

Hands-On Lab Activities

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RET II
2002-2004

Name: _____ Period: _____

1st Science Survey

1. What grade are you in?
2. What school did you go to last year?
3. What was the last science class you had? When was it? Who was your teacher?
4. What activities/ labs/ projects did you enjoy in that class? **WHY?** (List as many as possible.)
5. What activities/ labs/ projects did you dislike in that class? **WHY?** (List as many as possible.)
6. Do you like/enjoy science? Do you dislike science? **WHY?** (Please be honest! This will not affect your grade.)
7. What does the word ***SCIENCE*** mean to you?
8. What does a scientist do?
9. What are some activities you would like to do in this class?

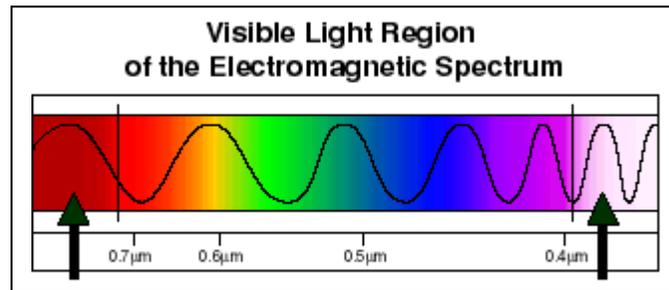
Visible Light Spectrum Lab

Objective:

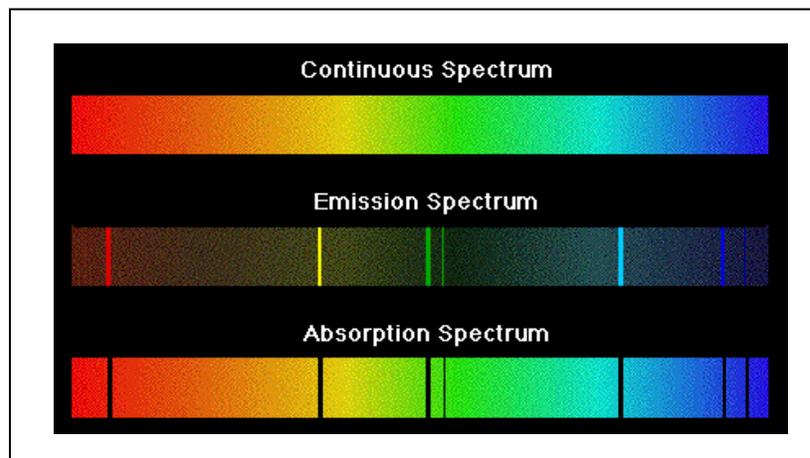
To investigate the basic properties of the visible light spectrum using emission tubes and spectroscopes.

Introduction:

In the study of astronomy, light is used to find the physical conditions, compositions and processes in distant objects (stars). A plot of the brightness of an object versus wavelength is called a *spectrum* and can be observed using a tool called a *spectroscope*.



There are three parts of a spectrum: *continuum emission* (or *blackbody radiation*), *emission lines*, and *absorption lines*. Every atom of a certain element will have the same pattern of lines all the time. The spacing between the lines is the same in both *absorption lines* and in *emission lines*.



We will be using spectroscopes to look at various elements that have been heated so that they have many emission lines. As you look through your spectroscope you will see a wavelength scale inside: 4 through 7, which represents a scale of 4000 Å through 7000 Å (Å stands for Angstroms).

Procedure:

1. As a class we will examine the light sources listed on your data table. They will not necessarily be shown in order.
 - a) Write down what type of spectrum you see (continuous, emission, absorption).
 - b) Draw a rough copy of the spectrum you see onto your data table. Show sharp and fuzzy lines, bright and faint lines.
 - c) Color in the spectrum in the appropriate places.
2. You will be shown a mystery gas. Compare the spectrum of the gas with those on your data table. What is the mystery gas?
3. Observe the overhead lights. Overhead lights are gas lamps with a white fluorescent coating placed on the tube. This coating distorts the spectrum and converts some blue light to redder colored light. Draw the spectrum you see onto your data table. Use the spectroscope to identify one of the gases found in the overhead lights.
4. Observe an incandescent lamp. Draw the spectrum you see onto your data table. While observing an incandescent lamp, separately take each of the colored filters and move them in front of the spectroscope. Describe what you see for each of the filters. What happened to the spectra?
5. Neon lights are made of colored tubing. Neon gas by itself emits a distinct spectrum and appears orange to the eye. How would you make a neon sign with blue and white lettering?
6. Observe light from the sun and draw the solar spectrum on your data table. ***NEVER LOOK DIRECTLY AT THE SUN!!!*** The Sun displays an absorption line spectrum. Examine the solar spectrum and locate the dark absorption lines. At what wavelengths do the dark absorption lines appear?
7. Observe a halogen lamp. Draw the spectrum you see onto your data table. Of the examples we've looked at today, what spectrum does halogen most closely resemble?

Name: _____

Visible Light Spectrum Lab- Data Sheet

Data Table:

Light Source	Spectrum Type	Colors Observed (Wavelength in thousands of Angstroms)						
		4	4.5	5	5.5	6	6.5	7
Argon								
Helium								
Hydrogen								
Mercury								
Neon								
Mystery Lamp								
Fluorescent (Overhead Lights)								
Incandescent								
Halogen								

Questions:

1. What is the mystery gas?
2. What gases can be observed in the fluorescent light?
3. Describe what you see happening with the following filters:
Red Filter-

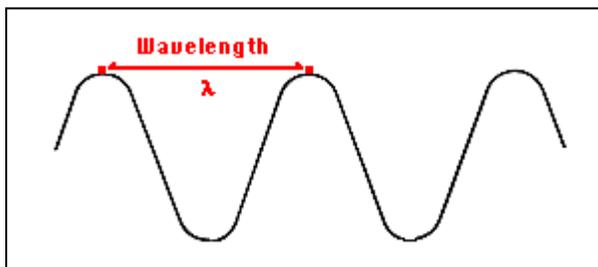
Blue Filter-

Green Filter-
4. How would you make a neon sign with blue and white lettering?
5. At what wavelengths do the dark absorption lines appear in the solar spectrum?
6. What has a spectrum most similar to the spectrum of a halogen lamp?

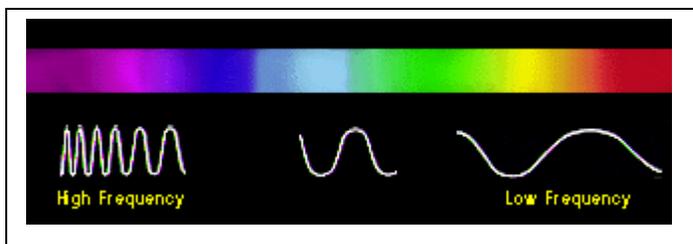
Visible Light Wavelength and Frequency Lab

Objective: Students will determine a constant relationship between the wavelength and frequency of colors within visible light.

Introduction: Visible light is part of the electromagnetic spectrum that we receive from the sun and is made up of the colors red, orange, yellow, green, blue, indigo, and violet (**ROY G BIV**). When sunlight passes through a prism, the light is bent and the colors within that light can be seen. All light travels in waves. Each type of light has its own specific wavelength and frequency. Wavelength is the distance between identical locations on waves that are next to each other.



Frequency is the number of wavelengths that pass a given point each second. Each color of light has a different wavelength. As shown in the diagram, red has the longest wavelength and violet has the shortest wavelength.



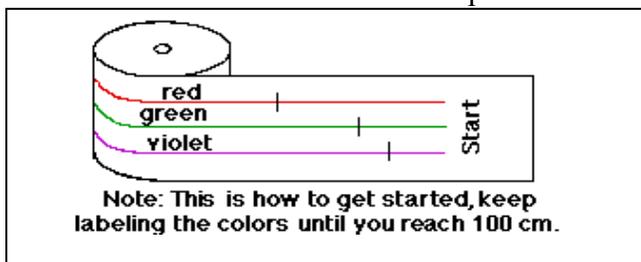
Materials:

Red, Green and Violet colored pencils
Manila folder
Masking tape

Meter stick
Scissors
140cm adding machine tape

Procedure:

1. Send one lab member to retrieve all materials.
2. Draw a vertical line 20cm from the beginning of the adding machine tape and label it "Start".
3. Draw a vertical line 100cm away from the start line and label it "End". There should still be 20 cm left over.
4. Draw three evenly spaced lines along the tape from "Start" to "End". The top line should be red and should be drawn 1cm down from the top. The middle line should be green and should be drawn 3cm down from the top. The bottom line should be violet and should be drawn 5 cm down from the top.



5. Divide the red line every 14cm and mark darkly with the red colored pencil every 14cm.
6. Divide the green line every 10cm and mark darkly with the green colored pencil every 10cm.
7. Divide the violet line every 8cm and mark darkly with the violet colored pencil every 8cm.
8. Use masking tape to fasten the “**End**” side of the adding machine tape to a pencil or pen and roll the adding machine tape up partway.
9. Open the manila folder and use a book to weight down the uncut side. The cut side should stand up straight.
10. Feed the “**Start**” end of the adding machine tape through the cuts on the manila folder until “**Start**” appears in the middle of the visible section.
11. **Trial Run (Use the Red Colored Line):**
 - One person will keep track of time. They will begin timing as they slowly pull the tape through the folder at a consistent speed. Make sure to note down the time when you are done.
 - One person will hold the pencil steady during the run.
 - One person will be a recorder and keep a tally of the wavelength marks as they become apparent.
12. **Trial 1 (Red Line):**
 - Use the same setup as above.
 - Be sure to pull the tape at a slow consistent speed.
 - Make sure to record the time and to tally the number of wavelength lines seen.
13. **Trial 2 (Green Line):**
 - Use the same setup as in the Trial Run.
 - Be sure to pull the tape at a slow consistent speed.
 - Make sure to record the time and to tally the number of wavelength lines seen.
14. **Trial 3 (Violet Line):**
 - Use the same setup as in the Trial Run.
 - Be sure to pull the tape at a slow consistent speed.
 - Make sure to record the time and to tally the number of wavelength lines seen.
15. Make sure everyone in the group has filled in the data on their own data sheets.
16. Determine the average number of wavelengths seen for each of the colors. Do not use the Trial Run data. To find the average, add the three totals and divide by three.
17. Determine the frequency for each of the colors. Do not use the Trial Run data. To find the frequency, divide the average for each color by the time.
18. Clean up the lab materials.
19. Answer the questions on the data sheet.

Name: _____

Visible Light Wavelength and Frequency Lab- Data Sheet

Data Table:

	<u>Trial Run</u>		Trial 1		Trial 2		<u>Trial 3</u>		Average (Total÷3)	Frequency (Average÷Time)
	Tally	Total	Tally	Total	Tally	Total	Tally	Total		
<u>Red</u>										
Green										
Violet										
Time										

Lab Questions:

1. Look at the wavelengths and frequencies of the three waves. What patterns do you notice about the relationships between the three colors?
2. Which color had the shortest wavelength?
3. Which color had the longest wavelength?
4. Which color had the highest frequency?
5. Which color had the lowest frequency?
6. What is the relationship of the red *wavelength* to the green *wavelength*?
7. What is the relationship of the red *wavelength* to the violet *wavelength*?
8. What is the relationship of the red *frequency* to the green *frequency*?
9. What is the relationship of the red *frequency* to the violet *frequency*?
10. If waves are moving at the same speed, what is the relationship between *wavelength* and *frequency*?
11. Based on the above relationship, if you were to look at a blue wave, would it have a higher or lower *frequency* than the green wave?
12. Based on the above relationship, if you were to look at an orange wave, would it have a longer or shorter *wavelength* than the green wave?
13. If **Velocity = Distance / Time**, what was the velocity of the waves in this lab?

White Hot Star Lab

Objective:

Students will experiment with a light bulb and some batteries to discover what the color of a glowing object reveals about the temperature of an object.

Introduction:

Stars come in different colors and have different levels of brightness. One star in the constellation Orion glows red; while Sirius, the brightest star in the sky glows a bluish white color. Astronomers use the color of light a star gives off to estimate the temperature of the stars.

Stars have **different colors** because they have **different surface temperatures**. **Emitted light** is the light that is **produced** by the object. Examples of emitted light include the light directly from flames, lamps, your computer screen and stars including the *Sun*. As materials get hotter they emit more light in different colors, while as they cool they emit less light and do it using different colors. Here you see a diagram of a bar of metal being heated from the left. It's hottest at the source of heat - "blue-white hot". It radiates away some of that heat so that a little further along the bar it is less hot; only "white hot", and it emits that color. The coolest portion is "red hot" and emits less heat than the other sections.



All stars are very hot! However, some stars are cooler or hotter than other stars. Cooler stars shine with more light in the yellow-orange-red areas of the spectrum. Hotter stars shine in the bluish areas of the spectrum. The following chart shows the relationship between the temperature of stars and their color.

<u>Class</u>	<u>Color</u>	<u>Surface Temperature (°C)</u>	<u>Elements Detected</u>	<u>Examples of Stars</u>
O	Blue	Above 30,000	Helium	10 Lacertae
B	Blue- White	10,000-30,000	Helium and Hydrogen	Rigel, Spica
A	Blue- White	7,500-10,000	Hydrogen	Vega, Sirius
F	Yellow- White	6,000-7,500	Hydrogen and Heavier Elements	Canopus, Procyon
G	Yellow	5,000-6,000	Calcium and other Metals	The Sun, Capella
K	Orange	3,500-5,000	Calcium and Molecules	Arcturus, Aldebaran
M	Red	Less than 3,500	Molecules	Betelgeuse, Antares

Materials:

Electrical tape, 2 conducting wires, Weak D cell battery, Flashlight Bulb, 2 Fresh D cell batteries

Procedure:

1. Tape one end of a conducting wire to the positive pole of the weak D cell battery. Tape one end of the second conducting wire to the negative pole.
2. Touch the free end of each wire to the light bulb. Hold one of the wires against the bottom tip of the light bulb. Hold the second wire against the side of the metal portion of the bulb. The bulb should light.
3. Record the color of the filament in the light bulb. Carefully touch your hand to the bulb. Observe and describe the temperature of the bulb. **(Data Sheet #1 & #2)**
4. Tape one end of a conducting wire to the positive pole of 1 fresh D cell battery. Tape one end of the second conducting wire to the negative pole.
5. Touch the free end of each wire to the light bulb. Hold one of the wires against the bottom tip of the light bulb. Hold the second wire against the side of the metal portion of the bulb. The bulb should light.
6. Record the color of the filament in the light bulb. Carefully touch your hand to the bulb. Observe and describe the temperature of the bulb. **(Data Sheet #3 & #4)**
7. Use the electrical tape to connect the two fresh D cell batteries in a continuous circuit so that the positive pole of the first cell is connected to the negative pole of the second cell.
8. Tape one end of a conducting wire to the positive pole of the top D cell battery. Tape one end of the second conducting wire to the negative pole of the bottom D cell battery.
9. Touch the free end of each wire to the light bulb. Hold one of the wires against the bottom tip of the light bulb. Hold the second wire against the side of the metal portion of the bulb. The bulb should light.
10. Record the color of the filament in the light bulb. Carefully touch your hand to the bulb. Observe and describe the temperature of the bulb. **(Data Sheet #5 & #6)**

Name: _____

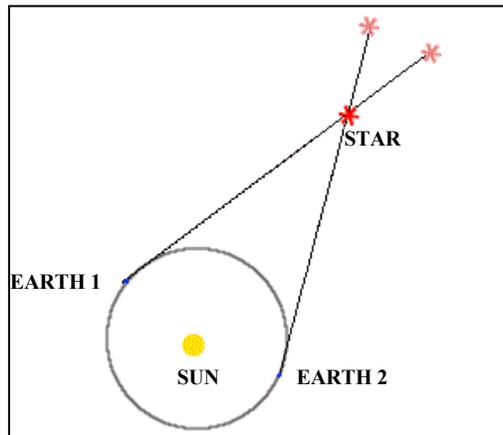
“White Hot” Star Lab- Data Sheet

- 1) What color was the light bulb with the weak D cell battery? Be as descriptive as possible.
- 2) Describe the temperature of the bulb with the weak D cell battery when you touched it. Relate the temperature to something else. Ex) The bulb was as hot as...
- 3) What color was the light bulb with the fresh D cell battery? Be as descriptive as possible.
- 4) Describe the temperature of the bulb with the fresh D cell battery when you touched it.
- 5) What color was the light bulb with 2 fresh D cell batteries? Be as descriptive as possible.
- 6) Describe the temperature of the bulb with 2 fresh D cell batteries when you touched it.
- 7) How did the color of the filament change in the three trials?
- 8) How did the temperature change in the three trials?
- 9) What information does the color of a star provide?
- 10) What color are stars with relatively high surface temperatures?
- 11) What color are stars with relatively low surface temperatures?
- 12) On the back, arrange the following stars in order from highest to lowest surface temperature and list the color that corresponds with each star. Alderbaran, Betelgeuse, Capella, Procyon, Rigel, Vega, 10 Lacertae.
- 13) What color is our Sun?
- 14) What temperature is our Sun?
- 15) What elements can be found in our Sun?
- 16) Which other star is similar to our Sun?
- 17) You go outside tonight and look at the sky through a telescope. You observe a bright blue star in the sky. What are 2 things you can tell me about that star?

Parallax Lab

Objective: To observe how parallax is used to determine the distance to stars.

Introduction: One of the most difficult problems in astronomy is determining the distance to objects in the sky. Objects can be measured in two ways, *directly* and *indirectly*. *Direct* measurements are made by stretching a tape or placing a ruler next to an object to find out how long it is. *Direct* measurements are made on objects that can be easily handled. If objects are too big or too far away, such as the case with planets and stars, *indirect* measurements must be made. **Parallax** is an example of an *indirect* measurement. The **parallax effect** is the apparent movement of an object when viewed against a stationary background from two different points. The distance to stars is calculated from the earth using two points, from opposite sides of the sun during the earth's orbit around the sun.



When astronomers measure parallax, they record the positions of the stars on film in cameras attached to telescopes. In this lab, you will set up a model of a telescope and use it to estimate distances.

Materials:

Masking tape, Paper clips, Pen, Black and red pencils, Metric ruler, Paper, Meter stick, Calculator, Lamp without shade (100 watt bulb), Box

Procedure:

STAR 1

- 1) Place a lamp in the middle of your lab station.
- 2) Place the box (your telescope) on your lab table so that the hole in the box points towards the light. Line the left side of the box up with the left edge of the table. Make sure the box is as close to the wall as possible.
- 3) Put a small piece of tape on the table below the hole. Use a pen to make a mark on the tape directly below the hole. This mark represents the position of the telescope when Earth is on one side of its orbit.
- 4) Take the piece of paper labeled **STAR 1** and place it inside the box with two paper clips. Make sure it is attached to the side opposite the hole.
- 5) Turn on the light to represent **STAR 1**.
- 6) With the **RED** pencil, mark the paper where you see a dot of light. Label this **Dot A**.
- 7) Move the box to the right edge of the table so that the sides line up.
- 8) Put a small piece of tape on the table below the hole. Use a pen to make a mark on the tape directly below the hole. This mark represents the position of the telescope when the Earth is on the other side of its orbit, six months later.
- 9) With a **BLACK** pencil, mark the paper where you see a dot of light. Label this **Dot B**.

- 10) Remove the paper.
- 11) Measure the distance in millimeters between **Dots A** and **B**. This distance represents the *Parallax Shift (mm)* for **STAR 1**. Be sure to record the measurement on your data table.
- 12) Measure the distance from the hole in your box to the paper at the back of the box in millimeters. This distance represents the *Focal Length (mm)* for **STAR 1**. Be sure to record the measurement on your data table.
- 13) Measure the distance between the two marks on your masking tape in millimeters. This distance represents the *Diameter of Orbit (mm)*. Be sure to record the measurement on your data table.
- 14) Measure the distance from the mark on your masking tape to the lamp in meters using a meter stick. This represents your *Actual Distance to Star (m)*. Be sure to record the measurement on your data table.

STAR 2

- 15) Move the lamp to the very edge of the lab table.
- 16) Take the piece of paper labeled **STAR 2** and place it inside the box with two paper clips.
- 17) Move the box back to the left side of the table so that the hole is directly above the mark on the masking tape.
- 18) Turn on the light to represent **STAR 2**.
- 19) With the **RED** pencil, mark the paper where you see a dot of light. Label this **Dot A**.
- 20) Move the box to the right edge of the table so that the hole is directly above the mark on the masking tape.
- 21) With a **BLACK** pencil, mark the paper where you see a dot of light. Label this **Dot B**.
- 22) Remove the paper.
- 23) Measure the distance in millimeters between **Dots A** and **B**. This distance represents the *Parallax Shift (mm)* for **STAR 2**.
- 24) Measure the distance from the hole in your box to the paper at the back of the box in millimeters. This distance represents the *Focal Length (mm)* for **STAR 2**.
- 25) Record your *Diameter of Orbit (mm)*; it'll be the same as for **STAR 1**.
- 26) Measure the distance from the mark in your masking tape to the lamp in meters. This represents your *Actual Distance to Star (m)*.

STAR 3

- 27) Move the lamp onto a desk a couple of feet away from your lab desk.
- 28) Take the piece of paper labeled **STAR 3** and place it inside the box with two paper clips.
- 29) Move the box back to the left side of the table so that the hole is directly above the mark on the masking tape.
- 30) Turn on the light to represent **STAR 3**.
- 31) With the **RED** pencil, mark the paper where you see a dot of light. Label this **Dot A**.
- 32) Move the box to the right edge of the table so that the hole is directly above the mark on the masking tape.
- 33) With a **BLACK** pencil, mark the paper where you see a dot of light. Label this **Dot B**.
- 34) Remove the paper.
- 35) Measure the distance in millimeters between **Dots A** and **B**. This distance represents the *Parallax Shift (mm)* for **STAR 3**. Be sure to record the measurement on your data table.
- 36) Measure the distance from the hole in your box to the paper at the back of the box in millimeters. This distance represents the *Focal Length (mm)* for **STAR 3**. Be sure to record the measurement on your data table.
- 37) Record your *Diameter of Orbit (mm)*; it'll be the same as for **STAR 1**.
- 38) Measure the distance from the mark on your masking tape to the lamp in meters. This represents your *Actual Distance to Star (m)*.

Prism Demonstration

Materials:

Projector, Prism, Red Filter, Green Filter, Blue Filter

Instructions:

- 1) Darken a room and shine the light from the projector through the prism so that the spectrum is visible on a white surface.

What will happen when a red filter is held between the prism and the spectrum? (Only the red part of the spectrum remains visible.)

- 2) Place the red filter between the prism and the spectrum.

Why did the other colors disappear? (The filter only allowed the red light to pass through.)

- 3) Repeat this procedure with the green and blue filters.

What will happen when red and blue filters are both held up? (No light will pass through.)

- 4) Place both red and blue filters between the prism and the spectrum.

Why did no light pass through the filter? (If the blue filter is held closer to the prism, the blue light passes through and then is blocked by the red filter. If the red filter is held closer to the prism, the red light passes through and then is blocked by the blue filter.)

Prism Demonstration

- 1. Describe what happens when a prism is placed on an overhead.**
- 2. What will happen when a red filter is held between the prism and the spectrum?**
- 3. Why did the other colors disappear?**
- 4. What will happen when a green filter is held between the prism and the spectrum?**
- 5. What will happen when a blue filter is held between the prism and the spectrum?**
- 6. What will happen when red and blue filters are both held up?**
- 7. Why did no light pass through the filter?**

Sunspot Demo

Objective:

Students will investigate how spheres and disks look from different angles.

Introduction:

Objects don't always look the same when viewed from different directions. This property is called perspective. Galileo used what he knew about spheres and disks viewed from different directions to show that sunspots are features on the surface of the sun, not objects between the Earth and the sun. In this activity you will investigate spheres and disks to see how Galileo arrived at his conclusions.

Materials:

Large Styrofoam ball, Small Styrofoam ball, Small Cardboard disc, toothpick, tape

Procedure:

- 1) Observe the small ball. Make a sketch of the small ball.
- 2) Rotate the ball 90° , and then make another sketch of the ball.
- 3) Did the shape of the ball change? Why or why not?
- 4) Observe the cutout disk upright. Make a sketch of the disk.
- 5) Rotate the disk 45° , and then make another sketch the disk.
- 6) Rotate the disk another 45° for a total of 90° , and then make another sketch of the disk.
- 7) Did the shape of the disk change? Why or why not?
- 8) Attach the small sphere to the larger sphere using a toothpick, at about the place of the equator.
- 9) Start with the small sphere facing you and make a sketch.
- 10) Rotate the larger sphere 45° , and then make another sketch of the spheres.
- 11) Rotate the larger sphere another 45° for a total of 90° , and then make another sketch of the spheres. This is what a very large planet near the sun would look like as it orbits the sun.
- 12) Remove the small sphere and attach the disk using tape.
- 13) Start with the disk facing you and make a sketch.
- 14) Rotate the larger sphere 45° , and then make another sketch of the sphere and disk.
- 15) Rotate the larger sphere another 45° for a total of 90° , and then make another sketch of the sphere and disk. This movement is what happens to sunspots as the sun rotates. This change in shape is called foreshortening.

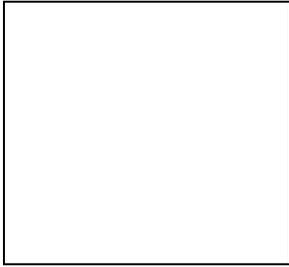
Discussion Questions:

- 1) How did the shape of the small sphere change as it moved across the surface of the large sphere?
- 2) How did the shape of the disk change as it moved across the surface of the large sphere?
- 3) You are out looking in a telescope at night. You see a shape pass in front of the sun and you hypothesize that it is a new planet. What would need to be seen as the planet travels across the sun to prove that it was actually a planet and not a sunspot?

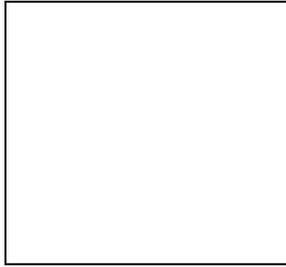
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Sunspot Demo- Data Sheet

1. Sketch of small ball.

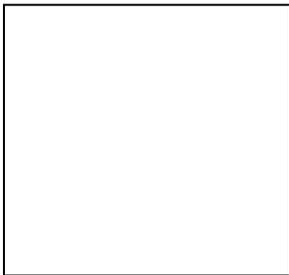


2. Sketch of small ball at 90°.

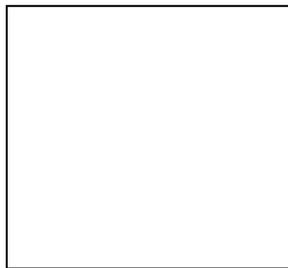


3. Did the shape of the ball change? Why or why not?

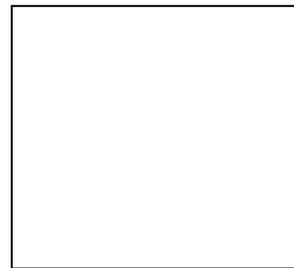
4. Sketch of disk.



5. Sketch of disk at 45°.

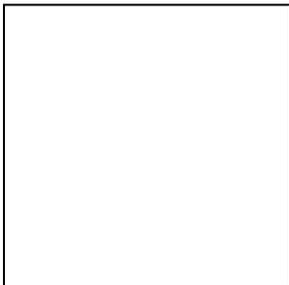


6. Sketch of disk at 90°.

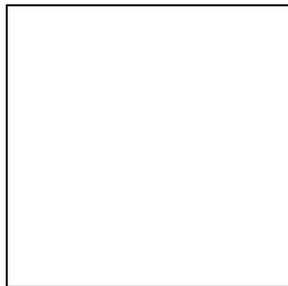


7. Did the shape of the disk change? Why or why not?

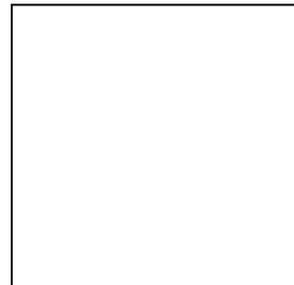
8. Sketch of spheres.



9. Sketch of spheres at 45°.



10. Sketch of spheres at 90°.



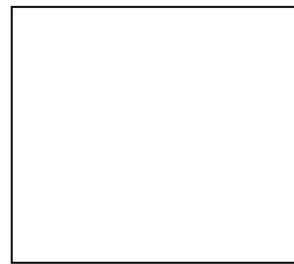
11. Sketch of sphere
& disk.



12. Sketch of sphere
& disk at 45°.



13. Sketch of sphere &
disk at 90°.



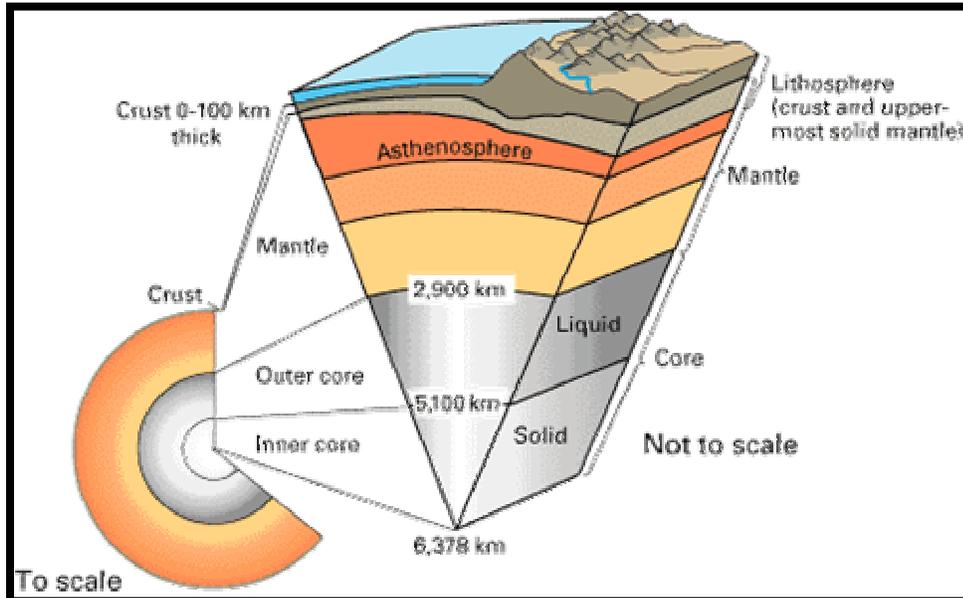
Crustal Density Lab

Objective:

Students will determine the differences in density of the Earth's continental and oceanic crusts.

Introduction:

The earth is made up of 4 main layers: the inner core, the outer core, the mantle and the crust. The lithosphere is made of the crust and the upper portion of the mantle. The lithosphere is broken up into smaller pieces called plates. These plates float on top of the asthenosphere.

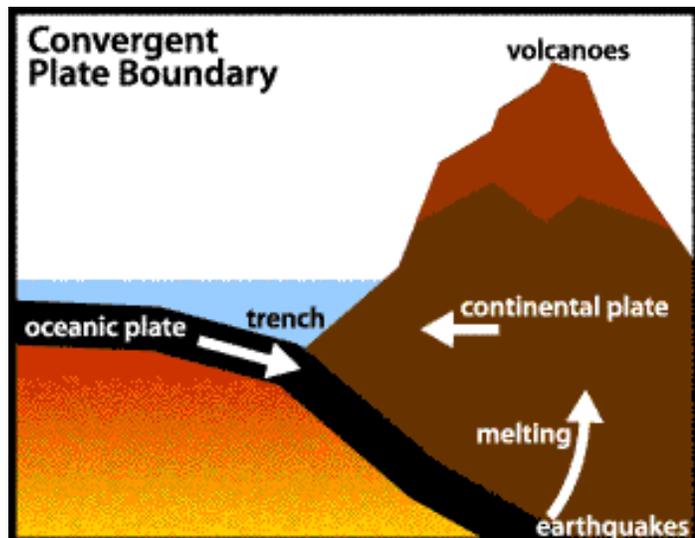


We live on the top of the crust. There are two main types of crust: continental crust and oceanic crust. The continental crust is composed mostly of granite. The oceanic crust consists of a volcanic lava rock called basalt. The basalt rock of the oceanic crust is much denser and heavier than the

granite rock of the continental crust. This means that the lighter continental crust rides on top of the denser oceanic crust.

Crust under the oceans, called oceanic crust, is much thinner than continental crust. It is only about 5 km thick while continental crust can be up to 65 km thick. Oceanic crust is made of a denser collection of minerals than continental crust. Oceanic crust consists of young basalt that is less than 200 million years old and that is presently forming at mid-ocean ridges. Since so much of the Earth is covered in ocean, almost two thirds of the Earth's surface is covered with oceanic crust.

Continental crust is on average older, more silica-rich and thicker than oceanic crust. The oldest parts of the continental crust include some rocks that are nearly 4 billion years old. New continental crust is still being generated at subduction zones. The average thickness of the continental crust is about 40 km, but beneath parts of



the Andes and the Himalaya mountain ranges the crust is more than 70 km thick.

Materials:

10 Samples of Oceanic Crust (Basalt)

10 Samples of Continental Crust (Granite)

Scales

250ml Graduated Cylinder

Procedure:

1. Record the mass and the volume of the ten different samples of oceanic crust on Table 10-1. Complete the following steps separately for each of the samples. Be sure not to mix up your samples.
 - a) Use the scale to find the mass, but be sure to zero the scale before placing the samples on the scale.
 - b) Fill the graduated cylinder to 100ml with water.
 - c) Carefully place your sample in the graduated cylinder along with the water.
 - d) Measure the new level of the water.
 - e) Volume of sample = New level – 100ml
 - f) Carefully empty the graduated cylinder. Dump water down the drain. Place the sample on a piece of paper towel to dry.
2. Record the mass and the volume of the ten different samples of continental crust on Table 10-2. Complete the above steps separately for each of the samples. Be sure not to mix up your samples.
3. Using the data you found above, calculate the density for each of your samples and record it in the appropriate column of your tables.

$$\text{Density} = \text{Mass} / \text{Volume}$$

4. Use the data from the ten oceanic crust samples in Table 10-1 to find: **a) average mass**, **b) average volume** and **c) average density**. To find the average, add the data from the ten samples and then divide by ten.
5. Use the data from the ten continental crust samples in Table 10-2 to find: **a) average mass**, **b) average volume** and **c) average density**. To find the average, add the data from the ten samples and then divide by ten.

Name: _____

Crustal Density Lab- Date Sheet

Table 10-1: Oceanic Crust

Sample Number	Mass (gram)	Volume (cm ³)	Density (gram/cm ³)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Average			

Questions:

1. Which type of Earth's crust is the densest?
2. Which type of Earth's crust is the least dense?
3. What type of rock makes up the continental crust?
4. What type of rock makes up the oceanic crust?
5. Which type of rock is the densest?
6. Which type of rock is the least dense?
7. Describe what would happen if a tectonic plate made of oceanic crust collided with a tectonic plate made of continental crust.
8. How is this influenced by their differences in density?

Table 10-2: Continental Crust

Sample Number	Mass (gram)	Volume (cm ³)	Density (gram/cm ³)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Average			

9. Describe the differences in density and rock types of oceanic and continental crust. Explain how these differences influence the interactions of tectonic plates.

Plate Boundaries Lab

Objective:

Students will investigate the three types of plate boundaries and model the resulting land formations that occur at each of the boundaries.

Introduction:

The earth is split up into three different layers. The top layer is called the crust and the crust is broken up to many pieces called plates. There are roughly about 20-30 plates that make up the top portion of the earth. These plates move around and have interactions with each other. The three main ways that the plates interact are called plate boundaries.

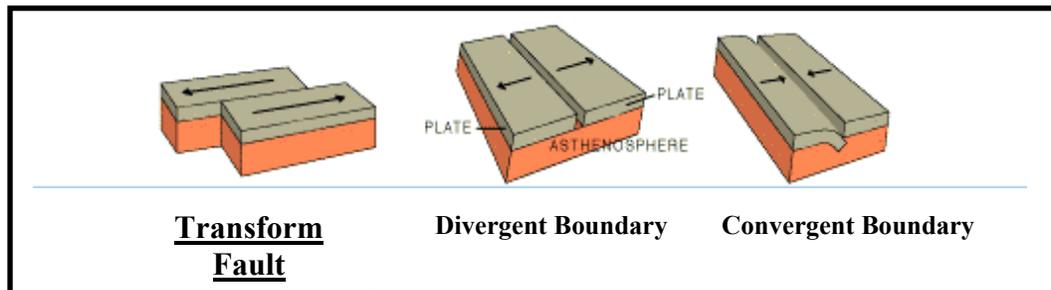
The first type of plate boundary is a ***divergent boundary***. Divergent boundaries occur when two plates move away from each other creating new crust. The best-known divergent boundary is the Mid-Atlantic Ridge.

Another type of plate boundary is a ***convergent boundary***. Convergent boundaries occur when two plates slowly collide together. There are three ways that plates can converge. Convergence can occur between an oceanic and a largely continental plate, or between two largely oceanic plates, or between two largely continental plates. In the lab today we will only be looking at collisions between two continental plates.

The last type of plate boundary is a ***transform fault boundary***. Transform Fault boundaries occur when two plates slide past each other. These plate boundaries tend to produce large quantities of earthquakes. The most famous Transform Fault boundary is the San Andreas Fault, only about 60 miles east of us.



In this lab we will be making representations of these three types of boundaries and looking at the landforms that are formed by these interactions.

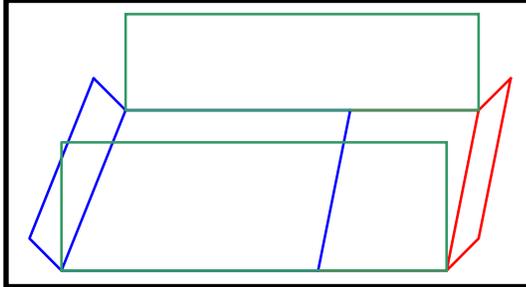


Materials:

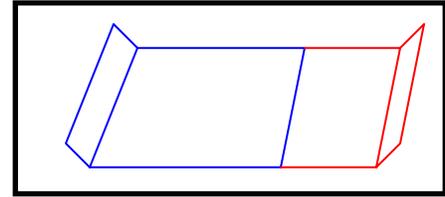
- Plastic Tray
- Beaker of Sand
- 2 Large Index Cards- Bent
- 2 Large Index Cards- Straight

Procedure:

1. Take the two bent cards and place them in the tray so that their bottoms overlap by at least two inches.



2. Have one person hold up



the straight cards against the two unbent sides.

3. Using the beaker of sand, fill up the area in between the 4 cards with sand. Carefully level out the

sand.

Trial 1:

4. Slowly push the two bent index cards towards each other. Observe the formation formed by the sand as you do this. Record your observations on the data sheet.

5. Carefully level out the sand so that it is flat again.

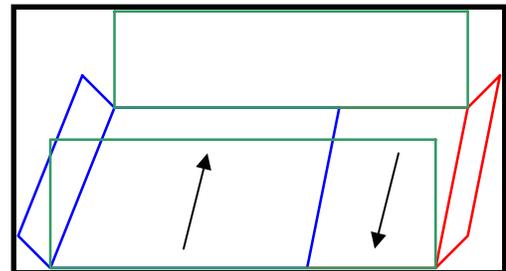
Trial 2:

6. Slowly pull the index cards away from each other. Observe the formation formed by the sand as you do this. Continue pulling the cards apart until you return to the starting position, the cards should overlap by about 2 inches. Record your observation on the data sheet.

7. Carefully level out the sand so that it is flat again.

Trial 3:

8. Slowly glide the index cards past each other in opposite directions. Observe the formation formed by the sand as you do this. Record your observation on the data sheet.



9. Clean up all your materials. Carefully pour the sand back into the beaker.

Name: _____

Plate Boundaries Lab- Data Sheet

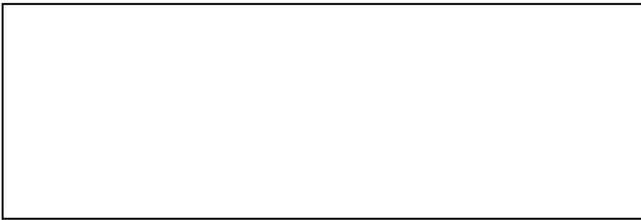
Pre-Lab:

1. What are the 4 layers of the earth?
2. What is plate tectonics?
3. What are the three types of plate boundaries?

Lab Data:

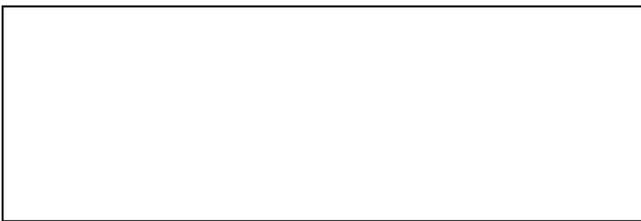
4. Describe what you observed when you pushed the two cards together in Trial 1.

5. Draw a picture of the results from Trial 1.



6. Describe what you observed when you pulled the two cards apart in Trial 2.

7. Draw a picture of the results from Trial 2.



8. Describe what you observed happening when you glided the two cards past each other in Trial 3.

9. Draw a picture of the results from Trial 3.



Post-Lab:

1. What type of plate boundary did Trial 1 represent?
2. What type of land feature is formed from this type of plate boundary?
3. Where on earth is there one example of this type of land feature?
4. There are three distinct types of this plate boundary, what are they?
5. What type of plate boundary did Trial 2 represent?
6. What type of land feature is formed from this type of plate boundary?
7. What is continually being created at this type of plate boundary?
8. Name one place on earth where you can see this type of plate boundary.
9. What type of plate boundary did Trial 3 represent?
10. What usually occurs at this type of plate boundary?
11. Name one place on earth where you can see this type of plate boundary.
12. You are talking with a friend from Nebraska. He tells you that you are crazy to live in California. Based on plate tectonics, what are two reasons he could give to think living in California is crazy.
13. Give a list of the natural disasters caused by plate tectonics. List at least 3. (More than 3 is worth extra credit!)

Earth Layers Demo

Materials:

Styrofoam Ball (Hollowed Out)

Water Balloon

Clay

Rectangular Crackers

Procedure:

1. What are the 4 layers of the earth?
2. How would you describe the crust?
3. How would you describe the mantle?
4. How would you describe the outer core?
5. How would you describe the inner core?
6. If you were to use the following items, what would represent the crust? The mantle? The outer core? The inner core?
7. Draw a picture of our example. Be sure to label the 4 layers.
8. What are some other everyday items you could use to make a model of the earth's layers?

Earth Layer's Demo

1. What are the 4 layers of the earth?
2. How would you describe the crust?
3. How would you describe the mantle?
4. How would you describe the outer core?
5. How would you describe the inner core?
6. If you were to use a styrofoam ball, a water balloon, some thin rectangular crackers, and clay, what would represent the crust? The mantle? The outer core? The inner core?
7. Draw a picture of our example. Be sure to label the 4 layers.
8. What are some other everyday items you could use to make a model of the earth's layers?

Convection Current Demo

Objective: To demonstrate convection currents in water and attempt to show how similar convection currents may be the cause of plate motion.

Materials:

Clear Plastic Pan

Cold Water

5 Styrofoam Cups

2 Food Colorings with Dropper

Hot Water

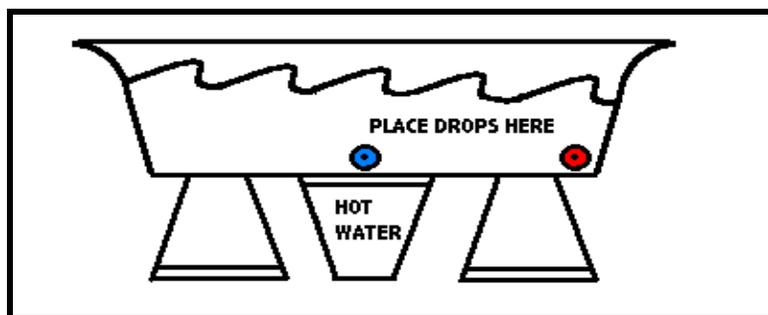
2 Popsicle Sticks

Metric Ruler

3 Thermometers

Procedure:

1. Fill the tray with cold water.
2. Record the temperature of the water in the tray.
3. Place the tray on 4 evenly spaced styrofoam cups. The cups should be turned upside down.
4. Fill the 5th cup with hot water and slide it under the center of the tray.
5. Place a couple drops of food color inside the tray, on the bottom in the center above the hot water cup.
6. Place a couple drops of the second food color inside the tray, on the bottom on the outside edge of the tray.
7. Observe for a couple of minutes.
8. Place one of the craft sticks onto the water's surface about 3cm to the left of the center of the pan. Place the second stick about 3 cm to the right of the center of the pan. Make sure the sticks are parallel to each other.
9. Observe the sticks for a couple of minutes.
10. Measure the temperature of the water in the center of the pan. Measure the temperature of the water at both of the edges of the pan.



Name: _____

Convection Current Demo

Pre-Demo:

1. What is a convection current?
2. What are some examples of convection? (At least 3.)

Demo:

3. What was the temperature of the water in the tray?
4. Describe the motion of the food coloring in the tray.

5. Draw a picture showing the movement of the food coloring. →



6. Describe the motion of the popsicle sticks in the tray.

7. Draw a picture showing the movement of the popsicle sticks. →



8. Temperatures at end of demo.

Edge	Center	Edge

Post-Demo:

9. Which way did the warm water move?
10. What happened to the warm water when it reached the surface?
11. Which way did the cooler water on the edges move?
12. Why does warm water rise? What happens to it?
13. Why does cold water sink? What happens to it?

9. What suggestions do you have to make the activities in this class better?