

Imagination Station

Identifying the patterns and contradictions in the world around us requires both an eager mind and active imagination. Imagination Station is a place where science and art blend together in a series of ten hands-on, interactive exhibits. Visitors are encouraged to explore frequency, pitch, pattern and rhythm to discover the art in sound. Sound vibration patterns are converted into visible waves as visitors discover the differences in varied sound. They can manipulate models to investigate the anatomy of the human eye and explore the brain's interpretation of images. Color mixing and perception experiments engage creative curiosity. A remarkable experience in conceptualization allows visitors to immerse themselves in innovative, body-driven interactive artwork that reacts to shadows as if they were solid.

OKLAHOMA
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FUNDED BY THE DONALD W. REYNOLDS FOUNDATION

Summary of Exhibits

EXHIBIT	CONCEPTS	EXHIBIT DESCRIPTION
Circular Scales	<ul style="list-style-type: none"> • Tonality • Melodic variation • Perception of Sound 	Visitors use mallets to play notes on either a whole toned or major scale. The whole toned scale notes are equally spaced, so that there is no recognizable leading tone. The spacing on the major scale varies.
Disagreeing About Color	<ul style="list-style-type: none"> • Color Perception 	Eleven dots of light surround a central dot. The dots are created by a mixture of red and green light that vary in hue from green to orange. Visitors select which dot they think best matches the central dot.
Talking Circles	<ul style="list-style-type: none"> • Optical Illusion • Negative Space 	Spin what looks like a large goblet and suddenly two people appear and begin talking.
Spinners	<ul style="list-style-type: none"> • Optical Illusions 	Use three different spinners to explore how their visual system adapts to spinning motion.
Illusions	<ul style="list-style-type: none"> • Optical Illusions 	Explore a series of optical illusions in poster format that illustrates the different ways the brain interprets information.
Eyeballs	<ul style="list-style-type: none"> • Eye Anatomy • Optics 	This exhibit consists of four model eyeballs – a nearsighted eye, a farsighted eye, an eye with an adjustable focal length, and an astigmatic eye. Images are formed on the back of each model, revealing the image inversion that takes place in the eye. Corrective lenses can be added or removed by the visitor.
Light Island	<ul style="list-style-type: none"> • Color Mixing • Reflective Light/Prisms • Additive and Subtractive Light 	Use mirrors, lens, prisms and filters to manipulate a series of white and colored lights.
Pitch Slider	<ul style="list-style-type: none"> • Perception of Sound • Melodic Variation 	A flexible metal rod is mounted over a sound box. Move sliders up and down to alter the rods effective length. The subsequent changes in vibration produced varied sounds.
Oscylinder Scope	<ul style="list-style-type: none"> • Rhythmic Variation • Melodic Variation • Perception of Sound 	Spin a large horizontal cylinder with one hand while strumming guitar strings with the other. The exhibit translates the vibration pattern into visible waves that can be varied by using a foot pedal.

EXHIBIT	CONCEPTS	EXHIBIT DESCRIPTION
Oscylinder Scope	<ul style="list-style-type: none"> • Rhythmic Variation • Melodic Variation • Perception of Sound 	Spin a large horizontal cylinder with one hand while strumming guitar strings with the other. The exhibit translates the vibration pattern into visible waves that can be varied by using a foot pedal.
Shadow Garden	<ul style="list-style-type: none"> • Art Interpretation • Creative Conceptualization 	Visitors can immerse themselves in this set of interactive artwork. Streams of sand or flitting butterflies react to the shadows as if they were solid.
Touch Spectrum	<ul style="list-style-type: none"> • Electrical Circuits • Touch Switch Technology 	Place a hand on the metal plates and become a conductor of electrical current. This touch switch controlled sound synthesizers reacts to variations in contact points with changes in tone.
Photonic Spectrum	<ul style="list-style-type: none"> • Sound synthesis • Sensors • Frequency 	This exhibit utilizes a series of photo resistors to control a sound synthesizer. Columns of sensors and lights react to the position and movement of the visitors hands by creating sounds that vary in frequency from high to low.
Chaotic Pendulum	<ul style="list-style-type: none"> • Chaos Theory • Magnetism • Pendulums 	Swing a pendulum over a metal plate containing three magnets. Vary the position of the magnets and try to predict that path the pendulum will trace.
Velvet Hands	<ul style="list-style-type: none"> • Haptic (touch) Illusions • Perception 	Feel a strange velvety, slippery or oily sensation by lightly rubbing the different mesh screens between hands pressed lightly together.

PASS Skills by Grade

SAND/BUTTERFLIES	OSCILLATOR SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
KINDERGARTEN										
SCIENCE – PROCESS SKILLS										
	•	•	•							1.1 Observe, describe, sort, classify objects
•	•	•	•	•						• 1.2 Participate in simple experiments
•	•	•	•	•						• 1.3 Ask questions, make predictions, communicate observations
SCIENCE – CONTENT – PHYSICAL SCIENCE										
	•	•	•	•						• 1.1 Observe, describe, sort, classify sensory attributes of objects
	•	•								1.2 Compare, describe the properties of objects
GENERAL MUSIC – CONTENT										
	•	•								1.1.a Melody
	•									1.1.d Rhythm
	•	•								• 1.1.f Pitch
										• 3.1 Participate in singing/playing instruments
										• 3.4 Play simple rhythmic patterns
VISUAL ARTS – CONTENT										
			•		•	•	•			1.1 Elements of Art (line,color,form,shape,texture,value,space)
•					•	•				4.1 Appropriate behavior viewing art

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 1										
SCIENCE – PROCESS SKILLS										
	•									1.1 Observe and Measure
	•	•	•	•					•	1.2 Compare and Contrast
	•	•	•	•						2.1 Classify by observable properties
•	•	•	•	•				•	•	3.1 Ask a question
•	•	•	•	•				•	•	3.2 Plan, conduct an investigation
•	•	•	•	•				•	•	3.3 Gather data
	•	•	•						•	3.4 Practice Safety, recognize hazards
•	•	•	•	•				•	•	4.3 Communicate results of investigation
GENERAL MUSIC – CONTENT										
	•	•							•	1.1.a Melody
	•									1.1.b Rhythm
	•	•								1.1.f Pitch
									•	3.1 Sing/play instruments
		•							•	3.5 Play simple pitch patterns
VISUAL ARTS – CONTENT										
					•	•	•			1.2 Elements of Art (line,color,form,shape,texture,value,space)
			•			•		•		3.1 Color Mixing
•	•	•	•	•	•	•	•	•	•	4.1 Behavior at a museum

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 2										
SCIENCE – PROCESS SKILLS										
	•									1.1 Observe and Measure
	•	•	•	•					•	1.2 Compare and Contrast
	•	•	•	•						2.1 Classify by observable properties
•	•	•	•	•				•	•	3.1 Ask a question
•	•	•	•	•				•	•	3.2 Plan, conduct an investigation
•	•	•	•	•				•	•	3.3 Gather data
	•	•	•						•	3.4 Practice Safety, recognize hazards
•	•	•	•	•				•	•	4.3 Communicate results of investigation
SCIENCE – CONTENT – PHYSICAL SCIENCE										
								•		1.2 Motion, interaction of objects through toys, playground activities
•										3.2 Shadow characteristics
GENERAL MUSIC – CONTENT										
	•	•							•	1.1.a Melody
	•									1.1.b Rhythm
	•	•								1.1.f Pitch
									•	4.3 Likes, dislikes of music of different styles
VISUAL ARTS – CONTENT										
					•	•	•			1.2 Elements of Art (line,color,form,shape,texture,value,space)
						•		•		3.1 Color Mixing
•	•	•	•	•	•	•	•	•	•	4.1 Behavior at a museum

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 3										
SCIENCE – PROCESS SKILLS										
	•	•	•	•					•	1.2 Compare and Contrast
	•	•	•	•						2.1 Classify by observable properties
•	•	•	•	•					•	• 3.1 Ask a question
•	•	•	•	•					•	• 3.2 Plan, conduct an investigation
•	•	•	•	•					•	• 3.3 Gather data
	•	•	•							• 3.4 Practice Safety, recognize hazards
•										4.1 Interpret, communicate pictures, bar graphs, tables
										4.2 Recognize, describe patterns/make predictions
	•	•	•	•					•	• 4.3 Communicate results of investigation
SCIENCE – CONTENT – PHYSICAL SCIENCE										
	•	•								• 1.2 Sound produced by vibrations
GENERAL MUSIC – CONTENT										
	•	•								• 1.1.a Melody
	•									1.1.b Rhythm
	•	•								1.1.f Pitch
VISUAL ARTS – CONTENT										
					•	•	•			1.2 Elements of Art (line,color,form,shape,texture,value,space)
			•			•		•		3.1 Color Mixing
•	•	•	•	•	•	•	•	•	•	4.1 Behavior at a museum

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 4										
SCIENCE - PROCESS SKILLS										
										1.1 Observe and measure (SI Units)
	•	•	•	•				•	•	1.2 Compare and contrast
	•	•	•	•						2.1 Classify by observable properties
										2.2 Arrange in serial order
•	•	•	•	•	•	•	•	•	•	3.1 Ask questions/form investigative plans
•	•	•	•	•		•	•			3.2 Evaluate design of investigation
•	•	•	•	•		•				3.3 Design, conduct investigation
•	•	•	•			•				3.4 Practice safety, recognize hazards
•	•	•	•	•		•				4.3 Make predictions based on patterns
•	•	•	•							5.1 Investigate questions different ways
•										5.2 Use measurement tools, technology
•	•	•	•	•	•	•	•	•		5.3 Formulate general statement for data
•	•	•	•	•	•	•	•			5.4 Share results
GENERAL MUSIC - CONTENT										
	•	•								1.3 Experiment with variations, understanding tempo, tone, dynamics
										1.4.c Harmony
•	•	•								1.4.f Pitch
	•	•								3.1 Participate through singing, playing instruments
										3.5 Play simple melodies on instruments
VISUAL ARTS - CONTENT										
•					•	•	•	•		1.3 Elements of art: line, color, form shape texture, value, space
•					•	•	•			2.4 How visual art in today's world
•	•	•	•	•	•	•	•	•	•	4.1 Appropriate behavior in a museum

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES		
GRADE 5											
SCIENCE - PROCESS SKILLS											
	•	•	•	•					•	•	1.2 Compare and contrast
	•	•	•	•							• 2.1 Classify by observable properties
											• 2.2 Arrange in serial order
•	•	•	•	•	•	•	•	•	•	•	3.1 Ask questions/form investigative plans
•	•	•	•	•			•	•			• 3.2 Evaluate design of investigation
•	•	•	•	•			•				• 3.3 Design, conduct investigation
•	•	•	•				•				• 3.4 Practice safety, recognize hazards
•	•	•	•	•			•				• 4.3 Make predictions based on patterns
•	•	•	•								• 5.1 Investigate questions different ways
•											5.2 Use measurement tools, technology
•	•	•	•	•	•	•	•	•	•	•	5.3 Formulate general statement for data
•	•	•	•	•	•	•	•	•	•	•	5.4 Share results
SCIENCE - CONTENT - PHYSICAL SCIENCE											
	•	•									• 1.3 Energy can be transferred
GENERAL MUSIC - CONTENT											
	•	•									• 1.2 Experiment with variations of temp, tone, dynamics, phrasing
											• 1.4.c Harmony
	•	•									1.4.f Pitch
VISUAL ARTS - CONTENT											
			•		•	•	•	•			1.2 Describe and use elements of art
•											2.3 Identify how visual arts are used today
•	•	•	•	•	•	•	•	•	•	•	4.1 Appropriate behavior in a museum

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 6										
SCIENCE - PROCESS SKILLS										
	•	•	•						•	1.1 identify qualitative/quantitative changes
										1.2 use appropriate tools to measure
										1.3 Observe and measure (SI Units)
•	•	•	•	•					•	2.1 Classify by observable properties
									•	2.2 Identify properties by which things can be ordered
•	•	•	•	•	•	•	•	•	•	3.1 Ask questions/form investigative plans
•	•	•	•	•		•	•	•	•	3.2 Evaluate design of investigation
•	•	•	•	•					•	3.3 Identify variables /controls in experimental set-up
•	•	•	•	•		•		•	•	3.4 Identify testable hypothesis
•	•	•	•			•		•	•	3.5 Design/conduct investigation
•	•	•	•						•	3.6 Practice safety, recognize hazards
•	•	•	•			•		•	•	4.1 Use appropriate method to report data
										4.2 Interpret tables/graphs
•	•	•	•	•		•	•	•	•	4.3 Evaluate data/develop reasonable explanations, predictions
•	•	•	•	•		•		•	•	4.4 Accept or reject hypotheses when given results
•	•	•	•					•	•	4.5 Communicate scientific procedures/explanations
•										5.1 Inquiry - Use observation/accurate measurements/identify variables
										5.2 Inquiry - Use technology to gather/analyze results
•	•	•	•	•		•	•	•	•	5.3 Inquiry - Review, summarize data/form logical conclusions
•	•	•	•	•	•	•	•	•	•	5.4 Inquiry - Formulate,evaluate explanations/suggest alternatives

Continued on next page →

SAND/BUTTERFLIES	OSCILLINDER SCOPE	PITCH SLIDER	LIGHT ISLAND	EYEBALLS	ILLUSIONS	SPINNERS	TALKING CIRCLES	DISAGREEING ABOUT COLOR	CIRCULAR SCALES	
GRADE 6 <i>continued</i>										
SCIENCE - CONTENT - PHYSICAL SCIENCE										
										1.1 Matter has measureable physical properties /Changes can be measured
										1.2 Changes in shape do not alter object's mass
	•	•	•							• 2.1 Energy exists in many forms/Energy can be transferred
GENERAL MUSIC - CONTENT										
	•	•								• 1.2 Experiment with variations of temp, tone, dynamics, phrasing
										• 1.4.c Harmony
	•	•								1.4.f Pitch
VISUAL ARTS - CONTENT										
			•		•	•	•	•		1.2 Describe and use elements of art
•					•	•	•			2.3 Identify art forms used in business and industry
•	•	•	•	•	•	•	•	•	•	4.1 Appropriate behavior in a museum

Splittin' Image

Teachers Reference Page

CONCEPTS

Visually introduces the concepts of reflective light.

GROUP EXHIBIT TIE-IN

Light Table

MATERIALS NEEDED (per student group)

- 2 4" x 6" flat mirrors taped together book-style
- or 1 8" x 6" piece of mirrored poster board folded to create two 4" x 6" panels
- 1 Penny
- 1 Test pad/data sheet



MATERIALS NEEDED FOR INQUIRY CHALLENGE

Mirror Board (poster board with a reflective mirror-like surface available at hobby and craft stores)
 tape
 ruler
 scissors
 wax paper or tracing paper
 clear acetate, transparency film or page protector
 small pieces of colored paper, sequins, beads or candy sprinkles
Optional: cardboard or plastic tubes of various sizes

SPLITTIN' IMAGE EXERCISE ANSWERS

Angle	Actual Number of Images
180°	2
90°	4
120°	3
60°	6
45°	8
30°	12

To find how many images there will be for any angle: $360 \div \text{ANGLE} = \text{NUMBER OF IMAGES}$

Inquiry Challenge—Helpful Hints

FINDING MIRROR BOARD

This cardstock is a shiny silver mirror paper. It is not a perfect mirror but you can definitely see your reflection in it.

AVAILABLE LOCALLY:

Hobby Lobby

AVAILABLE ON-LINE:

www.discountsschoolsupply.com

www.hygloss.com

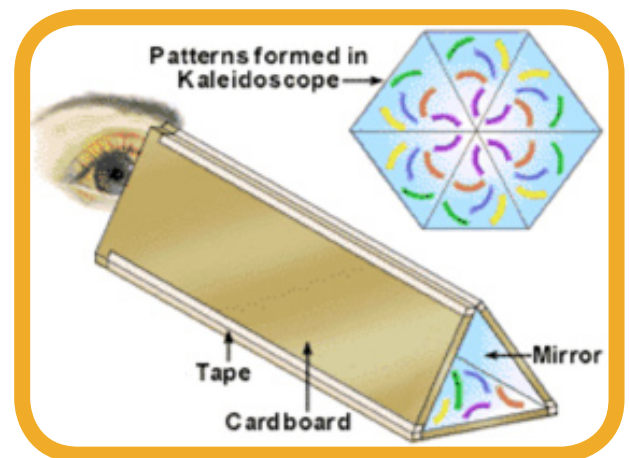
www.teacherstorehouse.com

www.educationalwarehouse.com



Students should be allowed to design and construct their kaleidoscope in their own way. However if someone is having difficulty with an idea or section, the following hints may be helpful.

- ▶ Each mirror section should ideally be the same size. The mirror board can be marked, scored and folded into the desired shape and held closed with tape.
- ▶ The object case is a thin, flat envelop that is easily made by holding the completed mirror tube against a piece of plastic or tracing paper and tracing around the edges. The plastic should be cut slightly larger than the traced area.
- ▶ A clear plastic piece and a frosted piece should be cut out and then all but one side taped together. The small fragments of paper or beads should be inserted into the open side. Then, the remaining side is taped together.
- ▶ The inner disk or cover of the case is clear, so that the items are easily reflected by the mirrors.
- ▶ The outer disk or cover of the object box is frosted so it diffuses the incoming light and acts like a screen.



PASS Skills for “Splittin’ Image”

	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
SCIENCE PROCESS SKILLS						
1.1	•	•	•	•	•	•
1.2	•	•	•	•	•	
2.1	•		•			
2.2	•	•	•	•	•	
3.1	•	•	•	•	•	•
3.2	•	•	•	•	•	•
3.3	•	•	•	•	•	•
3.4	•	•	•	•	•	•
3.5						•
3.6						•
4.2	•	•	•			
4.3		•		•	•	•
5.1				•	•	•
5.3				•	•	•
5.4				•	•	
SCIENCE CONTENT - PHYSICAL SCIENCE						
1.1	•					
1.3					•	
2.1						•
VISUAL ARTS						
1.3					•	
1.4				•	•	
2.2	•	•	•	•	•	
3.1	•	•	•	•	•	•
3.2		•	•	•	•	•
3.3					•	•
3.4	•	•	•			
3.5					•	•
4.3	•	•	•	•	•	•

Activity Page

Investigating the properties of reflected light

MATERIALS NEEDED (per student group)

- 2 4"x6" flat mirrors taped together book-style
- or 1 8" x 6" piece of mirrored poster board folded to create two 4"x6" panels
- 1 Penny
- 1 Test pad / data sheet

WHAT TO DO

- 1) Place the two mirrored surfaces on the test pad.
- 2) Line the mirrors up with the 180° angle. Place the penny in front of it. How many images of the penny do you see? Record your findings on the data sheet.
- 3) Move the mirrors to the 90° angle. Predict how many images you'll see. Place the penny in front of the mirrors, count the reflections and record your results.
- 4) Predict how many images you will see for each of the remaining angle measures. Move the mirrors to each measure and record your results.

Where your predictions correct?

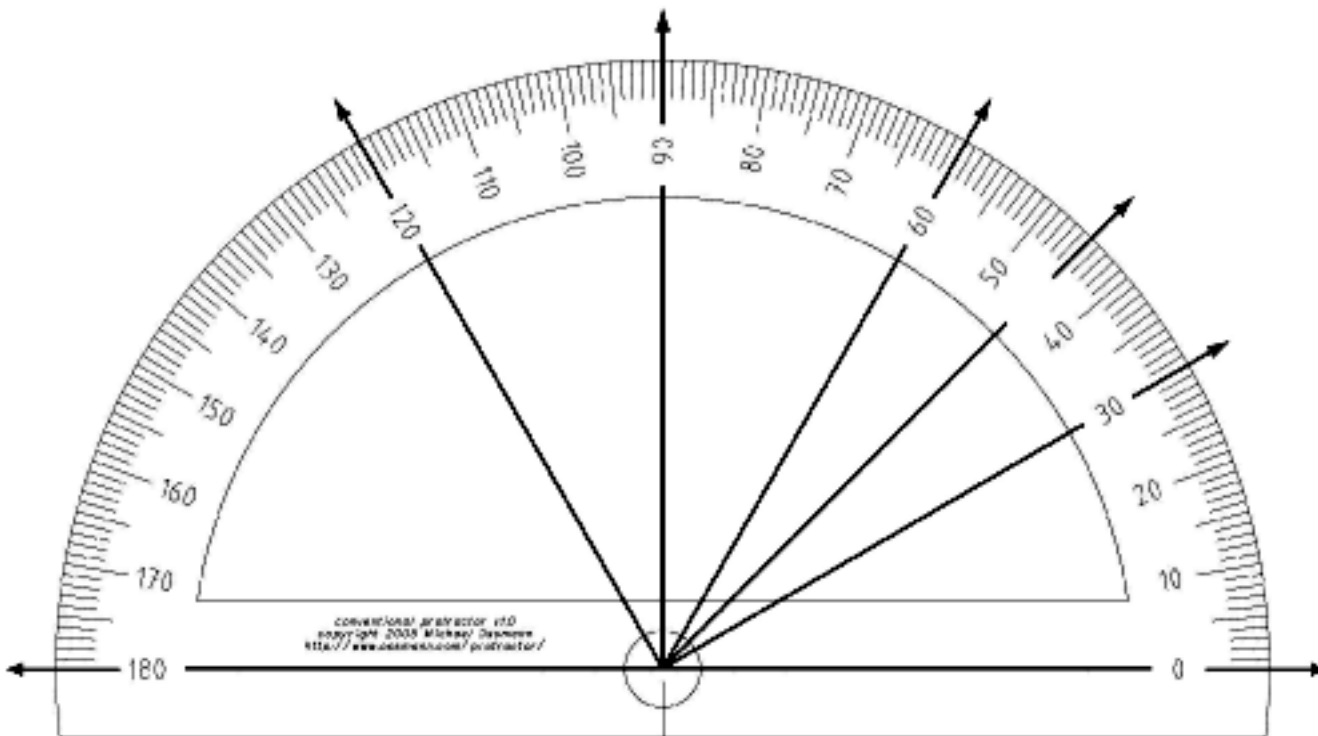
What relationship is there between the angle of the two mirrors and the number of images?

THINK ABOUT IT

How would adding a third mirror change the image pattern?

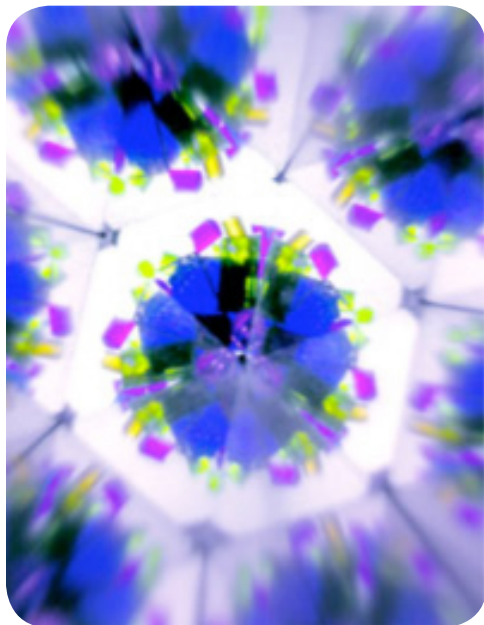
Test Pad / Data Sheet

Angle	PREDICTION: Number of Images	ACTUAL: Number of Image
180°		
90°		
120°		
60°		
45°		
30°		



Challenge Page

Investigating the properties of reflected light



Use mirrors to reflect light into beautiful shapes and patterns.

Think about the relationship between the angle of the two mirrors in the previous experiment and the number of images? Would adding a third mirror change the image pattern? How about a fourth mirror?

Kaleidoscopes come in all shapes and sizes, but they all have a viewing tube with an eyepiece and an object case at the far end of the tube.

Mirrored panels run the full length of the inside of the tube. The number of mirrors and the angles in which they're placed, determine the number of reflections that can be seen. Mirrors placed in different arrangements can produce dramatically different images.

The object case is usually filled with small bits and pieces of translucent or reflective items sandwiched between a clear cover that faces the front of the tube and a frosted cover in the back. There should be enough room in the case for the objects to tumble around into different patterns.

YOUR CHALLENGE

Create a unique kaleidoscope that produces the most complex patterns possible. Keep a log of your plans and progress. Share what you've learned.

MATERIALS (per student group)

Mirror Board (poster board with a reflective mirror-like surface)
 tape
 ruler
 scissors
 wax paper or tracing paper
 clear acetate, transparency film or page protector
 small pieces of colored paper, sequins, beads or candy sprinkles
Optional: cardboard or plastic tubes of various sizes

In 1816, Sir David Brewster, a Scottish physicist, was conducting experiments with reflective light. He constructed a tube-like instrument with mirrors that reflected loose pieces of glass to help him create symmetrical patterns. He called his device "kaleidoscope" from the Greek words for observer of beautiful forms. Even though he made it as a laboratory tool, the kaleidoscope became a very popular toy.

That's A Moiré

Teachers Reference Page

CONCEPTS

Visually introduces the concepts of wave interference and optical illusions.

EXHIBIT TIE-IN

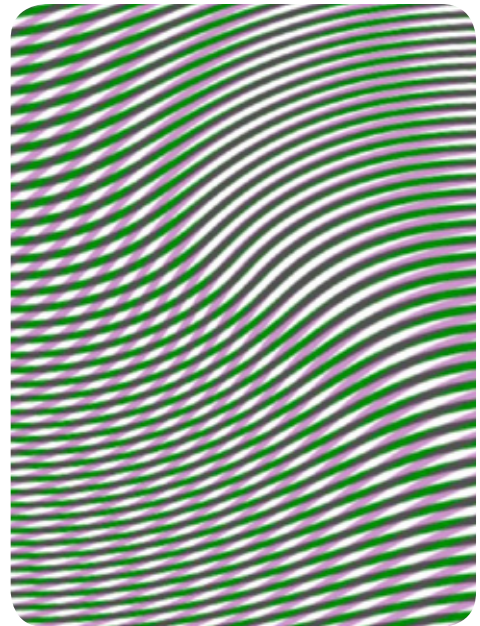
Optical Illusions

MATERIALS NEEDED (per student group)

small equal-size rectangles of plastic needlepoint canvas (#7 or 10 mesh)
or fiberglass window screen
tub of water
marbles

MATERIALS NEEDED (per student)

drawing paper
black pens or markers
transparency sheets for copiers



PASS Skills for “That’s A Moiré”

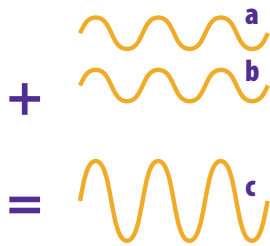
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
SCIENCE PROCESS SKILLS						
1.1						•
1.2	•	•	•	•	•	
3.1	•	•	•	•	•	•
3.2	•	•	•	•	•	•
3.4	•	•	•	•	•	•
3.5						•
3.6						•
4.2		•	•	•		
4.3		•		•	•	•
SCIENCE CONTENT - PHYSICAL SCIENCE						
1.1	•					
1.2		•		•		
1.3					•	
2.1						•
VISUAL ARTS						
1.2	•				•	•
1.3				•		
2.2	•	•	•		•	
2.4				•		
3.3	•	•	•	•		•
3.4	•	•	•			•
3.5					•	•
4.3				•	•	•

Wave Interference and Moirés

Teacher Background Information

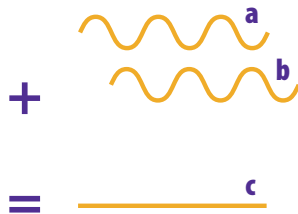
Moirés are interference patterns that are formed when two similar semi-transparent, repetitive patterns overlap, but are not aligned. Moiré patterns can easily be seen by looking through two chain-link or picket fences, window screens and even many loose weave fabrics.

Constructive interference



Wave interference is a phenomenon which occurs when two waves (light, sound, water, etc...) meet while traveling along the same medium. Wave interference can be constructive or destructive. **Constructive interference** occurs when two waves meet up going the same direction they combine into a larger one.

Destructive interference



On the other hand, **destructive interference** occurs when two wave going different directions meet, the resulting wave can be reduced or destroyed.

The name, moiré, comes from a fabric finishing technique that was developed in the 1400's. Fabric, like silk or rayon, is dyed or rolled to produce a wavy or rippled surface pattern.

Moiré patterns magnify differences between two repetitive patterns. If the two pieces are perfectly lined up, there will be no moiré pattern. If there's a slight misalignment between two objects, a large, very visible moiré pattern will appear. The bigger the misalignment the smaller and narrower the moiré pattern becomes.

The manufacturing industry uses this phenomena to locate microscopic areas of stress and strain in machinery. A grid outline of an object is compared to a reference grid. Small misalignments are easily seen.



Scanning moiré of a dented can

Activity Page

Investigate the properties of light in the design and construction of moiré patterns.

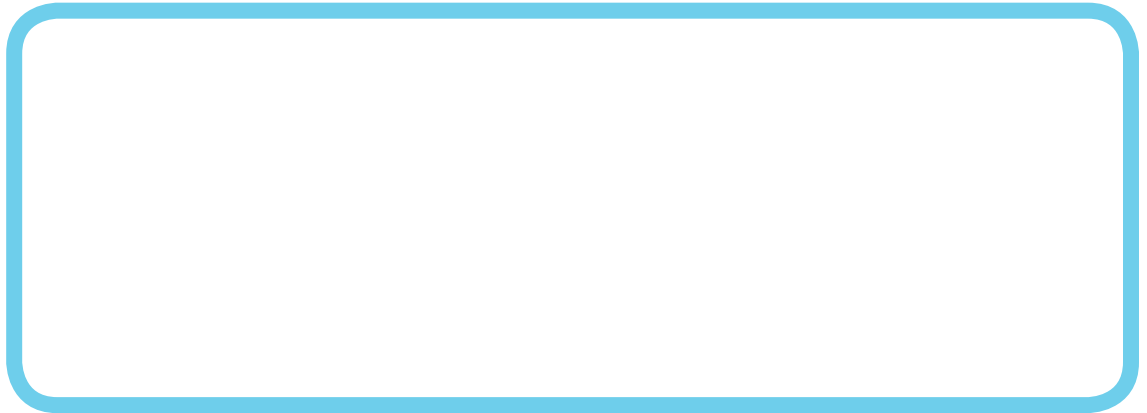
Focus on the concepts of optical illusion and wave interference.

MATERIALS NEEDED (per student group)

- small equal-size rectangles of plastic needlepoint canvas (#7 or 10 mesh)
- or fiberglass window screen
- tub of water
- marbles
- drawing paper
- black pens or markers
- transparency film for copiers

WHAT TO DO

Hold a marble about 10 inches above the center of a tub of water. Drop the marble and observe the wave patterns. Draw what you see →



Hold two marbles about 6 inches apart and about 10 inches above the tub of water. Drop the marbles and observe the wave patterns. Draw what you see →



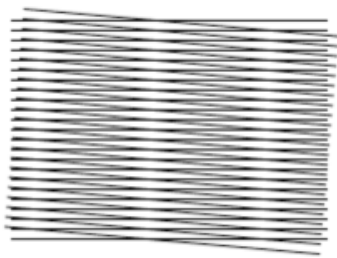
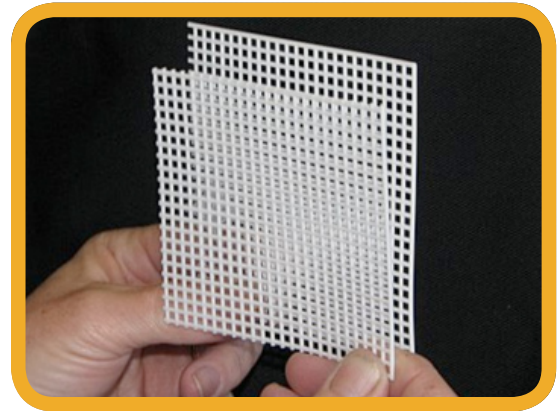
How are the two patterns different? Why?

Hold 2 squares of plastic needlepoint canvas or window screen up so that one is directly in front of the other. Hold them about 3/4 - an inch apart.

Look through the screen. Can you find the patterns created by light and shadow?

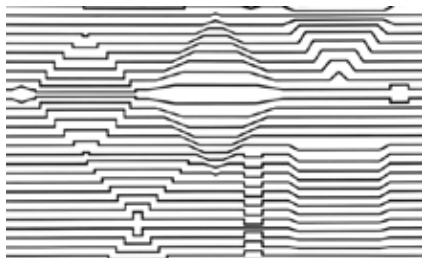
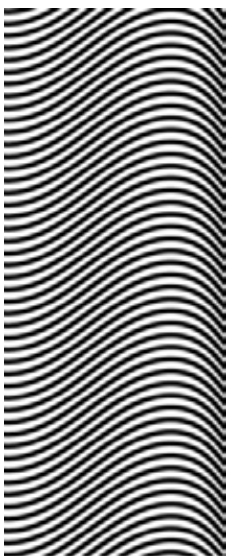
Move the front screen slowly from side to side, up and down and in a circle. Do the patterns change?

Move the back screen the same way. Are the patterns the same?



Moiré patterns are created when things with similar, semi-transparent, repetitive patterns overlap. Small movements often cause dramatic changes in the moiré patterns that your eyes see.

How is this phenomena similar to the waves created by dropping the two marbles into the tub?



CREATING MOIRÉ ART

Experiment by creating your own unique moiré piece. Draw a series of black lines in a repetitive way.

Think about the spacing between the line, the direction of the lines, the thickness of each line and the repetition in your pattern. What line pattern will create the most interesting moiré effect.

Once your drawing is complete, print a copy on transparency film.

Hold the transparency in front of the original drawing and move it around to see the new patterns as they emerge.

Fiction

If...

Sarah Perry

Publisher: Getty Trust Publications: J. Paul Getty Museum

Pub. Date: November 1995

ISBN-13: 9780892363216

Age Range: 4 to 8

46pp

In her first book, artist Sarah Perry has created twenty magical watercolors that are an open invitation to the imaginations of children. Beautifully produced in full color, these fantastic images conjure up a world of limitless possibilities where anything can happen: leaves turn into green fish... cats fly about on wings...and butterflies become a little girl's coat of many colors. Children of all ages will enjoy this book, the Getty Museum's first co-publication with the Children's Library Press of Venice, California.

Imagine a Day

Sarah L. Thomson, Rob Gonsalves (Illustrator)

Publisher: Simon & Schuster Children's Publishing

Pub. Date: February 2005

ISBN-13: 9780689852190

Age Range: 4 to 8

40pp

Imagine a day when your swing swings you higher than the highest treetops. Imagine a day when you can ride your bike up a path of falling leaves into the very tree they are falling from. Imagine a day when you release a handful of blue balloons into a cloudy, gray sky to create a postcard-perfect day. Imagine a day when the ordinary becomes the extraordinary...a day when anything is possible.

Imagine a Night

Sarah L. Thomson, Rob Gonsalves (Illustrator)

Publisher: Simon & Schuster Children's Publishing

Pub. Date: June 2003

ISBN-13: 9780689852183

Age Range: 6 to 11

40pp

Imagine a night when you can ride your bike right up the stairs to your bed. Imagine a night when your toy train rumbles on its tracks out of your room and roars back in, full sized, ready for you to hop on for a nighttime adventure. Imagine a night when a farmer plays a lullaby on his fiddle, and his field of sunflowers begins to dip and sway to the rhythm. Imagine a night when ordinary objects magically become extraordinary...a night when it is possible to believe the impossible.

With the intrigue of an Escher drawing and the richness of a Chris Van Allsburg painting, renowned Canadian artist Rob Gonsalves depicts that delicious time between sleep and wakefulness, creating a breathtaking, visual exploration of imagination and possibility that will encourage both children and adults to think past the boundaries of everyday life, and see the possibilities beyond.

Ish

Peter H. Reynolds, Peter Reynolds (Illustrator)

Publisher: Candlewick Press

Pub. Date: September 2004

ISBN-13: 9780763623449

Age Range: 5 to 8

32pp

Drawing is what Ramon does. It's what makes him happy. But in one split second, all that changes. A single reckless remark by Ramon's older brother, Leon, turns Ramon's carefree sketches into joyless struggles. Luckily for Ramon, though, his little sister, Marisol, sees the world differently. She opens his eyes to something a lot more valuable than getting things just "right." Combining the spareness of fable with the potency of parable, Peter Reynolds shines a bright beam of light on the need to kindle and tend our creative flames with care.

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It's Me, Marva!

A Story about Color and Optical Illusions

Marjorie Priceman

Publisher: Random House Children's Books

Pub. Date: May 2001

ISBN-13: 9780679889939

Age Range: 5 to 8

40pp

The explosion of Marva's new invention, the Ketch-o-matic, begins a series of zany adventures involving color combinations and reasons for optical illusions, like the changing design of her dress or a salesman's necktie. Ketchup on her yellow hair makes it orange, while red punch spilled on a yellow rug makes it orange and on a white pooch, pink. The intensely colored, cut-paper shapes and seemingly improvised, brushed lines create highly stylized scenes that are charged with visual energy. The didactic content is inventively incorporated into Marva's activities in ways to help enhance the learning, while the wild endpapers add to the visual fun.

Mole Music

David M. McPhail

Publisher: Henry Holt & Company, Incorporated

Pub. Date: October 2001

ISBN-13: 9780805067668

Age Range: 4 to 8

32pp

A spiritual story about the far-reaching effects of private actions. Mole has always led a simple life, but lately he feels something is missing. When he first hears someone playing a violin, Mole realizes that he longs to make beautiful music, too. Through practice and patience, Mole learns to play. And even though he plays alone, in the privacy of his underground home, his music has an effect on others that is more magical than Mole will ever know.

Moses Goes to a Concert

Isaac Millman

Publisher: Farrar, Straus and Giroux

Pub. Date: April 1998

ISBN-13: 9780374350673

Age Range: 4 to 8

40pp

Deaf people hear music by feeling the vibrations. You will discover that some have become expert percussionists. The class is attending a concert at which a deaf percussionist is soloing. She plays in her stocking feet to feel the vibrations of the instruments. The conductor signals her when she must move from one instrument to another. Each page has insets of Moses signing to his friends including the word and the sign. No disability can prevent a person from enjoying, playing and responding to music. Children can play drums, rhythm stick, and bells to recorded music, but let them play in their stockings!

The Musicians of Bremen

Niroot Puttapipat

Publisher: Candlewick Press

Pub. Date: October 2005

ISBN-13: 9780763627584

Age Range: 4 to 6

32pp

Once upon a time, Donkey, Dog, Cat, and Rooster, spurned by their owners, decide to set off to Bremen to make their way as musicians, each one according to his voice: Donkey a lute player, Dog a drummer, Cat a violinist, and Rooster a tenor. Along the way, the talented troubadours put on a show for a band of robbers who, it turns out, are in for a terrible fright.

Shadowville

Michael Bartalos

Publisher: Penguin Group (USA)

Pub. Date: April 1995

ISBN-13: 9780670861613

Age Range: 3 to 8

40pp

Although our daytime world is filled with shadows caused by sunlight, what happens in the night, when "there is no light, and shadows disappear from sight..."? This unusual picture book, with its bold, black illustrations of very active, comic shadows, a lively, rhyming text, and matching bold, black print, attempts to answer this question in an imaginative, child-like way. Although, scientifically, the premise that there are no shadows at night, may be incorrect, most young readers will still enjoy the idea of a magic land, where all sorts of odd shadow creatures engage in a variety of wacky activities. No wonder they're so quiet in the daytime.

The Sound of Colors

A Journey of the Imagination

Jimmy Liao, Sarah L. Thomson (Adapted by)

Publisher: Little, Brown & Company

Pub. Date: March 2006

ISBN-13: 9780316939928

Age Range: 4 to 8

80pp

In this breathtaking, evocative book, a young blind girl travels from one subway station to another while her imagination takes her to impossibly wonderful places.

The Artist's World

Degas and the Little Dancer

Laurence Anholt

Publisher: Barron's Educational Series, Incorporated

Pub. Date: August 2007

ISBN-13: 9780764138522

Age Range: 5 to 8

32pp

Young Marie wants to be a ballerina, but her parents have no money for lessons. She must earn what little money she can as an artist's model at a ballet school. Then, her life takes an unusual turn when she models for the famous sculptor, Edgar Degas.

Magical Garden of Claude Monet

Laurence Anholt

Publisher: Barron's Educational Series, Incorporated

Pub. Date: August 2007

ISBN-13: 9780764138553

Age Range: 5 to 8

32pp

Julie lives in Paris, but she longs to walk in a beautiful country garden. When her mother takes her on a visit to rural Giverny, Julie discovers a beautiful garden and befriends the man she believes is the gardener. In fact, he is the garden's owner, the immortal artist Claude Monet.

Matisse

The King of Color

Laurence Anholt

Publisher: Barron's Educational Series, Incorporated

Pub. Date: September 2007

ISBN-13: 9780764160479

Age Range: 4 to 7

32pp

When Monique, a young visiting nurse, steps into the home of an elderly patient, she finds herself in rooms filled with the most vivid color she has ever seen. Her patient is the artist Henri Matisse, and as Matisse recovers from his illness, he and Monique become good friends. Later, Monique enters a convent where she becomes a nursing nun—and by happy coincidence, she meets Matisse once again. Her religious order is so poor that they don't have a chapel of their own, but Matisse decides that with Monique's help, he can remedy that situation. He develops a sketch drawn by Monique into a brilliant set of stained-glass chapel windows, and then uses his influence to raise enough money for the chapel's construction.

Picasso and the Girl with the Ponytail

Laurence Anholt

Publisher: Barron's Educational Series, Incorporated

Pub. Date: August 2007

ISBN-13: 9780764138539

Age Range: 5 to 8

32pp

Here is the fascinating story—based on true fact—of a world-famous artist and a little girl who became one of his models. Sylvette first met Picasso in 1954, when she was a girl in the southern French town of Vallauris. At that time, she was the shyest and dreamiest girl among her friends, though today, she is a respected artist in her own right. When Picasso set up his studio in a nearby house, he spotted young Sylvette and was taken immediately by her classical profile and her lovely ponytail. When at last he convinced her to pose for what became the first of more than forty works of art, the two gradually became good friends. Before long, Picasso's portraits of Sylvette became famous around the world.

Van Gogh and the Sunflowers

Laurence Anholt

Publisher: Barron's Educational Series, Incorporated

Pub. Date: August 2007

ISBN-13: 9780764138546

Age Range: 5 to 8

32pp

One day, a strange man arrives in Camille's town. It is the artist, Vincent van Gogh. His extraordinary paintings of the sunflowers and the "Starry Night" entrance the young boy. But not everyone appreciates the genius of Camille's "Sunflower Man," and Vincent is forced to leave the town.

Vincent's Colors

Words and Pictures by Vincent van Gogh

Vincent van Gogh, Metropolitan Museum of Art

Publisher: Chronicle Books LLC

Pub. Date: November 2005

ISBN-13: 9780811850995

Age Range: 4 to 8

48pp

Vincent van Gogh is one of the world's most famous artists. Throughout his life, he wrote to his younger brother, Theo, about his colorful, dynamic paintings. This book pairs the artist's paintings with his own words.

Van Gogh's descriptions, arranged as a simple rhyme, introduce young readers to all the colors of the rainbow and beyond. The descriptive words combine with spectacular reproductions of many of the artist's most beloved and important works to create a perfect art book for young and old alike.

Non-fiction

Awesome Experiments in Light & Sound

Michael A. DiSpezio, Rob Collinet (Illustrator)

Publisher: Sterling Publishing
 Pub. Date: August 2006
 ISBN-13: 9781402723728
 Age Range: 9 to 12
 160pp

These kid-friendly experiments teach the scientific basics of light and sound. And they're easy to carry out, using the most ordinary materials found around the house. Just grab a boom box, toilet paper tube, rubber band, or drinking straw to create a little smart magic. And it's fun to make cereal dance to the music and watch light bounce off a mirror and hit a bull's-eye. Hear your heart pumping through a funnel and tubing. Build a "ray maker" to display the visible spectrum of light in a glorious rainbow tray. These experiments will change the way you look and listen to the world around you!

How to Think Like a Scientist Answering Questions by the Scientific Method

Stephen P. Kramer, Felicia Bond (Illustrator)

Publisher: HarperCollins Publishers
 Pub. Date: March 1987
 ISBN-13: 9780690045659
 Age Range: 8 to 12
 48pp

Every day you answer questions—dozens, even hundreds of them. How do you find the answers to questions? How can you be sure your answers are correct?

Scientists use questions to learn about things. Scientists have developed a way of helping make sure they answer questions correctly. It is called the scientific method. The scientific method can help you find answers to many of the questions you are curious about. What kind of food does your dog like best? Is your sister more likely to help you with your homework if you say please? Can throwing a dead snake over a tree branch make it rain? The scientific method can help you answer these questions and many others.

I Can Make Music Simple-to-Make and Fun-to-Play Musical Instruments for Young Children

Michael Purton

Publisher: Anness Publishing, Ltd.
 Pub. Date: March 2000
 ISBN-13: 9780754802235
 Age Range: 5 to 7
 48pp

This highly successful all-color children's series will delight readers and parents alike, with how-to activity projects aimed at the very young.

Light, Color and Art Activities

Barbara Taylor

Publisher: Crabtree Publishing Company
 Pub. Date: October 2002
 ISBN-13: 9780778711421
 Age Range: 8 to 9
 48pp

This collection not only includes a wide variety of art projects, but also ties them to the science of light and color. As one who remembers the first color wheel I ever created in kindergarten, these activities can have long lasting impact on a child's life. The first project is to make a mosaic with small squares of construction paper. This is preceded with a discussion of primary colors, how colors are mixed and the difference between colors for print and colors of light. The sun is the source of all light on Earth, and the second project is to make a sundial. The accompanying photo shows a beautifully painted sundial decorated with a bright orange sun. Reflections are explored by gluing sequins all over a small ball. It's always nice to see instructions for making a kaleidoscope that are easy enough for younger students to follow. This is a collection of art/science activities that are relatively easy to do with great results.

Shadow Play

Making Pictures with Light and Lenses

Bernie Zubrowski, Roy Doty (Illustrator)

Publisher: HarperCollins Publishers
 Pub. Date: May 1995
 ISBN-13: 9780688132101
 Age Range: 9 to 12
 112pp

Who thought shadows could be such fun? They are—with Shadow Play.

This lively science activity book shows you how to turn a cardboard box, a light bulb, and some Plexiglas into a shadow box, and then use the box to create fascinating shadows with everything from pieces of cardboard and wire to three-dimensional objects to clear glass bottles. Once you add a magnifying glass and make a few simple alterations, your shadow box becomes a box camera. By changing light sources and switching lenses, you'll be able to produce all kinds of special picture images. Over fifty imaginative experiments help you explore some of the basic properties of light—and discover how studying shadows led to the invention of the camera.

Sky Tree

Seeing Science Through Art

Thomas Locker, Candace Christiansen

Publisher: HarperCollins Publishers
 Pub. Date: August 2001
 ISBN-13: 9780064437509
 Age Range: 5 to 9
 40pp

A tree stands on a hill by a river. As the sky changes, so does the tree, its branches filling with clouds, stars, snow, birds, mists, and the golden spring sun. One tree can mean many things.

Thomas Locker's lyrical text records the changes in the tree's world just as simply as a child might observe them, and his magnificent paintings crystallize the natural phenomena that embellish the tree on each page. Questions at the bottom of each page lead to a unique discussion in the back of the book, where art and science are intertwined, and further depth is added to the wonder of Sky Tree.

Sound

Darlene Lauw, Lim Cheng Puay

Publisher: Crabtree Publishing Company
 Pub. Date: October 2001
 ISBN-13: 9780778706083
 Age Range: 9 to 10
 32pp

Hands-on experiments are sure to engage readers as they learn about sound in this fact-filled volume from the "Science Alive" series. The clear and easy-to-read text is accompanied by eye-popping color diagrams, illustrations and photographs. The brief but informative chapters make complex concepts easy to understand and cover topics such as transmission of sound, speed and qualities of sound and how we hear sound. Young readers can create an artificial ear and make a spy telephone from step-by-step, easy-to-follow instructions. They will also discover how doctors use sound to examine and treat patients.

Sound

Sally Morgan

Publisher: Heinemann
 Pub. Date: December 2007
 ISBN-13: 9781403499288
 Age Range: Young Adult
 64pp

How does sound become music? Can sound damage our ears? Why does a siren's sound change as it passes you? Sound looks at what sound is, how it is made, how sound waves travel, and how humans and other animals hear sound. Find out why sound travels faster through water than through air, how it is possible to "see" using sound, and how sound is recorded.

Two Hundred Ways of Using Imagery in the Classroom

A Guide for Developing Imagination and Creativity in Elementary Students

Michael T. Bagley, Karin K. Hess

Publisher: Trillium Press
 Pub. Date: June 1987
 ISBN-13: 9780898240849
 Age Range: 12 and up
 226pp

Website Selections

Musical Instruments

Musical instruments for kids to make

<http://www.mudcat.org/kids/>

Fifteen videos on making musical instruments

http://www.expertvillage.com/video-series/710_homemade-instruments.htm

Index of on-line drum, piano and guitar games.

<http://ababasoft.com/music/>

Music Theory

Good overview on music theory

<http://library.thinkquest.org/15413/theory/theory.htm>

Sound

Collection of experiments with sound

http://homepage.eircom.net/~kogrango/sound_experiments.html

Collection of experiments with sound

<http://wow.osu.edu/experiments/sound/soundlist.html>

Light and Optics

Arizona State University's Patterns in Nature module index for light and optics activities

<http://accept.asu.edu/PiN/act/activities.shtml>

Canadian Gr.5 website with background information and classroom activities on light spectrum, reflection, refraction, lens, color and more

<http://www.valemount.com/joel/lightoptics/>

Eyes

Good website for eye and eyesight information. Includes a section on eye anatomy and disease prevention and treatment and interactive eye disease simulators.

<http://www.eyecareamerica.com/eyecare/>

Exploratorium's cow eye dissection site

http://www.exploratorium.edu/learning_studio/cow_eye/

Optical Illusions

Good introduction to optical illusions. Illusion index included.

<http://kids.niehs.nih.gov/illusion/illusions.htm>

Large selection of optical illusions organized by category

<http://www.colorcube.com/illusions/illusion.htm>

Hundreds of interactive optical illusions, games and puzzles

<http://www.sandlotscience.com/>

Color Theory

General overview of color theory, symbolism, and its effect on the eyes and body.

<http://www.colormatters.com/colortheory.html>

Wet Canvas module with 16 lessons on color theory and mixing

<http://www.wetcanvas.com/ArtSchool/Color/ColorTheory/>

General color theory with good diagrams and illustrations

<http://www.tigercolor.com/color-lab/color-theory/color-theory-intro.htm>

Art Projects/Lessons

Dick Blick Art lesson plan archive

<http://www.dickblick.com/lessonplans/2008lessonplans/>

Princeton's Incredible Art Department includes early childhood-college lesson plans, art resources, teacher links, on-line galleries and more.

<http://www.princetonol.com/groups/iad/>

Disney's Walt Stanchfield's animation tutorial page

<http://www.animationmeat.com/notes/waltstanchfield/waltstanchfield.html>

Pixel Perfect's video lesson on digital art

<http://revision3.com/pixelperfect/>

On-line tutorials of printmaking techniques including etching, woodcuts, lithography and screenprinting

<http://www.moma.org/exhibitions/2001/whatisaprint/flash.html>