Expedition Bolivia - Live Chemistry Experiments

Introduction

During the i2P Bolivia expedition the i2P team will be conducting two experiments live over a satellite link via Digigone Software that select schools can replicate simultaneously in their classrooms. These experiments will illustrate simple principles of chemistry and human physiology.

Dr. George Agnes, expedition team member and chemist from Simon Fraser University will lead both the Youth Ambassadors and students following on satellite link through the experiments.

Experiment 1

(see module 5)

Temperature of boiling water

Date: Tues. May 17

Time: 10:15 AM Eastern Time

Equipment: Beaker, stand, Bunsen burner, distilled water, thermometer (held by a clamp)

Method: First establish the elevation of your community (school).

Half fill a small beaker with distilled water. Place the beaker on a stand and start heating it with a heat source (Bunsen burner). Use a clamp to mount a thermometer in a position that allows it to be easily read when the water is boiling. Bring the water to a steady boil. Record temperature of the boiling water at 15-second intervals, until three constant temperatures have been measured.

Expedition BOLIVIA: La Ruta de Sal

Discussion: The boiling temperatures of water at the participating schools and the i2P team at 12,000 feet in Bolivia will differ. The higher the elevation, the lower the boiling temperature of water. This is because the atmospheric pressure steadily decreases with increasing altitude.

Atmospheric pressure pushes down on all objects, including a beaker of water. When water is heated, water molecules can change state from liquid to gas (e.g. water vapor). The temperature at which a pure compound (e.g. water) is defined to be boiling, is the temperature at which that liquid's vapor pressure above the liquid is equal to atmospheric pressure. This means that a force that prevents a liquid from becoming a gas is the atmospheric pressure, and if the downward force of atmospheric pressure decreases it becomes easier for water molecules to be liberated as gas.

That is why the boiling temperature of water on the Salar de Uyuni should be lower than at schools at lower elevation. Tune in and see if this is what occurs!

EXPERIMENT 2

(SEE MODULES 5 & 6)

CO_2 Experiment

Date: Thurs. May 19

Time: 1:00 PM Eastern Time

Equipment: Beaker, 50 ml of freshly boiled water, bromothymol blue (dye), a dropper, a straw.

Method: Add a drop of bromothymol blue to the beaker of water. Introduce a straw and slowly exhale through the straw and into the water. Observe the color of the water before and after exhaling.

Discussion: CO_2 is the byproduct of cellular respiration, the burning of fuel in our cells. CO_2 is considered a waste product of metabolism and must be eliminated by the body. This is done by exhaling CO_2 through the lungs.

Breathing is triggered by sensors in the bloodstream called chemoreceptors, which measure chemical byproducts of exercise metabolism (CO_2) that cause the pH of the blood to fall. The lower the pH the faster a person will breathe. The harder muscles work - as is the case when one runs - the more the pH falls, causing the sensors to send more frequent messages to the muscles, and increasing the respiratory rate.

Bromothymol blue is a dye that is blue at a neutral pH but loses its color in an acid solution. Breathing into the water introduces CO_2 and causes the water to become acidic (the pH rises). The higher pH causes the bromothymol blue to lose its color.