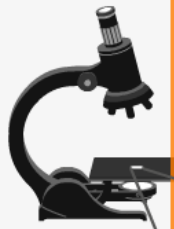


Mattel's China Experience: A Crisis in Toyland

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Background

A lack of calcium can lead to elders becoming susceptible to osteoporosis. There are a number of supplements already on the market such as Tums and Mylanta. However, these supplements are found difficult/unpleasant to swallow.

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Task

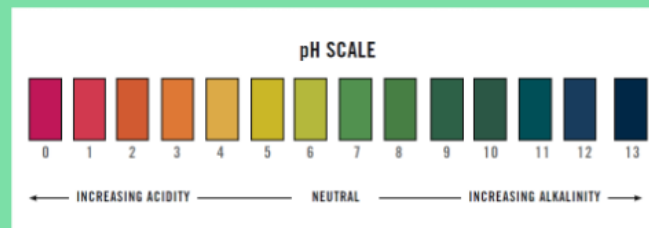
Design a calcium supplement that can be taken as a clear liquid.

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Safety Notes

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- It should be clear
- Have a pH between 4 and 10
- Doesn't contain toxic material
- Has a known concentration so people know how much should be consumed



Week 1

1. Mix calcium carbonate with six different sodium compounds
 - a. sodium carbonate
 - b. sodium sulfate
 - c. sodium nitrate
 - d. sodium chlorite
 - e. sodium oxalate
 - f. sodium phosphate
2. Record their reactions and indentify which ones produced precipitates

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Week 2

1. Dissolve two 0.5g samples of calcium carbonate in nitric acid and hydrochloric acid
2. Dissolve two 1.0g samples of calcium carbonate in the two acids
3. Record the volume of acid used to fully dissolve the compound
4. Once fully dissolved, test the pH
5. Find the concentration for the correct solution

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Equations Used

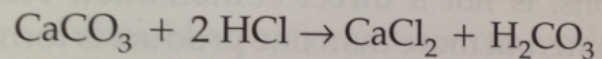
Starting Volume (mL) – Final Volume (mL) = Volume of Acid (mL)

$$\text{Sample Weight} \times \frac{1 \text{ mol CaCO}_3}{100.086 \text{ g CaCO}_3} = \text{moles of CaCO}_3$$

$$\frac{\text{moles of CaCO}_3}{\text{volume of acid (L)}} = \text{solution of concentration (M)}$$

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Results



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Week 1

1. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{Am}_2\text{CO}_3(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + 2\text{HNO}_3(\text{aq})$
2. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{Am}_2\text{SO}_4(\text{aq}) \rightarrow \text{CaSO}_4(\text{s}) + 2\text{HNO}_3(\text{aq})$
3. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{AmHNO}_2(\text{aq}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{AmNO}_2(\text{aq})$
4. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{HNO}_2(\text{aq}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{HNO}_2(\text{aq})$
5. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{Am}_2\text{C}_2\text{O}_4(\text{aq}) \rightarrow \text{CaC}_2\text{O}_4(\text{s}) + 2\text{HNO}_3(\text{aq})$
6. $\text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{H}_2\text{PO}_4(\text{aq}) \rightarrow \text{Ca}_2(\text{PO}_4)_2(\text{s}) + 2\text{HNO}_3(\text{aq})$

Week 2

The correct solution for us was the 1g of calcium carbonate dissolved in 19.5 mL of HCl with a reasonable pH of 5

$$1 \text{g CaCO}_3 \times \frac{1 \text{ mol CaCO}_3}{100.086 \text{g CaCO}_3} = 0.0099914074 \text{ mol CaCO}_3$$
$$\frac{0.0099914074 \text{ mol}}{0.0195 \text{ L}} = 0.512 \text{M}$$