The Next Generation Science Standards

There is no doubt that science—and, therefore, science education—is central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one's healthcare, science understanding is key. Science is also at the heart of the United States' ability to continue to innovate, lead, and create the jobs of the future. All students—whether they become technicians in a hospital, workers in a high tech manufacturing facility, or Ph.D. researchers—must have a solid K–12 science education.

Through a collaborative, state-led process, new K–12 science standards have been developed that are rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The Next Generation Science Standards are based on the *Framework for K–12 Science Education*

https://www.nextgenscience.org/get-to-know

A few details about the Next Generation Science Standards

- Every NGSS standard has three dimensions: disciplinary core ideas (content), scientific and engineering practices, and cross-cutting concepts.
- Scientific and Engineering Practices and Crosscutting Concepts are designed to be taught in context – not in a vacuum. The NGSS encourage integration with multiple core concepts throughout each year.
- The NGSS are standards, or goals, that reflect what a student should know and be able to do— they do not dictate the manner or methods by which the standards are taught.

The performance expectations are written in a way that expresses the concept and skills to be performed but still leaves curricular and instructional decisions to states, districts, school and teachers. The performance expectations do not dictate curriculum; rather, they are coherently developed to allow flexibility in the instruction of the standards. Thus, you will need to work closely with your classroom teacher(s) to choose important lessons that assist the teacher in meeting his/her educational goals.

The lesson ideas found below are merely suggestions of experiments that can be taught in a particular grade or unit of study. RESET will work closely with you, the volunteer, and the classroom teacher to choose experiments and determine the best ways to present.

Next Generation Science Standards (K-5) listed with experiments that may help teach the standard

PS – Physical Science; LS – Life Science;
ESS –Earth & Space Systems; ETS – Engineering Design, Technology and Application Science

3-PS2-1 Motion and Stability: Forces and Interactions

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Title: Introduction to Simple Machines

Subject: Physics

Objective: To demonstrate that simple machines can be found everywhere.

Summary. With hands on experience building and testing simple machine models, students will be able to identify simple machines found in their everyday life

Grade: Third

Vocabulary:

force

simple machine: enables a person to increase muscle strength

inclined plane

lever

fulcrum

wheel

axle

Complex machine:

Classroom Set up: These experiments can be conducted with the entire class together or by dividing class into smaller groups. We recommend one adult with each group (If only you and the classroom teacher, divide the class into two sections.)

Procedure:

Step 1: Explain that today we are going to experiment using simple machines. Do not mention the name of the simple machines yet!

Step 2: Set up a 2 x 4, a 25 lb. weight and a fulcrum for each group. Allow students to take turns Shifting the location of the fulcrum to determine if the fulcrum's placement has any effect on the ease of lifting the 25-pound weight.

Step 3: Explain that the students have just created a **lever.** The **fulcrum** the point on which a lever rests or is supported and on which it pivots.

Step 4: Ask students to carry a 25 pound from a starting line to an end line. Ask another student to carry it back. Continue until everyone has had a turn.

Place the 25-pound bag in the wheel barrow and allow student to now try moving the 25 bag now from start to finish line.

ASK: What do you notice? (the bag is much easier to move with the wheelbarrow.)

Explain: A wheelbarrow consists of 3 **simple machines** - lever, wheel and axle, and inclined plane.

Step 5: Ask students if they remember lifting the 25-pound bag earlier?

Step 6: Pretend that you are standing outside holding a heavy box (25 pounds) while looking up at a window. The window is about 5 feet of the ground. Your job is to get the heavy box into the window. How are you going to do this?

Throw the box into the air and cross your fingers? Not the best idea. Lift the box above your head and stand on your tippy toes? Again, not a great idea. This is when an inclined plane would come in handy.

An **inclined plane** is one of the six types of simple machines. It is exactly what it sounds like - it is a plane (a flat surface) that is inclined, or slanted at an acute angle. Inclined planes connect a lower level to a higher level, they make work easier. In science, '**work**' is when you apply **force** (a push or a pull) and it moves an object.

Place 25 pounds in a small box. Ask students to lift the box up to their shoulders if they are able. Now ask them to push the box (Here is where several 2 x 4 placed at different angles is helpful. If you only have one, take turns moving it to different angles as students finish trying out an angel) up one of the 2 X 4 which has been placed at various angles (Place the lever on different object such as. a bench, curb, top of a fence, etc.)

What do students observe?

Step 7: Have students all sit around you on the ground. Remind students that they have experimented with a lever, a wheel and axle, and an inclined plane.

ASK: Which was the example of the lever?

the wheel and axle? The inclined plane?

Step 8: Remind students that simple machines help us make work (which scientists call force) easier.

If teachers are interested in having you work with the students for the next several weeks and wish for you to focus one simple machine a week, be in touch with us at RESET and we can help you pan those lessons.

Materials

Material	Quantity	Where to purchase?
2 x 4 piece of wood	1/class + extra if possible	Home Depot
wheelbarrow	1/class	From home
25 pound weight	1/class	Sand bag, bag of rocks

Fulcrum	1/class	Block set in the kindergarten, log, foal roller
Small cardboard box	1/class	Home Depot

TITLE: Simple Machine: Pulley. (This lesson was a lesson created by SPECO volunteers at Drew Elementary)

SUBJECT AREA: Physical Science

GRADE: 3

VOCABULARY:

pulley

SET UP: No special set-up required

PROCEDURE:

Step 1:

Introduce yourself and any team members.

Step 2: Explains pulleys.

1. Brief explanation, question and answer about pulleys simple machines.
    a. A pulley is a simple machine that can be used to lift objects and transmit motion. Pulleys can either be moveable or fixed and multiple pulley wheels on one axle can be used.

Show video: https://pbskids.org/video/design-squad-nation/2342064713

b. Pulleys are wheels that are moved by ropes, chains or belts around their rims.
c. In a belt driven pulley, a continuous belt joins two pulley wheels. The wheel to which an external force is applied (effort) is called the drive wheel, and the other the driven wheel. The drive pulley wheel provides the input force and the driven pulley wheel delivers the output force. When the drive wheel turns the belt moves and causes the driven wheel to turn in the same direction. If the drive wheel is smaller than the driven wheel, the driven wheel will turn more slowly than the drive wheel.
d. Belt driven pulleys rely on belt friction to transmit motion. If the belt is too tight the belt will create wasteful friction forces on the pulley axle and bearing. If too loose the belt will slip and the effort is not used efficiently. Slip is an overload protection safety feature of belt-operated machinery.
e. For heavy lifting jobs; multiple pulley wheels can be combine into a lifting system that makes lifting heavy objects easier.

Step 3: Show examples of pulleys

d. Common examples of pulleys are found in window blinds, curtains and flagpoles.

Answer any questions.

Step 4:

Remind students about the Pulley "Maker Space" challenge.

CHALLENGE: Explain to students that they will be trying to create an experiment to demonstrate the use of pulleys to assist with changing the direction of a force applied to a cord using their imagination and Maker Space materials. Tie the use of Maker Space materials to the pulley video.

Step 5:

1. Each student begins collecting Maker Space materials available to use.
2. Each student begins brainstorming about how to create their pulley experiment using Maker Space materials.
3. Students will begin constructing their pulleys.
4. Scientists monitor and assist students.
5. You should have an example ready to go to assist the students.

Step 6:
Allow students to create, fail and try again and when class is almost over give students a 5 minute warning before clean up.

Step 7:
Have students put all extra maker space materials away

Step 8:
Debrief the students and ask how they set up their experiments and what did they learn.

a. Ask them how the video and building the Pulley simple machine helped them to understand its function?
b. If there is time, ask them to come up with things where the Pulley would be useful and helpful in their everyday life.

MAKER SPACE POSSIBLE MATERIALS

Below is a list of suggested materials with which students may fill their boxes. Not every student needs the exact same materials as another student. Students can add to materials, supplement, etc.

- Books
- Flattened box
- Egg carton
- large and small paper towel roll
- pieces poster board
- Aluminum foil
- paper plates

- pieces construction paper
- paper cups
- box of crayons
- Roll of tape
- glue stick
- balloons
- Pair of scissors
- Rubber bands
- Toothpicks
- corks
- Small and large paper clips
- Pennies, quarters
- popsicle sticks
- plastic spoons
- thin markers
- straws
- index cards
- Ruler
- string
- Metal washer
- screws
- pipe cleaners

TITLE: Simple Machine: Inclined Planes (Lesson first taught by SPECO volunteers at Drew Elementary)

SUBJECT AREA: Physical Science

GRADE: 3

VOCABULARY

Inclined plane

Load

Force

fulcrum

SET-UP: No specific set-up required

PROCEDURE:

Step 1: Introduce yourself and any team members.

Step 2: Explains inclined planes.

- Brief explanation, question and answer about incline planes simple machines.
- Incline planes are surfaces that are tilted to allow for easier movement of items either up or down.

Show video: https://www.youtube.com/watch?v=sTOWiDDgTIk

- Inclines make it easier to move something as opposed to lifting it.
  For example, would it be easier to lift a heavy package straight up to get it into a car, or does it take less energy (work) to roll or push it up a hill. It may take longer, but it is easier.
  Is it easier to lower something straight down while holding all the weight or sliding it down a hill?

Step 3: Show examples of inclined planes
skateboard ramp, dog ramp, ladder, slide (patents)

Answer any questions.

Step 4: Remind students of the Maker Space process.

1. Show the list of Maker Space materials
2. Explain to students that they will be trying to create an experiment to demonstrate the use of inclined plane to assist with moving items from a lower level to a higher level using their imagination and Maker Space materials. If time permits, will also experiment with use of incline planes to assist moving items down.
3. Tie the use of Maker Space materials to the inclined plane video.

Step 5: Each student should build a "load"

- Give each student a paper cup with a hole punched into one side to build the **load.**
- Give each students a number of coins, washers, screw, to add to cup to measure the **force.**

- Allow each student to begin brainstorming about how to create his/her inclined plane experiment using Maker Space materials.
- Students will begin constructing their "Lifting" inventions.
- Remind them they will need a Load, inclined plane and a force.

Step 6:

Set your "Ramp" flat on the desk with a last few inches of the ramp hanging over the edge of your desk.
Tie or tape the string to your load and tie the other end of the string to your cup. Dangle the cup over the back edge of the flat ramp. Make sure the string and object are free to move. Have student place lifting force (coins, washers, screws, etc.) in the cup, counting one at a time, until the load traverses up to top of ramp. Record the number of lifting force items this "lift" required.

Step 7: Now instruct students to place the ramp up higher (On a stack of 2 books, blocks, boxes) Perform same experiment and record the number of lifting force items were needed to move
the load up the ramp. If time permits try it again with ramp place on 4 books, blocks or boxes. TRY Six books or blocks or boxes!

Ask students to explain why they think the height of the incline plane make a difference.

If time permits, have students create experiment for assisting with a load moving down the inclined plane. Assist them with coming up with ideas. Examples:

a. Place a load at top of inclined plane with force hanging over the bottom of the plane and see how fast it moves to bottom when incline is at higher incline and at lower
b. Place different materials (aluminum foil, wax paper, plastic, bubble wrap) on the incline plane to see if it slows or speed up movement. Have students observe and tell you if they think the material made a difference, and if so why.

Step 8: Be sure to walk around and assist students with ideas if they are finding it difficult to move forward.

Step 9:

2. Debrief the students and ask how they set up their experiments and what did they learn.
    a. Tie it back to the video and ask them how building the inclined plane simple machine helped them to understand its function?
    b. Ask them if they made the connection between the inclined plane, load and force.
    c. Ask them how the simple machine itself provides assistance with moving items up from a lower level to a higher level and also moving from a higher level to a lower level.
    d. If there is time, ask them to come up with things where the inclined plane simple machine would be useful and helpful in their everyday life.

Maker Space Materials List (Appendix 1)

Below is a list of suggested materials with which students may fill their boxes. Not every student needs the exact same materials as another student. Students can add to materials, supplement, etc.

- Books
- Flattened boxes or cardboard pieces
- Egg carton
- large and small paper towel roll
- pieces poster board
- Aluminum foil
- paper plates
- pieces construction paper
- paper cups
- box of crayons
- Roll of tape
- glue stick
- balloons
- Pair of scissors
- Rubber bands
- Toothpicks
- corks
- Small and large paper clips
- Pennies, quarters
- popsicle sticks
- plastic spoons
- thin markers
- straws
- index cards
- Ruler
- string
- Metal washer
- screws
- pipe cleaners

TITLE: Simple Machine: Lever (First taught by SPECO volunteers at Drew Elementary)

SUBJECT AREA: Physical Area

GRADE. 3rd grade

VOCABULARY

Lever
Class 1 lever
Class 2 lever
Class 3 lever

SET-UP – No special set-up is required

PROCEDURE:

Step 1: Introduce yourself

- What do I do?
- My job is great because I get to ______.
- Get kids excited about STEM fields.

Step 2: Explanation of lever.

Show brief introducing levers and classes of levers (not narrated, remind students to pay attention/read).
https://www.youtube.com/watch?v=E8RA9Kw_laE

Step 3: Go through classes of levers.

Class 1 has the fulcrum placed between the effort and load.

Examples of class 1 levers include:

- Teeter-totter
- Oars on a boat

- Catapult
- Shoehorn
- Scissors
- Pair of pliers

Class 2 has the load between the effort and the fulcrum.

Examples of Class 2 levers include:

- Wheelbarrow
- Crowbar
- Nut cracker

Class 3 has the effort between the load and the fulcrum.

Examples of Class 3 levers include:

- Tweezers
- Stapler
- Mousetrap
- Broom
- Hockey stick

Step 4:

Explains to the students the Maker Space task for lever.

Explain to students that they will be trying to create an example of each class of lever using their imagination and Maker Space materials.
Tie the use of Maker Space materials to the lever video and classes of levers.

STEP 5:

Each student begins collecting Maker Space materials to use.
Each student begins brainstorming about how to build their lever using Maker Space materials.
Students will begin building their lever.

Scientists monitor and assist students.

STEP 6

With 10-15 minutes left in the hour

Debrief the students and determine what they learned.

Tie it back to the video and ask them how building the lever simple machine helped them to understand its function?

Ask How does the fulcrum location affect the usefulness of the lever.

Ask: How do simple machine itself provides assistance?

If there is time, ask them to come up with something they do in their everyday life is easier because of a lever.

Maker Space Materials List (Appendix 1)

Below is a list of suggested materials with which students may fill their boxes. Not every student needs the exact same materials as another student. Students can add to materials, supplement, etc.

- Egg carton
- large and small paper towel roll
- pieces poster board
- Aluminum foil
- paper plates
- pieces construction paper
- paper cups
- box of crayons
- Roll of tape
- glue stick
- balloons
- Pair of scissors
- Rubber bands
- Toothpicks
- corks
- Small and large paper clips
- pennies
- popsicle sticks
- plastic spoons
- thin markers
- straws
- index cards
- Ruler
- string
- Metal washer
- Baggie of pompom and cotton balls
- pipe cleaners

3-PS2-2 Motion and Stability: Forces and Interactions

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
Performance Expectation

TITLE: Air Pressure: **Pushing Air to the Limit**

PROCEDURE:

Step 1: Put a small hole near the bottom of the water bottle using the nail. Be careful push it through or tap it in with a hammer. (parental help may be required)

Step 2: Put a small hole through the lid of the bottle with the nail (you will probably have to tap this through with a hammer, the plastic is thicker. OR
Use Playdoh or soft putty instead of the lid and put over the top of the jar creating a lid and then push clear plastic straw through the opening

Step 3: Fill the bottle to the top with water, holding your finger on the hole on the side of the bottle. Screw on the lid on the bottle keeping your finger on the hole at the side of the bottle.

Step 4: Over the baking pan cover the top hole with your thumb
AND remove your finger from the side of the bottle.

Step 5: Watch and wait a second. What is happening? (Water is not pouring out)

Step 6: Take your thumb off the top now. What happens? (the water pours out)

Step 7: Tell students to alternate between putting your thumb back on the top of the lid hole and removing your thumb. Give the students a few minutes to play around with this.

Step 8: ASK Did you notice the only time the water poured out of the bottle was when you weren't covering the hole on the top? Isn't that strange? Why doesn't the water come out? Shouldn't gravity be pulling it down?

EXPLAIN: What we need to remember is that in addition to the force of gravity working here, we are also looking at a different force at work here. **Air pressure** is a strong force and it always acts in a certain way:

High Pressure moves towards Low Pressure.

Step 9: Have students repeat: High Pressure moves towards Low Pressure!

Step 10: Explain that air pressure is one of the most important topics in science, as it explains weather patterns, how airplanes fly and lots of other amazing things in our world. In fact, we can still move our bodies freely in all directions because air pressure is exerting force on us in all directions. The reason we do not get smushed by the force of air pressure is because the air pressure inside out bodies is the same as the air pressure on the outside.

When you covered the lid to the bottle, the water has less air pressure pushing on it. That means "low pressure." The air pressure outside the bottle is higher, so it actually tries to push into the bottle through the bottom hole. In doing so, it keeps the water in!

When you release the hole on the top the air pressure pushed down and the water is free to flow out the hole into your container.

Step 11: T**he Soda Bottle Crush**
Explain to the students that air pressure at any location changes over time. Sometimes air can be a high-pressure area and sometimes it can be in a low-pressure area depending on how much air is in a given area. If air gets heated, the air will rise and become a low-pressure area.

Step 12: Demonstrate the following experiment to the students. Tell the students to observe what is happening. The only words that will be spoken will be yours explaining what you are doing. Ask the students to focus on what happens

You will need a 2-liter bottle, a funnel and access to very hot water.

1. With a funnel sitting in the top of a two-liter bottle, I am pouring very hot water into the bottle. (Don't use boiling water because it might melt the bottle.)
2. I am keeping the hot water in the bottle for about a minute. Now I am pouring it out.

3. After pouring it out, I quickly put the lid on so no cold air can get into the bottle.
4. I am Setting it down on the table>. Watch carefully to observe what happens during the next couple of minutes. (The bottle will begin to crush.)
5. ASK: Why do you think the bottled was crushed. Take all answers and then explain: The hot water caused the air to heat up and created a low pressure. After the hot water was poured out and the lid was put on the air began to cool. The low air pressure was still in the bottle. The high pressure outside the bottle pushed in on the bottle, crushing it.

Ask the students to keep finding examples of High Pressure moves towards Low Pressure. We will talk about it again at our next session.

TITLE: CENTRIFUGAL FORCE

SUBJECT AREA: Physical Science

OBJECTIVE:
- To introduce the students to the concept of centrifugal force.
- To dispel the idea that science is obscure by giving everyday examples of how centrifugal force is around them.

SUMMARY: Who says science can’t be fun? An amusement park uses the principles of science to make exciting and sometimes terrifying rides. Rides that move in circles and steep curves make you feel like you are being pushed outward. That’s centrifugal force.

GRADE LEVEL: THIRD

VOCABULARY

Force: a push or pull. Many forces we cannot see like gravity and magnetic forces.

Centrifugal force: a force that is directed toward the center of a circle.

CLASSROOM SET UP: NO SPECIAL SET UP REQUIRED

BEFORE CLASS: View the video & practice. This takes practice!
https://www.youtube.com/watch?v=6haxdfnJcX8

MATERIALS:

DESCRIPTION	QUANTITIY	CAN BE PURCHASED AT
String	4 feet for demo	
1 4 foot string	1/2 students	
A Paper cup (7 or 8 ounce)	1 for demo	
Paper cup	1/2 students	
A ball point pen or pencil	1 for demo	
Penny	1/2 students	
Water		
Empty soda bottle	1/2 students	
Pebble with one flat side	1/2 students	

PROCEDURE

Step 1: Begin the class with the mini-bucket demo:

A. Make your own mini-bucket. With the pen poke a hole near the rim of the cup. Poke another hole directly across from the first hole, on the other side of the cup.
B. Cut two pieces of string about 2 feet long each. Attach each string to a side of the cup by looping it through the hold and tying a knot
C. Fill the cup halfway full of water and take the ends of the sting, and whip the bucket around the in a circle over your head. Be sure to stand far away from other objects.

Step 2: Show students a picture (or draw one) of a roller coaster when the cart is in the highest part of the loop https://www.smithsonianmag.com/science-nature/psychology-roller-coasters-180969607/

Step 3: ASK: "What is this?" (A roller coaster)

ASK "How is it that the people in the roller coaster stay in their seats when the roller coaster is upside down?" (If someone says because they have on seat belts, ASK How come the car itself does not fall down?) The goal here is to get students to think about what is pushing the riders against their seats, keeping them inside the car. Something is pushing the car against the tracks and keeping it there. (AIR)

Step 4: Explain that what is keeping the car and the people in place, as the cost to the highest part of the loop is a force. A force is a push or pull. The force that is acting on the roller coaster is a special force called centrifugal force. It is a force that points towards the center of the circle. The water in my demonstration stayed in the cup even when the cup was upside down because of centrifugal force.

Step 5: ASK can you think of other examples of centrifugal force?
(Clothes get stuck to wall of washing machine, ride at amusement parks where the wall spins and people get stuck to it standing up while the floor drops.)

Step 6: Divide the class into groups of two. Give each pair an empty soda bottle, and a pebble

Step 7: Provide the students with the following CHALLENGE:
Figure out a way to keep the pebble inside the bottle and floating above the bottom of the bottle for at least 10 seconds.

Give students time to try solutions. If a group is struggling a lot, give them the HINT: It has to do with the roller coaster and the people.

The goal is the get students to swirl the bottle in such a way that the pebble inside becomes attached to the wall of the bottle due to the centrifugal force of the bottle on the pebble, which in turn creates a force that opposes gravity.

If one pair is successful, ask them to explain what they did and why they think it worked. Allow other pairs to get their pebble to **defy gravity by being pushed against the surface of the bottle. The success depends on the speed on which the object is moving.**
If the bottle is swirled slowly, there is no way that you will get the pebble to say against the wall. In the same way, it the roller coaster traveled at a low speed along the rail, it would not complete the loop but rather fall.

Step 8; Hand out 1 cup with two holes punched, 1 string and 1 penny to each group (TIME SAVING TIP: Pre-cut the string and poke the holes ahead of class time)

Ask students to loop one side of the sting through the first hole and tie a knot. Loop the second end of the string through the second hole and tie a knot.

Place the penny in the cup.

ASK: What will happen if they spin the cup around their heads?

Step 9: Instruct pairs to spread out across the classroom, far from any other pair and take turns spinning the cup around their head.

Step 10: Give them time to try this challenge. Visit each group and ask what force is causing the penny to remain in the cup. Make sure they can all answer centrifugal force.

3-PS2-3 Motion and Stability: Forces and Interactions

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
Performance Expectation

TITLE: Conductors and Insulators

SUBJECT AREA: Electricity

GRADE 3rd grade

VOCABULARY

Conductor. A material through which electrons moves easily.

Insulator: A material through which electrons do not move easily.

Circuit: closed loop that electrons can travel in. A source of electricity, such as a battery, provides electrical energy in the **circuit**.
Unless the **circuit** is complete, that is, making a full circle back to the electrical source, no electrons will move.

CLASSROOM SET-UP: Divide the students into groups of 3 or 4

PROCEDURE:

Step 1: Have the basic parts of the circuit on your desk or teaching table & Ask students to name the basic parts of a circuit: – power source (battery), power receiver (light bulb) and wire.

Step 2: Teach the students how to make a wire from aluminum foil & tape

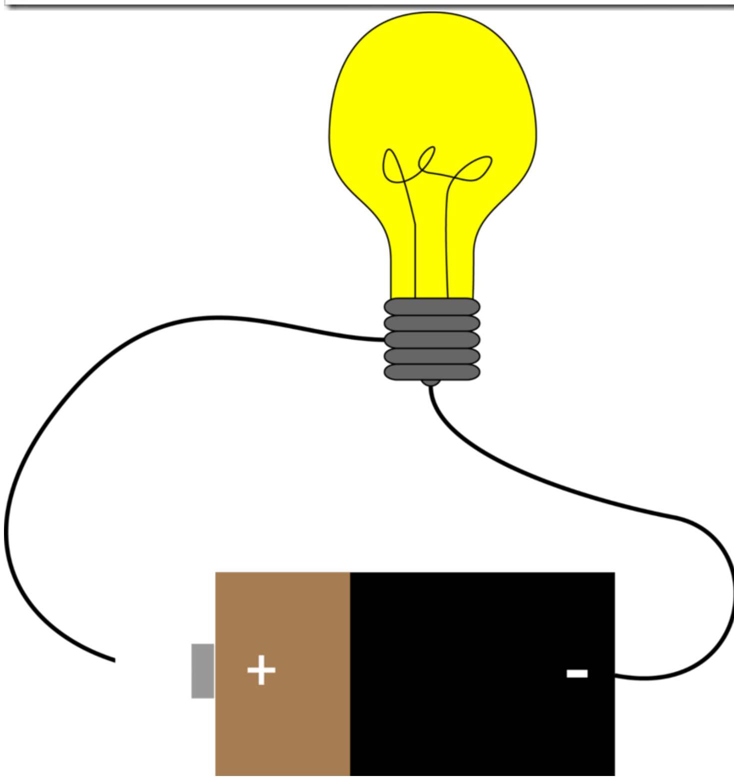
Pull out a piece of aluminum foil 2 o 3 inches from dispenser and cut. Place the foil down on your desk so that the length of the foil and lies down on your surface.

Cut a piece of tape the same size as the length (longest part) of your aluminum foil strip.

Lay the tape down so that it is as long as the aluminum foil at its greatest length. Cut out around the tape so that you have a long piece of foil covered with

A piece of tape. The tape is making the foil stronger and harder to tear.

Fold one of the long sides of the foil half way over the tape, and then the other half over the tape and aluminum foil creating a long strip of foil strengthened by the tape on the inside of the strip. Make two of these aluminum foil wires. These will be your wires for the circuit



Step 3: With two aluminum foil "wires", a D-cell battery and a light bulb, give students 5-6 minutes to see if students can figure out how to connect the parts to create a circuit which lights the power source, the light bulb.

Step 4: Once everyone is successful building a circuit, explain that it is electrons flowing through the wires creating a circuit. They have built a **closed** circuit because everything is connected properly and light bulb lights. If they lift one end of the foil off the power source (D cell) the circuit will be **open** and electricity will not flow.
ASK STUDENTS TO PUT CIRUITS DOWN, UNCONNECTED (OPEN). This is often hard for learners to do. Sometimes it helps to remind them if they keep the circuits closed, they may drain all the power they have in the D-cell battery.

Step 5: Introduce the terms insulator and conductor. What do students think these two terms mean? (Take all answers)

Step 6: Explain that a conductor is a material that allows electrons to flow freely from particle to particle creating a CLOSED circuit that keeps the light bulb lit.

Step 7: Explain that an insulator is a material that impede or stop the flow of electrons which creates an OPEN circuit and the light goes off.

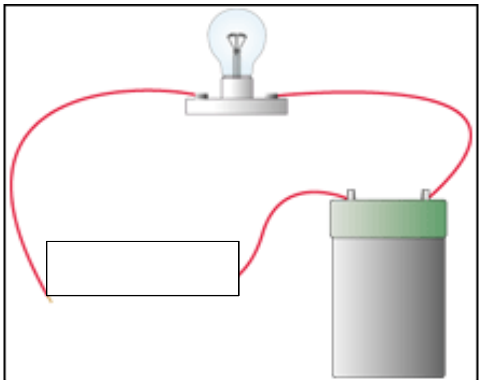
Step 8: Ask the students to get the squares of materials they have been given in their material bag.

STEP 9: Ask the students to create two imaginary columns on their desk and <u>predict</u> which materials are insulators and which are conductors. Place the insulators in one column and conductors in another When finished students should have two rows of materials lined up on their desk.

Step 10: Ask: How will we be able to find out if the predictions are correct?

Step 11: Using three copper wires in the materials bag, we will now build an open circuit.

Step 12: Next place the end of each unconnected wire on the material you have chosen to test, being careful not to let the two wires touch. If the light turns on, the material is a conductor. If the light bulb does not turn on, the material is an insulator and does not close the circuit.



White Rectangle above represents the piece of cloth or material being tested!

Step 13: Ask each student to test all the materials, carefully creating 2 new rows on their desk – one of insulators and one of conductors.

Step 14: If time permits, ask students which materials that they predicted were conductors turned out to be insulators?

Step 15. ASK. Do all conductors have anything in common?
The electrons need to be able to move freely from the battery through the wire, through the material to the power source, a lite bulb, in our case.

Step 16: NOTE TO Volunteer to Remind Classroom Teacher: Please remind students to remember to wear a wool sweater to class for our next session.

MATERIALS

Description	Quantity	Can be purchased at
D-Dry cell	1/student	Grocery or drug store
Flashlight bulb	2/student	Grocery or drug store
Aluminum foil	2 long pieces	Grocery
Tape	A roll/student	Provided by school
Pieces of materials to test: paper, aluminum foil, cotton, a nickel coin, felt, an iron nail	1/student	Around the house, or craft store

Copper wire		
Iron Nail – 3 or 4 inches long		

TITLE: STATIC ELECTRICITY

SUBJECT AREA: Electricity

GRADE: 3rd grade

VOCABULARY

atom: The smallest unit of an element, consisting of a dense, positively-charged nucleus surrounded by electrons.

conductor: A material through which charge moves easily.

electrode: A solid conductor through which a current enters or leaves a medium.

electron: The negatively-charged particle of an atom.

Insulator: A material through which charge does not move easily.

ion: An atom, group of atoms or molecule that has a net electric charge.

molecule: The smallest particle of a substance that retains the chemical and physical properties of the substance, and is composed of two or more atoms.

neutron: The neutral particle in an atom.

nucleus: The positively-charged central region of an atom composed of neutrons and protons.

proton: The positively-charged particle of an atom.

static electricity: The buildup of charge on an object, or the spark that is a result of a buildup of charge on an object.

CLASSROOM SET-UP: Lesson being taught virtually

PROCEDURE:

Step 1: Tell story about static electricity event during a cold evening: "I went to grab my nice fuzzy blanket out of the dryer while I was wearing my nice fuzzy socks. I walked across my nice fuzzy carpet and when I pulled the blanket out of the dryer, I felt a shock! When I pulled my blanket around me, it made my hair stand up!" Ask students about times they have experienced similar events and if they know what might have caused them to be shocked. Once enough students have mentioned static electricity, ask students what they think causes static electricity. Record their thinking on a white board (if one is available) to revisit at the end of the lesson.

*(***NOTICE TO VOLUNTEERS:** ***REMIND*** *any student who may have a latex allergy to not handle the balloon as it is made out of latex. Students should observe their classmates.)*

Step 2: Have students blow up their balloon and tie it closed with a knot. Have each student rub his/her balloon on their wool sweater that you hope they remembered to wear, or piece of wool, and then hold the balloon close to their hair. Observe that the student's hair stands on end.
Ask students to tear up a small piece of paper into about 20 pieces. Rub the balloon and hold it over the paper

Step 3: ASK: Why do you think that your hair stands up after rubbing it with a balloon? Why did the pieces of paper jump up to the balloon? Elaborate on the basics of static electricity, focusing on the fact that every object has a charge due to the electrons in it. If the charges of two objects are opposite, they will attract each other. If they are the same charge, they will repel each other.

ASK students if they can apply what they just learned and explain what happened with the hair experiment or the pieces of paper. Explain to them ***that the balloon carries a negative charge. The confetti carries a positive charge and so when the balloon gets close pulled the paper pieces are attracted to the balloon. Overtime the confetti gains the negative charge from the balloon, and thus falls off because they two objects now have the same charge.***
Have students repeat what you say phrase by phrase, and then ask them to say out loud the whole phrase.

Step 4:   Have students pull out their fruit loops and remove one fruit loop from the others and place it safely aside.   Now they should crush the dry cereal into small crumbs, not powder!

Step 5. Have students pick up their inflated balloon. Ask students what do they think they should do to the balloon to create static electricity.

Step 6. Have students vigorously rub the inflated balloon on the wool again. Ask students to predict what they think will happen when they put the balloon close to the cereal pieces?

Step 7. Have students place the part of the balloon that they rubbed close to the crushed cereal without actually touching it. Have students observe and discuss what happened. What do they think is happening on a molecular level to the balloon as they are rubbing it? Why did the cereal jump onto the balloon?

Step 8. Lastly, have students tie the piece string to the "set aside" piece of fruit loop. Tape the other end of the string to your desk or table so that the one piece of cereal will hang freely.

Step 9: Have students rub their balloon on the wool again and then bring the balloon near the hanging piece of cereal. Ask students to describe what happened when the balloon came close to the cereal. What happened after the balloon and cereal touched? Why do they think this happened? Help students put into words and explanation at the molecular level.

MATERIALS

Description	Quantity	Can be purchased at
Balloon	1/student	Grocery or dine store
Piece of string	10 inches/student	Hardware or grocery
Fruit loops	6pieces per/student	Grocery store
Small piece of paper		Office product store or target
Tape		Provided by school

TITLE: Electromagnets

SUBJECT AREA: Electricity and Magnetism

BACKGROUND: Engineering Connection

An electromagnet is a type of magnet that attracts metals with the help of electricity. Professor Hans Christian Oersted coined the term electromagnetism in 1820, which refers to the ability of a wire to carry electric current & produce a magnetic field

Engineers design electromagnets, which are a basic part of motors. Electromagnetic motors are a big part of everyday life, as well as industries and factories. We may not even realize that we interact with electromagnets on a daily basis as we use a wide variety of motors to make our lives easier. Common devices that use electromagnetic motors are: refrigerators, clothes dryers, washing machines, dishwashers, vacuum cleaners, sewing machines, garbage disposals, doorbells, computers, computer printers, clocks, fans, car starters, windshield wiper motors, electric toothbrushes, electric razors, can openers, speakers, music or tape players, etc.

GRADE: 3rd grade

VOCABULARY

Review vocabulary from past lessons

CLASSROOM SET-UP: Nothing special required

PROCEDURE

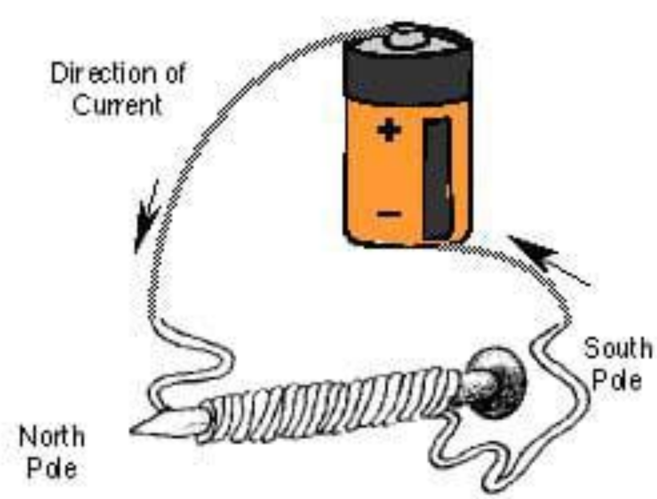
Step 1: Ask students if they have ever seen a video of a junkyard crane lifting up cars, moving them, and dropping them in a new location?
What do they think is going on in that scenario?

Step 2: Facilitate the discussion and guide the students to realize that the crane is a electromagnet that is being turned on and off.

Step 3: Today we are going to build our own electromagnets.

Step 4: Have the students look closely at the wire. What do they notice about the ends? Remind them that the plastic covering of the wire is an insulator so we needed to strip a bit of the plastic off so that we would be able to create a circuit electricity. Remember plastic was an insulator. Why do students think the wires are covered with an insulator? (to protect user)

Step 5: Demonstrate to the students how to neatly wrap the **wire** around the nail making certain that you leave enough **wire** free at each end so that you can attach the **battery**.
Coils should be tight and wrapped directly on the wire, not on top of other wires. Start by having students wrap only 10 coils around the nail. (they will wrap additional coils later)



Step 6: To TEST the power of the electromagnet, attach one end of the wire to the north pole of the battery (+ end) and the other end of the wire to the South

pole (- end).
Students can use their hands, tape or a rubber band to hold the wire on the battery.

NOTE TO VOLUNTEER: Students might tell you that their fingers are getting burned. They are not getting burned, but what they feel is the heat that builds up as the electrons are flowing quickly through the wires.
*Guide the students to **only hold the** ends of wire to the battery while they are testing….otherwise their batteries may lose their power.*
One other option is allowing them to attach a rubber band to the battery and slipping only one wore under the north pole and only attach the other end of the wire with a finger.

Step 7: Instruct the students to move the nail toward a paper clip. Can you pick it up? If No, wrap the wire 10 more coils around the nail. Now can students pick up a paper clip?
Have the students continue to add 10 coils at a time, testing to see if they can pick up a paperclip with the electromagnet. The wrapping should be done tightly spaced; if wires are wound on top of each other, the force of the electromagnet may be limited.

The more **wire** you wrap around the **nail**, the stronger your **electromagnet** will be.

STEP 8: Conclusion: Electromagnets work as long as there is electricity running through a wire. This will automatically allow you to generate a magnetic field. You must be wondering how electromagnets are different to the ordinary magnets that we have lying around in our house. Unlike these ordinary magnets, the magnetic field the electromagnet creates is only temporary. As long as there is a continuous flow of electrons, the electromagnet will work. The ordinary magnets on the other hand do not need electric current to work.

MATERIALS

Description	Quantity	Can be purchased at

3 Inch nail (made of zinc, iron or steel, but not aluminum)		
2 feet insulated copper wire		
D cell battery		
Paperclips		
Wide, short rubber band or electrical tape		

3-PS2-4 Motion and Stability: Forces and Interactions

Define a simple design problem that can be solved by applying scientific ideas about magnets.*
Performance Expectation

3-LS1-1 From molecules to Organisms: Structures and Processes

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
Performance Expectation

3-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

3-LS3-1 Heredity: Inheritance and Variation of Traits

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
Performance Expectation

3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.
Performance Expectation

3-LS4-1 Biological Evolution: Unity and Diversity

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
Performance Expectation

3-LS4-2 Biological Evolution: Unity and Diversity
Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
Performance Expectation

3-LS4-3 Biological Evolution: Unity and Diversity
Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
Performance Expectation

Title: Macroinvertebrates/Insects

Subject Area: Scientific Thinking and Inquiry, Pollution, Life Science,

Objective: How does the number of different species found reflect the water quality of the waterway?

Summary: Students will investigate leaf packs to discover macroinvertebrates and analyze the quality of the water based on what type of macroinvertebrates are found.

Background information:

How to create a Leaf pack:

When collecting leaves for your leaf packs it is important to use leaves from native species.

Find leaves around your stream and place them in an onion bag. Tie off the open end of your onion so that all of the leaves will not come out.

Submerge and attach your leaf pack to a rock - make sure it is tight and not moving up and down with the flow of the water.

Insects:

All insects are arthropods, animals that lack backbones and have jointed legs and external skeletons, or exoskeletons. Arthropods include such diverse animals as roaches, millipedes, tarantulas, and lobsters.

Insects have three distinct body parts: a head, a thorax, and an abdomen; many other arthropods have either more or fewer body areas. Insects also have two antennae, six legs, and almost all insects have wings. No other group of arthropods can fly. Insects go through either complete or incomplete metamorphosis.

Macroinvertebrates:

Macroinvertebrates are called "canaries of the stream" because they function as living barometers that indicate changes in water quality. Certain macroinvertebrates are very sensitive to pollution while others are very tolerant of pollution. The amount and type of macroinvertebrates found living in a stream, indicates the health of that particular stream.

These bottom-dwelling animals include crustaceans and worms but most are aquatic insects. Beetles, caddisflies, stoneflies, mayflies, hellgrammites, dragonflies, true flies, and some moths are among the groups of insects represented in streams. “Macros” are an important link in the food web between the producers (leaves, algae) and higher consumers such as fish.

Aquatic macros can be placed in one of three classes of pollution tolerance, ranging from highly tolerant to highly pollution sensitive or intolerant. These are class I, class II, and class III. Although these pollution tolerant groups, which include certain true flies and worms, can be found in the cleanest streams, their numbers should not dominate the community. On the other hand, the presence of mayflies, stoneflies, and caddisflies – sometimes referred to as the "canaries of the stream" because they are so sensitive to pollution – indicates good water quality.

<u>Metamorphosis:</u>
All insects go through a series of changes during their life cycle. Insect life cycles can be grouped as either complete or incomplete metamorphoses. A complete metamorphosis includes a pupae stage. The adult and larva tend to look very different from each other. Incomplete metamorphosis lacks the pupae stage and the nymph and adult are more similar in appearance. Most aquatic insects remain underwater in the immature stages, and leave the stream only as adults. The life cycles of macros can range from a few weeks to several years.

Grade Level: 3rd

Vocabulary:
Habitat- the environment in which an organism usually lives
Invertebrate- animal without vertebrae
Pollution-substances that contaminate environment especially human made wastes
Metamorphosis- A change in the form and often habits of an animal during normal development after the embryonic stage
Insects- are a major group of <u>arthropods</u> and the most diverse group of <u>animals</u> on the Earth

Classroom Setup:
Students should work in small groups. Each group should have their own leaf pack and sorting equipment.

Procedure:

At least three weeks prior to the day of the activity, create and install an appropriate amount of leaf packs in a stream near the school (see leaf pack instructions above).

Step 1: Engage the class in an introductory discussion and brainstorming session recording answers on the blackboard.

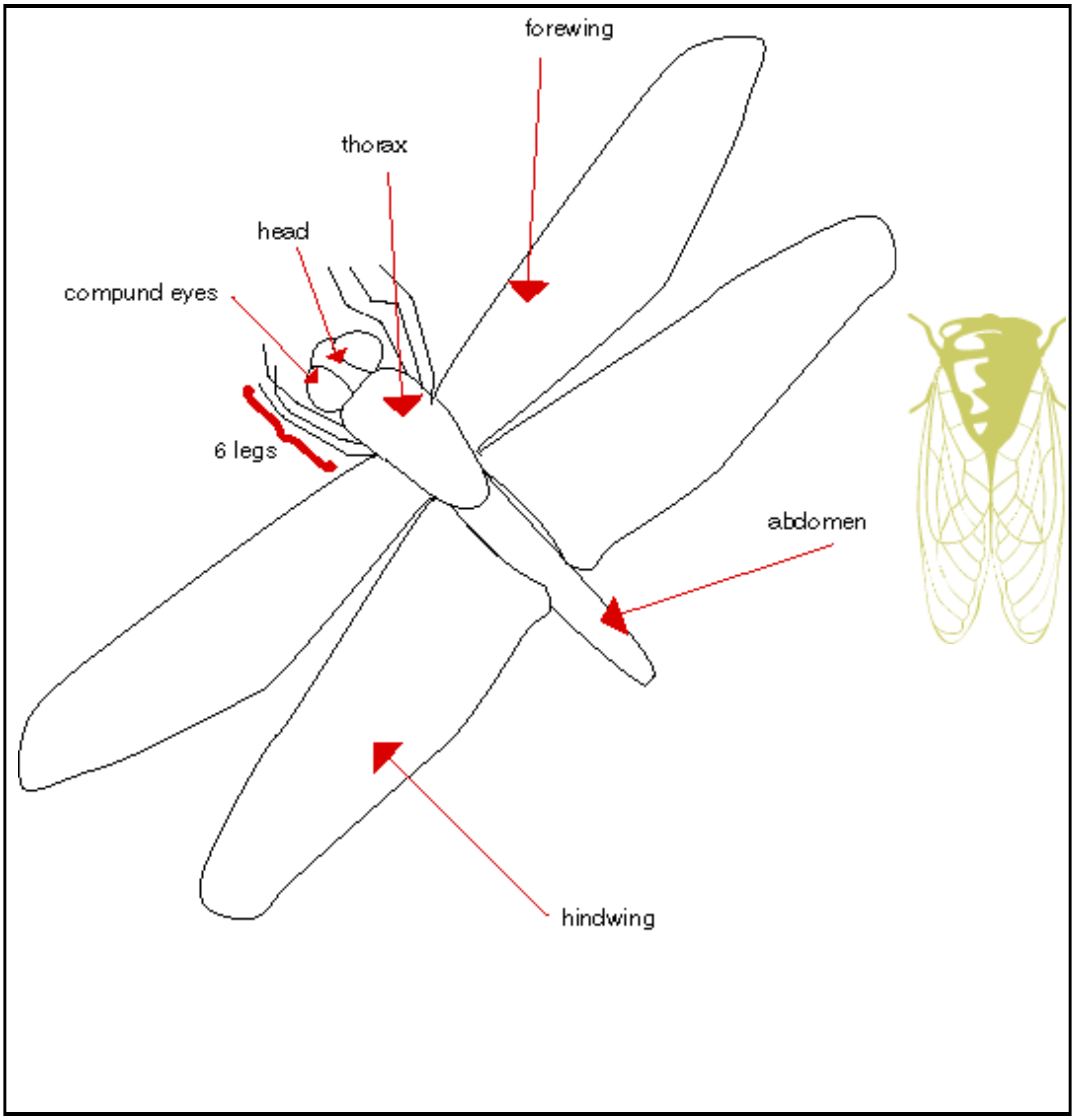
- What is pollution?
- How does a river become polluted?
- How can we determine if the water is polluted?

If the students do not identify signs of life as a water quality indicator, prompt then to think about this indicator, and list what living things live in a stream.

Step 2: Explain that they will be conducting an experiment to determine the water quality of a nearby stream using a specific “sign of life” – macroinvertebrates. (Explain macroinvertebrates if teacher has not done so prior to class.)

Step 3: Pass out the insect parts worksheet and discuss basic insect anatomy.

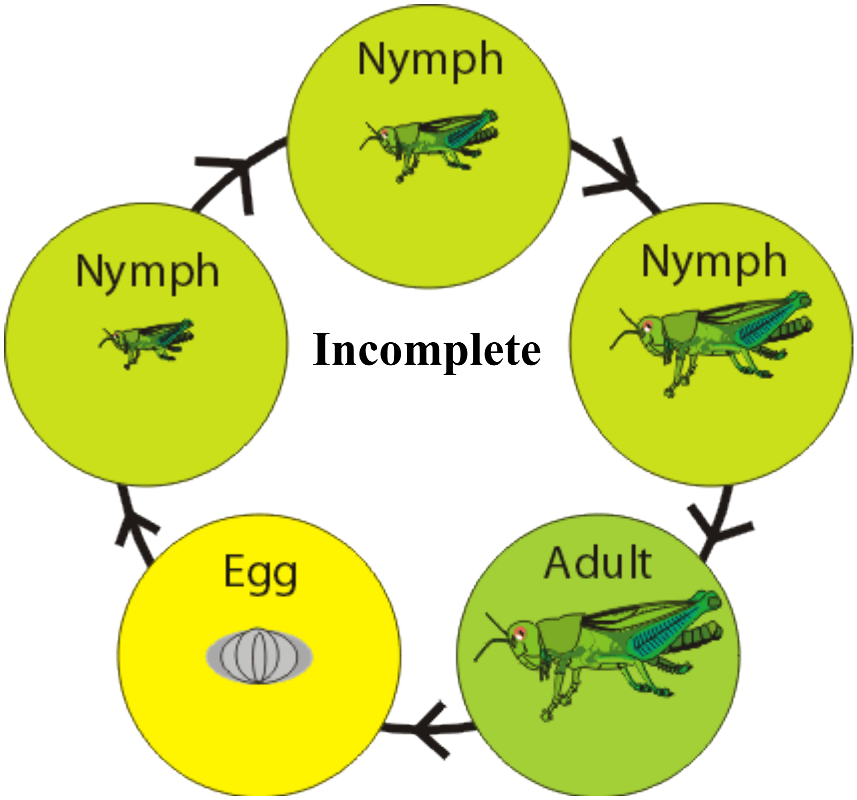
Insect Basic BASIC INSECT ANATOMY DIAGRAM

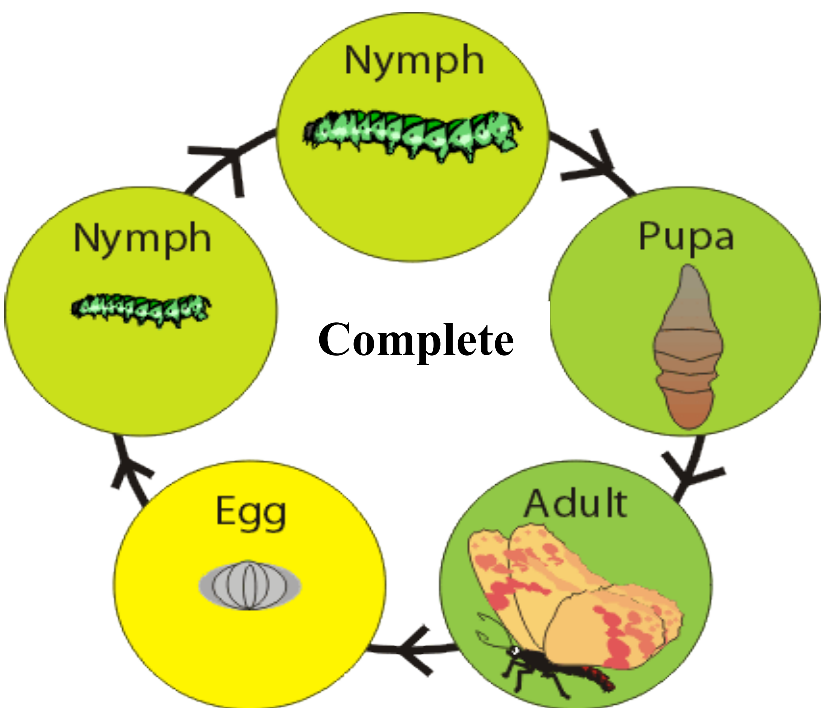


Step 4: For the purpose of identification, students will need to understand what stage of life the macroinvertebrates represent. Using a metamorphosis life cycle chart (below) explain the various stages of life that an insect goes through and what stages they might find in the leaf packs. Insects that undergo incomplete metamorphosis will be in the nymph stage, and insects that undergo complete metamorphosis will be either in the larva or pupa stage. The more questions you can ask, the better the students will be engaged.

Incomplete Metamorphosis	Complete Metamorphosis
(Egg – nymph - adult)	*(Egg - larva - pupa - adult)*
Mayflies	Caddisflies
Stoneflies	Dobsonflies/alderflies
Dragonflies/Damselflies	Beetles
True bugs	True flies
	Aquatic moths

Metamorphosis





Step 4: Each insect has a specific pollution tolerance.
Class I Pollution intolerant: These organisms are highly sensitive to pollution.
Class II Somewhat pollution tolerant: These organisms will be found in clean and slightly polluted waterways.
Class III Pollution tolerant: These organisms will be found in polluted, as well as clean aquatic ecosystems.

Step 5: In this experiment we depend on Leaf packs. A leaf pack is pile of leaves that have been in the stream for some time. Thus, Trees are an important component to the health of stream ecosystems. They provide shade, cooling the water and leaf fall provides food and shelter for a variety of aquatic life. Much streamside vegetation has been removed. How does the removal of trees affect the animals that depend on the leaves for food?

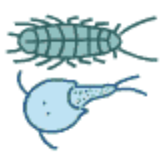
Step 6. Cover the tables with newspaper or drop cloths. Explain to students what they will be doing. Explain that they will be brushing off insects from the leaves into ice cube trays. By appearance alone they will begin to group certain insects together (i.e. ones with two tails vs. ones with three).

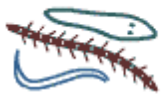
Step 7: Pass out leaf packs, hand- lenses, brushes, ice cube trays and Petri dishes.

Step 8: After the insects are in trays, the students can take individual insects out to examine in a Petri dish using a hand lens. Each student should record the species and number identified on the student lab sheet. At first, they should leave the last column empty.

Type of Insect	Species name	Number found	Pollution Tolerance

Group		Key Features	Group		Key Features
Crustacea - Ostracods		bean-like shell <2 mm	Alderfly nymph		one tail, long filaments along the abdomen
Crustacea - Copepods		long antennae, tiny eyespot: 0.5 - 3 mm	Caddisfly larva		a cylindrical case for protection, each species makes a distinct case from different material
Crustacea - Water fleas 'Cladocera'		antennae, large compound eye 0.3 - several mm	Stonefly nymph		two jointed tails
Water bears (Tardigrades)		8 stumpy legs body <1 mm See gallery links on the right for some of the finest video clips on the Web of these cute critters!	Mayfly nymph		three jointed tails, leaf-like (or other shaped) 'gills' on its sides

Water mites		8 legs, round body 0.5 - 5 mm	Damselfly nymph		three leaf-like tail appendages (gills), bizarre extendable jaws
Mosquito larvae (e.g. fly)		long body, often moves in S-shaped curves 1 - 20 mm	Dragonfly nymph		robust, no tail appendages, bizarre extendable jaws
Group		**Key Features**	**Group**		**Key Features**
Some larger freshwater crustacea - where Micscape has resources		Water louse (isopod) 10 mmFairy shrimp 10 cm and tadpole shrimp (branchiopods) 10 mm	Water-beetle larva		strong jaws, long segmented body, short legs
Freshwater shrimps (not true shrimps but amphipods)		curved, compressed body centimeter 25 mm	Water beetle adult		strong jaws, tough shield, many water beetles are fierce predators
Dronefly larva		this so called rat-tailed	Springtail		the grey spring-tail

		maggot has a long tubed tail for breathing			(lives on the surface of the water, often in large numbers, 0.5-2.5mm
Worms		long thin body, many non related forms	Water bears (Tardigrades)		8 stumpy legs, slow moving <1 mm
Other Insect stages		wide variety of forms >1 mm	Water bug nymph/adult		no jaws, possess a tube-like beak, the nymphs don't have wings, Backswimmer, water boatman. On the water surface: Pond skater

Step 9: Now that they have identified the organisms that were found, student's should use the worksheet below to determine what class of pollution tolerance each insect fits into using the chart below:

.

Indicators of good water quality	Indicators of fair water quality	Indicators of poor water quality
Mayfly larvae Caddisfly larvae Stonefly larvae Gilled snails Riffle Beetle - adult Planaria Water Peeny Hellgramite	Crayfish Riffle Beetle - larva Dragonfly Cranefly larvae Damselfly Scuds Alderfly Sowbug Watersnipe Fly Whirligig Beetle - larva Fishfly Clam or Mussel	Midge fly larvae Blackfly larvae Leeches Aquatic worms Lung snails

Step 10: Based on the species composition and tolerance levels, students should determine whether the water quality of the stream is excellent, fair, or poor.

Step 11: At the end of the lesson, if time, ASK:

1. How many different insects did you find?
2. How would the presence of trees along the streams affect the number of insects found?
3. What does the presence of these specific insects indicate about the water quality of the stream where they were found?
4. What are the main characteristics of all insects?

Materials:

Description	Quantity	Can Be Purchased At
Leaf pack bags; Made three weeks before class	1/group – Divide class size by 3 or 4 to determine the # required	Recycled onion/mesh bags (can have students save from home before beginning experiment)
Magnifying lens	One per student	https://www.kaplanco.com/product/90565/
Plant leaves	Found at location	Outside
Insect identification worksheets	One per student	Xeroxed by classroom teacher
Ice cube trays	Seven	Grocery store
Insect identification guides	1/group	Xeroxed by classroom teacher
Metamorphosis life cycle visual aid	1/group	Xeroxed by classroom teacher
Insect parts worksheet	One per group	Xeroxed by classroom teacher
Plastic spoons	One per student	
Small Plastic cup	One per student	Local grocery store
Eye dropper	Two per group	12/$5.99 https://www.lakeshorelearning.com

3-LS4-4 Biological Evolution: Unity and Diversity

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

TITLE: Outbreak (2 lessons)

SUBJECT AREA: Immunology

OBJECTIVE: To give students a cursory introduction to epidemiology through a demonstration, graphing a viral outbreak, and how immunization serves to protect the community.

GRADE: 3

VOCABULARY

Epidemiology
Epidemic vs Pandemic: AN EPIDEMIC is a disease that affects a large number of people within a community, population, or region. A PANDEMIC is an epidemic that's spread over multiple countries or continents.

Germ
Contagious
Virus
Bacteria
Parasite

SET UP:

PROCEDURE:

Step: Ask students what is a germ? Define virus versus bacteria versus parasite.
Ask student how do you get sick?
Explain that some illnesses are contagious. Ask if anyone knows what contagious means?
Ask: Can you tell me a common way of spreading germs? What are some things we can do to stop
the spread of germs?

Step 2: Ask what is an epidemic? Pandemic? (When a lot of people get sick from the same thing at the same time is called an epidemic. One very famous epidemic was the Black Plague during the middle ages. (The Black Death was also known as the bubonic plague. 12 ships from the Dead Sea came into port in Italy. People gathered on the docks to meet the ship, but they were met with a horrifying surprise. Most sailors aboard the ships were dead, and those still alive were gravely ill and covered in sores on their bodies. The most popular theory of how the **plague** ended is through the implementation of quarantines.). Now ask students if they can think of another epidemic or pandemic??

Step 3: Ask: What is a vaccine See if kids can define it. A Vaccine allows your body to fight off the infection. When you practice fire drills at school, you know what do if a real fire happens. Similarly, if you show your body what a flu virus might look like, it knows what to do if it gets exposed to the flu. What kinds of shots/ vaccines hare you received?

Step 4: Epidemiology. It is the study of how disease affects and spreads across a population. Today you are going to be epidemiologists and help study an outbreak of a new virus called (insert name of school)Pox?

Step 5: Push all the desks and chairs and tables to the side of the classroom or use a different large open space. Ask the students to spread out in the space.

Step 6: Explain that there will be 6 rounds (perhaps more) of one minute each (If fewer that 20 students shorten the time of each round accordingly)

Step 7: Explain to the class that they will be moving around the open space at a **walking** pace. When a round begins, the virus carrier will start sticking stickers on arms and hands of people. Other students should walk normally around the room and **NOT** try to avoid getting the sticker.

Step 8: Choose one student to be the virus carrier and hand him/her a pack of sticky notes or circle stickers. The virus carrier will walk around the open space putting stickers on students he/she comes close to as the other class members move around the open space at a walking pace.
Time ONE MINUTE (45 seconds if that feels better) and then have virus STOP and count the number of stickers passed out. Have each student create a worksheet to record the data.

Step 9: ROUND 2

Give the virus carrier three pieces of paper, only. As the round starts, the first three tagged students should pick up sticky notes from the teacher and they should begin to attach stickers to classmates. At the end of the specified time, count and record the number of stickered people.

Step 10: Pause here and ask the students about the difference between the two rounds. Which one got more persons stickered faster, and why? Which one is more realistic representation of a pandemic and why?

Step 11: Tell the students we are stopping here and will continue in our next lesson.

MATERIALS:

DESCRIPTION	QUANTITY	CAN BE PURCHASED AT:
Stickers	2 100 pack/class	Staples- https://www.staples.com/Post-it-Super-Sticky-Notes-Rio-5SSUC/product_586111?cid=PS:GooglePLAs:586111&ci_src=17588 UFCe_bL6xW2iLBoCmxwQAvD_BwE&akamai-feo=off
White board & markers		In classroom

OUTBREAK (Lesson 2 of 2)

Step 1: Ask students to restate what we learned last week.
What was the difference between Round 1 where only one carrier of the virus infected other people and Round 2 where those infected with the virus then infected others?

Step 2: Tell the students that now 20% of our class will receive the vaccine so that they are now immune from the vaccine. Attach a “Vaccine” sticker to each of their foreheads. Do a round like Round 2 in last session (multiple carriers). Count and record the infected people (immunized students do not get infected even if the get a virus sticker.)

Step 3. ROUND 4: Repeat round 2 but immunize 40% of the class

Step 4: ROUND 5: Repeat round 3 but immunize 60% of the class

Step 5: ROUND 6: Repeat round 4 but immunize 80% of the class (If you finish early with lots of time left, you can do a second trial with a new patient zero)

Step 6: Push the tables back into the normal desk formation and have students take a seat. Explain that our virus was spread by physical contact. Explain viruses can also be transferred by other means. Ask if anyone can think of other ways viruses could be transferred (airborne, foodborne, waterborne, etc.]

Have all create a bar graph for the number of people infected in each round.

Step 7: Divide class into four groups. Each should be assigned a different means of transmission – physical contact, airborne, food borne and waterborne. Task each group to prepare 3 suggestions for how to prevent the virus if it is transmitted in their assigned hypothetical manner.

Step 8: Have each group present their finding. How will they prevent the virus from hitting another school in their town?

Step 9: WRAP UP

- Are vaccinations important? Why?
- What do you think is meant by "herd-immunity" (the resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals are immune to the disease, especially through vaccination). Remind students of Step 5 above.
- Make sure tables and chairs have been returned to their proper places.

3-ESS2-1 Earth's Systems

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

3-ESS2-2 Earth's Systems

Obtain and combine information to describe climates in different regions of the world.

3-ESS3-1 Earth and Human Activity

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.