

In this activity, you will be conducting a virtual lab to analyze how atomic emission spectra are formed and how they differ between elements.

Virtual Lab: PhET Neon Lights & Other Discharge Lamps

You can find this simulation at <https://phet.colorado.edu/en/simulation/discharge-lamps>.

Part One: Relating Energy Changes to Light

1. Open the simulation, and choose Continuous for the Electron Production.
2. Next, select Configurable for Atom Type, set the # of levels to 2, and click the box next to Spectrometer.

3. Initially, the gap between the first and second energy level is very high. Look at the Spectrometer- what is the approximate wavelength of the light that is emitted?

4. Click and drag the “2” down in the energy level diagram about $\frac{1}{4}$ of the way down. What are the color and wavelength of the light that is emitted?

5. Continue to slide the second energy level closer to the first energy level. What is happening to the wavelength of light that is emitted as the electron falls back to the first energy level?

6. From these observations, how does the wavelength of light relate to its energy?

Part Two: Multiple Energy Level Changes

1. Now, choose Hydrogen for Atom Type. Click and drag the atom that is in between the two charged plates in the diagram to the left. What happens to the “Energy at collision” line in the energy diagram on the right hand side?

2. Keep the atom located so the “Energy at collision” line is near the top of the diagram and above all of the energy levels on the energy diagram. Start the simulation and let it run for 15 seconds.

Part Two: Multiple Energy Level Changes

3. Where are the majority of emission spectrum lines occurring? What does that tell you about the energy of the emission?

4. To what energy level are the electrons falling when these emissions take place?

5. How many different visible (between 400 and 700 nm) emissions are occurring?

6. Between which energy levels are the visible emissions taking place? Turn on “Squiggles” and click “Run in Slow Motion” to observe these.

7. How do the differences in the energy levels relate to the wavelength of light that is emitted?

Part Three: Multiple Atoms

1. Click on the Multiple Atoms tab at the top of the page, and click on Spectrometer under the energy diagram.

2. Do the wavelengths of the emissions change when there are now multiple hydrogen atoms compared to one hydrogen atom?

3. Now switch the atom to sodium. How does the spacing of the energy levels of a sodium atom compare to the hydrogen atom?

Part Three: Multiple Atoms

4. How do the wavelengths of the emissions for the sodium atom compare to the hydrogen atom?

5. Do these emission wavelength values fit in the understanding developed in Part 1 of the simulation? Explain.
