

Experiment 20

Carbonic Acid Equilibrium

In this experiment you will observe the change in the amount of dissolved carbon dioxide in "carbonated" water as it is allowed to escape at room temperature until it reaches a new equilibrium point.

Procedure

1. Weigh an opened, 250 mL can of soft drink to the nearest 0.01 grams.
2. Weigh out 6.00 grams salt (sodium chloride) in a plastic container. Keep for later.
3. Weigh an ice cream container to the nearest 0.01 grams.
4. Open the can of soft drink and pour it into the ice cream container. Weigh the empty can, and the ice cream container containing the soft drink.
5. Slowly, with stirring, add the salt to the soft drink until all of the salt has been added. There should be no more fizzing visible after the last of the salt has been added.
6. Weigh the container, soft drink and salt.

Questions

1. Use your results to calculate the original mass of soft drink in the can.
2. Calculate the *mass of CO₂* evolved.
3. Calculate the *volume of CO₂* evolved under **standard state pressure conditions and at 25°C**.
4. Outline any errors that may affect your answers.
5. Write the equation for the CO₂ / H₂O / H₂CO₃ equilibrium.
6. Use Le Châtelier's Principle and pressure changes to explain what happens to the [CO₂] in water when the lid of a soft drink is first opened. Reference to the equation is essential.

7. Use Le Châtelier's Principle, solubility, energy and pressure changes to explain what happens to the $[\text{CO}_2]$ in water when a can of soft drink is shaken up and then opened.
8. The dissolving of CO_2 in water is an *exothermic* reaction. In terms of equilibrium changes, why is it important to serve "fizzy" drinks chilled rather than warm?
9. Write an equation for the *dissociation* of carbonic acid.
10. Write an equation for the reaction between *hydrogen ions* (of an acid) with calcium carbonate.
11. Explain, using the above three equations, why limestone is more soluble in cold water than in warm water, hence why limestone caves are usually found in place where the temperatures are quite cold as well. eg Wellington (Wellington Caves), Marulan (Bungonia Gorge), Lithgow (Jenolan Caves) and Crookwell (Wombeyan Caves).