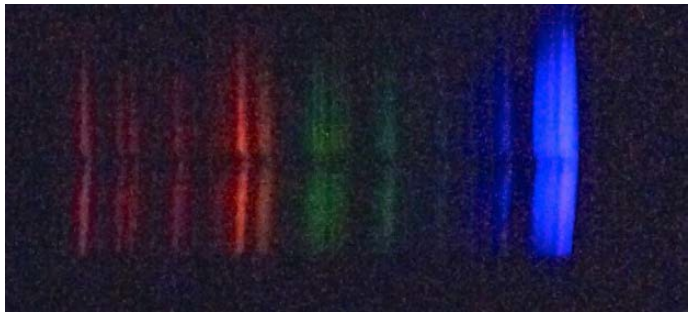
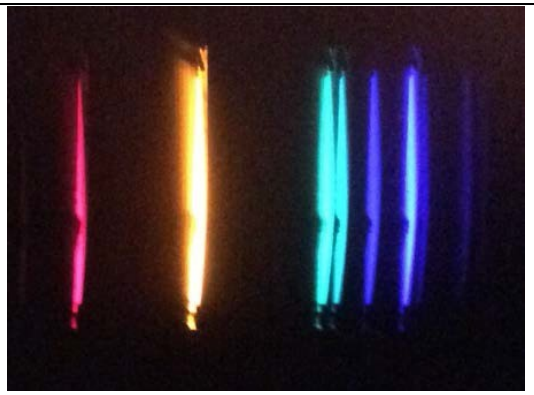
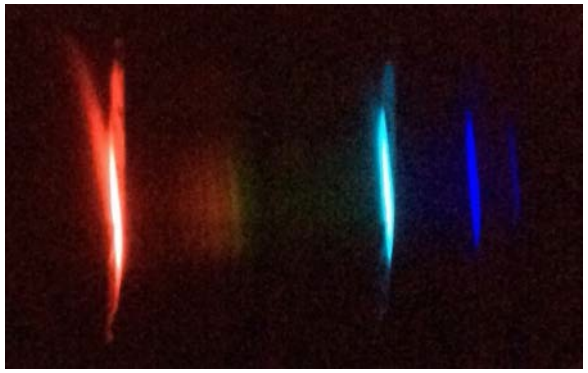
Known Chemical Element Spectra



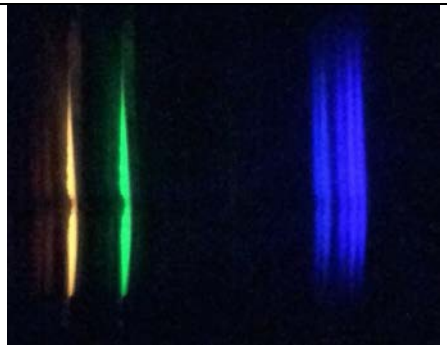
Argon (Ar)



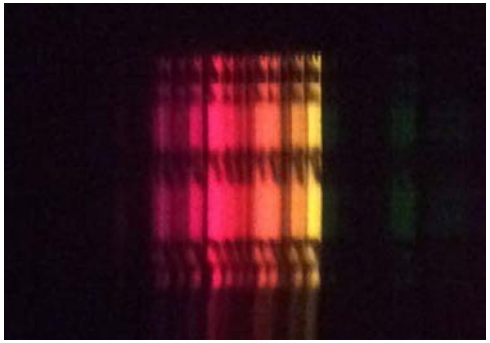
Helium (He)



Hydrogen (H)



Krypton (Kr)

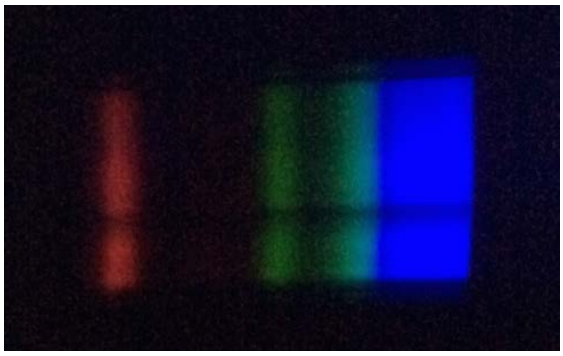


Neon (Ne)

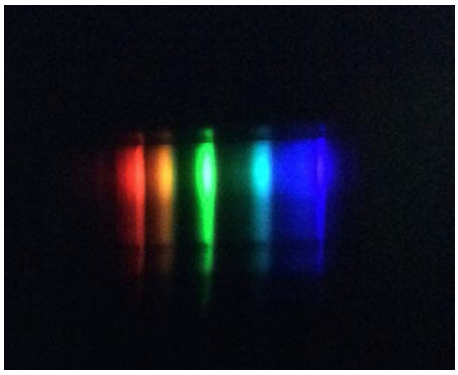
#: ____

Light Bulb Spectra

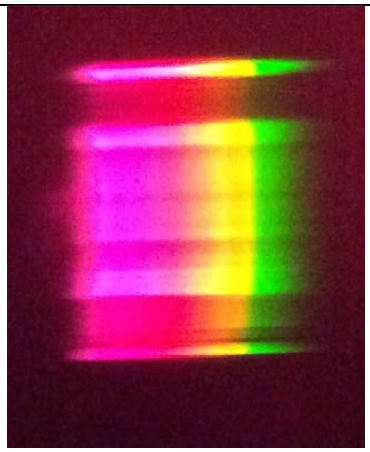
A

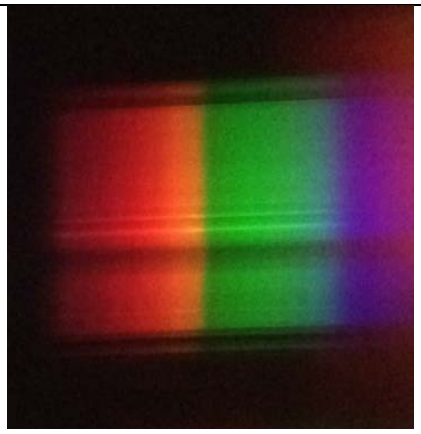


B



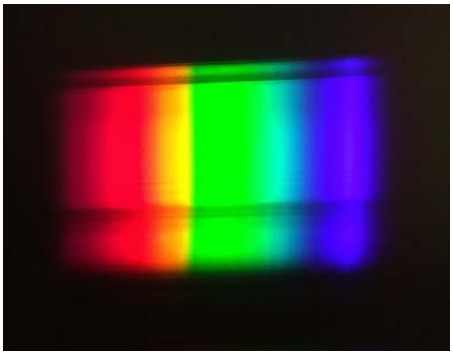
C





D

E



#: ____

SPECTRAL DETECTIVE

Purpose:

How can you identify a specific type of light bulb?

Hypothesis:

1. When scientists look at stars that are hundreds (or more) light years away, they can determine what chemical elements can be found in that star. How do you think that a scientist can do this even though the star is too far away for a spaceship to reach?

2. We are now going to watch a short video. At the conclusion of the video, re-answer the above question.

Materials:

- Cereal box
- Aluminum foil
- CD
- Tape
- Ruler
- Triangular protractor (or a 60-degree angle template)
- Scissors
- Various types of light bulbs

#: ____

SPECTRAL DETECTIVE

Procedure:

1. On Moodle, select the **Build Your Own Spectroscope** link (http://coolcosmos.ipac.caltech.edu/cosmic_games/spectra/makeGrating.htm).
2. Follow the directions to make your own spectroscope.
3. Point the spectroscope's slit at the first light bulb. Record the type of light bulb in the data table below.
4. Look through the opening at the top of the spectroscope and adjust the spectroscope until you see a spectrum (rainbow).
5. Use your phone or iPod to take a picture of the spectrum.
6. Sketch the spectrum in the data table below.
7. Compare the picture to the spectra on the **Light Bulb Spectra Sheet**. Look for the closest match.
8. Determine which known spectrum matches the type of light bulb and record its letter on the data table below.
9. Repeat for the other light bulbs.

Data:

Light Bulb Type	Spectrum Sketch	Known Spectrum Letter

Analysis:

How can you identify a specific type of light bulb? Write your response in CER (claim, evidence, reasoning) form. You can write this on the back of the lab sheet.

#: ____

SPECTRAL DETECTIVE

Conclusion:
Write a conclusion using the five things that should be in a good conclusion.

Design Challenge:

- Choose at least one aspect of the spectroscope to improve.
- Possible ideas:
  - Make the spectroscope more portable.
  - Reduce the amount of ambient (extra) light that enters the spectroscope.
  - Make the spectrum more sharp and clear (focused).
  - Have the spectroscope use fewer materials.
  - Make it easier to take a picture using the spectroscope.
  - Improve any other problems that you encountered.
- Build it and test it. Make any additional changes/modifications.
- Write a set of directions to build the new spectroscope.

#: ____

SPECTRAL DETECTIVE ACTIVITY #2

Purpose:

To identify unknown chemical elements using a spectroscope

Hypothesis:

Each glass tube contains a different chemical element in gas form. How can we use our spectroscopes to identify which chemical element is in each tube?

Materials:

- Spectroscope
- Glass discharge tubes, each containing a different chemical element
- Power supply to light the discharge tubes

Procedure:

1. Point the spectroscope's slit at the first light discharge tube. Record the letter on the discharge tube in the data table below.
2. Look through the opening at the top of the spectroscope and adjust the spectroscope until you see a spectrum (rainbow).
3. Use your phone or iPod to take a picture of the spectrum.
4. Sketch the spectrum in the data table below.
5. Compare the pictures to the spectra on the **Known Chemical Element Spectra Sheet**. Look for the closest match.
6. Determine the type of chemical element and record on the data table below.
7. Repeat for the other light bulbs.

#: ____

SPECTRAL DETECTIVE ACTIVITY #2

Data:

Discharge Tube Letter	Spectrum Sketch	Type of Chemical Element

Analysis/Conclusion:

How can you use a spectroscope to identify chemical elements? Write your response in CER (claim, evidence, reasoning) form.

Spectral Detective Summary Report

My activity was called Spectral Detective, and it involved the students following a set of directions to build a spectroscope that they would use to identify types of light bulbs as well as several chemical elements. The students then had an opportunity to improve the design.

The activity had several strengths.

- The students had to follow directions and measure accurately within a relatively tight tolerance to get the spectroscope to work correctly.
- The activity connects to both our study of properties of matter as well as waves and energy.
- The activity involves the students doing real science: using a spectroscope in much the same way a scientist would do.
- The activity uses primarily common household items and is inexpensive to complete.
- The activity has an engineering component where the students try to improve the design to solve one of the problems that they encountered.

The activity also had some weaknesses.

- The directions to make the spectroscope were somewhat confusing.
- The directions relied on the students having good measurement skills that many students have not yet developed.
- The activity, because of timing, was completed before we studied waves and energy.
- This was a totally new concept for most students so they did not know quite what they were supposed to see in the spectroscope. In other words, they did not know when their spectroscope was working correctly or what adjustments to make.
- We ran out of time for everyone to compete the design challenge. I made it extra credit, so in that sense the activity lost one of its strengths.

When I do this activity in the future, I would revise and improve it in several ways.

- I would revise the directions to make it more student-friendly (and include a lot of pictures).
- I would provide enough time for everyone to do the design challenge.
- I would find a scientist who could introduce and explain the uses of a spectroscope. I used a video that I found online, but an actual person (other than me) would be more effective.

Spectral Detective Summary Report

I also thought of a couple of possible extensions.

- The students could learn about the Doppler shift by looking at moving light sources to see how the spectrum would shift.
- The students could learn about how temperature affects the spectrum produced. In other words, the students could use the spectroscopes to find the temperature range of a light source.

Finally, the activity has a few cross-curricular opportunities.

- The major area is math. The students need to be able to measure with a ruler to the nearest quarter-inch and use a protractor to accurately draw an angle.
- The activity also connects with language arts because the students have to read a set of directions as well as write a set of directions for their improved design.
- The activity could connect to history because the students could research about the use of prisms and the development of the spectroscope.

Overall, the activity went well for a brand new, first time activity. I look forward to improving and using it in the future.