

Bohr Model of Hydrogen

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/bohr-model/>

Name: _____ Date: _____

Learning objectives

- Explain quantized energy levels in the hydrogen atom.
- Relate electron transitions to emitted or absorbed photons.
- Connect transitions to spectral lines.

Variables to change

- Initial energy level
- Final energy level

Procedure

1. Excite the electron to a higher level and watch it drop back.
2. Record the photon (color/wavelength) emitted for different transitions.
3. Compare transitions ending on $n=2$ (visible series) with others.

Observations

Record which transitions emit visible light and how photon energy relates to the size of the energy jump.

Questions

1. Why are only certain energies allowed?
2. What determines the energy of an emitted photon?
3. Which transitions produce visible light in hydrogen?

4. What happens when the electron absorbs a photon?
5. Why is the ground state ($n=1$) the most stable?

Answer key (instructors)

- **1.** The Bohr model quantizes the electron's orbits, so only discrete energy levels $E_n = -13.6/n^2$ eV exist.
- **2.** The difference between the two levels: $E_{\text{photon}} = E_{\text{high}} - E_{\text{low}} = hf$.
- **3.** The Balmer series — transitions ending at $n = 2$.
- **4.** It jumps to a higher level, but only if the photon's energy matches a level difference.
- **5.** It is the lowest energy level; the electron cannot drop any lower, so it stays there unless excited.

In the Bohr model the hydrogen electron occupies quantized levels $E_n = -13.6/n^2$ eV. Dropping between levels emits a photon of energy equal to the gap ($E = hf$); the specific gaps produce the discrete spectral lines, with $n \rightarrow 2$ transitions giving hydrogen's visible Balmer series.