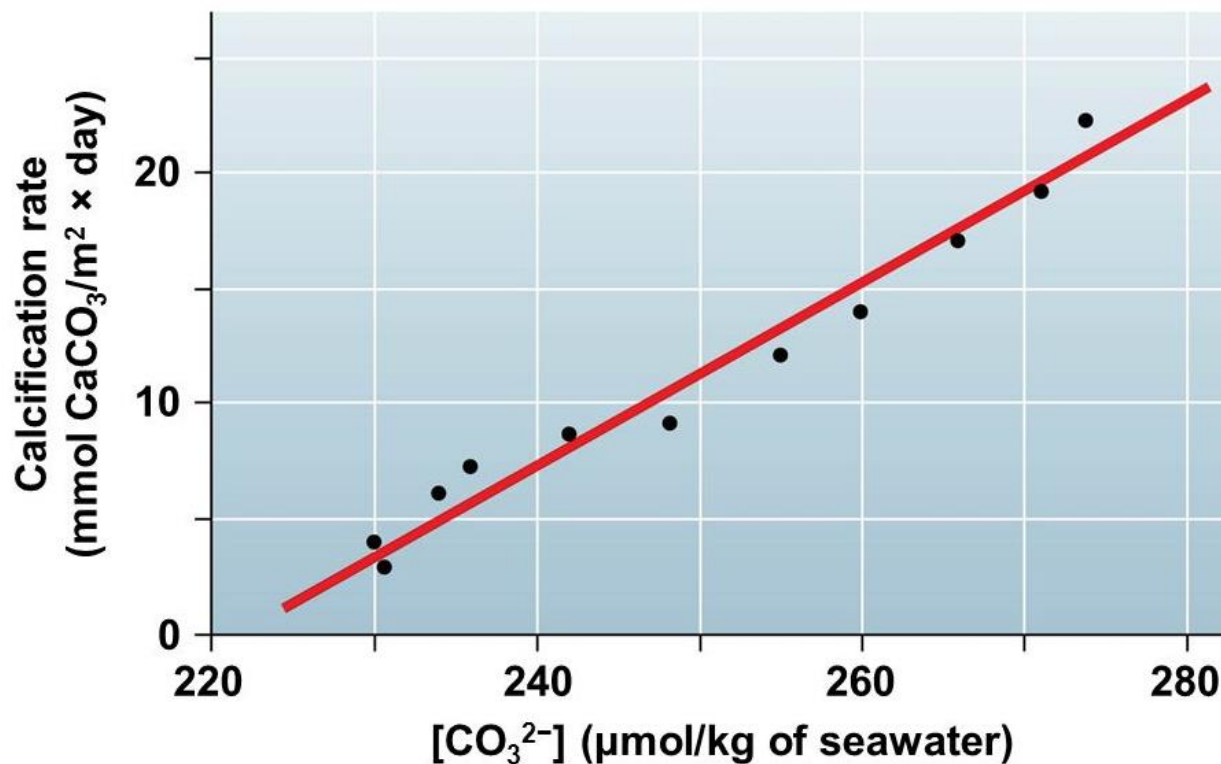


Carbonate Ion Concentration and Calcification Rate of a Coral Reef

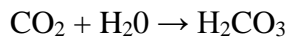
For several years, researchers measured the rate of calcification in a coral reef in a reef aquarium over differing amounts of dissolved carbonate ions in seawater. The results are shown in the graph below:



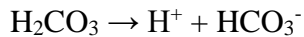
1. [SP 3] Identify the independent and dependent variables.
2. [SP 4] Based on this graph, state the relationship between carbonate ion concentration [CO₃²⁻] and calcification rate.
3. [SP 5] Consider a seawater carbonate ion concentration of 270 μmol/kg.
 - a) State the approximate rate of calcification.
 - b) Predict the number of days it would take 1 square meter of reef to accumulate 30 mmol of calcium carbonate (CaCO₃).
4. [SP 5] Consider a seawater carbonate ion concentration of 250 μmol/kg.
 - a) State the approximate rate of calcification.
 - b) Predict the number of days it would take 1 square meter of reef to accumulate 30 mmol of calcium carbonate.

The reactions below outline the fate of carbon dioxide in the ocean.

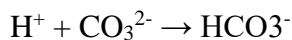
Step 1: atmospheric carbon dioxide dissolves in the ocean water and forms carbonic acid



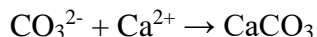
Step 2: carbonic acid dissociates into hydrogen ions and bicarbonate ions



Step 3: the hydrogen ions combine with carbonate ions to form more bicarbonate ions



Step 4: calcification results from carbonate ions reacting with calcium ions



5. [SP 3] Identify the step of the process that was measured in the experiment.
6. [SP 1] This research looked at calcification rates in a coral reef.
 - a) Describe the effect of decreased carbonate ion concentration on the growth rate of corals.
 - b) Using the reactions above, justify your description.
7. The use of fossil fuels is increasing the atmospheric $[\text{CO}_2]$. It has been hypothesized that increased atmospheric concentrations of CO_2 will slow the growth of coral reefs.
 - a) [SP 1, 6] Predict the effect this increasing $[\text{CO}_2]$ will have on the pH of the ocean. Justify your prediction.
 - b) [SP 6] Do the results of this experiment support the hypothesis? Justify your answer.
 - c) [SP 6] Suggest a reason we should be concerned about the growth rate of coral reefs.