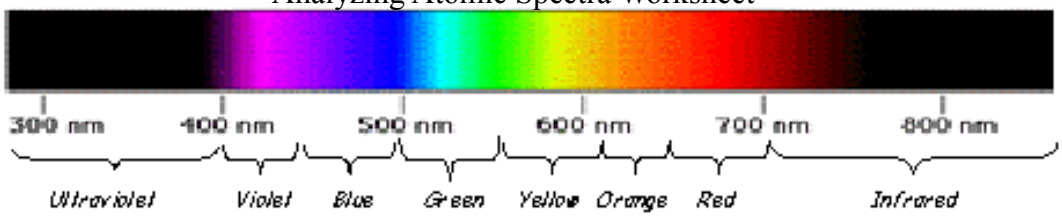
Name(s) _____Date:_____

Analyzing Atomic Spectra Worksheet



1. Look at the spectrum at the top of this page and determine the **colors** of the following four spectral lines? These are the four emission lines in the visible part of the spectrum for hydrogen.

410 nm _____ 432 nm _____ 486 nm _____ 656 nm _____

2. Arrange the following bands of light in order from longest wavelength on the left to shortest wavelength on the right. Remember that purple is short wavelength and high energy.

Radio Gamma Rays X-rays Visible Light Microwaves Infrared Ultraviolet

3. Arrange the same bands of light above in #1 in order from lowest frequency on the left to highest frequency on the right.

4. Arrange the same bands of light above in #1 in order from highest energy on the left to lowest energy on the right.

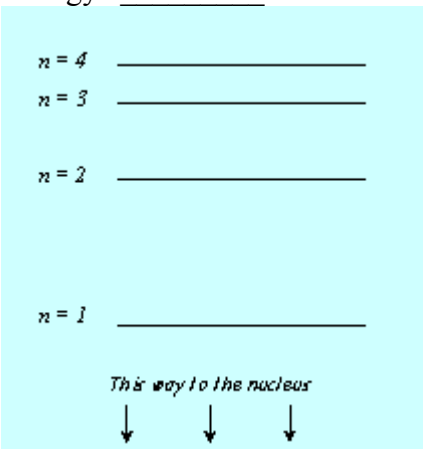
5. Which color of visible light has…

a) the shortest wavelength? _____ c) the least amount of energy? _____

b) the longest wavelength? _____ d) the greatest amount of energy? _____

6. The drawing on the right depicts only four of the many possible energy levels around the nucleus of an atom. Answer the following questions:

a) Draw arrows between energy levels for all possible energy transitions for this atom.



b) How many spectral lines will this atom produce from these energy levels?

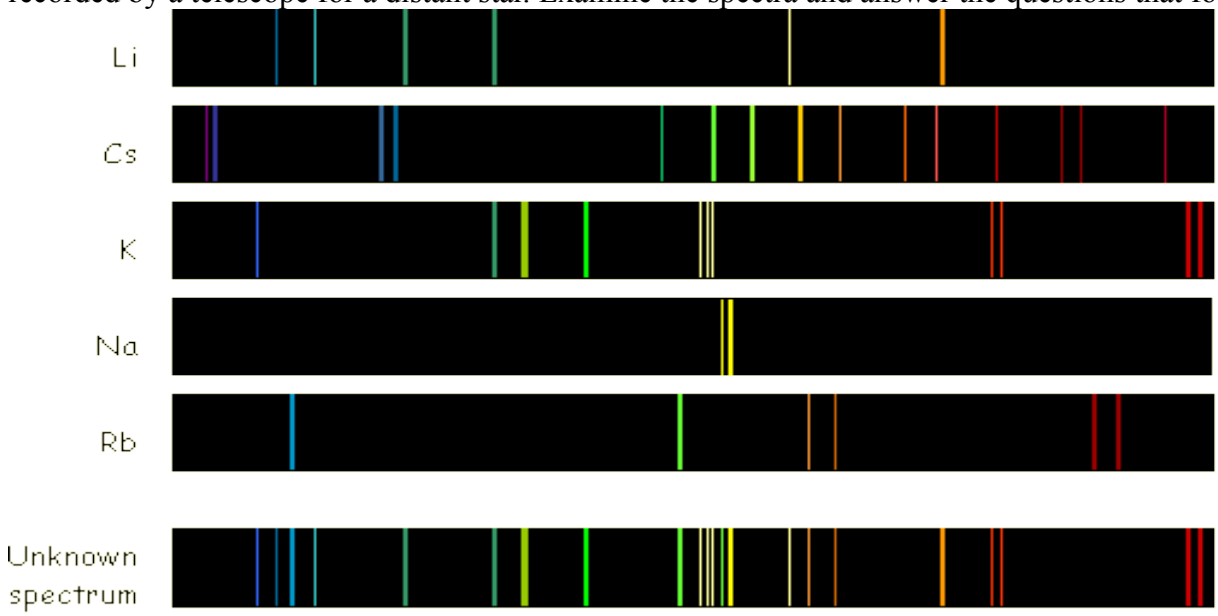
c) Which transition (from n = ___ to n = ___) will give you the highest frequency (shortest wavelength) of light?

d) Which transition (from n = ___ to n = ___) will give you the lowest frequency (longest wavelength) of light?

7. How does a hydrogen atom, which has only one electron, have so many spectral lines?

8. Why are spectral lines often referred to as “atomic fingerprints”?

9. Below you will find the known spectra for five common elements followed by the spectrum recorded by a telescope for a distant star. Examine the spectra and answer the questions that follow.



a) How does the light that astronomers see from distant stars and galaxies tell them that the same atoms with the same properties exist throughout the universe?

b) Which element is not in the star that produced the “unknown spectrum”? How can you tell?

14. Check out the two emission spectra below the full spectrum on the right. The top one is of the element lithium measured in a lab. The bottom one is the spectrum of a star taken with a telescope. The two spectra appear similar, but have some obvious differences. What are the differences, and how do you account for them?