Exciting Electrons

Background
Electrons are organized within an atom; they each “live” in a specific place within energy levels, which surround the nucleus. When an atom is left to its own device, the electrons are organized in what is called their ground state configuration. But when an atom is exposed to energy, electrons may absorb that energy and become excited. This means the electron is promoted to a higher energy level. The electron doesn’t stay there forever, it eventually returns to its ground state, and it releases the energy it initially absorbed. This energy is released in the form of a photon. In this activity, you will explore these ideas further with the help of a simulation.

Prelab questions

1. The simulation screen is shown above. The Energy Inventory (on the left) includes four energy quantities that can be used to excite the electron, currently in its Ground State. You will drag various amounts of energy that will be exposed to the electron into the ground state. When you click on the Excite! button (top right), that triggers the electron to absorb the energy. What do you think will happen immediately after clicking Excite!? Explain.

2. A few seconds after clicking Excite!, what do you think will happen, based on your answer to the previous question? Explain.
3. Why do you think there is an axis with the label Energy in the bottom right corner of the screen?

**Procedure**

2. Choose energy from the inventory that will excite the electron. You can choose one bar, or more than one bar. Indicate in the screen shot below the energy you chose. **Do not** yet click Excite! Predict what will happen.

3. Click Excite! Did you predict correctly what would happen? Explain.


5. Clear the simulation by clicking √.
6. Choose a different quantity of energy from the inventory. Indicate below the energy you chose. Do not yet click Excite! Predict what will happen to the electron and what you will see on the energy axis.
7. Click Excite! Did you predict correctly what would happen to the electron? Explain.


9. Clear the simulation by clicking ![clear](clear.png)

10. Have you received the message “Insufficient Energy Added Try Again!”? If yes, explain why you received that message. If no, choose energy from the inventory that you think may result in that message for step 11.

11. Choose a different quantity of energy from the inventory. Indicate below the energy you chose. Do not yet click Excite! Predict what will happen to the electron and what you will see on the energy axis.

12. Click Excite! Did you predict correctly what would happen to the electron? Explain.

14. Clear the simulation by clicking

15. Choose a different quantity of energy from the inventory. Indicate below the energy you chose. Do not yet click Excite! Predict what will happen to the electron and what you will see on the energy axis.

16. Click Excite! Did you predict correctly what would happen to the electron? Explain.


18. Clear the simulation by clicking

19. Refer to the photons you “observed” in questions 4, 8, 13, and 17. Identify what type of electromagnetic radiation each could be using this electromagnetic spectrum on the next page. Justify your choices.
20. If there was an additional excited state possible in this simulation, complete the diagram, including the energy needed to excite the electron to that excited state. Indicate what the energy axis would look like when the electron relaxes. Explain in words your justification for your drawings.

**Conclusion**
What did you learn from this investigation?