

LIMNIC ERUPTIONS

STATION #3A and 3B

TEACHER NOTES

KWLA Question: Why did the water sample from the bottom of the lake bubble when brought to the surface?

Inquiry: Have students identify some differences between the water at the bottom of the lake and the water at the top of the lake that may affect the dissolving of CO₂ in the water. Then, proceed with the following guided inquiry to explore the relationship between gas solubility and pressure.

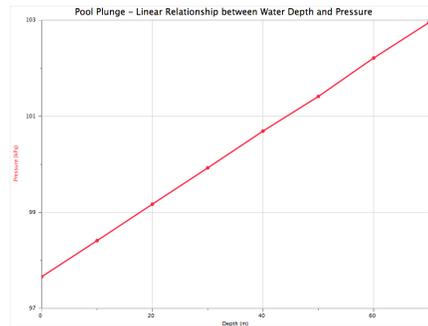
Guided Investigations and alternate methods:

3A - How does the environment at the bottom of the lake vary from the top in terms of pressure? (See “Pool Plunge” lab for detailed instructions - Real World Math with Calculators from Vernier Software, Inc.⁸)

Alternative procedure (without CBLs):

1. Place a beaker on a balance. Tare the balance so that the mass of the beaker is not recorded.
2. Add 100 ml water.
3. Record mass.
4. Add another 100 ml water to the beaker.
5. Record mass.
6. Repeat several more times.
7. Pressure may be calculated as follows:
 - a. Determine the surface area of the bottom of the beaker: $A = \pi r^2$
 - b. Force (in Newtons) is equal to the weight of the water (use $W = mg$ to calculate): Weight = Mass (reading from balance converted to kg) x Gravity (9.8 m/s^2)
 - c. Pressure = Force (as determined in b) / Area (as determined in a)

Sample results for pressure investigation:



Sketch and label a graph of the data collected.

Which layer of the lake is under the greatest pressure? Explain why. *Monimolimnion (lowest layer) is under the greatest pressure due to the mass of the upper layers pressing down on it.*

3B - How does the environment at the bottom of the lake vary from the top in terms of gas solubility?

Sample results for gas solubility investigation:

Draw what happens to contents of the syringe...

Low Pressure: *When the plunger of the syringe is pulled out, bubbles form in the solution and an air pocket forms in the syringe.*

High Pressure: *When the plunger of the syringe is pushed in, the air pocket and the bubbles disappear.*

Which environmental situation allowed more gas to dissolve into solution? *The higher pressure forces the gas to dissolve in solution.*

Explain why. *In the syringe, Henry's Law states that at a given temperature, the solubility of a gas is directly proportional to the pressure of the gas above the liquid. In other words, gases are more soluble under pressure. In the lake, hydrostatic pressure exerted by the layers of water above keeps the gas in solution. Temperature is also a factor in the solubility of gases; however, according to Handout III of the Lake Nyos study³, the water temperature at the surface and the bottom of the lake are nearly the same.*

Refer to 3A- Which layer of Lake Nyos would have more CO₂ gas dissolved in the water? *CO₂ would be more soluble in the monimolimnion (lowest layer) since it is under the greatest pressure.*

*See Sources page for footnote references.