

Analyzing Spectra Lab

Name: _____
Date: _____ Period: _____

Starlight, like any other light, separates into bands of color called a spectrum when it passes through a prism. However, a star's spectrum has dark bands along the spectrum. This is caused by the absorption of certain wavelengths of light by gas in the star's atmosphere. This type of spectra is known as an absorption spectrum.

Each element leaves a certain "fingerprint" of dark bands on a spectrum. Keep in mind, each element creates its own unique pattern of dark bands. Thus, by studying the bands in a star's spectrum, astronomers can tell what elements are present in the star. The same holds true for our sun.

In this activity, observe a spectra to determine the composition of the sun and several unknown stars. The known spectra produced by the elements sodium, helium, hydrogen, mercury, and calcium have been provided for you. These spectra were determined in a lab by passing light through gases of the "known" elements in order to see what bands they produced.

Objectives:

- 1) Understand how the spectrum produced by a star can be used to determine its elements.
- 2) Determine the composition of unknown stars using an absorption spectrum.

Materials: Colored Spectra, Ruler, Pencil

Problem: How would you use the spectrum of known substances in order to determine the elements present in unknown stars?

Form a Hypothesis:

If _____,
_____, then I will be able to determine the elements present in each of my unknown stars.

Procedures:

1. Using your ruler, you will match up the bands produced by all the "**known substances**" (ie. **sodium, helium, hydrogen, mercury, and calcium**) to each of our unknown star spectra.

**It is important to note that EVERY SINGLE line produced by the "known" element must be present in the unknown stars' spectra in order to determine that element is present.

2. Let's first compare our "known" substances with the spectra labeled "sun."
3. Compare the 4 lines produced by sodium gas with the "sun" spectra. If all 4 lines produced by sodium gas are present in the sun spectra, then we can say that our sun contains the element sodium. If yes, then record this element in the table for the sun.
4. Compare the 11 lines produced by helium gas with the "sun" spectra. If all 11 lines produced by helium gas are present in the sun spectra, then we can say that our sun contains the element helium. If yes, then record this element in the table for the sun.
5. Compare the 6 lines produced by hydrogen gas with the "sun" spectra. If all 6 lines produced by hydrogen gas are present in the sun spectra, then we can say that our sun contains the element hydrogen. If yes, then record this element in the table for the sun.

6. Compare the 9 lines produced by mercury gas with the “sun” spectra. If all 9 lines produced by mercury gas are present in the sun spectra, then we can say that our sun contains the element mercury. If yes, then record this element in the table for the sun.
7. Compare the 3 lines produced by calcium gas with the “sun” spectra. If all 3 lines produced by calcium gas are present in the sun spectra, then we can say that our sun contains the element calcium. If yes, then record this element in the table for the sun.
8. Repeat procedures 3-7 for the spectra of Unknown 1, Unknown 2, and Unknown 3. You will once again be comparing the spectra of the “known” substances to each of the Unknown spectra.

Data:

NAME OF STAR	ELEMENTS IN STAR
Sun	
Unknown 1	
Unknown 2	
Unknown 3	

Conclusion:

1. What is the name of the instrument that starlight must pass through in order to produce the rainbow colored spectrum? _____
2. What process produces the dark lines in the spectra? _____

3. What is the appearance of an absorption spectrum? _____

4. What is the appearance of an emission spectrum? _____

5. Which type of spectrum were you analyzing today? _____

6. How is a substance’s spectrum similar to a fingerprint? _____

Sodium



Helium



Hydrogen



Mercury



Calcium



Sun



Unknown 1



Unknown 2



Unknown 3



ANSWER KEY

HYPOTHESIS: IF I COMPARE THE BANDS OF THE KNOWN ELEMENTS WITH THE BANDS OF THE UNKNOWN STARS, THEN....

NAME OF STAR	ELEMENTS IN STAR
Sun	HELIUM, HYDROGEN, MERCURY
Unknown 1	SODIUM, HYDROGEN, CALCIUM
Unknown 2	HELIUM, CALCIUM
Unknown 3	HYDROGEN, MERCURY

- 1. PRISM**
- 2. THE GASES IN THE STAR ARE ABSORBING SPECIFIC COLORS OF LIGHT.**
- 3. RAINBOW SPECTRA WITH DARK BANDS.**
- 4. DARK SPECTRA WITH RAINBOW COLORED BANDS.**
- 5. ABSORPTION SPECTRA**
- 6. EVERY FINGERPRINT IS UNIQUE TO ONE PERSON, WHILE THE BANDS PRODUCED BY AN ELEMENT IN A SPECTRUM ARE ALSO UNIQUE ONLY TO THAT ELEMENT.**