

pH EXPERIMENT: Pre-Lab Discussion

SSS: SC.H.1.4.4, SC.H.1.4.5, SC.F.1.4.6, SC.F.1.4.8

INTRODUCTION

In this lesson students are introduced to the process of planning an experiment. Students will be engaged in scientific inquiry as they develop procedures for conducting the experiment and methods for analyzing the results (Volkman and Abell, 2003). Students will be given an opportunity to make decisions about group cooperation and safety, lab setup, experiment procedures, and reporting results for a pH experiment. The decisions made by the students will be compiled, edited, and then used to construct a procedure for setting up and conducting the pH experiment.

STUDENT LEARNING OBJECTIVE

1. Students will be able to work cooperatively to plan a pH experiment in order to test the pH levels of common household products.

MATERIALS

Teaching Aids

- Student-Centered Discussion Outline
- Group Handout (1 per group)
 - pH Experiment – PreLab Discussion (4 pages paper clipped together)

PROCEDURES

Agenda

- Quick Write: What are the most important aspects of planning an experiment
- Group Discussions
 - Form groups of four and complete PreLab Discussion worksheet
- Tomorrow's Topic: Conducting the pH experiment

Lecture

Introduction (10 min): Students pull out a sheet of paper and list the most important aspects of planning an experiment. Yesterday we discussed acids, bases, and salts, and we talked briefly about some of the acids found in our body. Can anyone give me an example of an acid found in our body? Hydrochloric acid. How about a base? Bile. How about salt? Sodium Chloride and bile salts. Collectively, the acids, bases, and salts in our body help to maintain homeostasis or another way to put it, they help to neutralize our body's solutions. The pH scale, a numerical scale that ranges from 0-14, is a good way of comparing the acidity and alkalinity of one substance to one another. Substances with pH values ranging from 0-6 are acids, those with pH values ranging from 8-14 are bases (alkalines), and substances with a pH value of 7 are considered neutral. All of the substances in our body would fall somewhere on the pH scale as would all of the cleaning and consumable products in our home, if they could be tested. Today we will plan an experiment to test the pH levels of several substances, tomorrow we'll discuss this plan and setup the lab, and Thursday we'll start the experiment.

PreLab Discussion Outline (5 minutes)

- 1) Form groups of four and distribute one page of the handout to each member in the group. Write the class period on the cover sheet.
- 2) Write your name on the cover page next to the title that corresponds to the handout page you received.
- 3) As a group you will discuss the four components of planning. However, it is your responsibility to complete your particular component. Of course, your ability to complete your component will largely depend on your group's effort and your encouragement of their efforts towards your cause. You will be given ten minutes to complete each component, and five minutes afterwards to finalize the entire plan.
- 4) I will introduce each component with a brief explanation of the main categories. You may not discuss any components that I have not introduced, however, you may go back and discuss previously introduced components.
- 5) When your group has finished all four components, arrange the pages in order, attach the cover sheet using the paper clip, and bring the plan to me for approval. To get approval, you must answer all the questions and complete all the sub-procedures.

Four Components of Planning an Experiment

Introduce each component using the outline provided below then allow students ten minutes to complete the worksheet.

Group Cooperation and Safety (10 minutes):

Prior Knowledge – Before we can conduct an experiment to test something, we need to know something about what we're testing.

Group Cooperation – If and how we work in groups must be considered carefully so we don't introduce errors into an experiment.

Lab Safety – Avoiding skin contact and protecting our eyes should be our number one concern in the lab, but there are other things to consider, such as, how we move around the lab.

Lab Safety/Rules – List five important rules that must be followed at all times while in the lab.

Lab Setup (10 minutes):

Substances – Each class will choose their substances, and then we'll pool all the data.

Equipment/Materials – Our understanding and ability to use lab equipment (beakers, graduated cylinders, stirring rods, etc.) will both save time and increase consistency in collecting data.

Lab Setup Procedures – List five procedures that must be followed in order for lab setup to be successful. Obviously there are more than five, but just state five.

Experiment Procedures (10 minutes):

Obtaining the Substance – During the experiment you will get some quantity of substance and bring it back to your station. If this is not done correctly the probability of producing unexpected results will increase.

Preparing the Solution – The purpose of this experiment is to determine the pH of various solutions and compare them with one another. If we lack consistency in the preparation of our solutions then we cannot compare our solutions.

Measuring pH – We already decided on using pH paper (check Lab Setup), but we must use this paper consistently or the probability of producing unexpected results will increase.

Reporting Results (10 minutes):

The pH Chart – Ultimately, we want to produce a chart that shows pH values for substances we tested, but we should have some idea of what this chart looks like before we start. Sometimes imagining the final product can be useful in planning the experiment. We don't want to collect data we're not going to report.

Graphing the Data – Graphs are an excellent way to visualize data. There are many different types of graphs (scatter, bar, line, 3-D), which types would be appropriate for presenting these data?

ASSESSMENT

Objective 1: Using the “pH Experiment: PreLab Discussion” handout, students will work cooperatively in groups to develop a plan for conducting a pH experiment. Specifically, students will answer questions and develop steps for setting up and conducting each component of the pH lab.

REFERENCES

Troy High –Labs Online – Environmental pH

http://www.troy.k12.ny.us/thbiology/labs_online/school_labs/ph_lab_school.html

Volkman, M.J. and Abell, S.K. 2003. Rethinking Laboratories: Tools for converting cookbook labs into inquiry. The Science teacher pp. 38-41