FASTER AND FASTER – A kinetics lab
AP Chem

Theory: Kinetics, catalysts
Purpose: To show that a catalyst becomes involved as a reactant, and that it allows for a lower activation energy.
Procedure: Use apron, goggles, and gloves for the experiment.

1. Label a 250 mL beaker A and add to it 100 mL of water.
2. Dissolve 10 g of potassium sodium tartrate in the water in beaker A.
3. Label 2 small beakers B and C. Add 20 mL of 6% hydrogen peroxide to beaker B.
4. In beaker C dissolve 1 g of cobalt (II) chloride hexahydrate in 15 mL of water.
5. Place beaker A on a hot plate and heat the solution to 50 deg C. Time the reaction according to the data table's specifications.
6. Remove the beaker from the hot plate and place it on a tray.
7. Add to it the contents of beaker B. Record your observation of the rate of reaction.
8. Add the contents of beaker C to beaker A.
9. Record your observation of this reaction rate.
10. Repeat of work with other lab graphs to obtain data at 2 more temperatures: 60 °C & 70 °C

Prelab Problem: Rate data for the chemical reaction $A_2(g) + 2BC(g) \rightarrow AB(g) + ABC_2(g)$ at 27°C (300 K) are shown in the following table:

Initial Concentration Of A_2, M	Initial Concentration Of BC, M	Rate of Formation Of AB, M/s
0.0020	0.0010	0.00010
0.0040	0.0010	0.00020
0.0040	0.0020	0.00040

1. What is the rate law expression for this reaction?

2. Write an acceptable mechanism for this reaction.

3. Calculate the rate constant for this reaction at 300 K.

Data:
#1 - Make a table and record your observations of the substances initially, during and after experiment.
#2 – Make another table (for each temperature) for your observations:
Initial Time – Time it takes for pink color to turn green – Time it takes for green to pink – total time for entire reaction.

Discussion:
1. On the action of hydrogen peroxide, the cobalt(II)-tartrate complex becomes oxidized to a green, probably binuclear, Co(III)-tartrate compound. What does this mean?
2. Predict the gases that are released as the green form is reduced by the tartaric acid.
3. This activity demonstrates a multistep mechanism. Draw a graph and label (as much as you can) to exhibit this mechanism.
4. Draw a Boltzmann distribution to show the varying temperatures in this experiment and their affect on threshold energy, thus reaction rate. Your graph should include all three temperatures.
5. What evidence do you have the that contents of beaker C acted a a homogeneous catalyst?

Conclusion:
Resources: