

### INTRODUCTION

**Lesson Theme:** Active hands on collecting and analyzing a variety of student samples at school and at the University of Buffalo.

**STEM Criteria:** LS1.c, LS2.b, LS2.a, LS2.c, RST. 11-12.7an12.8,W.11-12.1

**New York Standards:** 7.2A, 7.2B, 7.2C, 7.3A, 6.1C, 7.1B and 6.1E  
**Objectives:**

1. Develop knowledge and understanding of how to monitor and field test water, air, and soil samples.
2. Identify and explain the methods and purpose of probe-ware used in the laboratory. These tests include pH, Temperature, Dissolved Oxygen, Carbon Dioxide, and a variety of selected ions including Calcium, Fluoride, Potassium, Nitrates, Ammonia, Iodide and Copper.
3. Explain the role of chemical testing in the high school lab by hands-on practice with a variety of scientific probes. Explain why such a series of tests could improve the quality of health in people.
4. Explain how the UB facility can further analyze samples using instruments to obtain data that can be used to make environmentally sound decisions.

**What are the tools used to answer the objectives in the field or school available to Buffalo Public School students?**

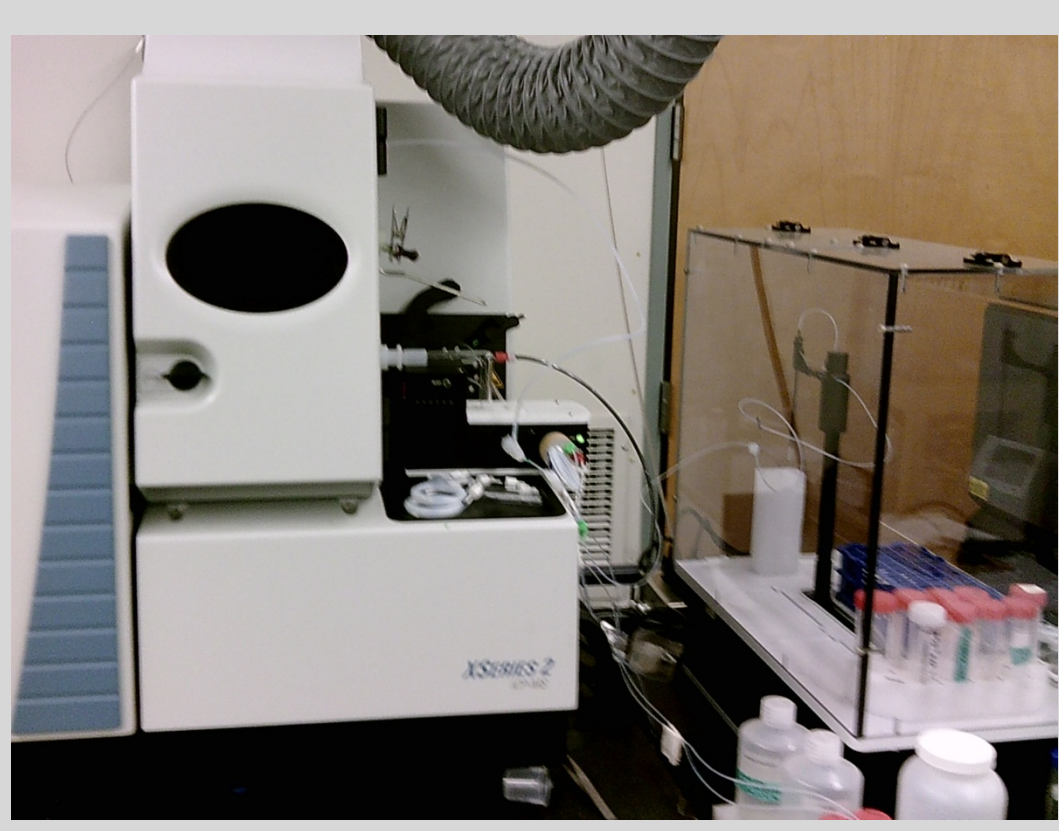


In the field and the classroom we can test specific characteristics such as: Temperature, pH, Salinity, GPS, Co2 content, and Dissolved O2 using the SPARKS hand held lab equipment/

Picture of SPARKS probes that could be used in the testing .

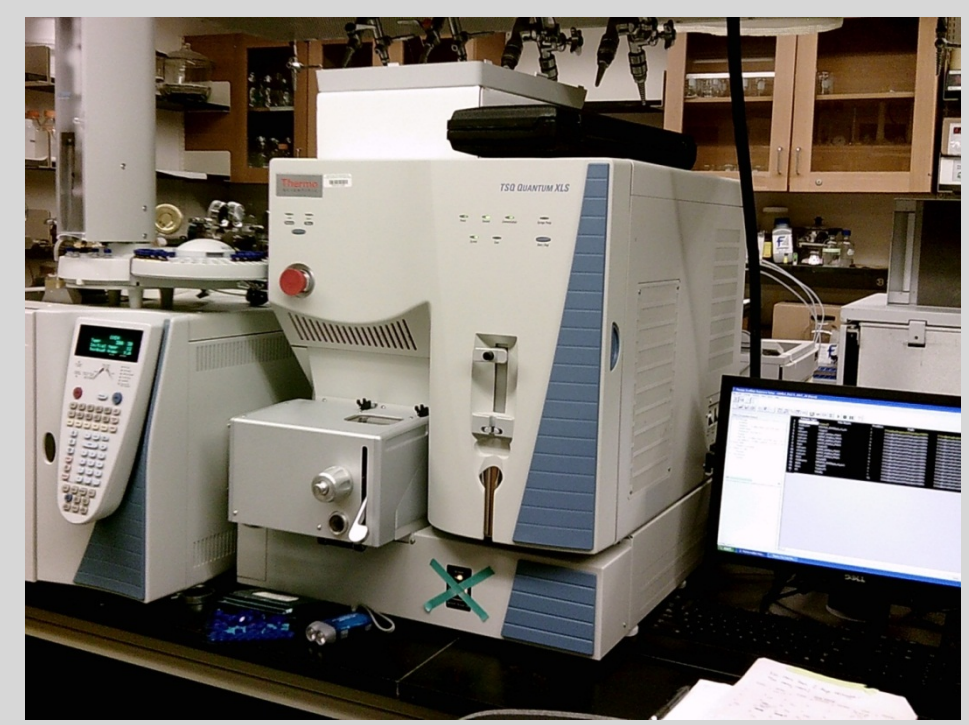


### What are the tools used at UB to analyze collected samples ?



ICP-MS used to test for Metals found in soil samples

GC/MS/MS uses liquid samples To identify specific chemicals In a sample.



TOF.SIMS\*5 uses liquid nitrogen and pictures to evaluate the amount of Elements and compounds

Questions that will focus the research.

What kind of substances do we want to look for in the Air, Soil and Water that we come in contact with on a daily basis?

Select specific substances, molecules, ions or elements to test. This will be based on student research or opinion.

These substances should include:

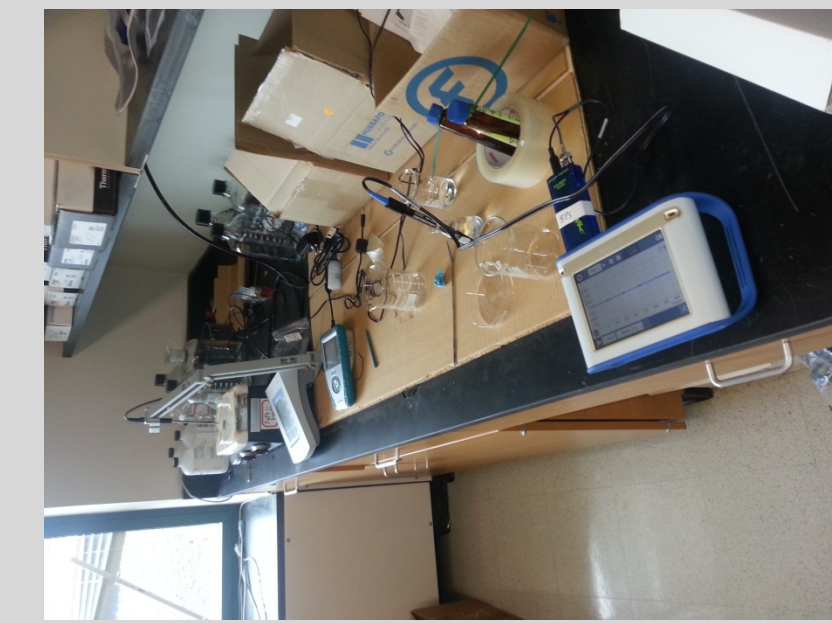
- Heavy metals** such as; mercury, nickel, lead, arsenic, cadmium, aluminum, platinum, and copper.
- Polycyclic aromatic hydrocarbons(PAHS)**
- Selected ION** sampling include copper, sodium, calcium, and potassium.

Research any key substances that are making environmental headlines.

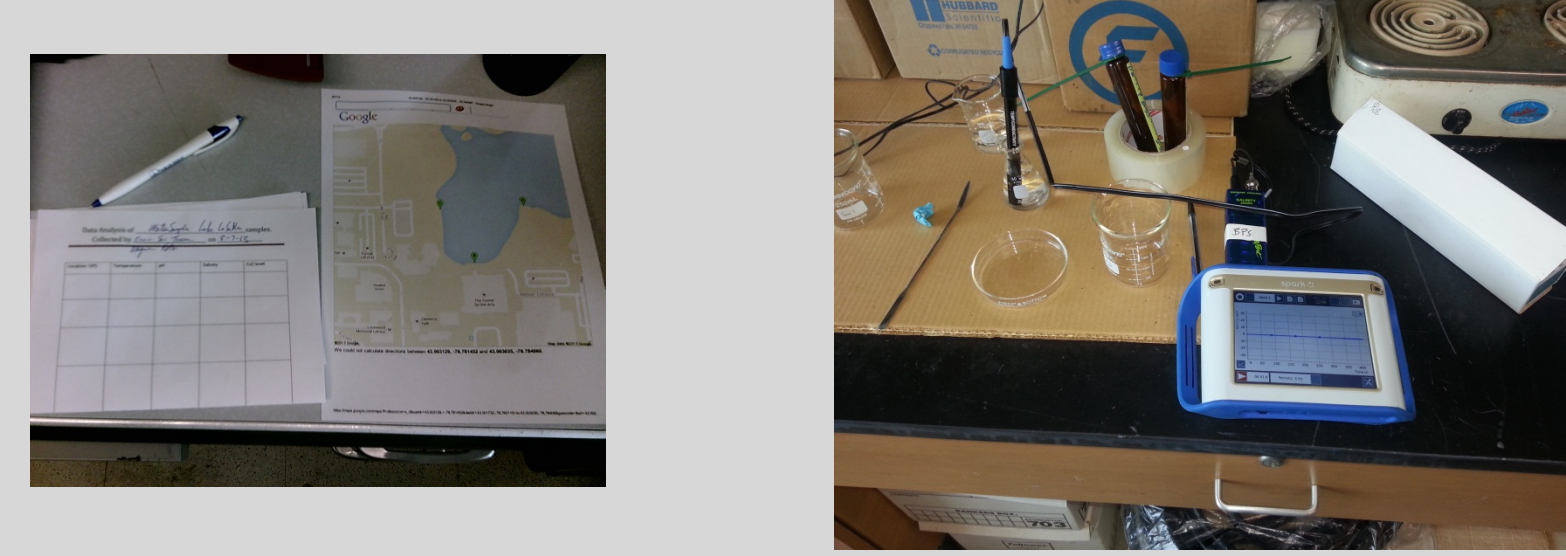
Picture of internet site research using GALE



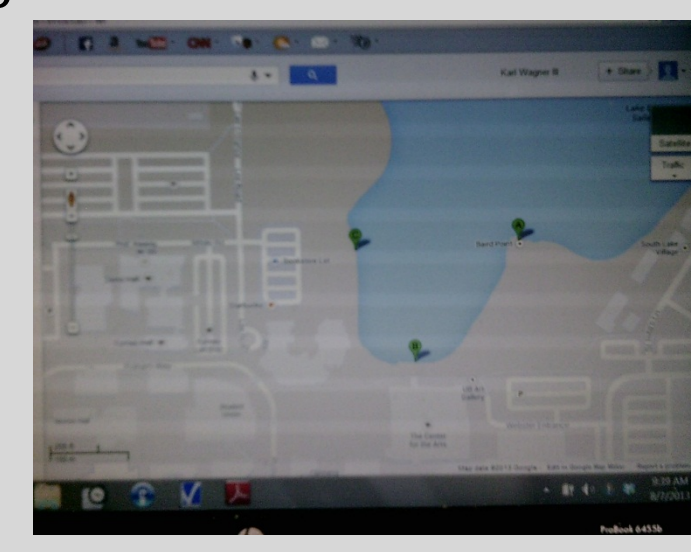
Research and set up a procedure that can analyze a student sample.



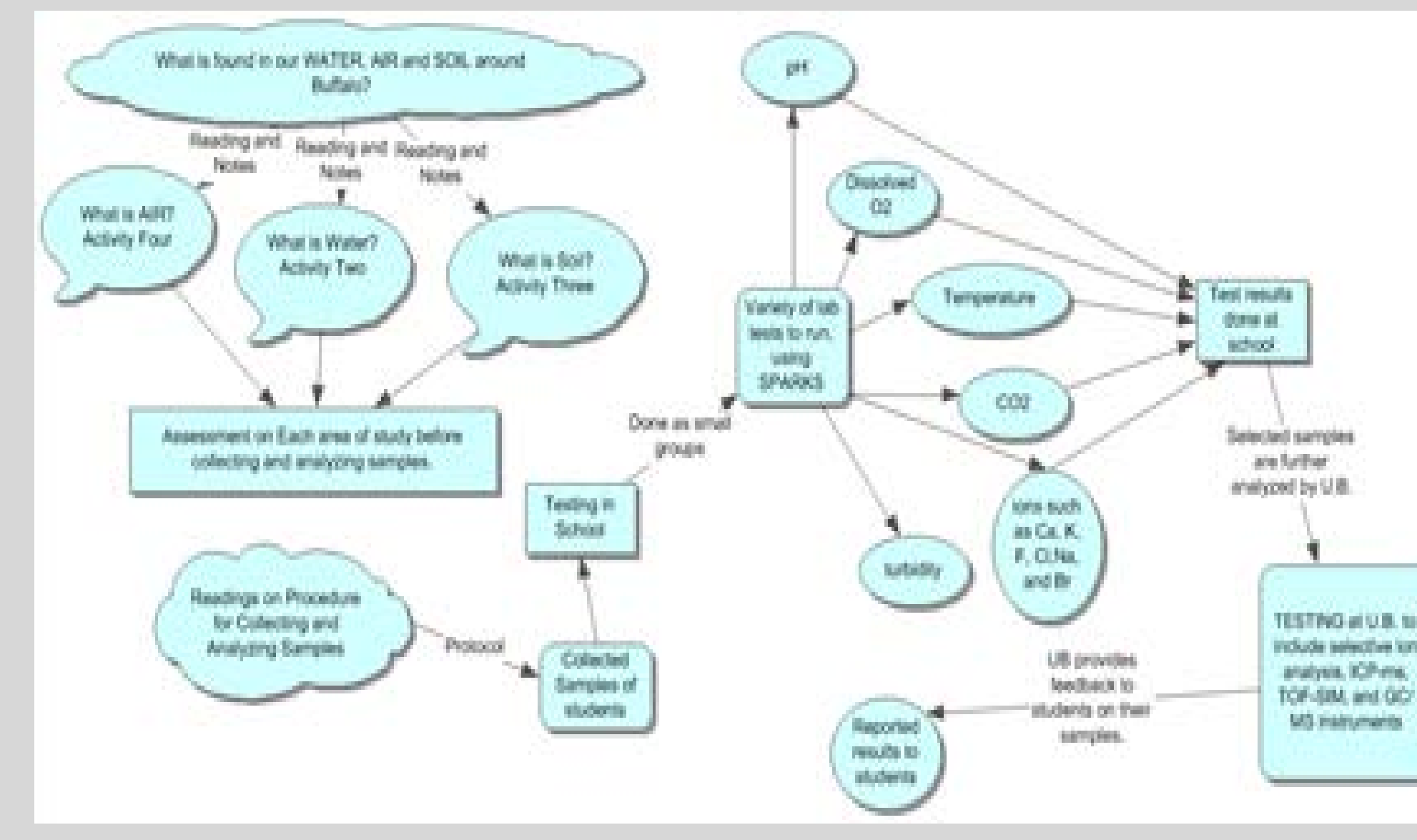
Develop a plan and site map of where samples will be collected.



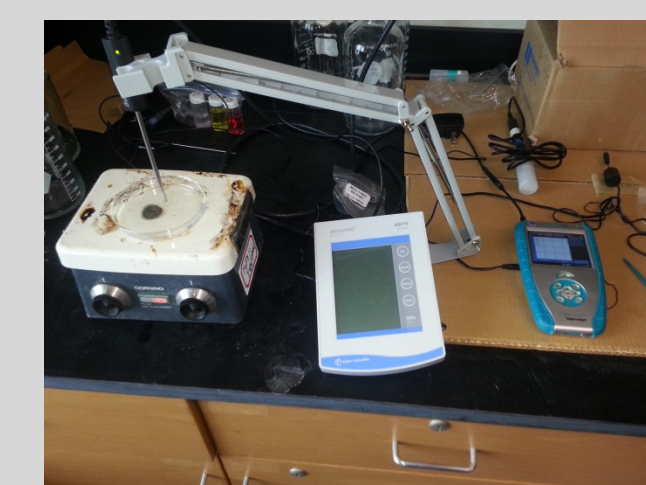
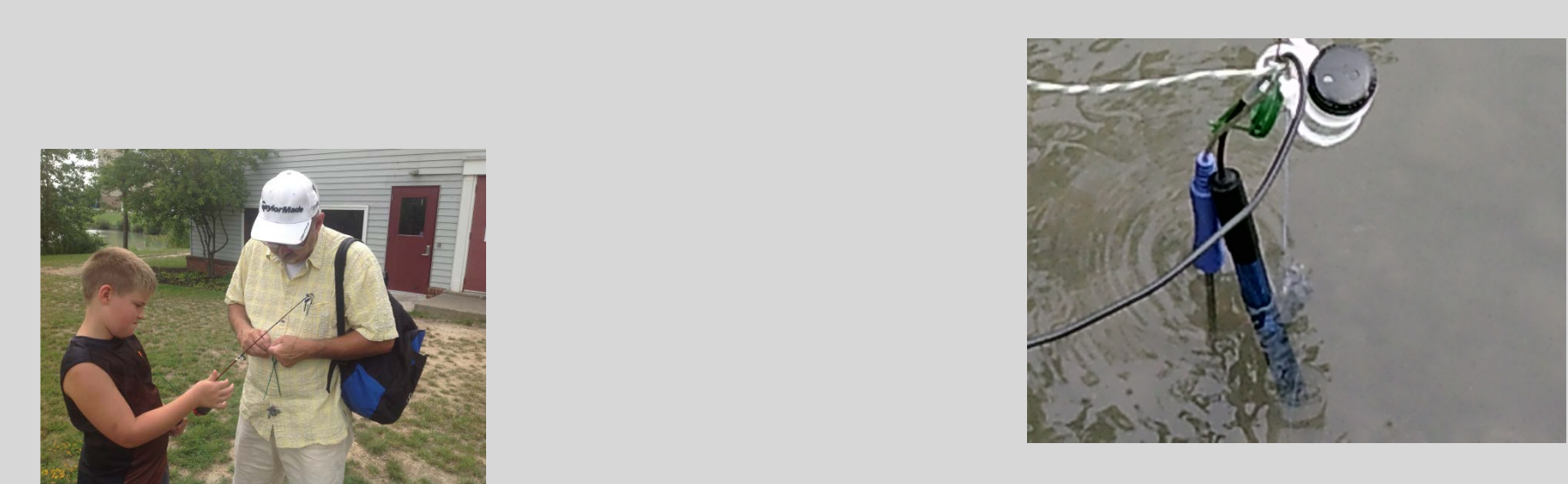
Make a prediction of which selected sites may show significant signs of concern.



Develop a plan of how to collect, secure and test the samples. What tests can be done on site, at school, and at UB?



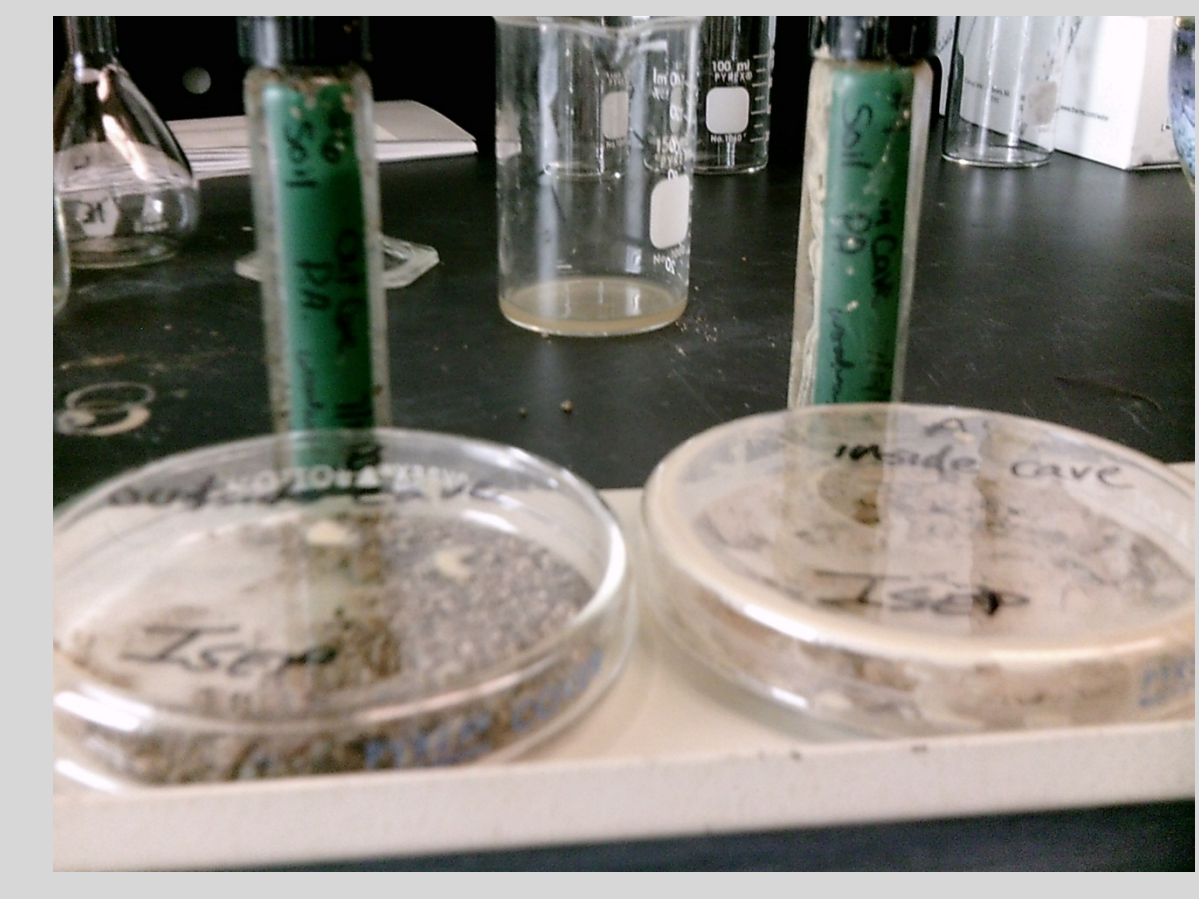
Collect the samples following developed protocol.



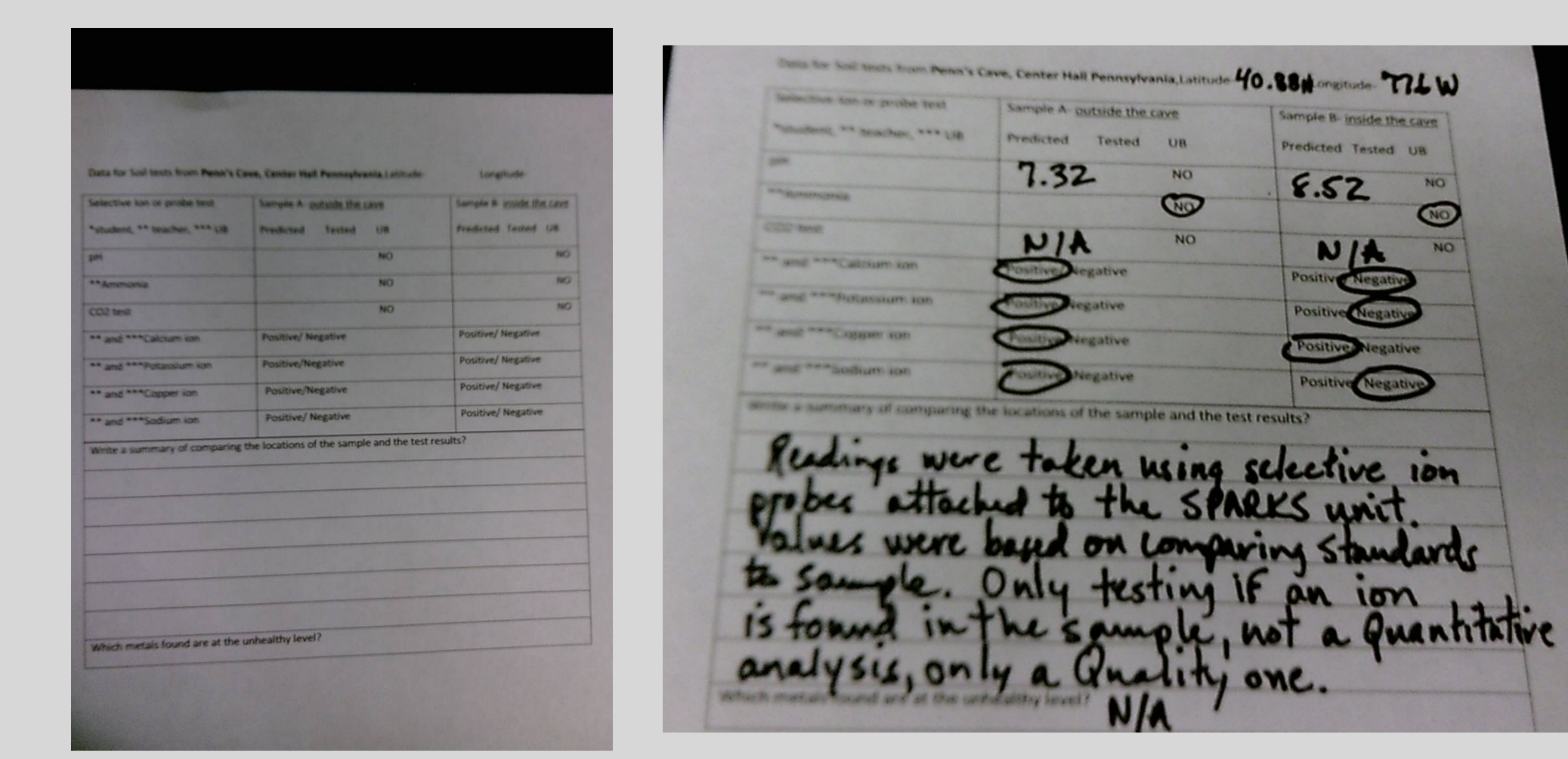
Samples were collected following the selected protocol and returned to the lab for analysis.



Samples were marked according to the developed protocol and secured for Testing using SPARKS.



Complete assigned tests in the school lab, record the data on developed data sheets.



Compare results and develop conclusions.

### CONCLUSIONS from TESTING.

As seen in the results the pH of the underground sample Showed a more basic pH most likely due to the filtering by the Rock strata. We were surprised that the underground sample tested negative for Calcium, a main element found in the limestone strata. The copper results could be from outside sources such as people putting coins in the water for luck. The method of transportation inside the cave was by motorized boat not factored into the analysis.

### AKNOWLEDGEMENTS

We would like to thank the ISEP program for allowing us to investigate and test this idea at the University at Buffalo. We would like to thank Dr. Alice Bergmann, Dr. Joseph Gardella and Dr. Diana Aga for their tours and explanations of the ICP-MS, the TOF-Sim and GC-MS/MS<sup>51</sup> instruments and lab facilities that helped in our reasearch.