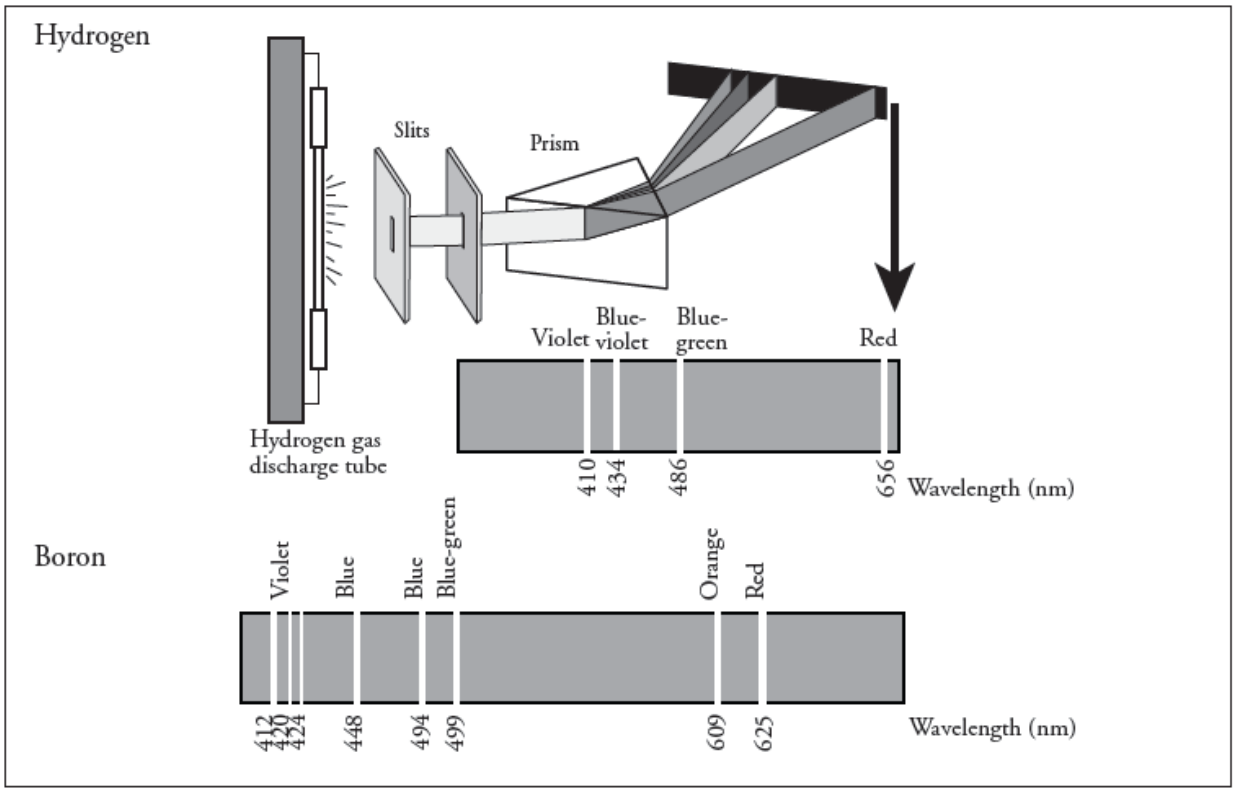
Name: _____ Date: _____ Period: _____ #: _____

Emission Spectra Practice

Model 2 – Emission Spectra for Hydrogen and Boron Atoms



1. Consider the **hydrogen** spectrum in Model 2.
   a. Which color of light corresponds to the shortest wavelength?
   b. Which color of light corresponds to the longest wavelength?
   c. Which color of light has the most energy?
   d. Which color of light has the least energy?

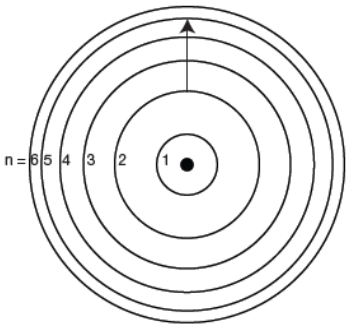
2. Does a gas discharge tube filled with boron emit the same wavelengths of light as a tube filled with hydrogen? Use evidence from Model 2 to support your answer.

3. "The spectral lines for atoms are like fingerprints for humans." How do the spectral lines for hydrogen and boron support this statement?

Circle the appropriate word to complete each statement in Questions 4–7:

4. Electrons and protons (attract/repel) each other.
5. As an electron gets closer to the nucleus the (attraction/repulsion) to the nucleus gets (stronger/ weaker).
6. For an electron to move from an energy level close to the nucleus to an energy level far from the nucleus it would need to (gain/lose) energy.
7. For an electron to move from an energy level far from the nucleus to an energy level close to the nucleus it would need to (gain/lose) energy.

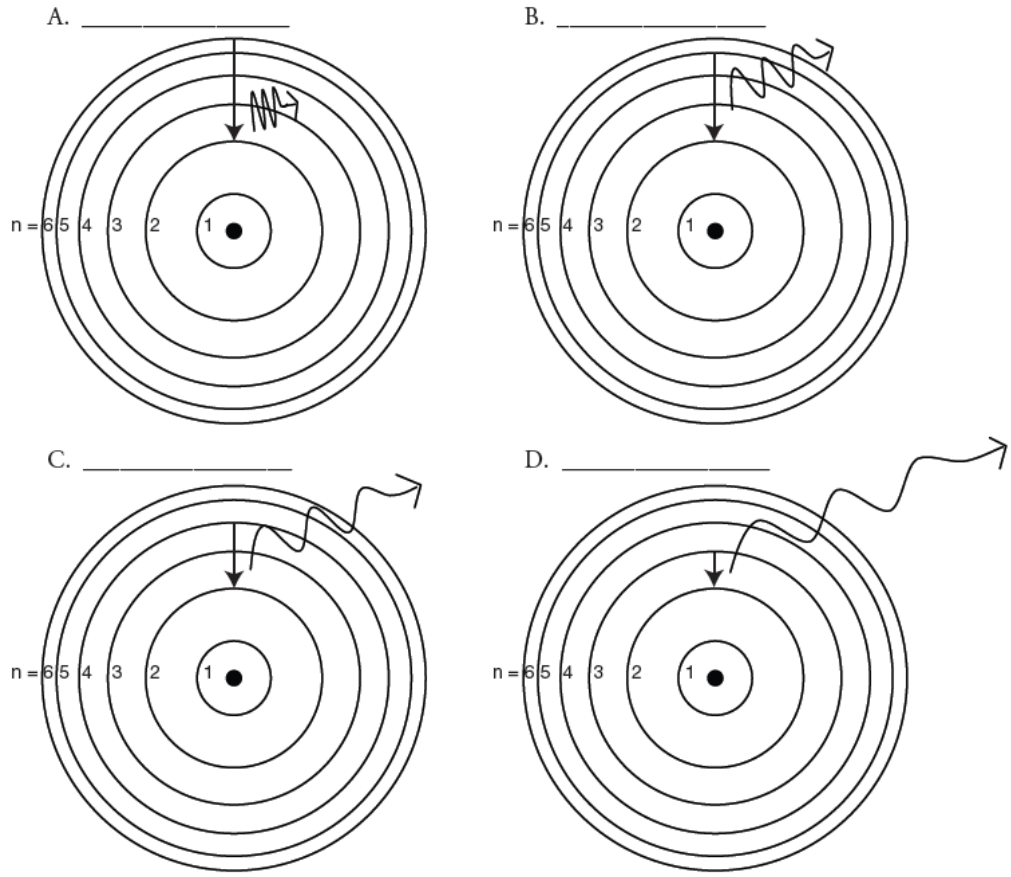
Read This! Niels Bohr modified Rutherford's Nuclear Atom model to explain how light interacted with the electrons in an atom to produce spectral lines. His model included electrons orbiting the nucleus at specific energy levels. Electrons absorb energy from various sources when they move from lower energy levels (ground state) to higher energy levels (excited states). Energy is released as electrons return to their lower energy levels.



8. Is energy absorbed or released for the electron transition shown to the right?

9. Identify the drawing (A,B,C, or D) in Model 3 that depicts a hydrogen atom with an electron moving from energy level **5 to 2**:
   - *a.* Label it with "n=5 to n=2" and color of light emitted.
   - *b.* This electron transition (absorbs/releases) energy.
   - *c.* This e^- moves from a (lower/ higher) energy state to a (lower/higher) energy state.
   - *d.* Is light absorbed or released in the electron transition?

Model 3 – Bohr Model of a Hydrogen Atom

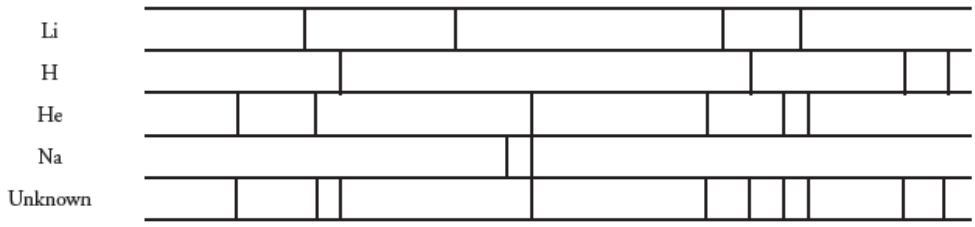


10. Label the other drawings with:
   - *a.* electron transitions that are occurring (n=? to n=?)
   - *b.* the wavelength and color (See Model 2 to identify the color of spectral lines produced in hydrogen. Use colored pencils to trace the light wave in each of the four pictures with the appropriate color.)

11. Explain why a single atom of hydrogen cannot produce all four hydrogen spectral lines simultaneously.

12. If Question 12 is true, how can we see all four colors from a hydrogen gas discharge tube simultaneously?

13. Below are diagrams for the bright line spectra of four elements and the spectrum of a mixture of unknown gases.



   - *a.* Which element(s) are not present in the Unknown?
   - *b.* Which element(s) are in the Unknown?