Atomic Spectra Virtual Lab

Name _____

Date _____

Period _____

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Atoms take in energy. Then they give it back as light. Each element gives off its own set of colors. In this lab you will light up gas tubes, look at them through spectroscope glasses, and zoom in to see why.

- ☐ I can tell which gas is in a tube from the bright lines in its spectrum.
- ☐ I can explain how an electron dropping to a lower energy level makes light of one color.

Part 1. Light it up (Bench view)

SEP 3, 4 · CCC Patterns

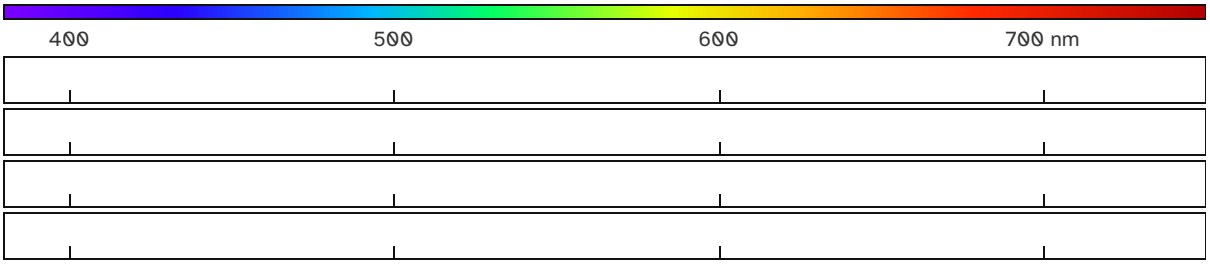
Click the **H** tube on the rack. Flip the switch on the power supply.

1. What color does the hydrogen tube glow? _____

Press **Put on spectroscope glasses**.

2. What happened to the glow when you put on the glasses?

3. Load each tube below. Look through the glasses. Draw the bright lines you see in the right place and color them in.



4. Fill in the table.

Gas	Color of the glow	How many bright lines?	Brightest line's color
Hydrogen			
Helium			
Neon			
Mercury			

READ FIRST. In the lab, find the yellow **Learn It** box and read it. Then answer 5.

5. Two tubes can glow almost the same color. Use the words **emission spectrum** to explain why the lines tell them apart better.

Part 2. Inside the tube (Click the lit tube. Press Single atoms, then Freeze.)

SEP 2 · CCC Cause and Effect

6. The small blue dots race through the gas. What are they, and where do they come from?

READ FIRST. In the lab, find the yellow **Learn It** box and read it. Then answer 7 and 8.

7. Find an atom with a photon leaving it. What had to happen to that atom first? Use the words **electron**, **energy level** and **photon**.

8. This model says "Not to scale." Name one way real atoms are different from the model.

NYSSLS: building toward HS-PS1-1, HS-PS4-4 (NYS Chemistry course map) and HS-ESS1-2 (DCI PS4.B: each element emits characteristic frequencies of light). Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept. See the teacher guide for the full alignment.

Part 3. One hydrogen atom (Load hydrogen, then press One atom)

SEP 4, 5 · CCC Energy and Matter

Use the drop buttons (**3 to 2**, **4 to 2**, and so on). Leave **Show wavelengths and colors** checked. Read the box at the top right after each drop.

9. Fill in the table.

Drop	Color of light	Wavelength (nm)	Energy released (eV)	Wavelength × Energy
n = 3 → n = 2				
n = 4 → n = 2				
n = 5 → n = 2				
n = 6 → n = 2				
n = 2 → n = 1				

10. Multiply each wavelength by its energy. Write it in the last column. What do you notice?

11. Which drop released the most energy? _____ Could you see its light? _____

READ FIRST. In the lab, find the yellow **Learn It** box and read it. Then answer 12.

12. Use your table to finish the pattern: A bigger drop releases _____ energy and makes light with a _____ wavelength.

Part 4. Mystery tubes (Press Mystery tube)

SEP 7 · CCC Patterns

Look at the glow and put on the glasses. Compare the lines to the **Fingerprints** chart. Make your guess before you press **Reveal**.

Trial	What lines did you see? (colors and where)	My guess	It was
1			
2			

13. Pick one mystery tube. **Claim:** It was _____. **Evidence:** Which lines proved it? **Reasoning:** Why do those lines prove it?

Part 5. More electrons, more colors

SEP 2, 6 · CCC Structure and Function

14. Load neon and turn it on. Look at the Energy levels diagram. About how many arrows are there? _____ (Hydrogen has only 4 visible lines.) Then load nitrogen (N_2) and look through the glasses. How do its lines look different from an atom's lines?

READ FIRST. In the lab, find the yellow **Learn It** box and read it. Then answer 15 and 16.

15. Use the words **electron** and **energy level** to explain why neon has so many more lines than hydrogen. Then explain why nitrogen makes bands instead of sharp lines.

Wrap it up

SEP 6, 8 · CCC Scale, Proportion, and Quantity

16. Scientists have never visited a star. But they know stars are made mostly of hydrogen and helium. Use what you learned to explain how they know.