Models of the Hydrogen Atom at phet.colorado.edu

Lesson plan

Learning objectives: Students will be able to

- connect the importance of inference from experimental data.
- explain the concept of energy absorption and energy emission.
- identify the significance of only specific wavelengths of light being absorbed or emitted.

Background: My students are in regular chemistry and most have not had physics. We have done several PhET activities including Build an Atom and Isotopes, so they have a basic understanding of the constituents of atoms. I want to use this activity as an introduction to a chapter called "Electrons in Atoms" which includes three main topics: Models of the Atom, Electron Arrangement in Atoms, and Physics and the Quantum Model. This will be the first lab where students are asked to make "black box" inferences, so part of the lesson is about helping them understand the difference between direct observation conclusions and inferences. Another major goal is for students to get a base understanding that electrons on atoms have a variety of energies to prepare them for learning electron configuration.

Models of the Hydrogen Atom **Introduction:** The student directions include hints on using the sim. This is a complex sim, so I did make the activity guided-inquiry.

Lesson: My students will work in pairs or individually to complete the student pages. I am assigning this on a test day. Our periods are 90 minutes long, I like to have a reading assignment or PhET for students to work on if they complete the test early. Since this is a very abstract unit, I thought using a guided-PhET might fit the situation.

Post-Lesson: I will project the student directions and go through the Learning Goals and ask students to share what they discovered. I will have the sim running in the background for several minutes prior to the discussion so that a nice spectrum will be shown. I will also have a second copy of the sim running to use for discussion. I am thinking that for this group which have not had physics that using the **Neon lights and Discharge Lamps** sim with the **spectrum** open may be very helpful because there are 3 other common elements to compare with Hydrogen and the Energy Level diagram is visible. I will also use the textbook (Chemistry by Willbrahm, Staley, Matta, and Waterman. Pearson 2005edition section 5.1)

Follow-up sims: I thought about using **Neon lights and Discharge Lamps** as a demo or as an assignment. I am a little concerned that the students will get excited electrons confused with photons.

> **Lesson**: **Neon Lights and Discharge Lamps: Ask "Why do lighted signs have different colors?"**
> Learning Goals
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> - Provide a basic design for a discharge lamp and explain the function of the different components.
> - Explain the basic structure of an atom and relate it to the color of light produced by discharge lamps.
> - Explain why discharge lamps emit only certain colors.
> - Design a discharge lamp to emit any desired spectrum of colors.
>
> Then, have the students play with the sim and tell them to write their ideas about the learning goals and encourage them to use illustrations. Students might prepare a presentation instead of turning the assignment in. Have them use the sim during their presentation to help explain their ideas.

Next Activity: Aspen Hotel – an analogy for electron configuration (included on PhET page for this activity)

Adapted from Handout by Ashley Webb 9/7/2011

Post-Lesson: Have a class discussion and perhaps assign the students to investigate Photoelectric Effect or Neon Light and Discharge Lamps and do a writing assignment or oral presentations about the learning goals in it.