**Experiment – Order of a Reaction**

*Adapted from experiment 11D – Order of a reaction, SMG laboratory experiments*

**Background information:**

* The reaction to be studied is between iodine and propanone. The overall equation is:
* CH3COCH3 (aq) + I2 (aq) 🡪 CH3COCH2I(aq) + H+(aq) + I-(aq)
* The reaction is catalyzed by hydrogen ions, formed from added HCl. The concentration of a catalyst is also a factor that affects the rate of a reaction.
* Starch solution is added as an indicator in this reaction. Starch forms a dark blue complex with iodine that is easily visible even at low concentrations. You will be measuring the time for this colour to disappear, which indicates that the reaction is complete. You will then calculate the rate of the reaction.

**Purpose:**

* To determine the order of a reaction with respect to each of the reacting substances
* To determine the overall order of a reaction
* To determine the rate constant (k) for the reaction

**Materials:**

4x100mL beakers

4x10mL graduated cylinders

Stirring rod

Marker

Safety goggles

2.0 M HCl

2.0M propanone (CH3COCH3)

0.010M I2 (in 40% ethanol by volume)

Starch solution

**Procedure:**

1. Put on safety goggles
2. Obtain four 100mL beakers and label them 1 through 4 and measure into each the indicated quantities of the reagents as listed. Use a different 10mL graduated cylinder for each reagent, except for the starch solution. Mix the first four solutions together, but DO NOT ADD THE IODINE YET.

Table 1 – Volumes of reagents to be mixed for each run

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Trial | 2.0M HCl | 2.0M propanone | Water | Starch solution | 0.010M I2 |
| 1 | 20.0mL | 8.0 mL | 0.0mL | 10 drops | 4.0mL |
| 2 | 10.0mL | 8.0mL | 10.0mL | 10 drops | 4.0mL |
| 3 | 20.0mL | 4.0mL | 4.0mL | 10 drops | 4.0mL |
| 4 | 20.0mL | 8.0mL | 2.0mL | 10 drops | 2.0mL |

1. As soon as you add the iodine to the mixture of the other four reagents, start timing, then stir the solution. Watch for the blue-black colour of the starch iodine complex to disappear. As soon as the colour has disappeared, record the time since mixing.
2. When you have finished all four trials, record your data in the class google spreadsheet so class averages can be calculated.
3. Dispose of all mixtures down the sink with plenty of water

**Analysis**

Determine the order of reaction with respect to each of the reactants and the overall order of the reaction. Calculate a value for the rate constant (k), including units. You may use your data for the calculations unless you suspect some problem with your data (if it is very far from the class average) in which case please note this and use the class average. You should carry uncertainty through for finding concentration, rate, and k, but uncertainty is not needed for the order of reaction, as that should be a whole number.