

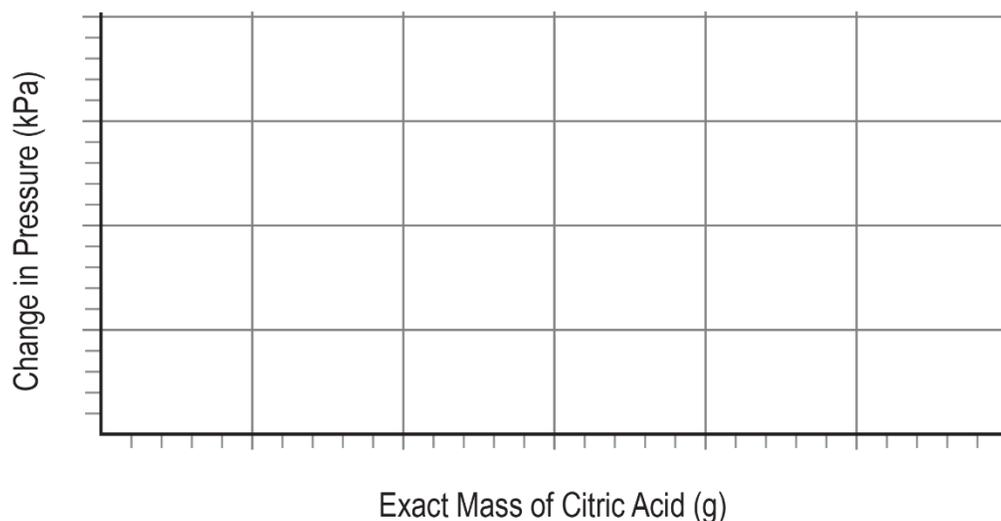
8D – DETERMINING LIMITING REACTANTS

Analysis

Table 1 – Pressure change

| Trial # | Approximate Mass of $C_6H_8O_7$ (g) | Exact Mass of $C_6H_8O_7$ (g) | Initial Pressure (kPa) | Final Pressure (kPa) | Change in Pressure (kPa) |
|---------|-------------------------------------|-------------------------------|------------------------|----------------------|--------------------------|
| 1 | 0.10 | | | | |
| 2 | 0.20 | | | | |
| 3 | 0.30 | | | | |
| 4 | 0.40 | | | | |
| 5 | 0.50 | | | | |

1. Navigate to Page 2 in SPARKvue. Enter the change in pressure for each run to create a graph of Change in Pressure (kPa) on the y-axis and Exact mass of citric acid (g) on the x-axis. Scale the graph and then reproduce the graph on your paper. Add a title to your graph.



2. Each 40-mL sample of sodium bicarbonate you measured contained 0.41 g of dissolved sodium bicarbonate. Calculate the number of moles of sodium bicarbonate for each trial. Show one sample calculation and record your answers in Table 2.

3. Calculate the number of moles of citric acid in each trial. Show one sample calculation below and record your answers in Table 2.

Table 2 – Analysis of pressure change

| Trial # | Mass of NaHCO ₃ (g) | Moles of NaHCO ₃ (mol) | Exact mass of C ₆ H ₈ O ₇ (g) | Moles of C ₆ H ₈ O ₇ (mol) |
|---------|--------------------------------|-----------------------------------|--|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Questions

1. Each trial used the same amount of NaHCO₃. What happened to the pressure as you added increasing amounts of citric acid? Why did this happen?
2. Based on the graph, what is the ideal amount (in grams) of citric acid required to react with 0.41 g of NaHCO₃? Explain how you determined this answer.
3. Based on the graph, which trial is closest to the ideal amounts of reactants? Explain how you chose this trial and eliminated the others.

4. In Table 2, find the moles of each reactant for the ideal trial you identified above. According to the table, what is the ideal $\text{NaHCO}_3 : \text{C}_6\text{H}_8\text{O}_7$ mole-to-mole ratio, in simplified whole number coefficients?
5. When citric acid and sodium bicarbonate react, the products are sodium citrate ($\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$), water, and carbon dioxide. Write the balanced chemical equation including state-of-matter symbols in your balanced chemical equation. How does the $\text{NaHCO}_3 : \text{C}_6\text{H}_8\text{O}_7$ mole ratio in the balanced equation compare to the ratio that you determined in question #4?
6. Which reactant, if any, was a limiting reactant in each trial? Enter your responses in the table. Support your answers with evidence from the lab.

Evidence for the Limiting Reactant

| Trial # | Limiting Reactant | Supporting evidence |
|---------|-------------------|---------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |