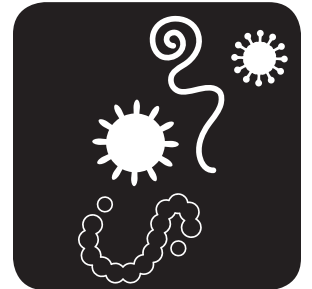
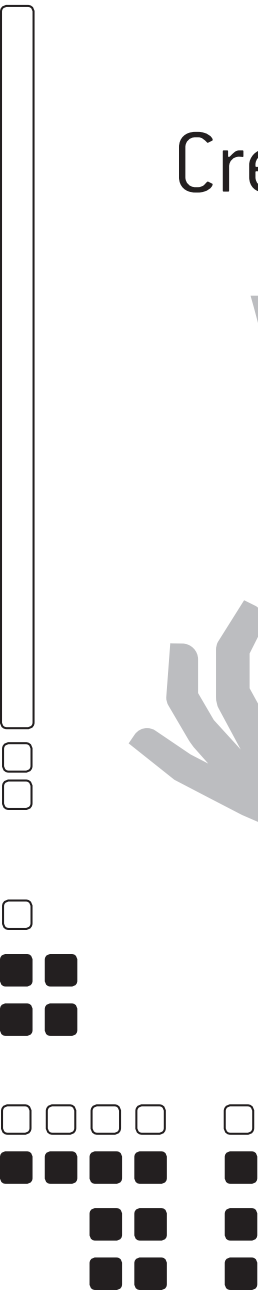


Liberty Science Center
Discovery ChallengesSM

Communication: Create a Secret Message!

Grades: 6-8



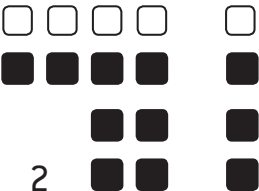


Language and the ability to communicate abstract ideas may be the single most important trait that separates humans from other animals. Learn how human communication has evolved from handprints on cave walls to the digital tools that link us today. In this *Discovery Challenge*, students explore different forms of communication and create a secret message!



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Teacher Overview

What is a Discovery ChallengeSM?

A Discovery Challenge:

- Forges connections between Liberty Science Center’s exhibitions and what is being studied in the classroom.
- Focuses and leverages student learning during visits.
- Encourages inquiry and critical thinking.
- Is aligned to national, New Jersey and New York science standards.

Before Your Visit:

- Complete the pre-visit lesson with your class to get students primed and ready for what they will discover at Liberty Science Center.
- Copy the *Exhibit Challenge Booklet* and distribute them to your students and chaperones.

During Your Visit:

- Encourage students to visit at least three or four exhibitions to help structure their exploration. Students should record observations by both writing and drawing in their booklets.

After Your Visit:

- Complete the post-visit wrap-up with students to foster continued discussion and discovery back in the classroom. *Career Quest* extensions can be used to introduce students to career possibilities stemming from their favorite exhibitions.
- Use the suggested list of resources to design additional relevant and engaging learning experiences for your students.



Technology Tie-Ins

Look for **SNSE Spots!**—**SNSE (Science Now, Science Everywhere)** allows you to use your phone to get extra information about exhibitions while on site and also allows you to learn more about the exhibitions you enjoyed after your visit.

Major funding provided by National Science Foundation 

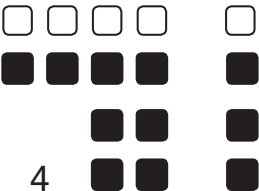
Liberty Science Center Discovery Challenges are available on our website at www.lsc.org/discoverychallenges.



Curriculum Standards Alignment

Topic: Communication: Create a Secret Message!

Grade Levels: 6-8



NEW JERSEY – Core Curriculum Content Standards

English Language Arts:

- 3.1. Reading
- 3.2. Writing
- 3.3. Speaking
- 3.3. Listening
- 3.5. Viewing and Literacy

Social Studies:

- 6.2.C. Economics, Innovation and Technology
- 6.2.D. History, Culture and Perspectives

World Languages:

- 7.1. World Languages

Technology:

- 8.1. Educational Technology
- 8.2. Technology Education, Engineering and Design

21st Century Life and Careers:

- 9.1. 21st Century Life and Careers
- 9.3. Awareness, Exploration and Preparation
- 9.4. Career and Technical Education

NEW JERSEY – Core Curriculum Content Standards for Science

5.1. Science Practices

- 5.1.B. Generating Scientific Knowledge Through Active Investigations
- 5.1.C. Reflect on Scientific Knowledge
- 5.1.D. Participate Productively in Science

5.2. Physical Science

- 5.2.C. Forms of Energy

5.3. Life Science

- 5.3.A. Organization and Development

NEW YORK – Mathematics, Science and Technology Education

- 1 - Analysis, Inquiry and Design
- 2 - Information Systems
- 3 - The Living Environment
- 4 - The Physical Setting
- 6 - Interconnectedness: Common Themes
- 7 - Interdisciplinary Problem Solving
- 8 - English Language Arts



Your Challenge: Create a Secret Message!

Throughout history, humans have needed to pass secret messages from one person, or group, to another. Morse code, invented in 1840, was used to pass information over long distances using a series of long and short signals now interpreted as auditory “dit’s” and “dah’s.”

Some have also said that people using the Underground Railroad communicated through visual symbols sewn into quilts. Although this is now thought to be a myth, this is an interesting example of a visual secret code. Other messages such as the Voynich manuscript have never been deciphered.

Your challenge is to communicate a message to your friends in a new and interesting way. Your message can be written or spoken, based on a current language, symbols or artwork. It should appeal to at least one of your five senses and be understandable only by those who “speak your language.” You must decide how your message will be shared with others.



About Communication

People have been communicating with one another since the dawn of time. Communication is the act or ability of sharing thoughts, opinions, information and/or ideas. It may not be something we think about in great detail, but communication is all around us. There are many different forms of communication including spoken, nonverbal, written, symbolic, electronic and digital communication.

Information is gathered through the five senses and sent to the brain. Based on this information, the brain forms thoughts which are then sent to the body and expressed as words, expressions, or gestures. Written and symbolic communication use symbols, signs, and letters to depict language. Electronic and digital communication includes computers, televisions or digital signals such as text messages or email.

How you communicate can also depend on culture. For example, in the United States and England, holding out your arm with your palm facing away from you means “stop.” However, in some Asian countries, this gesture is used when someone is asking permission to speak. An English-speaking person from the U.S. might call their home an “apartment” while an English-speaking person from England would call it a “flat.” This illustrates that the same idea may be communicated differently depending on one’s cultural context.





Pre-Visit Lesson: Sights and Sounds

Objectives

Students will be able to:

- Understand that sounds travel in a wave
- Experiment with the frequency of a wave to learn how frequency and pitch are related
- Observe that light can be reflected, refracted and absorbed
- Understand that our eyes detect light using rods and cones



Materials

- Plastic or metal 12-inch rulers
- Heavy books
- Clear jars
- Pencils
- Index cards
- Colored construction paper
- Mirrors
- Flashlights
- “Persistence of Vision” print-out
- Slinky
- Dominoes

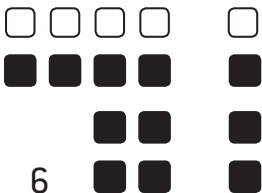
Procedure

SOUND

- Use the slinky to demonstrate the differences in waves, especially between transverse and compression (longitudinal) waves (see Resources).
- Have the students work individually or in groups to set up a line of dominoes. Have students push over the first domino and watch them fall to model how a compression wave travels. Did the first domino touch the last domino directly? Is this similar to how sound travels? How?
- Discuss how we can manipulate characteristics of sound such as frequency, pitch and amplitude.
- Ask students to use a 12-inch ruler to produce sounds of different frequencies. Extend the ruler over the edge of a desk. Place a book on top of the ruler to keep it tight against the desk. Allow students to pluck the ruler and listen to the sound that it makes. Move the ruler back and forth so that different lengths are extended over the desk. How does the sound change with different lengths of the ruler? Can you actually see a difference in how much the ruler moves as the sound changes? What is the relationship between frequency and pitch?

SIGHT

- Discuss how light travels in straight lines, called rays, until it interacts with an object or material and is refracted, reflected or absorbed.
- Ask the students to place a pencil in a clear jar of water and observe it from all angles. What appears to happen to the pencil in the water? Why? Shine a focused beam of light (like from a small flashlight) into this same jar of water. This should be done in a darkened room if possible. Is this an example of refraction, reflection or absorption?
- Shine the flashlight onto a mirror to observe another property of light, reflection. This should be done in a darkened room if possible.





Post-Visit Wrap-Up: Do I Speak Your Language?



Discussion of Findings

Encouraging students to communicate observations in their own words is key to developing understanding. After your visit, bring students together so they can share what they discovered (observations, notes, drawings) while exploring Liberty Science Center’s exhibitions.

Development of Projects

Students should work in groups to develop their message. The message can be written or spoken, based on a current language or alphabet, comprised of symbols or artwork, and should appeal to at least one of the five senses. Students can develop the message in whatever way they choose, or be asked to develop in a specific format (i.e., one that only uses symbols or pictures, one that must be understood by someone who is blind, one that incorporates touch or taste, etc.). Students may also be directed to develop a message for a particular situation—for example, to convey information in an emergency situation in such a way that it could be hidden in plain sight, or leave a message for a future generation that may not speak your language.

Students should prepare an explanation and a poster presentation of how they developed their message to share with their classmates. Their presentation should include not only their message and how it was developed, but also the advantages and limitations of their “language” and how they predict it could be used.

Presentation of Projects

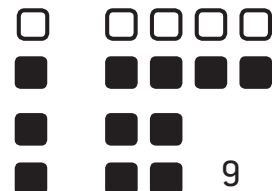
Provide students with time during class to present their poster presentations. Students should allow their classmates time to understand this new language and decipher their message.

Extensions

To extend learning across the curriculum, students can:

- Research the history and use of Morse Code. Write a message using Morse Code.
- Study the Underground Railroad and the use of quilts to communicate. Decide for yourself whether this form of communication is a historical fact. Have students create their own “quilts” using paper and colored pencils.
- Animals communicate differently than humans. Research unique and different ways animals communicate with and sense the world. One interesting example is the Manatee and its ability to “touch” at a distance.
- Introduce students to a message no one has ever been able to decipher: the Voynich manuscript.





Career Quest

Here are some suggestions about exposing students to careers related to this Discovery Challenge:

- Have students share the different careers they learned about while exploring Liberty Science Center’s exhibitions.
- Allow students to use the Internet to research these and other careers related to this Discovery Challenge, including what the jobs entail, the education and special skills needed, and where someone would work in this capacity.
- Invite a guest speaker/parent/guardian to come in and share his or her related career experiences. Some examples may include a language teacher, sign language instructor, astronaut, communications specialist, graphic designer, or advertising expert.

Resources

Liberty Science Center Programs

For more information about Liberty Science Center’s exciting educational offerings please visit www.lsc.org.

iTunes University

Open iTunes and go to the iTunes Store. On the home page, select iTunes U from the iTunes Store menu in the upper left hand column. From here, select the “Beyond Campus” option under the heading of Education Providers in the third menu of the left hand column. Under “L” you will find Liberty Science Center. From this page you can access information and video about Liberty Science Center’s exhibitions and educational programs.

For the supplemental information that corresponds to this Discovery Challenge, please click the Discovery Challenge tab and download the free video titled Create a Secret Message for Grades 6-8.



Websites

Longitudinal and Transverse Wave - Dr. Dan Russell, Kettering University

<http://paws.kettering.edu/ffdrussell/Demos/waves/wavemotion.html>

Yale University Beinecke Rare Book & Manuscript Library

Voynich Manuscript

<http://beinecke.library.yale.edu/digitalibrary/voynich.html>

National Underground Freedom Center

<http://www.freedomcenter.org/underground-railroad/#>

Reflection and Its Importance: The Law of Reflection

<http://www.physicsclassroom.com/Class/refln/u13l1c.cfm>

Refraction and a Boundary: Refraction and Sight

<http://www.physicsclassroom.com/Class/refrn/U14L1b.cfm>

The White River Valley Museum: Morse Code History

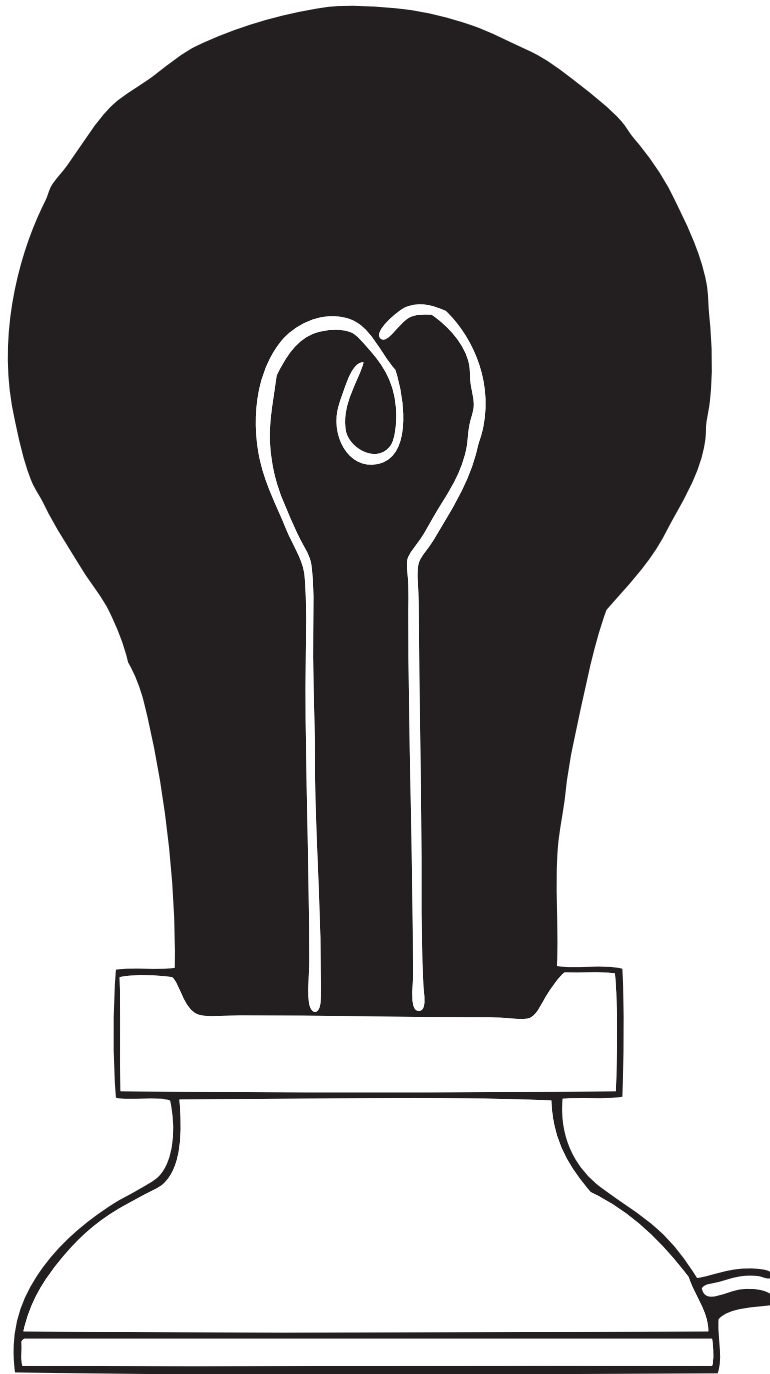
<http://www.wrvmuseum.org/morsecode/morsecodehistory.htm>

Color and Vision: Visible Light and the Eye's Response

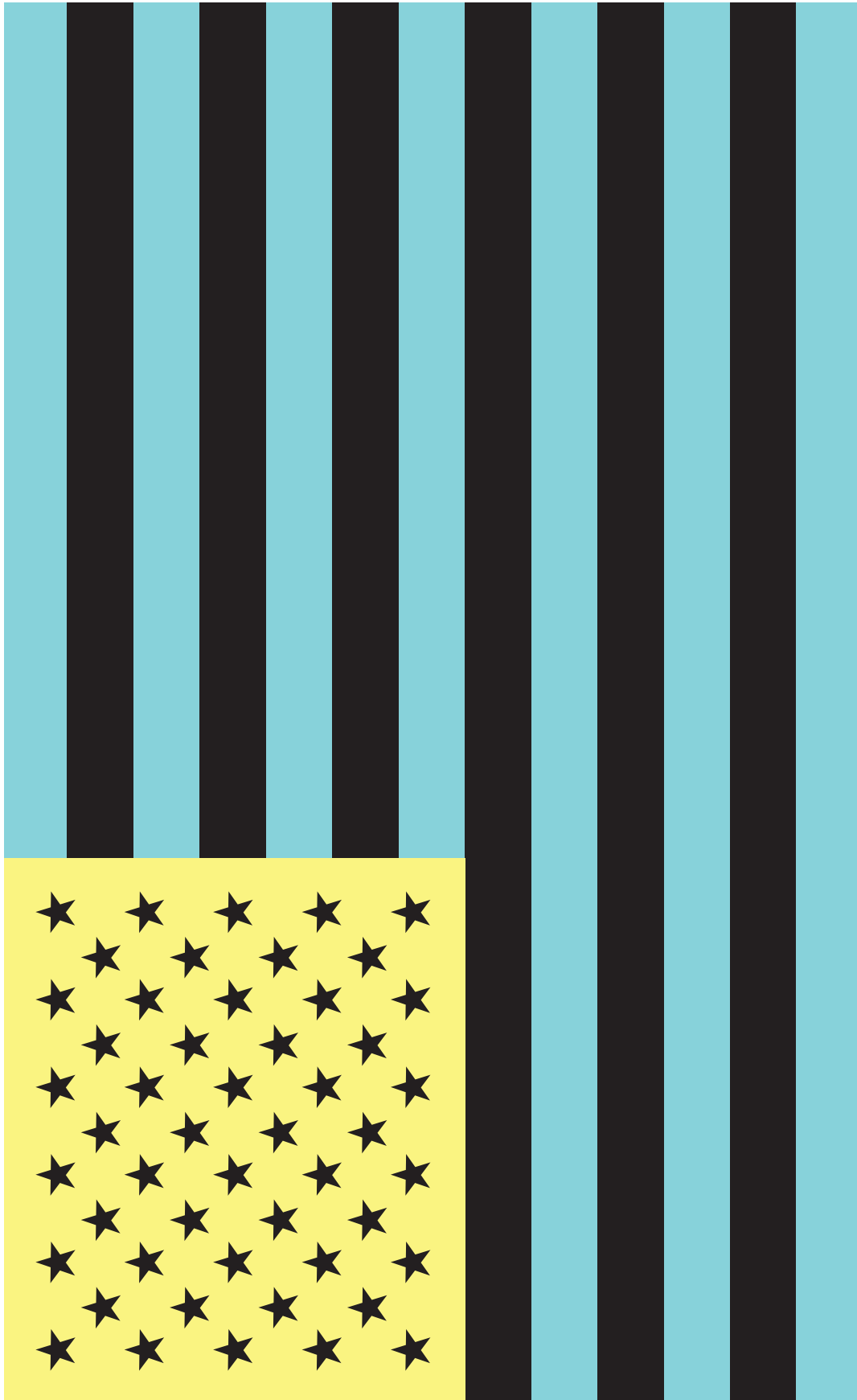
<http://www.physicsclassroom.com/Class/light/u12l2b.cfm>



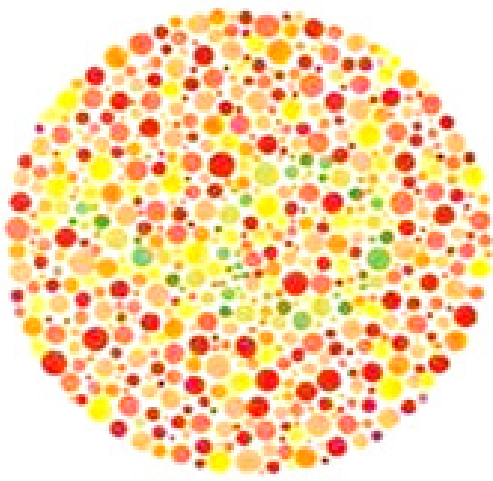
Persistence of Vision



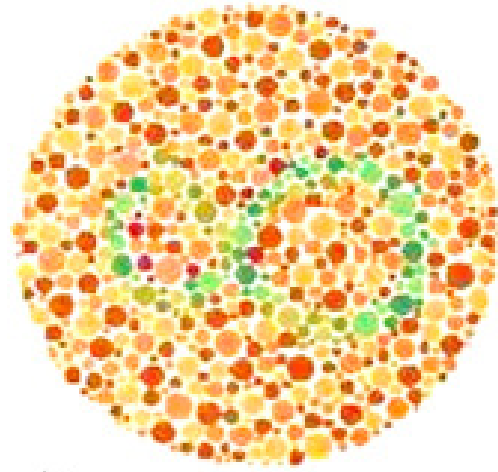
APPENDIX A



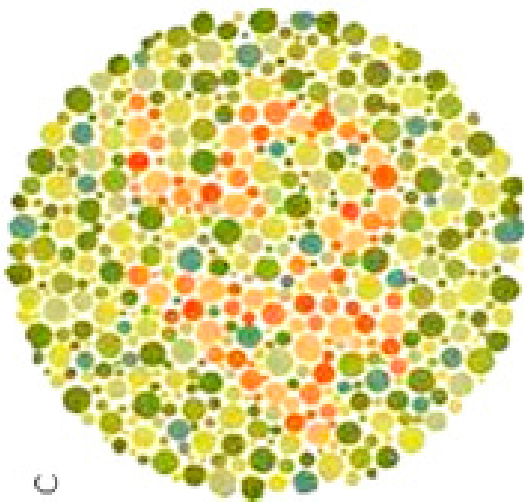
APPENDIX B



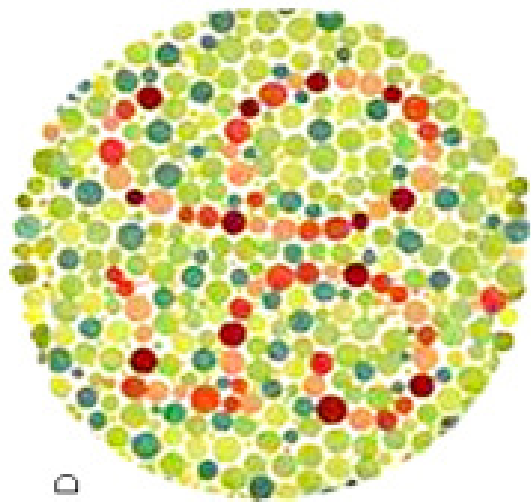
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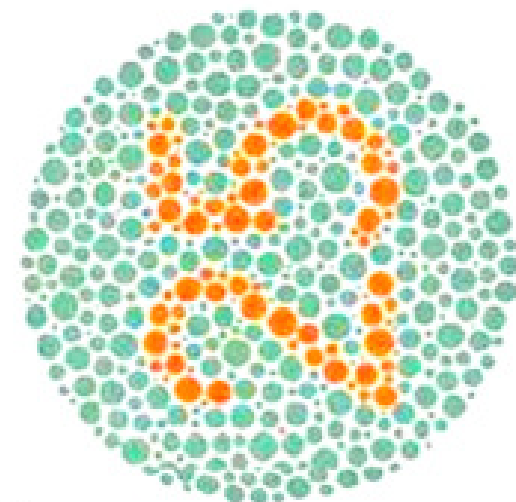
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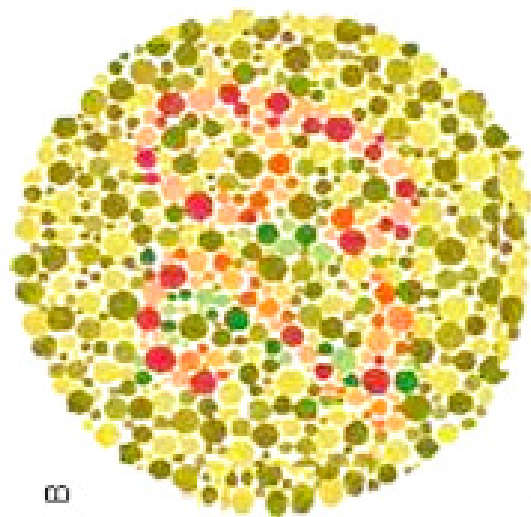
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A

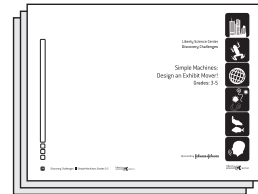
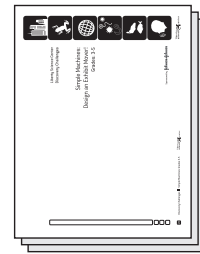


B



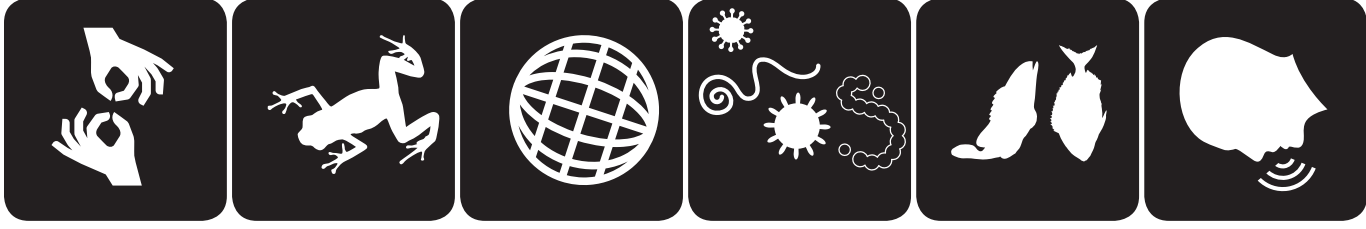
Preparing Your Booklets

1. Remove the next 12 pages from this packet. **DO NOT** re-arrange the placement or order of these pages.
2. Photocopy the pages so they are double-sided. Make as many copies as you need.
3. Fold each booklet in half.
4. Give one booklet to each student and chaperone in your group.



Liberty Science Center
Discovery ChallengesSM

Communication:
Create a Secret Message!
Grades: 6-8



Liberty Science Center
Liberty State Park
222 Jersey City Boulevard
Jersey City, New Jersey 07305 USA
201.200.1000
www.lsc.org

Exhibit Challenge Booklet

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NOTES



SKETCH PAD

NOTES



SKETCH PAD

We Suggest:

- ✔ Visit at least three of the Exhibit Challenge locations. If one is unavailable, move on to another.
- ✔ Use the booklets to record your observations and create drawings of what you see.
- ✔ Think about how you can apply what you have learned to your challenge project.

1. Communication: How Do You Communicate?

WHERE TO GO

Third Floor, Entrance to *Communication*

WHAT TO DO

- Use the signals and networks touch screen to vote about how you contact your friends.
- Look at how others responded to the question.

CONSIDER THIS

- What is the most common communication method surveyed here?
- How will you communicate your message with your friends?
- Do you think this is a representative sample of the population?

OTHER THINGS TO TRY

- Try the touch screen labeled Digital Media and Content to your left.
- What are other ways that people get and receive information?

NOTES



SKETCH PAD

NOTES



SKETCH PAD

NOTES



SKETCH PAD

2. Communication: How You See

WHERE TO GO

Third Floor, *Communication*, How You See exhibit

WHAT TO DO

- Observe the eye model to learn how your eyes and brain work together to help you see.
- Experiment with the image by pressing the labeled buttons.

CONSIDER THIS

- Why does the image change?
- Will your message be visual? How will sight play a part in your message?
- Can you think of any situations in which a visual message would not be effective?

OTHER THINGS TO TRY

- Sometimes your eyes can play tricks on you. Try looking up optical illusions at www.magiceye.com/3dfun/stwkdisp.shtml. Could you hide your message in an optical illusion?

NOTES



SKETCH PAD

8. Communication: Sampling



WHERE TO GO

Third Floor, *Communication*, Signals and Networks Section,
Sampling Your Voice Exhibit



WHAT TO DO

- Follow the instructions to record a message.
- Look to your left to read about how your voice is converted into digital information.
- Listen to your message and zoom in on the samples.



CONSIDER THIS

- Will you transmit your message electronically?
- How could you utilize binary code to send your message?
- What problems might you encounter if your recording device is low quality?



OTHER THINGS TO TRY

- Go to the Pixel Power Exhibit behind you.
- Turn the red, green and blue knobs to try and match the color of your shirt.
- Observe how you can use binary code to represent colors.

NOTES



SKETCH PAD

3. Communication: Sign Language

WHERE TO GO

Third Floor, *Communication*, Body and Language section,
How You Sign exhibit

WHAT TO DO

- Use the touch screen to sign with Deborah.
- Observe how Deborah can express emotion in the “non-manuals” section.
- Try copying Deborah and signing on your own.
- Read about body/coactive/hand over hand signs.

CONSIDER THIS

- How could you use signs to convey your message?
- How many senses could be used?
- Would your signs be felt or seen?

OTHER THINGS TO TRY

- Sign language is an effective form of communication for the hearing impaired. Learn more about how the human ear works at the How You Hear exhibit behind you.

NOTES

SKETCH PAD

7. Communication: Braille

WHERE TO GO

Third Floor, *Communication, Symbols, Signs and Writing* section, Writing Braille exhibit.

WHAT TO DO

- Use the Writing Braille kiosk to speak your name.
- Observe how the six raised dots can be used to make all 26 letters of the alphabet.
- Complete Challenge 3 of the Reading Braille exhibit to your right and solve the Braille riddle.



CONSIDER THIS

- Which senses do you use when reading Braille?
- How could you use this to send a secret message?
- What is the reason for the size of the dots? Does this relate to how you would use this to send a message?



OTHER THINGS TO TRY

- Go back to the entrance of the Symbols, Signs and Writing section to the Quipu exhibit.
- Use the rope to form a number. Can you think of other less common ways to send your secret message?

NOTES



SKETCH PAD

4. Communication: Pictograms

WHERE TO GO

Third Floor, *Communication*, Symbols, Signs and Writing section, Pictograms exhibit

WHAT TO DO

- Use the touch screen to play the pictogram guessing game.
- Follow the instructions to create your own pictogram.
- Read about pictograms on the panel in front of you.

CONSIDER THIS

- What information can you gain from the pictogram even though there are no words?
- Would a stranger understand the meaning of the pictogram you created?
- How would you use pictograms to communicate with your friends?

OTHER THINGS TO TRY

- Go to the Make Your Mark exhibit behind you. Use the Graffiti Wall to leave a message.
- Would you want to leave your message in plain sight in a public graffiti space?

NOTES

SKETCH PAD

10

15

6. Communication: Secret Messages and Hidden Meanings

WHERE TO GO

Third Floor, *Communication*, Symbols, Signs and Writing section, Secret Messages and Hidden Meanings exhibit

WHAT TO DO

- Use the touch screen to read about several different methods of encryption.
- Create and decode a message using the Caesar Shift method.

CONSIDER THIS

- Do you want to encode your message in this way?
- How would you create your own encryption?

OTHER THINGS TO TRY

- Think of a new method of encoding a word.
- Use the sketch pad on the opposite page to explain your method.

NOTES



SKETCH PAD

5. Communication: Rebus Pictures

WHERE TO GO

Third Floor, *Communication, Symbols, Signs and Writing* section,
Can You Write a Rebus? exhibit

WHAT TO DO

- Build a rebus sentence using the buttons.
- Try to make a 3-word, 5-word and 7-word sentence.
- Create a compound word (for example, bee + 4 = before).

CONSIDER THIS

- How difficult would it be to create a complex message using a rebus system?
- How would you prevent a message sent this way from being easily decoded?

OTHER THINGS TO TRY

- Use the sketch pad on the opposite page to draw your own rebus symbol.

NOTES



SKETCH PAD

12

13
