MODULE m1

THINKING ABOUT LIGHT AND OPTICS

INTRODUCTION

Module 1, Thinking about Light and Optics, is made up of three activities that can be used at any time throughout this unit of study.

Activity 1: Perspectives: Powers of 10
Activity 2: K-W-L: What I Know, What I Want to Know, What I Learned
Activity 3: Using Media to Explore Light and Optics

Activity 1, Perspectives: Powers of 10, is an effective way to get students to look at things in new ways; Activities 2 and 3, in particular, can be used any time. These activities can, and should, be used several times while students are asking and answering questions about lenses, color, light, shadows, and optics in general. Use of these activities is enhanced by the Extensions that include ways to incorporate mathematics, literature, history and social studies, art, and reading and writing in science.

Module 1 differs from the other 7 modules in *Science, Optics & You* in that it stands alone and does not rely on one concept building upon another. That feature allows you to use the strategies in Module 1 at any time or with other units of study.

The Powers of Ten interactive web-based tutorial can be used to enhance this module, explain difficult concepts, and enrich the classroom experience: http://micro.magnet.fsu.edu/optics/tutorials/java/powersof10/

Activity 1

Perspectives - Powers of 10

Scientists look at things in very particular ways using sophisticated equipment, everyday instruments, and unlikely tools. Some things that scientists want to see are so small that they need a hand lens, or a microscope; other things are so large that they need a powerful telescope, for example, to focus in on one small part. Students will use observational skills, math skills, and their imaginations to complete this activity that was inspired by the video, "Cosmic Voyage" (35 minutes, IMAX Corporation, Cosmic Voyage, Inc.).

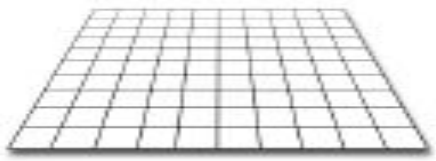
Plan to complete this activity in stages. You could set aside ½ hour or 1 hour each day to complete the steps and stages of the activity. This activity is also appropriate for a weeklong (or more) mini-unit on how things look from different perspectives. The variations are almost endless!

Materials:

- ☐ Pre-cut butcher paper, bulletin board paper, or the end roll of newsprint from a local newspaper (1M square for each group)
- ☐ Meter stick, tape measure, or other measuring device (string cut in equal lengths will do)
- ☐ Science Notebooks
- ☐ Crayons, markers, or pencils
- ☐ Assorted objects, such as leaves, notebook paper, photographs,
- ☐ M. C. Escher print, poster or photocopied image (to complete the artist vignette portion of the activity)
- ☐ Hand lenses
- ☐ Field microscopes

WHAT WILL THE STUDENTS DO?

There are several variations of this activity that become apparent as you read through the directions. You will determine how best to facilitate the students' discovery of how things appear depending upon one's perspective.



Part I

1. Students will work in pairs or small groups. Using their 1M square piece of paper, they can trace one student's outline.

2. Then, students will choose one object for each person in the group (like leaves, pieces of paper, pieces of newspaper, photographs, etc.), and place the items around the "body," and outline them as well.

3. Now, have students go back and put in as much detail as possible on the smaller objects. [The purpose here is not to examine the detail on a human body, but to put the item the students will examine into perspective.]

4. Students should record what they are doing and what they see in their Science Notebooks.

5. Have students divide the paper into 10 equal parts by moving around the paper marking it off in one-tenth of a meter (10 centimeters) increments. Then they can use their tape measures or other straightedge to connect the horizontal marks and the vertical marks. What will be left is a grid with 100 squares on top of their original drawing.

6. In their Science Notebooks, students draw what they see in *one square* of the paper and then answer the following questions:

   How is what you see different from what you saw at first?

   Why are your drawings different?

   Would you have to be larger or smaller to see what you drew?

   What would happen if we divide the paper into smaller boxes?

7. Have each student cut out one square that has something drawn in it.

8. Students should draw themselves in that square so that they are comparing the detail from the larger item originally drawn to their own image. (In other words, they will be looking at the original object as if they were 10cm tall.)

9. Now, take that square and divide *it* into ten equal parts, again marking around the paper, but this time in 1-centimeter increments.

10. *What do you see now?* You can discuss this as a whole group or have students write their observations in their Science Notebooks.

11. Ask students: *Do you have to move away from something or closer to something for it to look bigger?*

12. Tell students to draw a picture of themselves in the smaller box. *Is this what it would be like to be a giant? Or, is this what it would be like to be an ant?*

Part II

1. Students use the 10-cm squares that they cut out and observe the drawings using 10X hand lenses.

2. Students draw what they see through the 10X lens and answer the following questions:

   How is what you see through the lens different from what you can see with your eyes?

   Why would a person want to use a hand lens to look at something?

   What do you think you would see if you could get even closer?

3. Now, students cut out another square. This time they will cut out one of the smaller (1 cm) squares.

4. Discuss with students what they can see. Some students will be able to see great detail depending upon how much detail they put into their work in the first place. Others will say that all they can see is "paper." That is all right because the next step will be to put the square into their field microscope with the 100X attachment.

5. Students place their squares in the field microscopes. Even those who saw "only paper" will be able to see a great deal of detail in the paper fibers or perhaps graphite where they drew lines.

6. Students write or draw (or both) what they see in their Science Notebooks.

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ENCOURAGE STUDENTS TO WRITE DOWN OR DISCUSS WITH ONE ANOTHER ANY QUESTIONS THAT THEY HAVE AS THEY ARE WORKING ON THIS ACTIVITY.

Use the activity as a jumping off point for a discussion about how scientists study things. Ask students:

What would you do if you wanted to look at something that was very tiny?

What could you use to look at something far away?

EXTENSIONS:

Writing. Choose a person, pet, or thing and ask students: What would you see if you could keep getting closer and closer to it? In the case of a dog, for example, students will probably identify hair and skin, inside their ears or eyes or noses, fleas. Encourage students to go even further with those types of ideas and then write a story about a child with special powers who can see things at the cellular or atomic level.

Reading. Read *The Borrowers* (ISBN: 0-15209-990-5) and have students predict before each chapter or portion of the book some scenarios that they might expect to hear or read about. Then, students can check their predictions and discuss how accurate they were. Students can draw pictures to illustrate the story. They will make the connection between their drawings and the drawings they did in the Perspectives Activity.

Art. Make a class cartoon or comic book based on the way things look to someone or something very small or very large. Each student or group of students could contribute a panel or portion of the book that could be shared with other classes.

Game. Play a game where students each describe an item as seen by an ant. Then, each student reads his or her description to the entire class as the others try to figure out what they are "looking at."

HISTORICAL VIGNETTE: ROBERT HOOKE

In 1665, Robert Hooke (1635-1703) improved upon earlier microscopes developed by Anton van Leeuwenhoek and Zacharias Janssen. His compound microscope consisted of an objective lens used to focus light on what he was examining, an eyepiece lens, and a "field lens" that Hooke used to increase the field of view. The light source that he used was either sunlight or an oil lamp that he attached directly to the microscope. By using a microscope, Hooke was able to show people things that were previously invisible. Hooke published a book, *Micrographia*, that contained detailed drawings of plants and insects that he called "minute bodies."

Hooke is not as well known as his contemporary, colleague, and rival, Isaac Newton. However, his contributions to the field of experimental science are well documented. The fact that he had to contend with a contemporary who wanted to discredit him and his work is a subject for class discussion. Students could think about other famous men and women in history who may have had to deal with this type of situation. For example, Rosalind Franklin who worked with Francis Crick and James Watson. Although she was instrumental

in the discovery of the structure of DNA, Crick and Watson are credited with the discovery and received a Nobel Prize for it.

Activity. Students research and present their findings on Robert Hooke and Isaac Newton. Presentations include who, what, why, when, and where; in particular, students should note contemporary current events, linking scientific accomplishments with political and social happenings. For example, Isaac Newton's scientific gift emerged during a time that he was self-taught, studying at home for 2 years while Trinity College at Cambridge was closed because of an outbreak of plague.

ARTIST VIGNETTE: M. C. ESCHER

M. C. Escher's graphic work is popular on t-shirts, ties, and other items of apparel, so it may be familiar to some of the students. The images are easily obtainable so Escher would be an appropriate artist to introduce with this activity. The book, *M. C. Escher: The Graphic Work* (Barnes & Noble Books, ISBN 1-56619-789-9), contains an introduction written by the artist and illustrations of many of his most famous works.

Maurits Cornelis Escher (1898-1972) studied graphic arts in the Netherlands and created his works based on different ways of looking at things. In particular, he discovered that drawing figures that were impossible based upon the laws that govern how things work was particularly challenging. Escher was not a good student and lived for the 2 hours each week that he was instructed in art. In fact, Escher never graduated and repeated grades two times. Even the artwork that he submitted for a final grade was not thought of as good enough to receive the highest grade. Escher's father still believed, however, that his son could and should become an architect. In 1919 he entered the School of Architecture and Decorative Arts in Haarlem, The Netherlands. Escher traveled extensively with other artist friends sketching and creating woodcuts for which he would later become famous.

Activity. Although some of Escher's prints are disturbing, particularly for young children, others, like "Dewdrop" fit in very well with the Perspective Activity. His work "Puddle" could be used as a starter for a story about "What happened here?"

Research. There are also several web sites featuring Escher prints where students can access the images directly. As usual, it is recommended that you thoroughly explore any web sites that you recommend to students.

ACTIVITY 1

Perspectives - Powers of 10

In this activity, you will be looking at things in different ways. Scientists look at things using special tools like microscopes, or tools that might surprise you, like eyeglasses or hand lenses. Some things are so small that scientists must use powerful microscopes and some things are so large or so far away that they need a powerful telescope. Imagine what it would be like to be a flea on a dog's back or the giant in Jack and the Beanstalk walking through a normal-sized village. What would things look like to the *Indian in the Cupboard* or *The Borrowers* who live under the floorboards?

Materials:

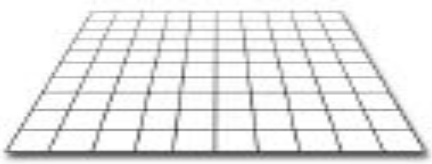
- ❑ Pre-cut butcher paper, bulletin board paper, or the end roll of newsprint from a local newspaper (1M square)
- ❑ Meter stick, tape measure, or other measuring device (even string cut in equal lengths will do)
- ❑ Your Science Notebook
- ❑ Crayons, markers, or pencils
- ❑ Assorted objects, such as leaves, notebook paper, photographs
- ❑ Hand lens
- ❑ Field microscope

1. With a partner, take your piece of paper that has been cut to measure 1 meter square and trace a person's body outline near the edge of the paper.

2. Choose an object for each of you. This could be a large leaf that you bring from home or gather in the schoolyard, an article from a newspaper, a photograph, or a large flower like a sunflower. Trace it on the same paper near the body outline. Put as much detail on the drawings as you can.

3. Now, divide your paper into 10 equal parts by moving around the paper and making a mark every 10 centimeters on the edges of the paper. Use your tape measure or other measuring device to do this.

4. Connect the marks so that you have 10 vertical lines on the page and then 10 horizontal lines. You now have a "grid" with 100 boxes of equal size.



5. Look at *one square* and draw what you see in your Science Notebook.

6. In your Science Notebook, answer these questions:

   How is what you see in the small square different from what you saw in the larger square? Why do you think your drawings are different? What would happen if we divided the paper into even smaller boxes?

7. Choose 1 square that has something drawn on it and cut it out. Draw a person in that square like you did at the very beginning with the large piece of paper.

   What do you see now? Do you have to move away from or closer to something for it to look bigger?

8. Take your small square (the one you cut out) and divide it into 10 equal parts by making a mark at each centimeter (1cm) all around the paper.

9. Draw a picture of a person in this little box. [You should have a picture of a person and a piece of the object that you had drawn at the beginning.]

   Is this what it would be like to be a giant? Or, is this what it would be like to be an ant?

ACTIVITY 2

K-W-L: WHAT I KNOW, WHAT I WANT TO KNOW, WHAT I LEARNED.

A STRATEGY FOR LEARNING.

The K-W-L chart can be used to help students clarify their ideas about difficult concepts and take responsibility for their own learning. It is also an opportunity for teachers and students to look at possible misconceptions and use them as a vehicle for asking questions and finding ways to answer them. A simple, yet effective strategy, the chart itself is divided into three columns: K – what I know, W – what I would like to know, and L – what I have learned. Students create the charts and keep them accessible so that as they work on light and optics, they can enter new ideas, new information, and new questions at any time.

K W L

In this activity, students will make entries on their K-W-L charts about lenses. Since you have already completed Activity 1, students have probably already discussed microscopes, telescopes, binoculars, and other devices that assist us in seeing things that are very small or very far away. Some students will have quite a large number of entries for their K-W-L charts; others will have fewer, but may have more questions in the W column. Encourage students to make entries in the W column in the form of questions, further emphasizing the process of asking and answering questions in special ways with special tools. Students should be motivated to make additions to their K-W-L charts as the unit progresses.

The K-W-L can be used as a culminating activity, having students enter what they think they have learned at the end of one of the activities or at the end of the entire unit of study. This strategy can be used with other areas of study and is an ongoing assessment of student mastery of difficult concepts. A sample K-W-L chart is included with the student page of this activity.

MATERIALS:

- ☐ K-W-L Charts
- ☐ Science Notebook

Assessments. Check K-W-L charts either periodically or at the end of a set period of time. From time to time, however, remind students to write on their charts so that they will not have to try and remember everything at the end when you are ready to assign a grade. If students are filling in their charts in a way that makes sense to them and they can discuss their ideas with you, then they have successfully completed this task.

Students can share K-W-L charts with one another. For younger children, making a K-W-L chart on butcher paper on their table or desk so it is accessible as they are working might be helpful. Completing a class K-W-L with children who cannot write may help some students to articulate their ideas by talking them out with others.

Have students react to each other's K-W-L charts by answering the following questions in their Science Notebooks: (1) How is your K-W-L chart like your classmate's? (2) Are there changes that you wish to make on your chart? What are they and how can you change it? (3) What information is missing from your K-W-L that would help you?

EXTENSIONS:

Expanding the K-W-L. You can add a column to the K-W-L chart in which students identify sources for answering their questions. It then becomes a K-W-W-L, adding "Where I can find the information." For some students, this would be listing books, magazines, people, or places where they could find answers to their questions; it could also be a list of web sites students have accessed to find information.

Research. Have students design a plan for gathering the information that would help them answer their questions. Putting something in the W column that a student wants to learn about serves no purpose unless the student has a strategy with which he or she can find the answer. A research plan or list of possible ways to find the information will help some students begin their search for answers.

Presentation. Students design a way to present their completed K-W-L chart to the whole class, to a group of students, or as part of a class poster session. If you are doing a class K-W-L, students may wish to present their findings to other classes or to younger students. This will encourage others to ask questions and students will have to explain their findings. When all students have had a chance to see what others have done, brainstorm a class list of questions that remain unanswered. Use this list for students to plan and implement a way to test ideas and answer questions.

Expository writing:

> *Scientists ask and answer questions.*
> *Choose one question from your K-W-L chart and think about how you answered the question.*
> *Write a description of how you discovered the answer to your question.*

Narrative writing:

> *Lenses are used in many different ways, for example in glasses, contact lenses, or binoculars. Imagine that a person put on the wrong glasses and saw everything much larger than it really is. Write a story about the kinds of adventures this person with the wrong glasses would have.*

HISTORICAL VIGNETTE: BENJAMIN FRANKLIN (1706-1790)

Benjamin Franklin is known for many inventions, sayings, and accomplishments. One of his inventions, the bifocal lens, was created because he became frustrated when he discovered that he was both near-sighted and far-sighted. He had two pair or glasses and was constantly switching from one pair to the other until he cut the lenses of both pairs in half and mounted one on top of the other in one frame. Then he could read small print and see objects far away with the same pair of glasses. As is often the case, an inventor created a new product because of a problem that needed to be solved.

Benjamin Franklin was the son of an Englishman who left England for America in 1683. Benjamin's father became a candle and soap maker reacting to a need for these items among the colonists. Because he had to change his occupation to earn a living (he was a textile dyer in England), Benjamin's father insisted that each of his sons learn a marketable trade. Benjamin showed the most promise of the Franklin children and so was enrolled in school at the age of 8. However, he had difficulty in mathematics and had to be withdrawn from school and served as an apprentice in the printing business.

Benjamin's older brother, James, was already in the printing business, so Benjamin's father saw this as a way for him to blend his love of books and reading with a trade. Through his brother's connections with booksellers, Benjamin began reading the classics in literature and philosophy, learning as he apprenticed. His cleverness and talent contributed to his brother's success when he established a new newspaper, the *New England Courant.* When he was only 16, Benjamin wrote stories using the pseudonym Silence Dogood and slipped them under the door of his brother's newspaper. No one knew who the author was, but the articles were published and made the newspaper, and Silence Dogood, famous. Benjamin left Boston and his brother's shop and went to Philadelphia after his brother's jealousy over Benjamin's success led to a fistfight between the two boys.

Franklin used his skill as a printer to find work in Philadelphia and, through a series of events that could only be termed serendipity, Benjamin became a success. Benjamin married and started

his own printing business. He had a long and full life as a international diplomat, scientist, printer, statesman, philosopher, musician, and economist. Franklin's experiments with electricity are well documented as are his many inventions that include the Franklin stove, catheter, and the lightening rod.

Activities. Encourage students to read *Ben and Me : A New and Astonishing Life of Benjamin Franklin As Written by His Good Mouse Amos* (ISBN 0316517305) by Robert Lawson. This is the "true" story of Benjamin Franklin and his many adventures and accomplishments as told by his mouse-friend, Amos. Students can discuss the biography genre and how it can be accomplished with humor and fun.

Have students choose a famous person and imagine what pet that person would have. Then, students can write a story about something that happens to that person from the pet's point of view. Encourage students to include events that they have researched to provide a feeling of realism to their writing.

ARTIST VIGNETTE: JACQUES-LOUIS DAVID (1748-1825)

Jacques-Louis David was chosen for this vignette because of the influence of political events upon his work. His art was used for political means, preserving major events and prevailing attitudes at the time of the French Revolution. After being imprisoned for his participation in political rallies and voting for the King's execution, David was released because of his loyalist wife's influence. After his release, David transferred his efforts to painting Napoleon and his exploits. When Napoleon was defeated at Waterloo in 1815, David fled to Brussels, where he died ten years later.

David's work is filled with minute detail of political life in France around 1800. However, his attention to detail did not always portray reality. One famous work, *Napoleon in His Study*, is David's interpretation of Napoleon. The furniture and surrounding accessories are true to the style of that time.

David's works are housed in the Louvre Museum in Paris, in the National Gallery in Washington, DC, and in the Musée Royale des Beaux Arts in Brussels. David combined portraiture with the neoclassical style of painting, contributing to the establishment of what is known as the French Empire style.

Activity. Have students choose a contemporary or historical political person that has commissioned a portrait. Either have students create the portraits *or* have students plan the portrait, determining surroundings, furniture, accessories, or important documents that they may wish to have in the portrait. Then, students should be able to explain to others the importance of each element of the painting and how it characterizes the subject. [In fact, the portrait of Napoleon discussed above was commissioned by an Englishman who was trying to gain Napoleon's favor in hopes of having the Stuarts restored to the British throne.]

Activity 2

K-W-L: What I know, What I want to know, What I learned.

A strategy for learning.

The K-W-L chart is a way for you to put in writing some of your ideas about lenses. You will be using this chart from time to time, so leave yourself plenty of room for adding and taking away ideas, questions, and information. The chart has 3 columns: K – what you already know about lenses; W – what you would like to know about lenses; and L – what you have learned about lenses. The L column gets filled in as you discover new things, so at first, it will have a lot less in it than the other columns.

1. Design your K-W-L chart. If you have already done this, or if your teacher has given you a chart, make sure that you have enough room to use it for a long time. [You can design your K-W-L chart in a variety of ways. Be creative. Ask your teacher or Media Specialist for some suggestions.]

2. In the K part of your chart, write the things that you think you know about lenses. Don't worry about being right or wrong!

3. Now, under the W section, enter any questions that you have about lenses. Also list types of lenses that you may wish to learn about (for example, contact lenses or wide-angle lenses). In your Science Notebook, list ways that you could answer these questions or find more information.

4. The L column is where you will put things that you have learned. For example, if you asked the question, "How do contact lenses work?" you can put the answer to this question in the L column. As you fill in the L column, you may have even more questions that you will put in the W column.

K W L

ACTIVITY 3

Using Media to Explore Light & Optics

As science educators, we ask our students to take the information we provide in the classroom and use it to interpret their world. In the study of light and optics, we are dealing with people and subjects that appear frequently in newspapers, magazines, on radio or on television, as well as online via the internet and e-mail. Add to this the fact that young people are frequently targeted by media because of their buying power. According to Consumer's Union, young people from 6-12 spend nearly $11 billion annually; children 13-17 spend $57 billion *of their own money*, and about $36 billion of their parents' money.

Combine the marketing value with the fact that most of the information that we get about the world is supplied in some form to us by the media and we have an area that is ripe for misinterpretation and misunderstanding. Helping students analyze, evaluate, and interpret the messages to which they are constantly exposed and helping them to create new messages becomes a mandate for teachers. These are skills which are assessed by standardized tests that are used by policy makers and the general public to evaluate school progress.

This activity provides you and your students with some basic information about news reports and advertisements, some suggested strategies for incorporating the newspaper and magazines into the science classroom, and ways to integrate the skills used to analyze and interpret messages into other subject areas. Activities and Extensions can be used throughout the *Science, Optics & You* materials or can stand alone with this or other units of study.

Some information and suggestions were found in *Mastering the Message* and *Messages and Meanings*, publications sponsored by the Newspaper Association of America Foundation, and "Using the Newspaper in Secondary Science," by Dr. John Guenther and Dr. William LaShier, The University of Kansas. How you use this activity will of course depend on the level of your students, but even the youngest students can benefit from discussing how to interpret the great variety of messages to which they are exposed.

News Reports are reports, columns, and features found in newspapers that inform, entertain, and persuade. Students cannot, of course, control the content or the tone of news reports, so they need strategies to help them analyze and interpret what they read and hear. The three main types of news reports are described below.

Informational news reports:
- Address the 5 W's and the H (who, what, why, when, where, and how)
- Present interesting details in an organized way
- Identify sources
- Support the main idea with quotes and information
- Include commonly-used words to help explain technical or subject-specific terms
- Utilize a consistent style

Articles written for entertainment:
- Address a specific audience
- Support the main idea in an interesting or entertaining way
- Use entertaining vocabulary
- Present an organized piece of writing in an creative way
- Present unusual stories or information

Articles written to persuade:
- Capture the reader's attention by using persuasive words
- Identify a specific topic, opinion, theory or idea
- Include strong arguments
- Combine facts with personal opinion
- Present a well-organized sequence of ideas

News reports differ from advertisements although advertising uses persuasive writing in ways that sometimes makes us think they are really news reports. Children need to be aware of the fact that an advertisement is *always* there to convince them to buy something. Advertisements have the following easily-identifiable features:
- Capture your attention by presenting a product in a desirable way
- Present information
- Encourage you to take action
- Make you feel positive about a specific product or activity

Materials:

- ☐ Newspapers, magazines, or predetermined newspaper articles and advertisements
- ☐ Science Notebook
- ☐ Supplies for creating presentations

WHAT WILL THE STUDENTS DO?

Students will be doing one or more of the suggested activities. The Student Page provides alternative activities for students to complete. Some activities are best suited to individual work and others, for example creating a public relations campaign, are better suited to collaborative groupwork. The Student Page gives students choices so that issues of not receiving newspapers or magazines, or not having a television at home will *not* dictate the way you use this activity, nor will it exclude students for those reasons. Regardless of the nature of the work that students are assigned, it is important that they continue to ask and answer questions, and relate what they are reading and experiencing with their study of light and optics. Some of the activities refer to specific inventors, artists, or historical figures. Most of these are included in the artist and historical vignettes that accompany each of the activities.

EXTENSIONS:

Research. Have students identify and investigate people who have had an influence on mass media *or* people who either invented an optical device or developed a technique or theory that relates to light and optics. Then, students can look at how mass media would have affected the development and marketing of that device. For example, when Galileo built and tested his telescope, only men of science or those of great wealth could own an instrument like that. His discoveries and observations led to a controversial way of viewing our world. If there were newspapers that could publish word of his great invention, how would this affect the public acceptance or rejection of his ideas?

Writing. Students create their own light and optics newspaper or magazine that explains some of the major concepts in this unit. For example, a headline might read, "Scientist Discovers How Rainbows are Formed!" The story that follows would include the students' explanation of how water droplets act like prisms and separate the colors of sunlight.

Art. Have students create a cartoon that represents one of the concepts they have learned about in studying light and optics. The cartoon could be a cartoon strip, a comic book, or single frame (like *Dennis the Menace*). You may wish to have the students exchange cartoons or have an exhibition of work that is viewed by all. Encourage students to explain how they created their cartoon and why they chose the concept to represent.

Current Issue. Students identify an issue related to one of the activities (for example, moving lighthouses that are in danger of falling into the ocean because of coastline erosion) and learn more about it, report it to their classmates, and discuss how it relates to the study of light and optics. Along with the reporting, students should identify *why* it is a newsworthy event or issue.

ACTIVITY 3

Using Media to Explore Light & Optics

Much of the information that you get comes from the media — newspapers, magazines, radio, and television. You are the focus of the media because of your "buying power." Young people from ages 6-12 spend nearly $11 billion each year. Children between the ages of 13 and 17 spend $57 billion of their own money and about $36 billion of their parents' money. Because you are the focus of so much media attention, you need to become a good consumer of information, just like you would be a consumer of toys, food, or games.

Since you are studying light and optics (for example, light, lenses, color, shadows, mirrors, and rainbows), this will be the main thing that you will think about when you use newspapers, magazines, television, or radio to complete these activities. You will choose one or more ways to look for how the topic of light and optics is found in the media.

Remember: If you choose an activity that requires you to watch a *news program*, that does *not* mean a talk show like Rosie O'Donnell or Oprah Winfrey. It is *not* a news magazine show like *Dateline* or *20/20*.

1. Use the newspaper to find ads for instruments or electronic equipment that use lenses or optical tools to work. For example, DVD players, video recorders, optical scanners, or digital cameras. Cut out the ads and glue them in your science notebook. Answer these questions: Do the ads say anything about light, color, lenses, or optics? Why do you think information about light, lenses, color, or optics is needed or not needed for people to want to buy this product? How would you write the ad?

2. Find all the ads that you can about one type of instrument or piece of electronic equipment that use lenses or optical tools to work. For each of the ads or articles, answer the following:

    - Who are these ads designed for?
    - Would this ad be used anywhere, or just in your community?
    - How does the company get your interest?
    - Would you buy the product? Why or why not?

3. Design an advertisement for Galileo's telescope. Before you begin, think about these questions and write your answers in your Science Notebook. If Galileo had a newspaper or magazine in his town in Italy, how do you think he would advertise his new invention? Would he want *everyone* to have one, or would Galileo want only a few people to be able to have a telescope? What features of the telescope would Galileo want to show off? What kinds of things would people expect to see if they bought a telescope?

Galileo

4. Look in the newspaper for articles or advertisements about new kinds of eye surgery. Radial keratotomy and lasix surgery are two ways to correct vision and laser surgery is used to remove cataracts so that people can see clearly. Think about how these new types of surgery have changed to way people think about glasses and contact lenses. Underline or highlight parts of the articles or advertisements that you think are hard to understand. Answer the following question in your Science Notebook: What kinds of things about light and lenses should a person know when he or she is trying to understand about the choices for correcting vision?

5. Each day in newspapers, in magazines, on television, and on the radio, people are talking about our planet, the stars, our universe. One of the reasons that this is so interesting for a lot of people is that we have very good equipment that helps us look at stars, planets, moons, rings, and distant galaxies. For example, almost every day since it was launched and placed in space, the Hubble Telescope has been in the news. Find as many articles as you can that discuss new ways of looking at our universe. Cut out the articles, put them in your Science Notebook, and answer the following questions:

- Why is this article interesting enough to be in the newspaper?
- Why is it so important for us to learn about what is happening in space?
- How do lenses, light, and colors help us learn about the universe? [To answer this question, you may have to look up information about colors of stars, distances between stars and planets, and how fast or slow things are moving in the universe.]

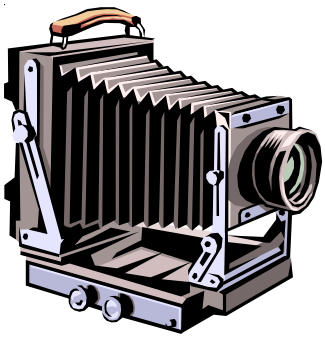
6. Write a newspaper or magazine story about a person who has used light, color, or optical instruments to change the world around us. Remember to use the 5 W's and the H (who, what, when, where, why, and how). You can choose a famous inventor, like Thomas Edison or Benjamin Franklin, or an artist who used color and light in new ways, like Leonardo da Vinci. Or, you can write about a style of painting, like pointillism or impressionism.

7. Develop a public relations campaign for an optical invention that has changed our world. It could be an invention from a long time ago, like the microscope, or it could be a recent invention, like fiber optics. A public relations campaign does the following:

   - always says positive things about the client
   - stands for a certain point of view
   - uses many different media to get the message out: bumper stickers, radio and television messages, brochures, stickers, buttons, debates, town meetings, videos, etc.
   - usually has a slogan, song, or jingle

   When you have chosen the product, theory, or point of view that you wish to support with your campaign, plan your strategy and remember, you will be presenting this to your classmates.

8. Photographs are a major feature of newspapers and magazines. Sometimes people read articles because a photograph has caught their attention. The art and technology of photography continues to grow and change based on new ways to use lenses and new technology for cameras. Look at a newspaper or magazine and think the following questions (you may have to do some research). Answer them in your Science Notebook.



- Before cameras, were there newspapers?
- Did newspapers have illustrations before photographs were used?
- How do photographs change the way people read and understand news articles?
- How would newspapers be different is photographs were not used?
- What kinds of photographs do *you* like looking at in the newspaper?

9. Many photographs that are used in newspapers are prepared on computers. Computers "digitize" images that are sent to newspapers all over the world via satellite. Local photographs can be scanned into computers and can be changed by the person at the newspaper in charge of getting pictures ready to be printed. Sometimes the images are changed, words or parts of pictures taken out, colors changed to bring out a certain part of the photograph, or even taking out words that appear in the photograph on clothing or pieces of paper that someone is holding. When you read the newspaper, do you think you should be told if the photograph has been changed? With your classmates, discuss whether you think photographs used in news stories should be changed, if they are changed, should the reader be told, and who should be in charge of deciding whether photographs are changed? When you have brainstormed this with your classmates, write three paragraphs in your Science Notebook about how you feel about each of the three questions: (1) should photographs be changed? (2) who should change them? And (3) should the reader be told?

10. Contact your local newspaper. Find out how newspapers use color. When you look at a color photo or advertisement in a newspaper, sometimes the color seem to separate. (Be sure to get a newspaper so that you can observe first hand what it looks like before you write your questions.) Find out why this happens. In your Science Notebook, write down questions that you want to ask about using color in newspaper stories. After you interview someone at your local newspaper, write the responses in your Science Notebook also. Then, write what you think about the use of color in newspapers.

Student SELF-CHECK

MODULE 1: Thinking About Light & Objects

Now that you have completed Module 1, follow the directions below as a self-check to see if you need more practice.

1. Draw a horizontal line 4 cm long.

2. Draw a vertical line 5 cm long.

3. How many centimeters are on a meter stick?

4. If you wanted the biggest view of the eye of a bug, which instrument would you use, a hand lens or the field microscope?

5. If your hand lens is marked 10X, what does that mean?

6. Draw a square that is 2cm on all sides.

7. A field microscope can magnify things 100X. What does that mean?