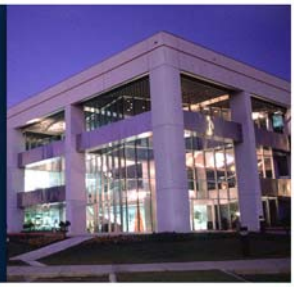
Classroom Visit Pre/Post Materials



NATIONAL HIGH MAGNETIC FIELD LABORATORY
FSU • UF • LANL

FLORIDA STATE UNIVERSITY
VIRES ARTES MORES
1851

NATIONAL SCIENCE FOUNDATION

The National High Magnetic Field Laboratory
Center for Integrating Research and Learning
1800 East Paul Dirac Drive
Tallahassee, Florida 32310
(850) 644-7191 * Fax: (850) 644-5818

Table of Contents

The National High Magnetic Field Laboratory

What is the NHMFL?

- The National High Magnetic Field Laboratory is a working science research laboratory utilizing state-of-the-art high magnetic field research systems. It is a world leader in magnet-related research and technology.

- The laboratory is one of nine in the world and the only one in North and South America. It was established in 1990 by the National Science Foundation and the State of Florida and is operated by the Florida State University, the University of Florida, and Los Alamos National Laboratory.
- The NHMFL brings together distinguished scientists and technicians from many disciplines including physics, chemistry, biology, geology, engineering, and materials science.
- Research at the NHMFL has implications and applications in medicine, energy, communications, electronics, the environment, transportation, and materials research and development.
- The laboratory is committed to enhancing science education with extensive educational programming at all levels.

How will your students benefit from the visit and the suggested activities?

- Students will hear firsthand about what is done at a science research laboratory.
- Students will learn about diverse career opportunities in science and scientific research.

Pre-Visit Activities

The suggested pre-visit activities introduce students to basic ideas about the topic and the processes of science. Activities are correlated to the Sunshine State Standards and also include reading and writing extensions.

Post-Visit Activities

The suggested post-visit activities are designed to reinforce and expand upon what was learned by your students during the visit. The activities encourage students to analyze their ideas and spark further interest in science.

The NHMFL Education Website

You and your students are encouraged to visit the NHMFL education Website before and after your visit:

http://education.magnet.fsu.edu

Pre-Outreach Activity: What Do We Already Know?

Teacher Background:

A simple, yet effective learning strategy, a K-W-L chart, is used to help students clarify their ideas. The chart itself is divided into three columns:

K	W	L
What we **K**now	What we **W**ant to know	What we **L**earned

Materials:

- Chart Paper
- Markers

Activity Instructions:

1. Copy the K-W-L chart and pass out so that each student has their own sheet. Explain how the chart is to be filled out, then brainstorm with the class and have the students list everything that the they know about light and lenses. There are no right or wrong answers.

2. Next have the students list everything that they want to know about light and lenses. You may need to provide prompts such as:

If light experts were here, what questions would you ask them?

If you were a scientist, what would you like to discover about light?

3. Keep the chart accessible so that you and the students can enter ideas, new information, and new questions, at any time. The class can return to the K-W-L chart after completing the activities. As students learn the answers to their questions, list the answers in the L column of the chart

4. K-W-L charts are useful in identifying misconceptions that students have about light and lenses. Once the misconceptions are identified, have students design a way to test their ideas, reflect on what they observe, and refine the original conclusion.

5. Periodically, return to the K-W-L chart during the activities to check off items from the W column and to add to the L column. Students may want to add items to the W column to further their explorations.

Standards:

Grades 3-5: SC.C.2.2.1, SC.H.2.2.1
Grades 6-8: LA.C.1.3.1, SC.H.1.3.5, SC.H.2.3.1

NAME_____
TOPIC_____
TEACHER_____

WHAT DO YOU **K**NOW	WHAT DO YOU **W**ANT TO KNOW	WHAT HAVE YOU **L**EARNED?

K W L

Pre-Outreach Activity: Mirrors and Multiple Images

Teacher Background:

The reflection of light involves two rays, the incoming, or incident ray, and the outgoing, or reflected ray. The law of reflection states that two reflected rays are at identical angles. Reflected light follows Snell's Law, which states that the angle of incidence will equal the angle of reflection.

Materials:

- Mirrors and Multiple Images worksheet
- Two hand-held mirrors per group
- Masking tape
- Protractor
- Pencil or other writing utensil
- Penny, paperclip, or other small object

Activity Instructions:

1. Have the students take two mirrors and place their reflective sides against each other. Tape the back of the mirrors together, so that they open like a book.

2. Place the hinged mirror on the worksheet provided and open it up to one of the angles indicated. Place the object between the mirrors as close as possible.

3. Count the number of images that you see, and record the number in the data table.

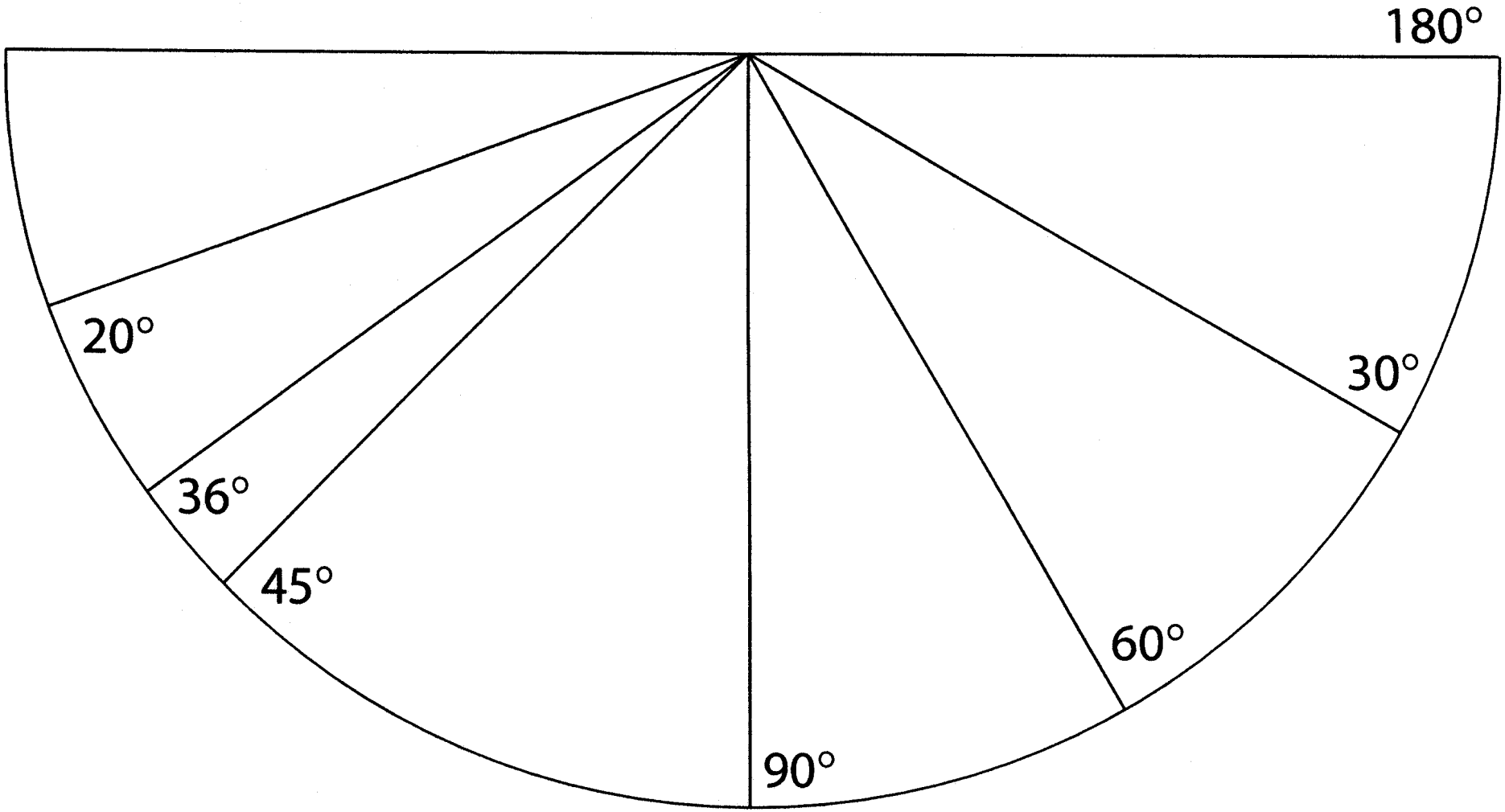
4. What happens as the angle increases? decreases? How can you use this information to send secret messages?

Leonardo Da Vinci:

Leonardo da Vinci (1452-1519), known as a genius of the Renaissance, was an artist, inventor, engineer, theatre designer, and architect. He is well known for his many notebooks and sketchbooks that continue to be used for study today. Leonardo's notebooks are significant because he not only recorded his observations of natural phenomenon; he attempted to figure out how things work. To explain his work, Leonardo wrote long descriptions that included diagrams of his scientific and mechanical projects.

Da Vinci wrote in Italian using a special kind of shorthand that he invented himself. People have long been puzzled by his use of "mirror writing" in his notebooks. His notes started at the right side of the page and moved to the left. Only when he was writing something intended for other people to read did he write left to right. Contemporaries of da Vinci recorded that they saw him write and paint left-handed. He also made sketches showing his own left hand at work. Being a lefty was highly unusual in Leonardo's time. Because people were superstitious, children who naturally started to write with their left hands were forced to use their right hands. No one knows the true reason Leonardo used mirror writing. Some people think Leonardo chose to write in reverse because writing left to right was messy. The ink just put down would smear as his hand moved across it. Writing in reverse prevented smudging.

Try writing your signature in cursive from right to left. Then try writing while looking in a mirror. Hold a pencil in each hand. Write backwards with your writing hand, while writing forward with the opposite hand.



ANGLE BETWEEN MIRRORS	NUMBER OF IMAGES
20	
30	
36	
45	

ANGLE BETWEEN MIRRORS	NUMBER OF IMAGES
60	
90	
180	

Post-Outreach Activity:
Breaking up White Light

Teacher Background:

White light is made up of all the visible colors in the electromagnetic spectrum. A prism can be used to separate the colors. As light passes through the prism, its speed changes and it is refracted. Because of the angle of the plane of the prism, each frequency of light is refracted differently. Violet has the highest frequency and is refracted the most. Red has the lowest frequency and is refracted the least. The rest of the colors fall somewhere in between.

Materials:

- Overhead projector
- Diffraction grating
- Two pieces of 8½" x 11" paper
- Colored pencils
- Common transparent objects such as: sunglasses, colored report covers, plastic wrap, etc.

Activity Instructions:

1. Place the two sheets of paper on the projector creating a slit between the sheets about 1 cm wide.

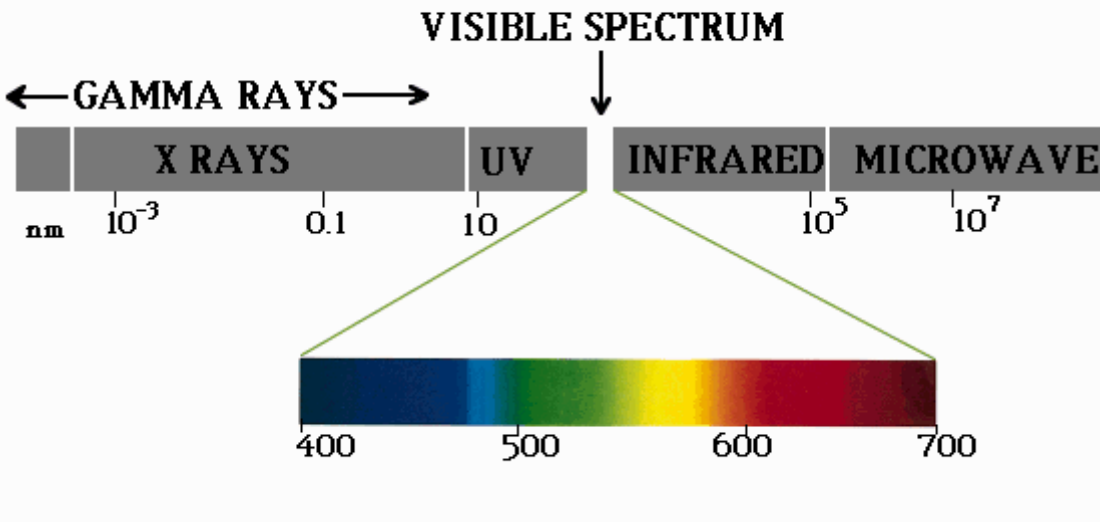
2. Turn on the projector and project the slit on a surface. Hold the diffraction grating about 6-8 cm in front of the upper lens of the projector. Rotate the diffraction grating until you get a full spectrum on either side of the slit.

3. Have students color in the visible spectrum that they see. There may be more or less colors than the traditional ROYGBIV (red, orange, yellow, green, blue, indigo, violet). Explain to the students that white light is made up of all the colors combined together.

4. Place common transparent objects on the overhead projector, and see how they filter light. Have students draw what they see. What differences can they identify between this drawing and the one done in step 3?

Standards:

Grades 6-8: SC.A.1.3.1, SC.A.2.3.1, SC.A.2.3.3, SC.B.1.3.3, SC.B.1.3.6, SC.C.1.3.2, SC.H.1.3.1, SC.H.1.3.2, SC.H.2.3.1
Grades 9-12: SC.A.2.4.6, SC.H.1.4.1, SC.H.1.4.4, SC.H.1.4.5

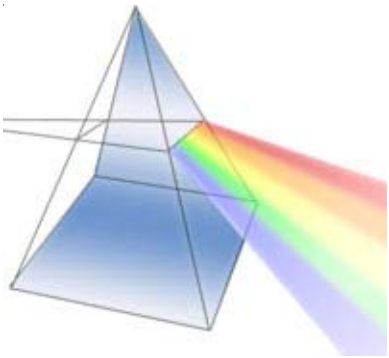


FCAT Sample
Practice Questions

1. Light waves change speed as they approach Earth. Which of the following causes **most** of the change in speed of the light waves?

A Mountains
B Oceans
C Atmosphere
D Gravity

2. Sage gets a prism for his birthday. When he shines a flashlights into it, a rainbow is created from the other side.

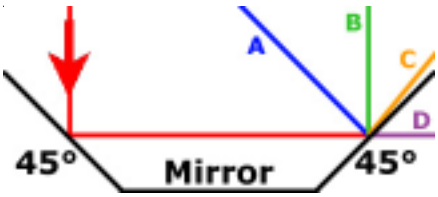


Sage's Prism

What principle of optics **best** explains why this happens?

F Reflection
G Refraction
H Repulsion
I Birefringence

3. Sabrina sets up three mirrors so that they are all at forty-five degree angles to each other.



Sabrina's Mirror Set-up

Sabrina then shines a beam of light at the first mirror, and watches it reflect. Which path **best** describes the path the beam of light will take next?

A path A
B path B
C path C
D path D

4. This is called a Newton Color Wheel and contains all the colors of the rainbow. What will you see when the color wheel is spun?

Newton Color Wheel

F Black
G Rainbow
H White
I Blue

Vocabulary List:

Attract	To cause to draw near by a force.
Electromagnet	A temporary magnet that is run with electricty.
Magnet	An object that is surrounded by a magnetic field and that has the property, either natural or induced, of attracting certain metals. All magnets have a North and South pole.
Magnetic field	A region around a magnet in which objects are affected by the magnetic force.
Magnetic Pole	The north or south pole of a magnet, where the magnetic field is the strongest.
Permanent Magnets	A piece of magnetic material that retains its magnetism after it is removed from a magnetic field.
Repel	To push back or away by a force.
Temporary Magnets	A piece of magnetic material that demonstrates the properties of a permanent magnet only while in a magnetic field.

Notes

Center for Integrating Research and Learning

National High Magnetic Field Laboratory
1800 East Paul Dirac Drive
Tallahassee, Florida 32301
850-644-4707
850-644-5818 Fax

http://education.magnet.fsu.edu
http://www.magnet.fsu.edu

Tours & Outreach:
Carlos R. Villa
villa@magnet.fsu.edu
850-644-7191