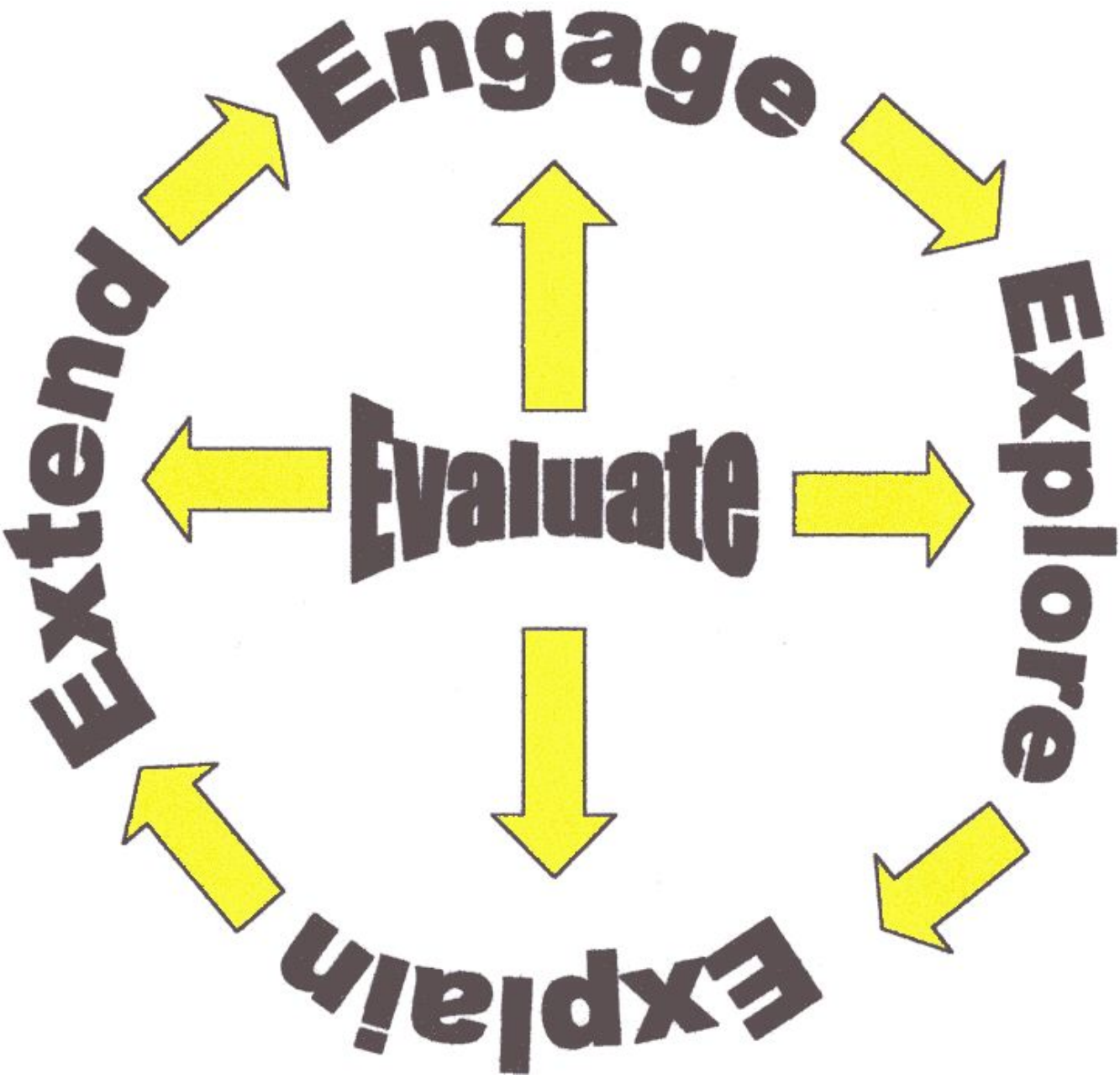


The 5E Model of Teaching

Grade 5

Students' Role and Actions in the 5E Model

"5E's"	Consistent with Model	Inconsistent with Model
Engage	● Asks question such as "why did this happen? What do I already know about this?" ● Shows interest in the topic	● Asks for the "right" answer ● Offers the "right" answer ● Insists on answers or explanations ● Seeks on solution
Explore	● Thinks freely but within limits of the activity ● Tests predictions and hypotheses ● Forms new predictions and hypotheses ● Tries alternatives and discusses them with others ● Records observations and ideas ● Suspends judgement	● Passive involvement ● Works quietly with little or no interaction with others ● "Plays around" indiscriminately with no goal in mind ● Stops with one solution
Explain	● Explains possible solutions or answers to others ● Listens critically to others' explanations ● Questions others' explanations ● Listens to and tries to comprehend explanations offered by teacher ● Refers to previous activities ● Uses recorded observations in explanations	● Proposes explanations from "thin air", with no relationship to previous experiences ● Brings up irrelevant experiences and examples ● Accepts explanations without justification ● Does not attend to other plausible explanations
Elaborate	● Applies new labels, definitions, explanations and skills in a new but similar situation ● Uses previous information to ask questions, propose solutions, make decisions and design experiments ● Draws reasonable conclusions from evidence ● Records observations and explanations ● Checks for understanding among peers	● "Plays around" with no goal in mind ● Ignores previous information or evidence ● Draws conclusions from "thin air" ● In discussion, uses only labels provided by teacher
Evaluate	● Answers open-ended questions by using observations, evidence, and previously accepted explanations ● Demonstrates understanding or knowledge of concept or skill ● Evaluates his or her own progress and knowledge ● Asks related questions that would encourage future investigations	● Draws conclusions without using evidence or previously accepted explanation ● Offers only "yes" or "no" answers and memorized definitions or explanations as answers ● Fails to express satisfactory explanations in his or her own words ● Introduces new, irrelevant topics

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades 3-5 Core Scientific Inquiry, Literacy and Numeracy *How is scientific knowledge created and communicated?*	
Content Standards	**Expected Performances**
SCIENTIFIC INQUIRY ♦ Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. **SCIENTIFIC LITERACY** ♦ Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science. **SCIENTIFIC NUMERACY** ♦ Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**B INQ.1** Make observations and ask questions about objects, organisms and the environment. **B INQ.2** Seek relevant information in books, magazines and electronic media. **B INQ.3** Design and conduct simple investigations. **B INQ.4** Employ simple equipment and measuring tools to gather data and extend the senses. **B INQ.5** Use data to construct reasonable explanations. **B INQ.6** Analyze, critique and communicate investigations using words, graphs and drawings. **B INQ.7** Read and write a variety of science-related fiction and nonfiction texts. **B INQ.8** Search the Web and locate relevant science information. **B INQ.9** Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials. **B INQ.10** Use mathematics to analyze, interpret and present data.

Grade 5 Core Themes, Content Standards and Expected Performances	
Content Standards	**Expected Performances**
Energy Transfer and Transformations – What is the role of energy in our world? **5.1 - Sound and light are forms of energy.** ♦ Sound is a form of energy that is produced by the vibration of objects and is transmitted by the vibration of air and objects. ♦ Light is a form of energy that travels in a straight line and can be reflected by a mirror, refracted by a lens, or absorbed by objects.	**B 17.** Describe the factors that affect the pitch and loudness of sound produced by vibrating objects. **B 18.** Describe how sound is transmitted, reflected and/or absorbed by different materials. **B 19.** Describe how light is absorbed and/or reflected by different surfaces.
Structure and Function – How are organisms structured to ensure efficiency and survival? **5.2 - Perceiving and responding to information about the environment is critical to the survival of organisms.** ♦ The sense organs perceive stimuli from the environment and send signals to the brain through the nervous system.	**B 20.** Describe how light absorption and reflection allow one to see the shapes and colors of objects. **B 21.** Describe the structure and function of the human senses and the signals they perceive.
Earth in the Solar System – How does the position of Earth in the solar system affect conditions on our planet? **5.3 - Most objects in the solar system are in a regular and predictable motion.** ♦ The positions of the Earth and moon relative to the sun explain the cycles of day and night, and the monthly moon phases.	**B 22.** Explain the cause of day and night based on the rotation of Earth on its axis. **B 23.** Describe the monthly changes in the appearance of the moon, based on the moon's orbit around the Earth.
Science and Technology in Society – How do science and technology affect the quality of our lives? **5.4 - Humans have the capacity to build and use tools to advance the quality of their lives.** ♦ Advances in technology allow individuals to acquire new information about the world.	**B 24.** Compare and contrast the structures of the human eye with those of the camera. **B 25.** Describe the uses of different instruments, such as eye glasses, magnifiers, periscopes and telescopes, to enhance our vision.

Grade 5

Physical Science

Energy Transfer and Transformation
Sound and Light

Content Standard

The student will understand that sound and light are forms of energy.

Focus Questions:

What is sound?
How does sound help us to communicate?
How do objects make sound?
How does sound travel?
What is light?
How does light travel?

Essential Understandings:

- Sound and light are forms of energy.
- Objects can be identified by the pitch and loudness of the sounds they make.
- Pitch and loudness are determined by the object's' properties (ie. length and tension).
- Sounds originate from vibrations.
- Sound receivers detect sound.
  Ears are an example of a sound receiver.
- Sound travels through solids, liquids, and air in the form of vibrations.
- Light can be reflected, refracted or absorbed by various objects.
  The eye is a light receiver.
- Light travels in a straight line.

Suggested Activities:

Observe and compare sounds made by dropped objects.
Create a sound code for sending messages.
Observe, compare, and record how sound travels through solids, liquids, and air.
Construct musical instruments to explore sound sources and vibrations.

Investigate how the human ear receives sound.
Experiment to investigate the distances sound can travel.
Experiment to see how sound can be made louder.
Experiment to see how pitch can be changed.
Use pre-recorded sounds to predict their sources.
Use various materials to observe whether they reflect, refract or absorb light.
Construct a pinhole camera.
Invite HighTouch/High Tech for in-house field trip.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe that sound travels through various media Observe that sounds are made when objects are dropped, and that sound originates from vibrations
Communicating:	Use a code to communicate with others
Comparing:	Compare how sound travels through various media
Inferring:	Infer that the pitch of a sound depends on the properties of the sound source
Applying:	Make and use a pinhole camera
Predicting:	Predict which materials will reflect, refract or absorb light

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

How to Make and Use a Pinhole Camera

Can Or Box Pinhole Camera

When you make a pinhole camera to accept roll or sheet film, use a small, light-tight can or box as the camera body.

Pinhole camera made from a can.

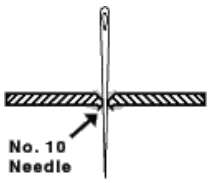
You can use any can that has a tight-fitting top. A 2-pound coffee can makes a good pinhole camera. You can use a clean paint can, a vegetable shortening can, a peanut can, or even a cylindrical oatmeal box. If the can you use has a plastic lid, you can paint the lid black. Be sure to paint it inside and out; then before using it, check to make sure no paint has chipped off. Chipped or peeling paint on the lid will allow light to enter the camera and ruin your pictures.

Paint the inside of the camera body with dull black paint or line it with black paper to prevent light reflections.

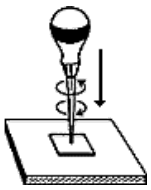
The Pinhole

With a noncartridge camera, make the pinhole in the end opposite the removable end. It's easier to attach the film to the removable end. You can make the pinhole in the box or the can itself, but it's much easier to make it in a separate piece of heavy black paper or thin metal. Then fasten this piece over a larger hole cut in the center of the permanent end of the can or box. Heavy-duty aluminum foil or the backing paper from Kodak roll film is good for this purpose.

For a camera with the pinhole 3 to 6 inches from the film, you'll get the best results if the pinhole is about 1/75 inch in diameter. You can make a hole this size by pushing a No. 10 sewing needle through the paper or metal to a point halfway up the needle shank. See illustration. You'll get a smoother hole if you rotate the needle as you push it through. If you're using aluminum foil or paper, sandwich it between two lightweight cards while you make the pinhole. This will help you make a smoother, rounder hole.



You can also make a good pinhole in soft aluminum sheet metal. Place the aluminum on a hard surface (such as tempered hardboard). Make a small hole in the aluminum with an awl or an ice pick. Don't press too hard--the tip should just barely break through the surface. See illustration. The hole will be ragged. Enlarge and smooth it by pushing a No. 10 needle into it from the indented side. You can smooth the rough edges with very fine sandpaper and then open the hole with the tip of the needle. You can use the same method to make the pinhole directly in the metal of the can by working the hole through from inside the bottom of the can.



If you make the pinhole in a separate piece of black paper or metal, you should now make a hole 1/4 inch or more in diameter in the center of one end of the camera body. Then tape your pinhole in position over the center of the hole.

You can check your pinhole to make sure it's perfectly round by looking through the back of the camera. To see if the image is clearly visible, aim the camera toward a printed page to determine if you can see the letters clearly.

The Shutter and Viewfinder

The shutter for the camera can be a flap of opaque dark paper hinged with a piece of tape. You can use a small piece of tape to hold the shutter closed while you aren't taking a picture.

A viewfinder for a pinhole camera, while usually not necessary, can be made of cardboard or wire. The larger frame should be slightly smaller than the film size and located directly above the pinhole at the front of the camera. If the film isn't square, the viewfinder should have its longer dimension parallel to the longer dimension of the film. The small frame is a sighting peephole directly above the film and squarely behind the center of the large frame.

When you aim your camera at subjects closer than 5 feet, tip the camera up slightly to allow for parallax--the difference between the view you see through the viewfinder and the image recorded on the film. This effect is caused by the separation between the viewfinder and the pinhole.

Loading a Can or Box Pinhole Camera

You can load the camera either with film or fast photographic paper. Paper is easier to handle since you can load it into the camera under a safelight. If you don't have a safelight, you can work by the light of a flashlight covered with several thicknesses of red cellophane paper placed 6 to 8 feet away. Most film, on the other hand, must be handled in total darkness. Your choice of film or paper may depend in part on the exposure times. Paper, because it is less sensitive to light than film, will probably require an exposure of about 2 minutes for sunlit subjects. Film may require only 1 or 2 seconds for subjects in sunlight.

If you decide to use paper, try KODABROMIDE Paper F (glossy), No. 2, Single Weight. You can obtain this paper in the 4 x 5-inch size available in 100-sheet packages, or 5 x 7-inch size in 25-sheet packages from your photo dealer (corners may have to be trimmed to fit a cylindrical camera). If you use film, you can cut up a roll of KODAK TRI-X Pan Film or KODAK T-MAX 400 Profesional Film, 120 size, into 2 3/8-inch squares or 2 3/8 x 3 1/2-inch pieces. This must be done in total darkness, of course. At night a closet will probably be dark enough if lights in adjoining rooms are turned off. Sheet film, such as KODAK Tri-X Pan Professional Film, is easier to use because it's flat.

A camera made from a 2-pound coffee can will take a 2 1/4 x 3 1/4-inch piece of film or photographic paper. You can use a 3 1/4 x 4 1/4-inch piece if about 1/2 inch is clipped from each corner of the film or paper. A camera made from a 1-gallon paint can will take a 4 x 5-inch piece of film or paper.

When you have the size of paper or film you need, tape it firmly to the inside of the end of your camera opposite the pinhole. The emulsion should face the pinhole. The emulsion side of photographic paper is the shiny side. The emulsion on roll film is on the inside of the curl. Sheet film is identified by notches cut into one of the shorter sides. When you hold the film in a vertical position with the notches in the top edge toward the right side, the emulsion is facing you. Another way to determine the emulsion side of either paper or film is to touch both sides with a moistened finger. The emulsion side will feel slightly tacky. Test near the edge to avoid a fingerprint in the center of the picture. You will need to tape down the four corners if you use cut-up roll film or paper. Taping two diagonal corners will work for sheet film. Close the camera, making sure the shutter is closed.

Exposure

To get clear, sharp pictures, you must keep your camera very still while the shutter is open. Use tape or a lump of modeling clay to hold your camera to a table, windowsill, chair, rock, or other firm support. Lift the black paper to uncover the pinhole and keep the pinhole uncovered for the recommended time. Cover the pinhole with the black paper between exposures.

The following table gives exposure recommendations for a can or box pinhole camera. These recommendations are approximate. It's a good idea to make three different exposures for each scene, as explained above, to be sure you'll get a good picture.

KODAK Film or Paper	Bright Sun	Cloudy Bright
TRI-X Pan, T-MAX 400, or ROYAL Pan Film 4141 (ESTAR Thick Base)	1 or 2 seconds	4 to 8 seconds
T-MAX 100 Film	2 to 4 seconds	8 to 16 seconds
KODABROMIDE Paper, F2	2 minutes	8 minutes

Processing and Printing

Print film negatives in the usual way. If you use KODABROMIDE Paper to make your picture, make the camera exposure long enough to allow the resulting paper negative to be a little darker than an ordinary photographic print. Dry the paper negative and make a contact print from it in the normal way, with the emulsion (picture) side of the paper negative toward the emulsion (shiny) side of the printing paper.

Grade 5

Life Science

Structure and Function
Sense Organs

Content Standard

The students will understand that the sense organs perceive and respond to information in the environment, which is critical for survival.

Focus Questions:

What are the sense organs?
How do the sense organs help us to survive?
How do they receive signals from the environment?
How do they send signals to the brain through the nervous system?

Essential Understandings:

- The sense organs are: eye, ear, tongue, nose, skin.
- The sense organs help us to survive.
- The nervous system controls the activity of the body.
- The sense organs are linked to the nervous system: central (brain and spinal cord) and Somatic (nerves and neurons).
- Each of the senses has specific structures and functions that enable them to receive and send signals.
- Light absorption and reflection allow one to see the shapes and colors of objects.

Suggested Activities:

Compare and contrast the sense organs of humans to those of other organisms (animal adaptations).
Discuss how lack of a sense affects remaining senses (ie. take away sense of sight to do touch experiment).
Observe models of sense organs to see their structure.
Explore sense of touch using materials with different textures.
Explore sense of smell using materials with different scents.
Explore the sense of taste with different foods at home.

Create a journal to record findings of sense experiments.
Re-enact the sending and receiving of signals through role-play.
Perform various reaction time tests.
Explore internet to acquire relevant data and to implement suggested activities

SCIENTIFIC THINKING PROCESSES

Observing:	Identify and label various structures within the sense organs
Communicating:	Discuss findings from home taste tests Discuss the process of the nervous system role-play
Comparing:	Compare the structure of human sense organs to the structure of animal sense organs
Organizing:	Organize results of taste test into categories of salty, Sweet, bitter and sour Organize the results of the reaction time test
Applying:	Apply knowledge of nervous system to complete role-play
Predicting:	Predict what will happen to senses when one is removed

EMBEDDED TASK

All students will perform the Catch. It! experiment in order to assess understanding of inquiry and the nature of science through questioning using the 5E Model of Teaching.

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Grade 5
Earth Science
Earth in the Solar System
Earth, Moon and Sun

Content Standard

The student will understand that objects in the solar system are in a regular and predictable motion.

Focus Questions:
What makes up the solar system?
What is the position of the Earth in relation to the Sun?
What is the position of the Moon in relation to the Sun and the Earth?
What is the difference between rotation and revolution?
What are the phases of the moon?

Essential Understandings:
- The solar system is made up of the Sun (a star), planets, moons and other objects.
- The solar system is constantly changing.
- Gravity is the force that keeps objects in a regular and predictable motion.
- Different sized objects have different amounts of gravity.
- Two types of planets are in our solar system - the rocky planets (Mercury, Venus, Earth, Mars) and the gas giants (Jupiter, Saturn, Uranus, Neptune).
- An asteroid belt divides the inner rocky planets from the outer gaseous planets.
- A star is a hot, glowing ball of gases.
  Our Sun is a medium-sized, yellow star.
- An orbit is the path a planet follows as it circles the Sun.
- A planet is a body in space that orbits around the Sun in an elliptical path.
- Some planets have satellites called moons.
- The Moon is a natural satellite of the Earth and both orbit the Sun.
- The phases of the Moon are caused by different amounts of shadow and reflected sunlight cast toward Earth (full, new, waxing, waning, gibbous, crescent).
- Rotation is the turning of the Earth on its axis or center.
- Revolution (orbit) is the movement of a body around the Sun.

Suggested Activities:

Construct a model of the sun, earth, and moon system.
Construct moon phase calendar.
Create a journal and describe the phases of the moon.
Attend a field trip-observatory or planetarium (Science Center of Connecticut).
Visit local observatory and planetarium (New Milford School District).
Role-play the relationship between rotation and revolution.
Perform Crater experiment to demonstrate force of gravity.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe phases of the Moon
Communicating:	Discuss the gravitational pull of the Sun on the Earth and the Moon
Comparing:	Compare the relationship between the size of an object and its gravitational pull Compare the Earth and Moon
Organizing:	Organize the phases of the moon based on phase calendar
Applying:	Role-play to demonstrate rotation and revolution
Predicting:	Predict the causes of day and night Predict the phases of the moon

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources:

Grade 5

Physical Science

Science and Technology in Society

Tools to Enhance the Senses

Content Standard

The student will understand that humans have the capacity to build and use tools to advance the quality of life.

Focus Questions:

What is technology?
How has technology allowed for the acquisition of information in the world?
How has technology advanced human life?
How have tools changed throughout history?
How do human sense organs, specifically the eye, compare with current tools?

Essential Understandings:

- Technology has enabled humans to enhance their senses, allowing them to acquire new information.
- There are similarities and differences between the structure and function of the camera and the human eye.
- Eye glasses, magnifiers, periscopes and telescopes are tools used to enhance our vision.
- Tools have changed and progressed over time.
- Tools are constantly changing to improve life.

Suggested Activities:

Invite local experts (optometrists, photographers, ENT physicians, phone technicians) to share information about tools used in their professions.
Dissect a camera to compare it to the structure of the human eye.
Create a tool that will enhance human life (Invention Convention).
Construct and discuss a timeline for the development of the telescope.
Debate the question, "Does science create technology or does technology create science?" and have students write a defense of their position.
Research Some of the hazards that can lead to vision and hearing loss.
Explore internet to acquire relevant data and to implement suggested activities.

SCIENTIFIC THINKING PROCESSES

Observing:	Observe the parts of the camera
Communicating:	Communicate individual position on Science and Technology question
Comparing:	Compare tools used in the past to those of the present Compare the camera to the eye
Organizing:	Organize the development of the telescope
Applying:	Develop a tool to enhance life
Predicting:	Predict how tools will develop in the future

Teacher Notes

Additional Focus Questions:

Additional Scientific Thinking Processes:

Additional Essential Understandings:

Additional Suggested Activities:

Resources: