

Name _____

Date _____

Chemistry 12

Experiment on Measuring Reaction Rates

Purpose:

To use an electronic balance to measure the rate of a reaction.

Equipment and Materials:

1 electronic balance
marble (calcium carbonate) chips
6 M hydrochloric acid
safety goggles
one 250 mL beaker and one 100 mL beaker

Procedure:

WARNING!: Hydrochloric acid is corrosive to the skin and eyes. If you spill any, notify the teacher immediately. If you get any in your eyes, immediately go to an eyewash station and flush with water for 10 minutes. Notify the teacher.

1. Read through this whole procedure before you start.
2. Put on safety goggles and keep them on until the lab is finished!
3. Get a 250 mL beaker and add enough marble chips to just cover the bottom.
4. Zero an electronic balance and place the beaker with the marble chips on it.
5. In a 100 mL beaker, obtain about 50 mL of 6.0 M hydrochloric acid.
6. Making sure your goggles are on, carefully but quickly pour the hydrochloric acid into the beaker with the marble chips while it is still on the balance. Be careful not to spill any!
7. After about 5 seconds record the mass reading on the balance next to time “0” on the table on the next page.
8. Read the mass at 10 second intervals and record on the data table on the next page. Continue the readings until you get three readings without any change.

9. When you're finished, pour the liquid in the beaker down the drain, being careful not to dump any of the marble chips down the drain. Rinse any unused marble chips in the beaker with water, then put them in the container designated by the teacher.

Data and Observations:

Time (s)	Total Mass (g)	Time (s)	Total Mass (g)
0.0		120.0	
10.0		130.0	
20.0		140.0	
30.0		150.0	
40.0		160.0	
50.0		170.0	
60.0		180.0	
70.0		190.0	
80.0		200.0	
90.0		210.0	
100.0		220.0	
110.0		230.0	

Questions:

- The reactants in this experiment are calcium carbonate ($\text{CaCO}_{3(s)}$) and hydrochloric acid ($\text{HCl}_{(aq)}$). The products are calcium chloride (CaCl_2), water and carbon dioxide gas. Write a **balanced** formula equation for this reaction. Include the subscripts.

- The decrease in the mass of the system is due to the _____ gas escaping.
- If the system loses 1.0 gram, it means that ____g of CO_2 has been produced.

4. Using the Microsoft Excel Application, plot a graph of Total Mass (g) vs. Time (s).
5. Calculate the average rate of decrease in mass during the first 30 seconds.

$$\frac{\Delta \text{ mass (g)}}{\Delta \text{ time (s)}} = \frac{\text{g}}{\mathbf{30.0} \text{ s}} = \underline{\hspace{2cm}} \text{ g/s}$$

6. Calculate the average rate of decrease in mass during the second 30 seconds (30 s to 60 s).

$$\frac{\Delta \text{ mass (g)}}{\Delta \text{ time (s)}} = \frac{\text{g}}{\mathbf{30.0} \text{ s}} = \underline{\hspace{2cm}} \text{ g/s}$$

7. Calculate the average rate of decrease in mass during the third 30 seconds (60 s to 90 s).

$$\frac{\Delta \text{ mass (g)}}{\Delta \text{ time (s)}} = \frac{\text{g}}{\mathbf{30.0} \text{ s}} = \underline{\hspace{2cm}} \text{ g/s}$$

8. How did the rate during the second 30 second interval compare with the rate during the first 30 second interval?

9. How did the rate during the third 30 second interval compare with that during the first and second interval?

10. Suggest a reason to explain why the rate changes as the reaction proceeds.

11. Look at the graph. What happens to its slope as the reaction proceeds?

 . Draw a tangent to the curve at time = 30 seconds. Take the slope of the tangent. The **slope is equal to the rate** at this particular time.

Slope of tangent = g/s Rate at t=30 s = g/s