2.3) INSTRUCTOR'S GUIDE TO BUFFERING CAPACITY

Overview: The table below provides sample values using carbonate as the buffering agent. Sodium bicarbonate (baking soda) was not tested as a buffer in this trial but results should be similar.

Table 2 Sample Data

10 mL Sample	Initial pH at 1X concentr.	Initial pH at 0.1X concentr.	Initial pH at 0.01X concentr.	Final pH	Drops 0.1M HCl needed to acidify 1X concentr.
Spring	7.5	N/A	N/A	4	2
Creek	7.5	N/A	N/A	4	2
SW	8.5	N/A	N/A	4	9
Na_2CO_3	11.5	11.5	11.3	6	50,000*
NaOH	11.0	10.1	9.2	5	250

*This is based on 25 mL 0.1M HCl needed to acidify 10 mL 0.01X Na_2CO_3

Answers to Questions: 1) Answers may vary depending on the freshwater sources. 2) Seawater has more buffering capacity than freshwater. 3) The buffer (Na_2CO_3 or $NaHCO_3$). 4) Seawater almost always has the highest pH for natural water samples. 5) Answers may vary; both prepared solutions will have similarly high pH. 6) No, because the strong bases often have higher initial pH, but little or no buffering capacity. 7) Usually the pH of the sodium hydroxide changes more after dilution because it is not a buffer. 8a) The strong base. 8b) The pH of the buffer drops more gradually. 8c) The sodium bicarbonate or sodium carbonate solution. 9) Garden lime is the buffer because it is less corrosive and the carbonate ions act as buffering agents.

Logistics: Use a broad range pH indicator read for more accurate pH readings.

Degree of Difficulty: 2—This lab is relatively easy to organize. The main difficulty is explaining buffers to students with a limited knowledge of chemistry.

Materials: Splash-proof lab goggles; wide range pH indicator solution; an eye dropper or pipette; distilled water; Na_2CO_3 or $NaHCO_3$; NaOH; HCl; water samples.