student sheet Name_____

Title: Oscillating Clock

Introduction: The study of chemistry requires students to learn to make careful measurements and calculations. A small error can lead to inaccurate results or even missing the exciting reaction altogether. In this experiment you will practice your ability to correctly calculate how to make solutions and correctly prepare these solutions. Your reward is a very cool reaction called the oscillating clock, a phenomenon not entirely understood by science!

Materials:

- Malonic acid, $CH_2(COOH)_2$
- potassium iodate KIO_3
- manganese sulfate $MnSO_4 \cdot H_2O$
- 50.0 mL of 3.6 M hydrogen peroxide (H_2O_2)
- 3% [w/v] starch in a dropper bottle.
- 2.00 M solution sulfuric acid
- graduated cylinders
- test tubes and rack (optional)

Prediction: How could a chemical reaction act like a clock?

Procedures:

1. Prepare or gather the following solutions:

   - solution 1-100.00 mL of 0.150 M malonic acid ($CH_2(COOH)_2$ and 0.0200 M manganese sulfate ($MnSO_4$)

   - solution 2-100.00 mL 0.20 M potassium iodate (KIO_3) in 0.0800 M sulfuric acid. 50.0 mL of 3.6 M hydrogen peroxide (H_2O_2)

   - solution 3-You will be provided with 50.0 mL of 3.6 M hydrogen peroxide (H_2O_2) and 3% [w/v] starch in a dropper bottle.

2. Add 20.0 mL of each of the 3 solutions (1,2, 3) to a graduated cylinder or large test tube.

3. Make sure you have created a data table to record your observations of the mixtures after the reactions start.

4. Add several drops of starch to each tube. Record your observations.

Data:

Analysis:

1. How were these reactions like a clock?

2. Why are they called oscillating?

3. Did any of your preparations not work? Why do you think that was?

4. Why is precise measurement and calculation important in a reaction such as these?

5. What variables could you change in these reactions to change their equilibrium?

Conclusion: