Lesson 8: Acids, Bases, and the pH Scale

I. **Time:** 50 minutes

II. **Materials:**
   b. PowerPoint Presentation: “Acids, Bases, and the pH Scale”
   d. Demonstration materials: acids, base, 2 beakers, litmus paper, vinegar, egg shells

III. **Objectives:**
After successful completion of the lesson, students will be able to:
   a. Define and describe acids and bases
   b. Compare and contrast acids and bases
   c. Define and draw the pH scale
   d. Define buffers and explain how they are related to biological systems.
   e. Explain how neutralization disassociation reactions relate to the formation and neutralization of acids and bases.

**Maryland State Objectives:**
   a. **Expectation 1.5:** The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.
      i. **Indicator 1.5.2:** The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.
   b. **Expectation 3.1:** The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes.
      i. **Indicator 3.1.1:** The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.
      ii. **Indicator 3.1.2:** The student will be able to discuss factors involved in the regulation of chemical activity as part of a homeostatic mechanism.
   b. **Expectation 3.2:** The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.
      i. **Indicator 3.2.1:** The student will explain processes and the function of related structures found in unicellular and multicellular organisms.
      ii. **Indicator 3.2.2:** The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism.

IV. **Lesson:**
   a. **Opening:** (5 minutes)
      i. Ask the students if they can describe or give them an example of acids and bases. You may want to demonstrate something like egg shells in vinegar. Also remind the students that these substances are water plus something else. It is the properties of water that create acids and bases in the first place. An acid and base are not two totally separate chemicals but are related.
   b. **Development:**
      i. Pass out the handout “Acids, Bases, and the pH Scale”.
      ii. Using a computer, bring up the PowerPoint file “Basic Chemistry part 2”
      iii. Show the presentation and have students follow along on their handouts and fill in the missing words on the blanks. **(20 minutes)**
         1. **Slide 1** – Tell the students we will be talking about Acids, bases, and Ph scale today.
         2. **Slide 2** – Ask the students where they have experienced acids burning.
         3. **Slide 3** – Demonstrate an acid turning litmus paper red.
         4. **Slide 4** – Ask the students what would happen if they let their hand soak in laundry detergent. Tell them that strong bases break down organic molecules like protein.
         5. **Slide 5** – Demonstrate that a base turns a litmus paper blue.
         6. **Slide 6** – Ask students how water might react with non-ionic compounds.
7. **Slide 7 & 8**– Have students follow along on their diagrams as you discuss the pH scale. Emphasize that the pH scale is a measurement of the concentration of hydrogen ions in solution. The numbers on the scale are from powers of 10. And as the scale changes one number the magnitude changes by 10.

8. **Slide 9**– Ask the students if they have ever heard the term “buffer” and talk about something that acts as a sponge towards change.

9. **Slide 10** – Ask the students to explain how sodium hydroxide acts as a buffer.

10. **Slide 11**– Ask the students to explain why buffers might be important in biology. Use blood as an example.

   iv. Have students read the handout “Acids and Bases” from http://www.biologyjunction.com/acids%20and%20bases.doc

   v. Instruct them read the first page, color the molecules in each reaction, and then answer the questions in groups of 2 or 3. *(20 minutes)*

   vi. You may wish to review the questions as a class.

   c. **Closing:** *(5 minutes)*

      i. Give each student group a topic to summarize for the rest of the class. Assign the topics acid properties, base properties, acid examples, base examples, ph Scale, and buffers.

V. **Suggested Assessments:**

   a. Have students draw and label the pH scale without looking at their notes.

   b. Give examples of biological buffers and ask the students to explain how they work.

   c. Student completion of “Acids, Bases, and the pH Scale” handouts will assess the above objectives.

VI. **Related Links/Resources:**

   a. The handout “Acids and Bases” from http://www.biologyjunction.com/acids%20and%20bases.doc illustrates the basics of acids and bases and is a suggested student activity for this lesson.