 3.6 M H_2O_2. How long will it take for the concentration to decrease to 0.25 M?
6. The concentrated H_2O_2 we purchase is 3.6 M and comes with a warning that it needs to be kept refrigerated. Why do you think that warning is placed on the bottle?