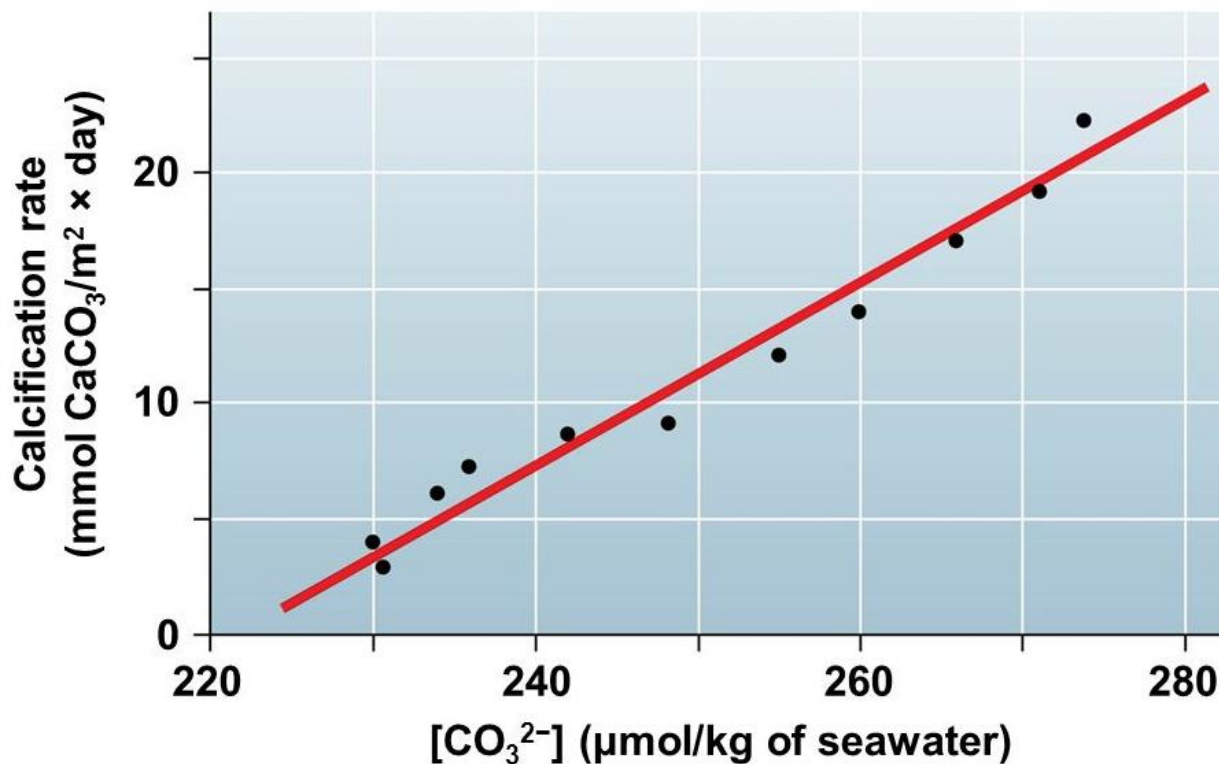


## Carbonate Ion Concentration and Calcification Rate of a Coral Reef

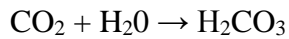
For several years, researchers measured the rate of calcification in a coral reef in a reef aquarium over differing amounts of dissolved carbonate ions in seawater. The results are shown in the graph below:



1. Identify the independent and dependent variables.
2. Based on this graph, state the relationship between carbonate ion concentration [CO<sub>3</sub><sup>2-</sup>] and calcification rate.
3. 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 (CaCO<sub>3</sub>).
4. 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.

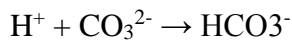
Step 1: atmospheric carbon dioxide dissolves in the ocean water and forms carbonic acid



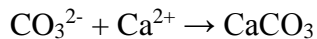
Step 2: carbonic acid dissociates into hydrogen ions and bicarbonate ions



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. Identify the step of the process that was measured in the experiment.

6. 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  $\text{CO}_2$  will slow the growth of coral reefs.

a) Predict the effect this increasing  $[\text{CO}_2]$  will have on the pH of the ocean. Justify your prediction.

b) Do the results of this experiment support the hypothesis? Justify your answer.

c) Suggest a reason we should be concerned about the growth rate of coral reefs.