Energy Levels of the Hydrogen Atom

Name: _

When the electron in a hydrogen atom absorbs energy, it jumps to a higher energy level and is said to be in an "excited" state. The electron then spontaneously releases its energy and falls back to a lower energy level, called the "ground" state. The different frequencies emitted by the hydrogen atom in its emission spectrum correspond to different energy level transitions in the atom.

The visible spectrum

(approximate	wavelengths	are all	x 10-7 m)
approximate	wavelengens	arc an	A 10 · 111)

wavelength :	4.0	4.5	5.0	5.5	6.0	6.5	7.0	
color:	violet	blue	blue-green	green	yellow	orange	red	

1. a) Consider a sample of hydrogen atoms with their electrons in randomly distributed energy levels from n = 1 to n = 3. What different light bands would be found in the emission spectra?

- b) What bands would be found in the emission spectra of hydrogen with electrons randomly distributed in energy levels n = 1 to n = 5?
- 2. The electrons which drop from higher levels back to n = 2 produce light in the **visible** range. What transitions in question 1b which would result in visible light bands in the emission spectrum of hydrogen.
- 3. a) Which of the transitions you listed in question 2 above would be responsible for the red band in the hydrogen emission spectrum?
 - b) Which of the transitions above would correspond to the blue band in the visible emission spectrum of hydrogen?
- 4. a) What type of light do you think would be emitted by the hydrogen electrons which drop from higher levels back to energy level 1?
 - b) What type of light is emitted when hydrogen electrons fall from higher levels back to energy level 3?





5. a) Consider a sample of helium atoms with their electrons in randomly distributed energy levels from n = 1 to n = 3. What different light bands would be found in the emission spectra?

- b) What bands would be found in the emission spectra of helium with electrons randomly distributed in energy levels n = 1 to n = 6?
- 6. The electrons which drop from higher levels back to n = 2 produce light in the **visible** range. What are the transitions in question 5b which would result in visible light bands in the emission spectrum of helium.
- 7. a) Which of the transitions you listed in question 7 above would be responsible for the orange band in the helium emission spectrum?
 - b) Which of the transitions above would correspond to the violet band in the visible emission spectrum of helium?
- 8. a) What type of light do you think would be emitted by the helium electrons which drop from higher levels back to energy level 1?
 - b) What type of light is emitted when helium electrons fall from higher levels back to energy level 4?