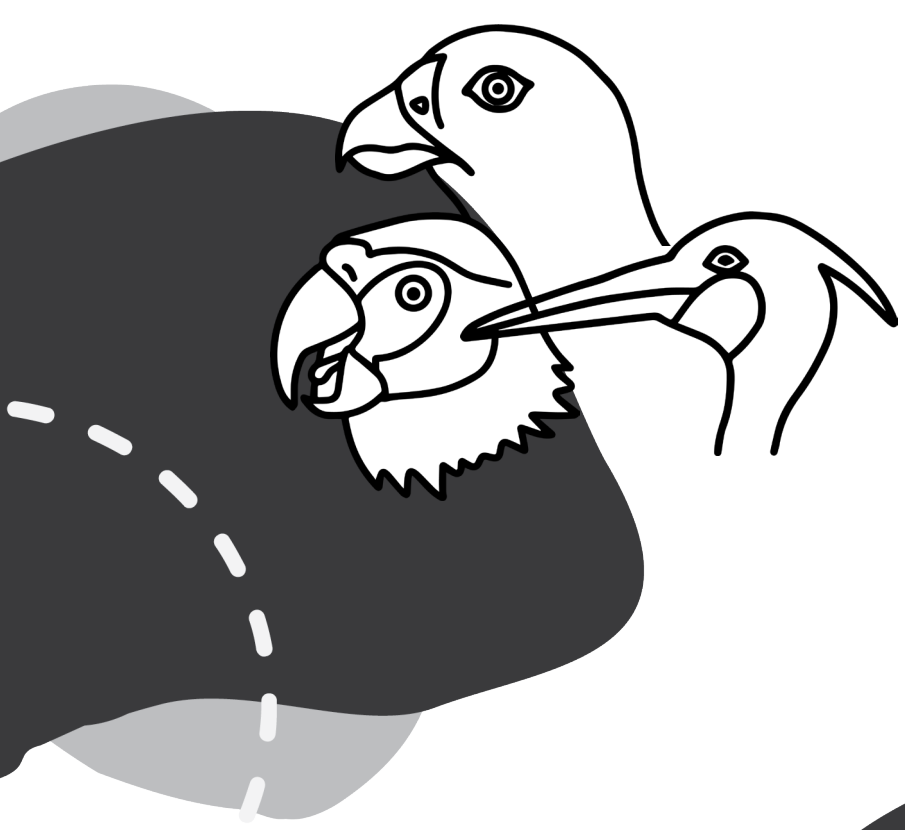
WISE Activity Booklets

A STEM activity booklet for fun on-the-go learning!
Made by WISE Kid-Netic Energy

DIY Activities
Puzzles
Challenges
... and more!



Grade 4
JULY 2020

Habitats & Communities - Light
Sound - Rocks, Minerals & Erosion

University of Manitoba

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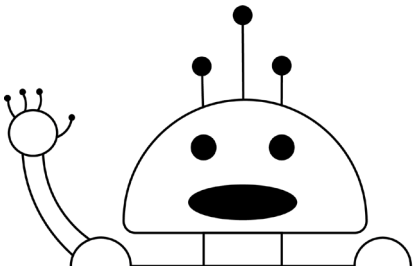


Hello there!

WISE Kid-Netic Energy is a not for profit STEM (Science, Technology, Engineering, and Math) outreach organization at the University of Manitoba. Our organization offers science and engineering workshops, clubs, camps and events to youth from Kindergarten to Grade 12 throughout the province of Manitoba. We reach on average 25 000 to 50 000 youth depending on funding levels. Our approach is simple – present STEM in messy, memorable and engaging ways so Manitoba youth feel motivated to learn more and more. We reach all Manitoba youth, and we particularly target underrepresented youth like girls, indigenous youth and youth facing socio-economic challenges.

All of us at WISE Kid-Netic Energy have been working hard to create these booklets to continue to bring our fun and educational STEM activities to Manitoba youth during these unprecedented times. We are disappointed that we cannot see you in person, and hope that these monthly booklets bring some STEM excitement to your life.

These booklets have been created by our student instructors who are all studying engineering, science, or in another STEM-related field at university. Peek the last page of this booklet to see who created the activities, experiments and recipes within.

All the activities in this booklet are based on the Manitoba Science curriculum. For any teachers viewing this booklet, all the SLO codes are listed at the bottom of each page.

If a link is listed at the bottom of the page, and you have access to the Internet, follow it to check out a video of the activity our instructors have created just for you.

We hope that you enjoy doing the experiments and activities as much as we loved creating them for you.

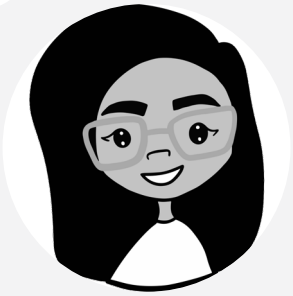
In this Grade 4 booklet, the science topics you will be exploring are: habitats and communities, light, sound, rocks, minerals and erosion, and more!

Best of luck, and until we see you again,

the WISE Kid-Netic Energy Crew

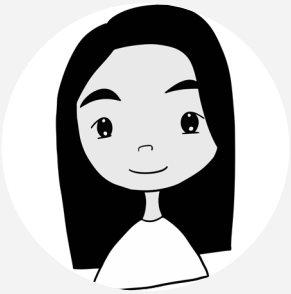
P.S. If you have any suggestions for activities or experiments you would like us to try, contact us through our website, or social media accounts that are listed on the last page of this booklet.

Meet our Amazing Authors!



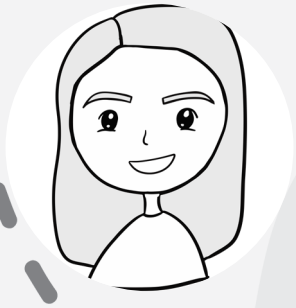
Alora

Alora just finished her fifth year in university, working towards her bachelor of Science with a major in Neuroscience and a minor in French. She is currently attending the University of Winnipeg. She is aspiring to become a high school science teacher and a guidance counsellor. In her spare time, she enjoys reading, writing, and playing the ukelele.



Amaris

Amaris just finished her first year in sciences at the University of Winnipeg and plans on majoring in biology. In her free time, Amaris likes reading, playing piano and baking.

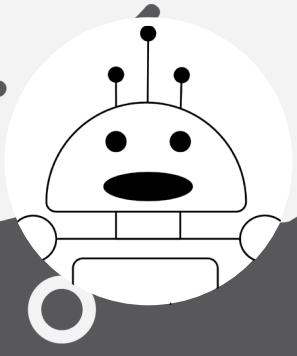


Katy

Katy has completed her second year of Biosystems Engineering at the University of Manitoba and is passionate about environmental sustainability and working with kids. In her spare time she enjoys running, painting, and spending time outside.

Zoe

Zoe just finished her first year of Engineering, and is entering the department of Civil Engineering in the fall. She loves math, and in her free time enjoys walking her dog, as well as playing volleyball and ultimate frisbee.



Esiw the Robot

Esiw is a friendly robot that loves to help kids learn about computers & coding! Esiw loves to do math, solve problems and make people laugh!

Biomimicry Community Search

Biomimicry is when humans use designs and ideas from nature to solve problems.

EXAMPLES

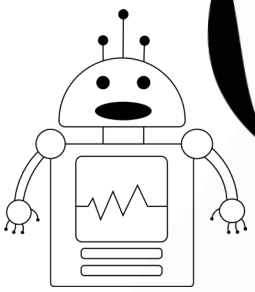
DUCK FEET: Ducks have webbed feet to be able to move more water when they swim. Based on the webbed feet of a duck, humans designed diving fins, or flippers, that can be attached to our feet to help us swim better. That's biomimicry!

SPIDER WEBS: Think about how the shape of a net resembles the shape of a spider's web and serves a similar purpose. Spiders build webs to catch prey for food, and humans use fishing nets to catch fish for food.

VELCRO: Velcro uses the same technology as burrs. Burrs come from some plants, and help them spread their seeds. A burr has tiny hooks covering its outer surface, which lets it stick to people and animals to carry the plant seeds further away from the original plant. Velcro is human designed with very similar small hooks to attach multiple materials together.

In this activity, you will try to find examples of biomimicry in your home and community! On the next page, can you complete the first two examples that have been started for you by identifying the human technology in example #1 and the natural inspiration in example #2? Then can you fill out example #3 and #4 based on other examples you find around you?

Human Technology:	Natural Inspiration:	What is similar about both?
Swimming flippers	Webbed duck feet	_____
Fishing net	Spider web	_____
Velcro	Burrs	_____
Esiw the robot	Human beings	_____
Shock absorbing technology	Woodpeckers	_____
Digging train tunnels	Earthworms	_____



I am a robot, not a living thing, but I can talk and share information similarly to how you can communicate with other humans. My face and body is designed to look a bit like a human (with eyes, mouth, arms, etc.) and I am programmed to learn kind of like how a human does. Many "humanoid" robots like me are inspired by the natural design of human beings. So I am another example of biomimicry!

SLO: 4-1-01, 4-1-06

EXAMPLE #1

Location found:

Name of human technology:

Function / purpose: *To allow something to fly and travel through the air without falling*

Natural inspiration: *Bird wings that help birds fly*

EXAMPLE #2

Location found:

Name of human technology: *Solar panels*

Function / purpose: *To collect light from the sun and convert the light into energy that can be used for different purposes such as electricity and light*

Natural inspiration:

EXAMPLE #3

Location found:

Name of human technology:

Function / purpose:

Natural inspiration:

EXAMPLE #4

Location found:

Name of human technology:

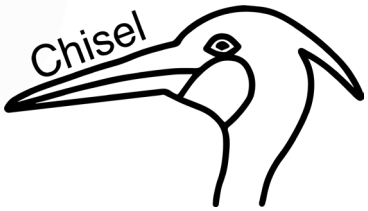
Function / purpose:

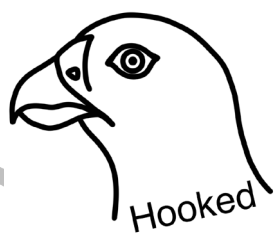
Natural inspiration:

Match the Food to the Beak

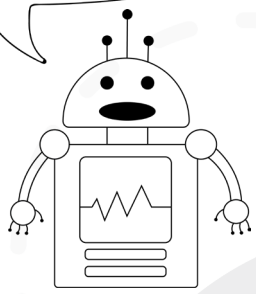
Birds' beaks are helpful for gathering and breaking apart food, and their shape and size play a huge part in a bird's diet. For example, an owl is a predatory bird that eats small snimals like mice. It has a hooked beak that helps it tear away pieces of meat.

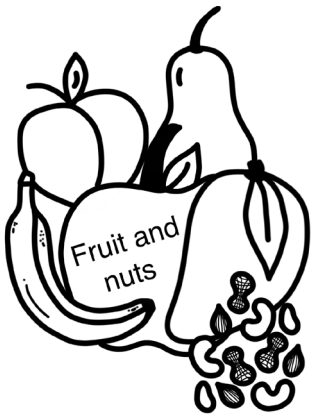
Colour the different kinds of food that birds eat, then match them to the beak shape that you think works best for that type of food.

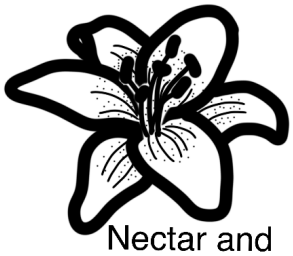


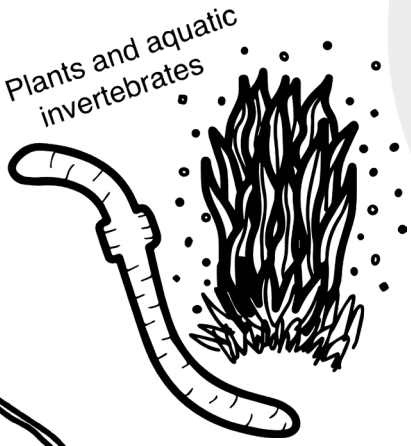


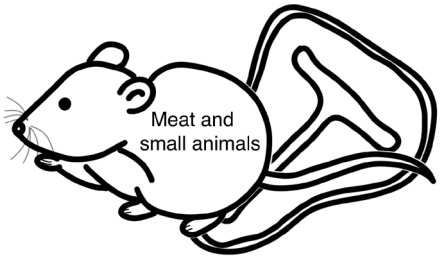
In computer language, a **variable** is like a category, or a labelled box that can contain different things inside. With birds, the beak shape and beak size are examples of variables because they are different from bird to bird. A strainer beak or a stout beak are examples of the specifics that can be contained in the "beak shape" variable.

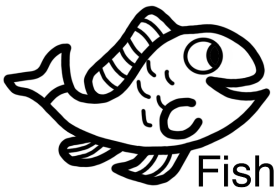












SLO: 4-1-01, 4-1-04

Shadow Measuring

The shadows you see outside are caused by objects blocking the light from the sun. The sun reflects off these objects, resulting in a dark figure in the shape of the object on the ground where light did not reach. In this activity, we will see how the position of a light shining on an object (a cutout image of Esiw the robot) affects the size and position of a shadow.

1 Let's start by predicting what might happen.

PREDICTIONS

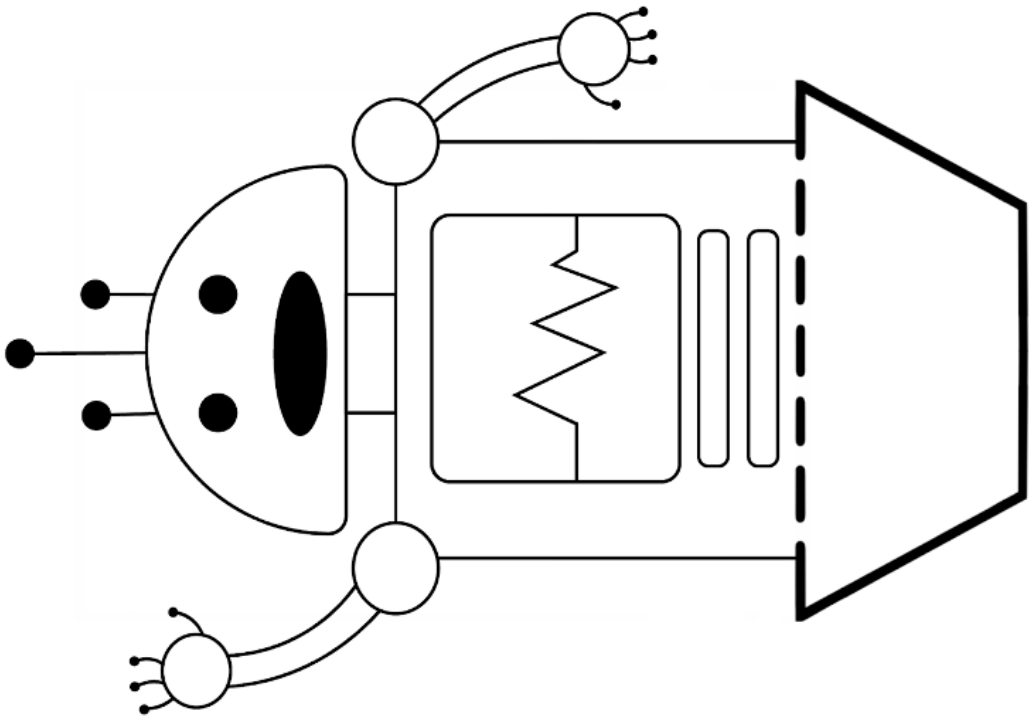
What will happen when you shine a light towards Esiw? Circle your answers in the table below:

POSITION OF LIGHT	DIRECTION OF SHADOW	LENGTH OF SHADOW
In front of Esiw	Towards light / Away from light	long / medium / short
Behind Esiw	Towards light / Away from light	long / medium / short
Above Esiw	Towards light / Away from light	long / medium / short

What will happen to the shadow when you move the light closer to Esiw? Circle your answer:

The shadow will get longer The shadow will get shorter

2 Colour the picture of Esiw below, then cut them out along the solid lines. Fold along the dotted lines to make a stand for Esiw then put them in a dark place.



SLO: 4-1-01, 4-2-12

3. Grab a flashlight and two rulers. Set one of the rulers down on the floor behind Esiw (for measuring the shadow length). The other ruler will be for measuring the distance between the light and Esiw.

4. This step is a bit tricky, so ask for someone's help if you need it! Hold the flashlight a little above and a little in front of Esiw. See the shadow that is produced.

   Take a look at the table below. For each of the distances (0 cm, 5 cm, 10 cm, 15 cm, and 20 cm), position the flashlight so that this is the distance between the tip of the flashlight and the top of Esiw. For 0 cm, the tip of the flashlight should be touching Esiw. Try to keep the height of the flashlight the same each time (a little above Esiw).

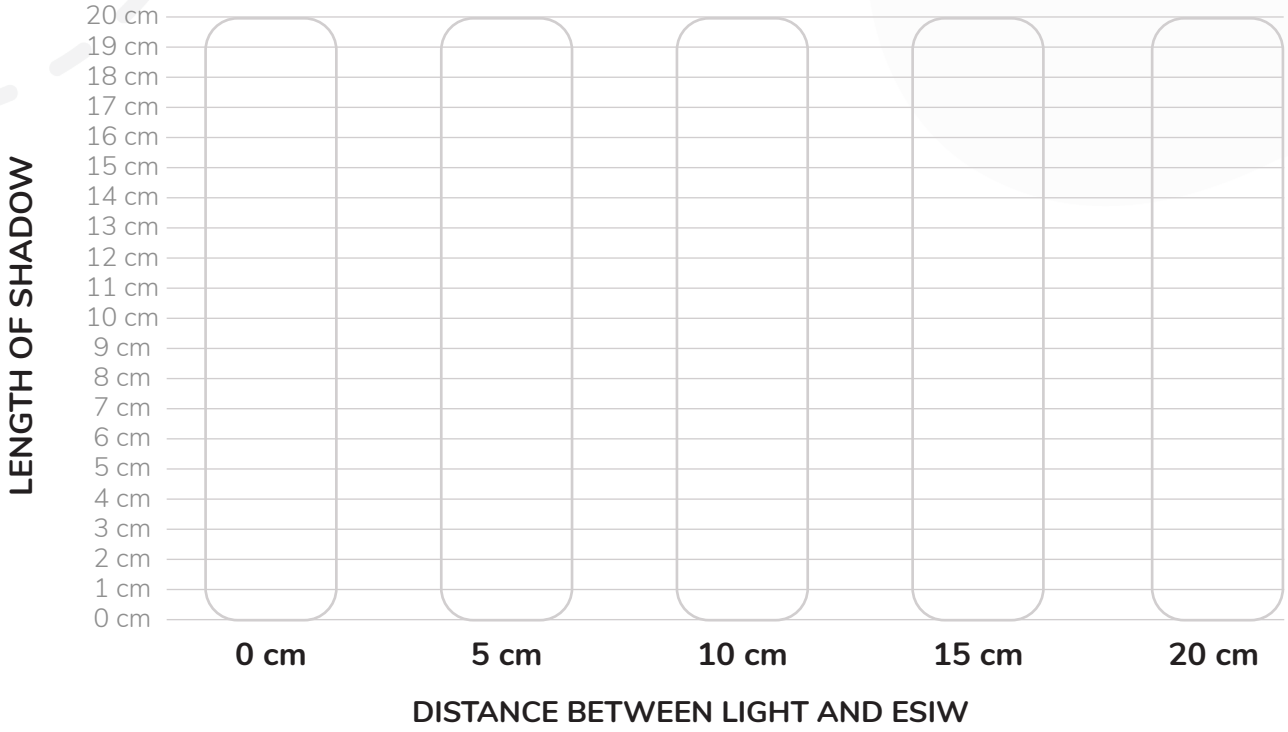
5. For each of the flashlight distances, measure the length of the shadow (using the ruler you placed behind Esiw). Write this down, and also record which direction the shadow goes.

OBSERVATIONS

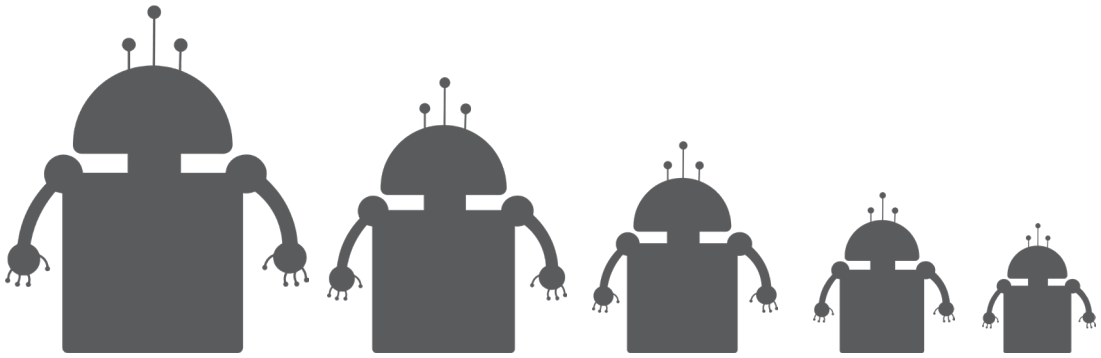
DISTANCE BETWEEN LIGHT AND ESIW (cm)	DIRECTION OF SHADOW	LENGTH OF SHADOW (cm)
0	Towards light / Away from light	
5	Towards light / Away from light	
10	Towards light / Away from light	
15	Towards light / Away from light	
20	Towards light / Away from light	

This part of the page is intentionally left blank, because the previous page is meant to be cut up.

6 Now, we're going to try graphing! A graph is like a way to see all the things you just observed in one place. Below, colour each bar up to the mark that matches the shadow length you measured.



7 Alternately, if measuring and graphing the shadow length is difficult (or you want to try a different method), you could hold up a piece of paper behind Esiw, and trace the shadow on each one. Try tracing the shadows lined up, side-by-side, like this:



8 Look at your drawings or graph, and think about the following questions:

When was the shadow the longest?

When was the shadow the shortest?

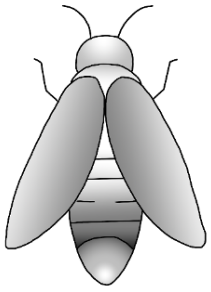
Did this match up with your predictions, or were you surprised?

Natural or Artificial Light

NATURAL LIGHT is light that is produced without human involvement; we have no control over the amount, duration, or intensity of natural light. The main type of natural light is sunlight, which is essential to our life here on Earth (plants use sunlight for photosynthesis, which makes some of the oxygen that we breathe, and also makes food for all organisms on the food chain). Some living organisms (for example, glow worms) can also produce their own natural light, called bioluminescence.

ARTIFICIAL LIGHT is made with human inventions / human involvement, and usually requires a source of energy such as electricity or a battery to produce it. Artificial light is different from natural light because humans can control the quality, quantity, duration and intensity. It is often used when the sun, a natural light source, is not shining.

Which of these light sources would you call "natural" sources, and which would you call "artificial"? In the box below each item, put an A for artificial or an N for natural.

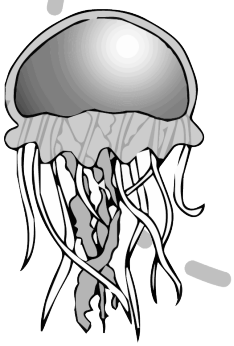


Firefly ☐

Candle ☐

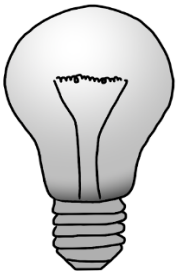
Fire ☐

Flashlight ☐

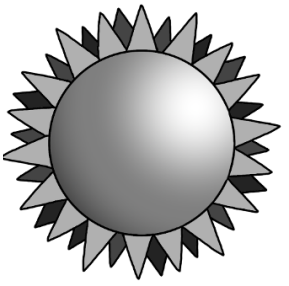


Jellyfish ☐

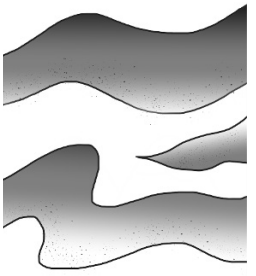
Lightning ☐



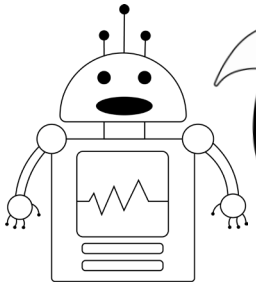
Lightbulb ☐



Sun ☐



Aurora Borealis ☐



Hey everyone, it's me, Esiw again! In computer language, saying "yes" and "no" is very similar to turning a light switch on and off. It's called **binary**. In binary, the number 1 means yes, (or on) and the number 0 means no (or off). On the next page, let's use binary to turn lights on or off.

SLO: 4-2-01, 4-2-06

Light Source Binary

In each scenario, identify which lights are turned on or off using binary code (1 for “on” and 0 for “off”).

SCENARIO #1
You and your friend are having a sleepover, and you go downstairs to watch a movie. You don’t want to have a glare on the TV from the basement lights because you won’t be able to see what’s happening on the screen very well. What should you do with the basement lights, as well as the TV?

- [ ] Basement lights
- [ ] TV

SCENARIO #2
You are biking home from your friend’s house after the sun has just gone down. You want to make sure cars can see you in case any pass by. Which light sources should be “on” and which are “off”?

- [ ] Front bike light
- [ ] Rear bike light
- [ ] Sunlight

SCENARIO #3
You and your sibling are baking cookies, and you want to check to see how cooked they are without opening the oven and losing heat. What should you do with the oven light?

- [ ] Oven light

SCENARIO #4
You and your family want to have a fire in your backyard. It’s already dark out and kind of hard to see where to walk to get down to the fire. Which light sources do you think are available to you?

- [ ] Yard lights
- [ ] Flashlight
- [ ] Fireflies
- [ ] Sunlight

After a couple hours, your family is tired and all wants to go to bed because it’s getting late, but what should you make sure to do before you go in the house?

- [ ] Fire

SCENARIO #5
Your whole family sleeps on the top floor of your house, and you are the last one downstairs because you were studying for a test. You are done studying and want to go to bed. What should you do before you head upstairs to go to bed (especially if you want to save energy overnight)?

- [ ] Downstairs lights
- [ ] Computer light

SCENARIO #6
You’re playing a game of hide and seek with your friends and it’s dark out, so you, the tagger, have a flashlight. You can hear someone rustling in the bushes but don’t want them to know you’ve found them. What should you do with the flashlight?

- [ ] Flashlight

Light Catchers

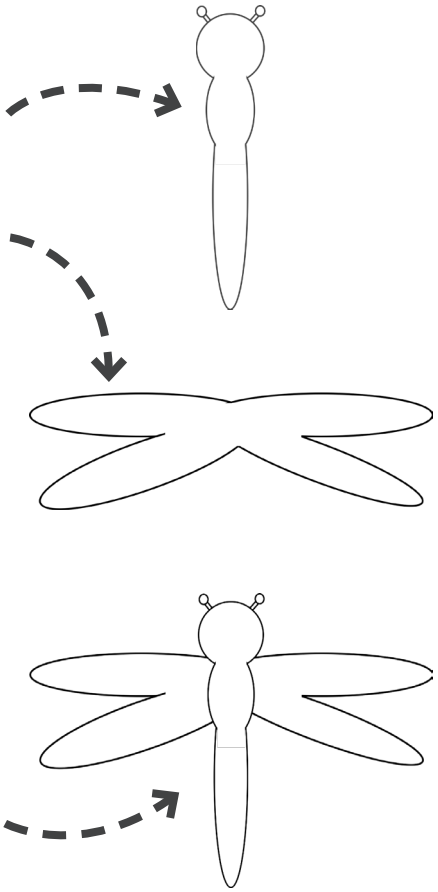
When visible light hits an object, it can be absorbed, reflected or pass through that object, or a combination of these things can happen.

We can "catch" light using a mixture of translucent and opaque materials. Let's learn to make some lightcatchers! Here are two different ways of doing this so you can decide at home which one you like best.

Version 1 - Tissue Paper Dragonfly

MATERIALS

- Tissue paper (the more colours the better!)
- Wax paper
- Construction paper / white paper
- Glue stick
- Pencil crayons / markers / crayons
- Scissors



1. Cut the body of your dragonfly out of white paper or construction paper. Optional: decorate the body with markers, pencil crayons, or crayons!
2. Cut the wings of the dragonfly out of wax paper (in whatever wing shape you like).
3. Cut your tissue paper into squares, play around with size or shape as you wish!
4. Put glue on a small section of the wax paper and stick some pieces of tissue paper where there's glue. Feel free to overlap some of the pieces of tissue paper for some cool colour effects! But remember the thicker the tissue paper, the less light will come through.
5. Repeat step 4 all over the wings until one side is completely covered!
6. Place the opaque body over the wings and glue it down.
7. Allow the glue to dry before taping it onto a window. Admire your multicoloured masterpiece!

DEFINITIONS

TRANSPARENT: **all** visible light passes through. We can see through materials that are transparent, and see objects through them very clearly. Eg: water or glass.

TRANSLUCENT: **some** light passes through. You can see shadows of objects behind translucent objects, but not clear images. Eg: wax and tissue paper, or frosted glass.

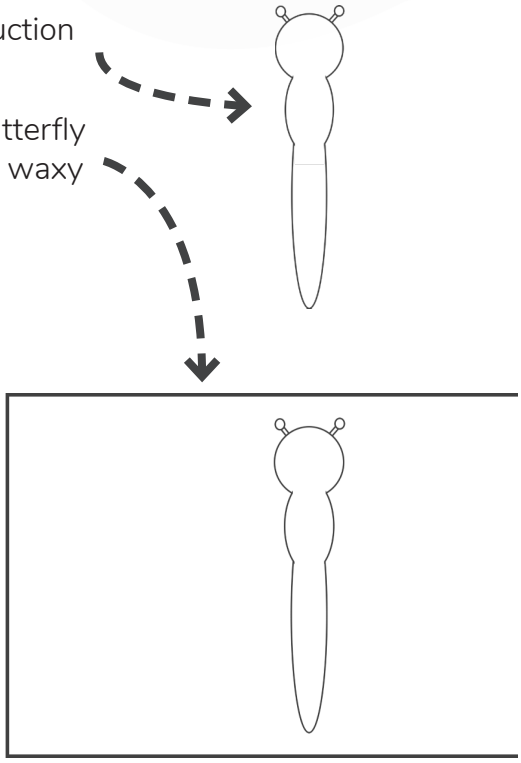
OPAQUE: **no** light passes through. They either reflect or absorb light, which can turn into heat. Eg: metal (can be quite reflective), stones, and wood.

SLO: 4-1-01, 4-2-10, 4-2-14

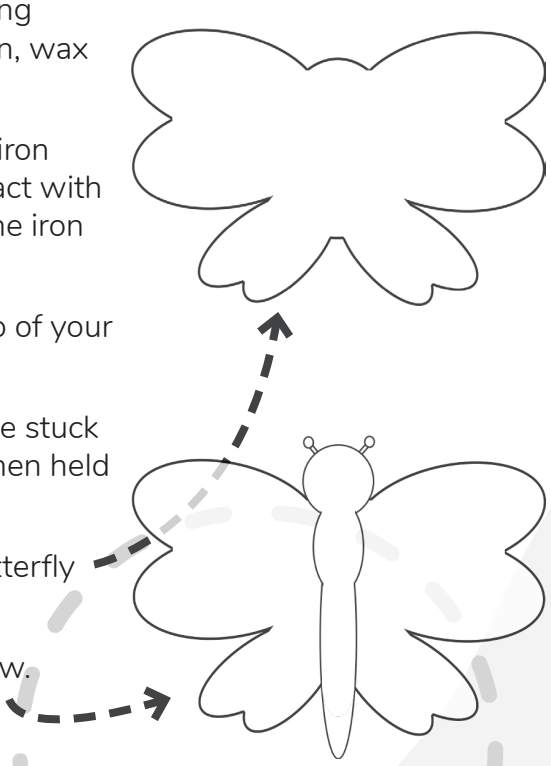
Version 2 - Crayon Wax Butterfly

MATERIALS

- Wax paper
- Scissors
- White paper / construction paper
- Crayons (to melt)
- Pencil / crayon sharpener
- Clothing iron
- Old towels / rags x 2
- Glue stick
- Ironing board
- A heavy book



1. Cut out the body of your butterfly from white paper or construction paper. Decorate as desired.
2. Take two sheets of wax paper larger than the body of your butterfly (you will later cut these into your butterfly wings). Identify the waxy sides of the paper.
3. Shave the crayons of your choice using the pencil or crayon sharpener. We want very fine pieces that will melt easily.
4. Place one of the rags/towels down on the ironing board. Place one piece of wax paper down on top of that rag with its waxy side up.
5. Sprinkle the finely ground wax crayon on the wax paper, in whatever colour pattern you like! Make sure you only have a thin layer of the ground up crayon, too much wax will make it opaque. It's okay to have a few uncovered areas.
6. Place the second piece of wax paper on top of the freshly sprinkled wax. Make sure the waxy side is facing down.
7. Place the second towel on top. The layers you should now have in front of you (from bottom to top) should be the ironing board, a towel/rag, wax paper (waxy side up), ground crayon, wax paper (waxy side down), and another towel.
8. With adult supervision, once your iron is hot, very carefully iron your crayon wax sandwich. The iron should only be in contact with the top towel. It won't take long for the wax to melt. Keep the iron moving on the top towel for 1-2 minutes.
9. Remove the iron, unplug it, and place the heavy book on top of your wax sandwich while the wax cools.
10. Once the wax is cool, the two pieces of wax paper should be stuck together from the crayon wax and should be translucent when held up to the light.
11. Take the now multicoloured wax paper and cut out your butterfly wings in whatever wing shape you like.
12. Glue the butterfly wings to the body and mount on a window. Admire your multicoloured masterpiece!

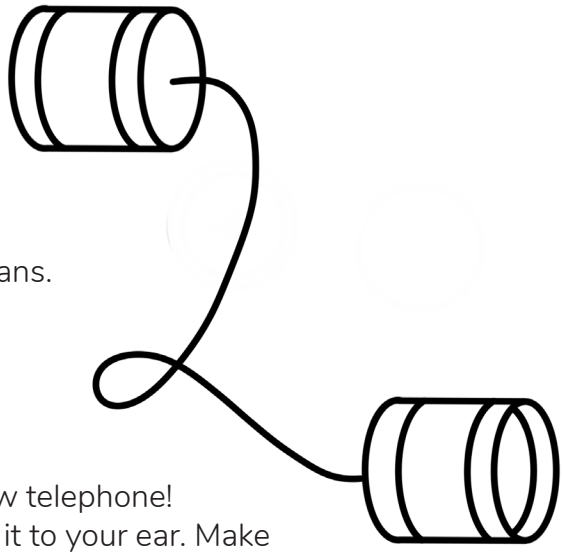


Tin Can Telephone

All the sounds you hear are vibrations in the air. In this activity, you can try controlling the path those vibrations take, to send messages to your friend with your very own tin-can telephone (old-school style!) When you talk into the can, the vibrations are transmitted down the string and the sound is reproduced in the other can for the second person to hear.

MATERIALS

- Two metal cans (empty soup cans work well)
- 1 Long string
- Scissors or a sharp blade



1. Ask an adult to help you cut holes in the clean metal cans. Cut one hole in the middle of the bottom of each can.
2. Thread both ends of the string through each can and secure it with a knot. It should look like this image:
3. Now grab a friend and talk to each other with your new telephone! Put the can to your mouth to talk and listen by putting it to your ear. Make sure the string is tight between the cans to make the sound come through clearer.

CHALLENGE:

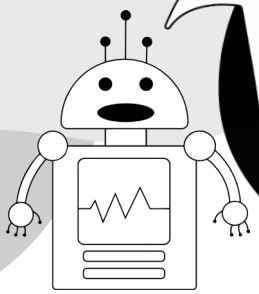
Try changing the materials and see which materials work the best. Here are some suggestions:

Instead of a tin can, try one of these:

- Plastic cup
- Paper cup
- Styrofoam cup

Instead of a string, try one of these:

- Twine
- Wire
- Elastic bands



Did you know that cellphones work similarly to the tin can telephone? Both involve a transmission of **data** (or information) through waves. When you send a text, the message is transmitted through radio waves. The radio waves then need to be picked up by a cellular tower and then transmitted over to the receiver. In your tin can phone, your voice is carried by mechanical sound waves along the string. In other words, tin cans are like cellphones and the voice carried by sound waves are like text messages carried by radio waves.

SLO: 4-3-01, 4-3-05, 4-3-07, 4-3-16

Straw Flute

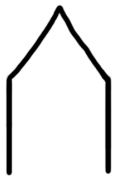
In this activity you can play with the pitch of a sound by playing with frequency. Notice how when you cut chunks off the end of the straw, the pitch of the vibration gets higher? This is because when the straw gets shorter, so do the waves that are being produced. A shorter wavelength produces a higher frequency, and a higher frequency means a higher pitch.

MATERIALS

- Scissors
- A plastic straw (thinner ones tend to work better)
- Optional: a straw slightly larger than the first one

1. Flatten down about 1 ½ inches at one end of your straw.
2. Cut the flattened end of the straw at a diagonal on both sides of the end so it makes a point shape in the middle, as shown in the diagram:

3. Put the pointed end of the straw into your mouth and blow. Make your mouth look like you have no lips by pulling back your lips, so they cover your teeth. This is important because if you blow on the straw making an "O" shape with your mouth, you won't get a vibration sound. Play around with how far you put the straw in your mouth. If you cannot hear the sound, either slowly move the point back and forth in and out of your mouth or change your lip shape until you hear it. This takes a bit of practice.

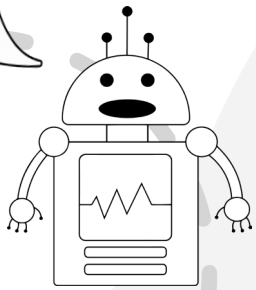


While blowing through your straw, get an adult to help you with cutting small chunks off the bottom end to see how the pitch changes.

OPTIONAL:

If you have another straw a bit larger than the one you made into a flute, you can cover the smaller straw with the larger one and slide the larger straw up and down as you blow to make a mini trombone!

When the straw is shorter, its shorter wavelength and higher pitch is like a specific **output** in code. Answer the question below to figure out what the output would be if the straw was longer.



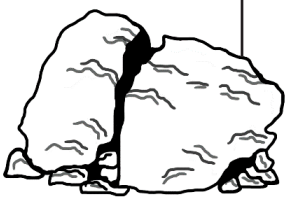
What do you think would happen to the pitch of the sound if the straw got longer as you were blowing into it?

SLO: 4-3-01, 4-3-06

Rock Weathering

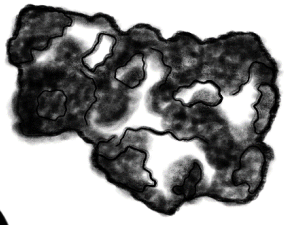
How does the natural world affect rocks? Weathering is a natural process where rocks are broken down into smaller pieces. Weathering can be physical, chemical, or biological, depending on the cause of the change.

DEFINITIONS

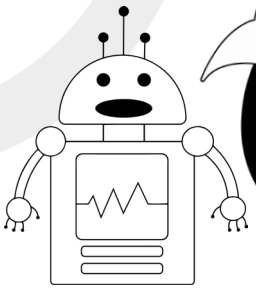


PHYSICAL WEATHERING is caused by changes in temperature and precipitation (including rain, snow, and wind). Rocks affected by physical weathering can be smooth and rounded by water or split into pieces by dramatic temperature changes. These rocks are most often found beside bodies of water or in places with big temperature changes.

CHEMICAL WEATHERING is caused by acids and salts. Rocks affected by chemical weathering often have grooves and holes in their surface. When acidic rainwater mixes with rock, parts of the rock can be dissolved, or washed away. Chemically weathered rocks are most likely to be found in damp and warm environments.



BIOLOGICAL WEATHERING is caused by plants, animals, and even human beings! Did you know that plants / mosses / lichens growing on rocks, and people and animals walking on rocks are examples of biological weathering? These changes are found in environments with lots of plants, animals, or human activity.



Loops in computer science are super important! Loops are instructions that are repeated over and over until a specific condition is met. Rock weathering works a lot like this: think of a rock in the ocean, with waves physically weathering it. **While** the rock remains in the water, this will keep happening. But if the rock is removed, the loop will end!

Weathering Investigation Chart

1. Your job is to explore your natural environment and find 4 rocks. These rocks will help you fill out the Weathering Investigation Chart below. The rocks can be from other environments too but remember where they came from.
2. Select your first rock. Write down the location where you found the rock.
3. Draw a picture and describe the appearance of the rock.
4. Identify the type of weathering you think the rock experienced. It could be physical, chemical, biological, or a combination of all three, as explained above.
5. Explain what you think caused the rock to weather, and why. It could be water, plants, animals, etc. Base your answer on the location you found the rock, as well as its appearance.

SLO: 4-4-01, 4-4-08, 4-4-14

ROCK #1

Location found: **Appearance description:** **Type of weathering:** **Cause of weathering:**	**Drawing:**

ROCK #2

Location found: **Appearance description:** **Type of weathering:** **Cause of weathering:**	**Drawing:**

ROCK #3

Location found: **Appearance description:** **Type of weathering:** **Cause of weathering:**	**Drawing:**

ROCK #4

Location found: **Appearance description:** **Type of weathering:** **Cause of weathering:**	**Drawing:**

Rock Comics - Part 1: Igneous

Check our next issue for Part 2: Metamorphic

Answer Keys

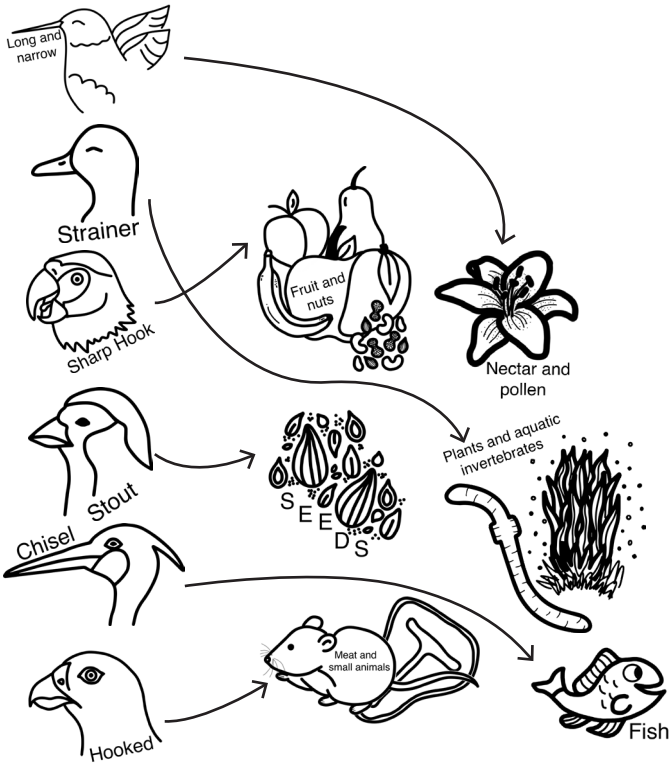
4 - Biomimicry Community Search

Possible Answers:

EXAMPLE #1 Name of Human Technology: Airplanes/Airplane Wings.

EXAMPLE #2 Source of Natural Inspiration: Plants that photosynthesize to convert sunlight into usable energy.

6 - Match the Food to the Beak



10 - Natural or Artificial Light

- N Firefly
- A Candle
- N Fire
- A Flashlight
- N Jellyfish
- N Lightning
- A Lightbulb
- N Sun
- N Aurora Borealis

11 - Light Source Binary

SCENARIO #1 0 Basement lights 1 TV

SCENARIO #2 1 Front bike light 1 Rear bike light 0 Sunlight

SCENARIO #3 1 Oven light

SCENARIO #4 1 Yard lights 1 Flashlight 1 Fireflies 0 Sunlight 0 Fire

SCENARIO #5 0 Downstairs lights 0 Computer light

SCENARIO #6 0 Flashlight

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