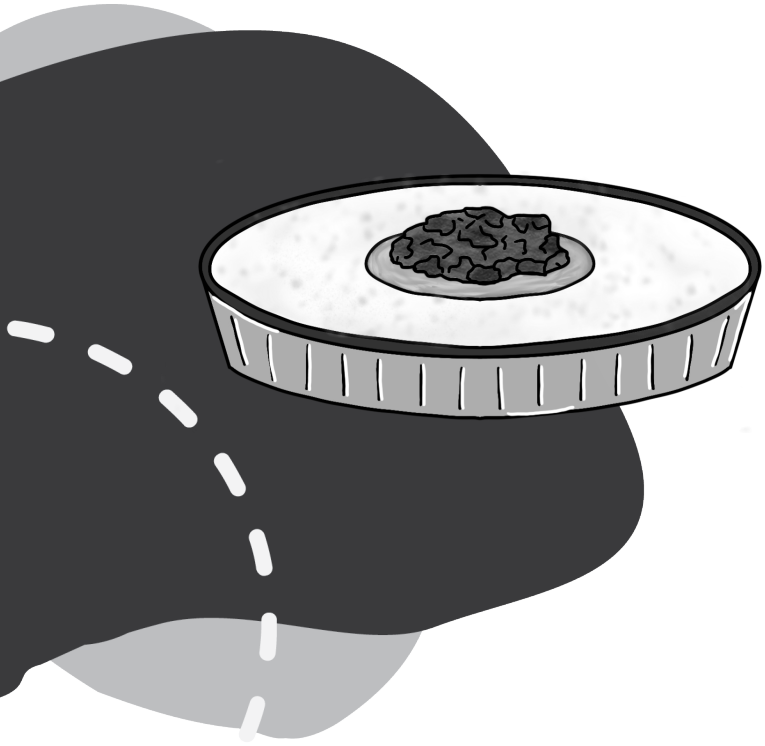
WISE Activity Booklets

A STEM activity booklet for fun on-the-go learning!

Made by WISE Kid-Netic Energy



DIY Activities
Puzzles
Challenges
... and more!

Grade 7
VOLUME 5 - 2020

Interactions within the ecosystems - Forces and structures - Particle theory of matter - Earth's crust

University of Manitoba

WISE Kid-Netic Energy is a proud member of Actua

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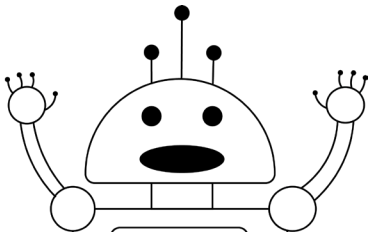


Hello there!

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 next 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.

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

In this Grade 7 booklet, the science topics you will be exploring are: interactions within the ecosystems, forces and structures, the particle theory of matter, Earth's crust and more!

Best of luck, and until we see you again,

the WISE Kid-Netic Energy Crew

WISE Kid-Netic Energy
ENGINEERING FUN SCIENCE

go CODE GIRL
ALLEZ CODER LES FILLES

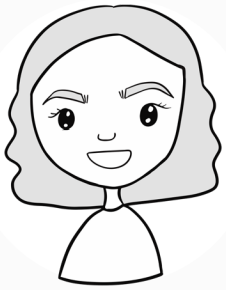
happening on

SATURDAY
February 6, 2021

Go Code Girl is an annual event that celebrates computer engineering and computer science! This year, WISE Kid-Netic Energy is offering Go Code Girl virtually for girls in Grades 7 to 9! To meet our event partners, sign up for the event and to learn how you could win prizes leading up to the event, visit our website!

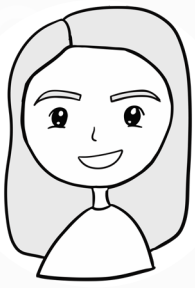
For more info & to sign up go to wisekidneticenergy.ca/go-code-girl!

Meet our Amazing Authors!



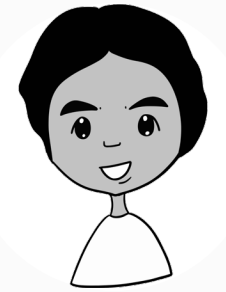
Brenna

Brenna is in her third year of mechanical engineering and loves learning about the science behind how things in our world work! In her free time she likes baking, seeing friends, and playing with her dog.



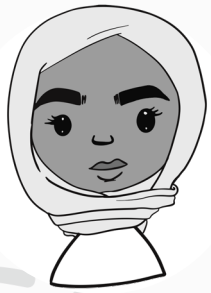
Katy

Katy is in her third 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.



Olivia

Olivia is in her third year of biosystems engineering. She hopes to work in renewable energy or water treatment in the future. In her free time, she plays and refs touch football and enjoys watching cooking shows.



Reem

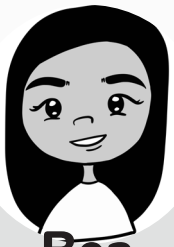
Reem is in her second year of science at the U. of M and her favourite classes are psychology and microbiology. In her free time, she loves to watch movies and bake desserts

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!

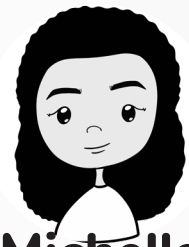
... and our Incredible Editors!

Alex



Bea

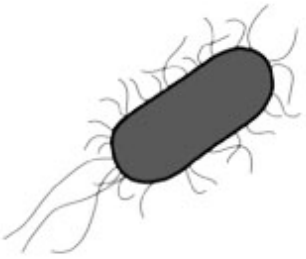
Mahalia



Michelle

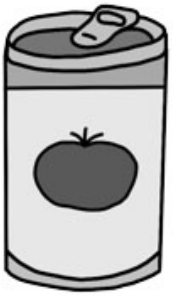
Did You Know? Microbe Edition

Did you know that micro-organisms are the oldest form of life and are the largest mass of living material on Earth. Let's explore some of the micro-organisms in everyday life.



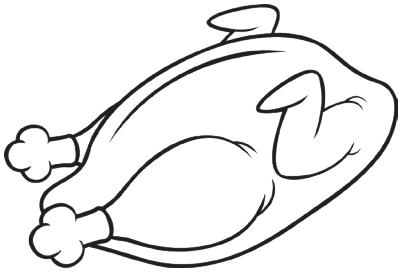
E. coli: A bacteria that is found in the small intestine of warm blooded animals. Certain strains can cause severe abdominal cramps, bloody diarrhea and vomiting.

Penicillin: The first group of antibiotics to come from moulds that are used to treat bacterial infections.

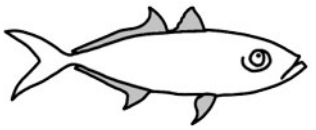


Clostridium botulism: A bacterium that produces toxins under low oxygen conditions. This bacterium is one of the most toxic substances known. Even tiny amounts can cause illness or death. This bacterium can grow in cans or jars.

Lactobacillus bulgaricus: The main bacterium used in yogurt production and in some cheeses. It is a beneficial bacteria because it prevents bad bacteria from growing in the digestive tract.



Campylobacter jejuni: The main cause of food poisoning and is usually transmitted in raw chicken. Catching it causes gastroenteritis and bloody diarrhea.



Psychotropic bacteria: A bacteria that spoils fish. Fresh fish won't have a strong fish smell unless it spoils.

This activity continues on the next page!

Deinococcus radiodurans: A microbe that is extremely resistant to radiation and can be used to clean up toxic waste.

Streptomyces griseus: The smell of soil after it rains can be attributed to this microbe and more importantly, it is a antibiotic smell we can detect after rain. It comes from an organic compound called geosmin, which is produced by these microbes.

How to avoid these bad microbes

E. Coli

Wash your hands often and especially after going to the bathroom. Cook meat and poultry to the same minimum temperature and wash fruits and vegetables well.

Clostridium botulism

Do not eat from cans that are swollen, gassy, or spoiled and follow the proper canning procedures for at home canning.

Campylobacter jejuni

Cook meat and poultry to the same minimum temperature to kill this microbe. Use different cutting boards for raw meat and produce to avoid cross contamination.

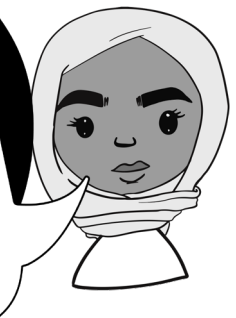
Reem wants to tell you about some more interesting microbes!

Mycobacterium tuberslosis: Causes tuberculosis - a slow, fatal respiratory disease.

Rickettsia rickettsia: Causes Rocky Mountain Spotted Fever, it's usually transmitted by tics and mice.

Streptococcus pyogenes: causes strep throat and if it is left untreated and or gets into the blood, it can cause scarlet fever and flesh eating disease.

Candidatus brocadia anammoxidans: this organism can be used in nitrogen removal and can be used for treating waste water.



Human Impact on the Environment

Consider the decisions below and decide whether they help the environment or hurt it. Circle one of the two options!

1. The Eastern Cottontail Rabbit is released back into the wild after increasing the population by breeding them in captivity.

   Helping Hurting

2. A elementary school near the forest wants to clean plastics and garbage from the pond.

   Helping Hurting

3. The recent lightning storm has started a few small fires in the forest, the local firefighters have been called to stop the fires.

   Helping Hurting

4. One of the locals came back from a trip to Europe and brought back a purple loosestrife and would like to plant it in the forest.

   Helping Hurting

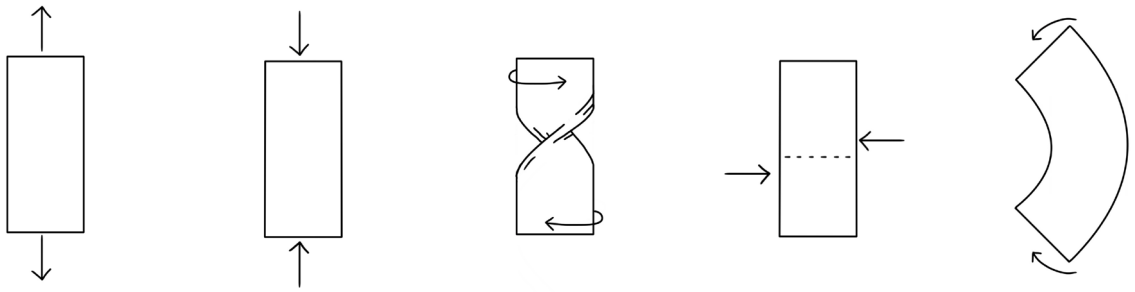
5. Draining wetlands for human use: an engineering company would like to build a dam by destroying the wetland in that area.

   Helping Hurting

Do you know of any other examples where decisions by humans have impacted the environment in a helpful or hurtful way?

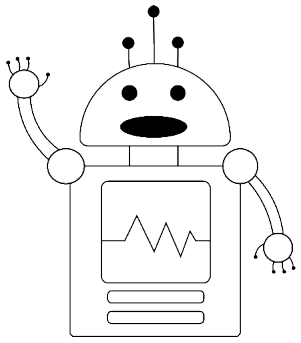
Transforming Objects

There are lots of different forces that might be affecting an object! Engineers need to make sure that structures are strong enough to handle the forces they will experience so they don't crack, bend, or break. But these forces can also change objects in useful ways that we want. Here are five different types of forces:

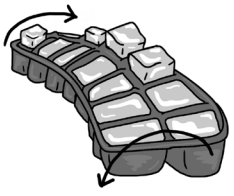


Tension is stretching/ pulling forces in line with each other.	Compression is squishing/ pushing forces in line with each other.	Torsion is twisting forces in opposite directions.	Shear force is pushing forces that are parallel, but not in line with each other (like tearing, cutting, or sliding).	Bending is turning forces paired together.

We can compare the forces changing an object to the functions in computer code! For coding, we start off with an input, and a function changes the data to give a certain output. In this case, the input is the original object, the function is the force applied, and the output is the transformed shape.



Can you write out what force is causing each change below?

	Input	Function	Output
1			

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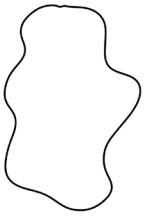
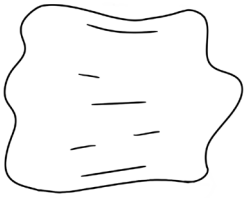
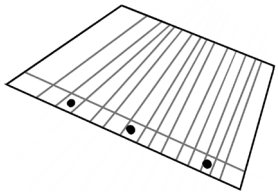
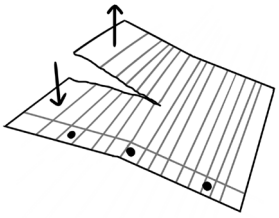
	Input	Function	Output
2			
3			
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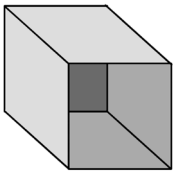
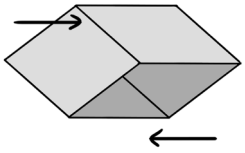
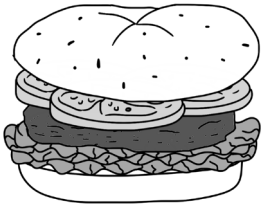
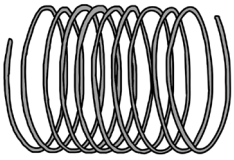
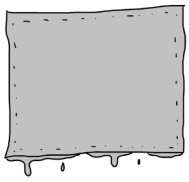
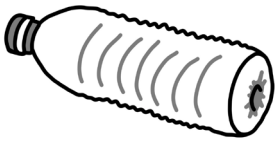
5			

Given the input and function, can you draw what the output for each object might look like?

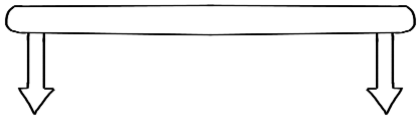
	Input	Function	Output
6		Bending	

This activity continues on the next page!

	Input	Function	Output
7		Compression	
8		Tension	
9		Torsion	
10		Compression	

Centre of Gravity

The centre of gravity is the point where the weight is even on all sides. In an object like a ruler, the weight is even on both sides.



What is the centre of gravity in this drawing?
Remember: The weight is equal on both sides of this image.

The arrows represent the force of gravity pulling the object to the Earth. If the object is heavier on one side, the arrow will be bigger.

Before doing the experiment below, test out some items around your house! Try to balance them on your finger and see how you need to position the objects in order to achieve balance.

Note: Do not try this with anything that is fragile or is made of glass!

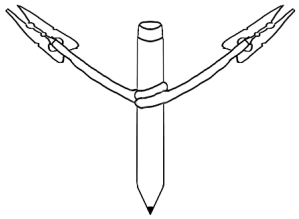
The Wavy-Arms Balancing Challenge

Materials

- A wooden pencil or popsicle stick
- A pipe cleaner
- Clothespins or other small items to use as weights, like nuts or metal washers

Instructions

1. Wrap the entire pipe cleaner around the pencil, tightly so it stays in place. Make sure the pipe cleaner is even on both sides.

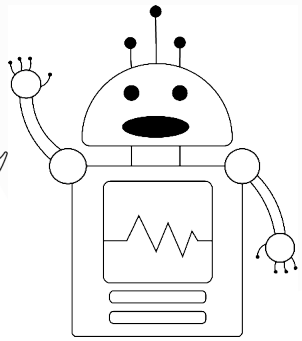


2. Attach one clothespin to each end of the pipe cleaner.

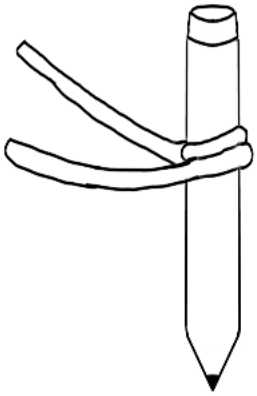
3. Balance the tip of the pencil on either your finger, or something small like a chopstick or a fork. Move around the weighted arms and see how that changes the centre of gravity! It may even seem like it's defying gravity.

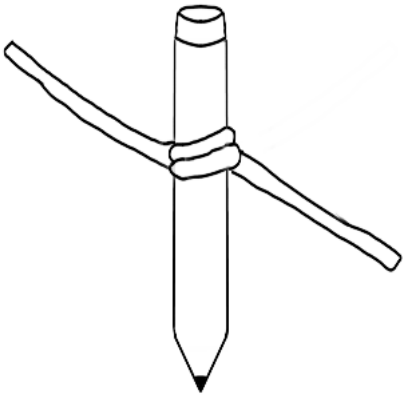
This activity continues on the next page!

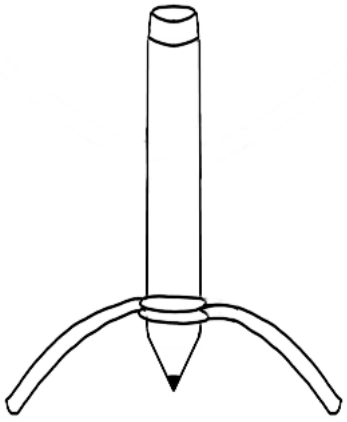
Using a conditional statement, If the centre of gravity is found, Then the object balances. If else, the object will fall. Continue this process on a loop until the centre of gravity is found.



Here are some positions you can make the arms of your device. Try each one and anymore you can come up with! What angle does the pencil have to be standing at in order to maintain balance?







In here, draw the position that is most optimal, meaning the one that is the best at balancing.

Homemade Lava Lamp

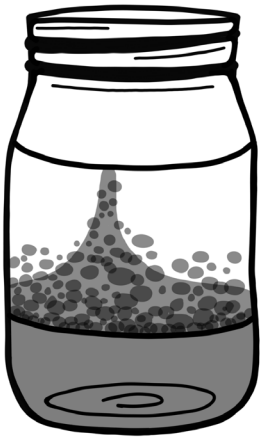
Lava lamps are mesmerizing to watch! The bubbles constantly move and change shape before your eyes. Below are the supplies and steps required to make your own lava lamp at home using three different methods.

Method 1: With Alka-Seltzer

Supplies

- Clear bottle or jar
- Water
- Vegetable oil (or baby oil)
- Food colouring
- Alka-Seltzer tablets

Steps



1. Fill 1/3 of your container with water.
2. Fill the top 2/3 of your container with oil.
3. Add 6 drops of food colouring to the jar. Watch to see where the food colouring settles. Which layer has a higher density? Note: The layer on the bottom must be denser to support the weight of the top layer.
4. Break your Alka-Seltzer tablet into 4 and add the quarters to your lava lamp one at a time until you have added the whole tablet. Watch the reaction occur!

Method 2: With Water-Soluble Aspirin

Supplies

- Clear bottle or jar
- Water
- Vegetable oil (or baby oil)
- Food colouring
- Water soluble asprin tablet

Steps

1. Fill 1/3 of your container with water.

This activity continues on the next page!

2. Fill the top 2/3 of your container with oil.

3. Add 6 drops of food colouring to the jar.

4. Add the water-soluble asprin tablet to the lava lamp and watch the reaction!

Method 3: With Baking Soda and Vinegar

Supplies

- Clear bottle or jar
- Water
- Vegetable oil (or baby oil)
- Food colouring
- Baking soda
- Vinegar

Steps

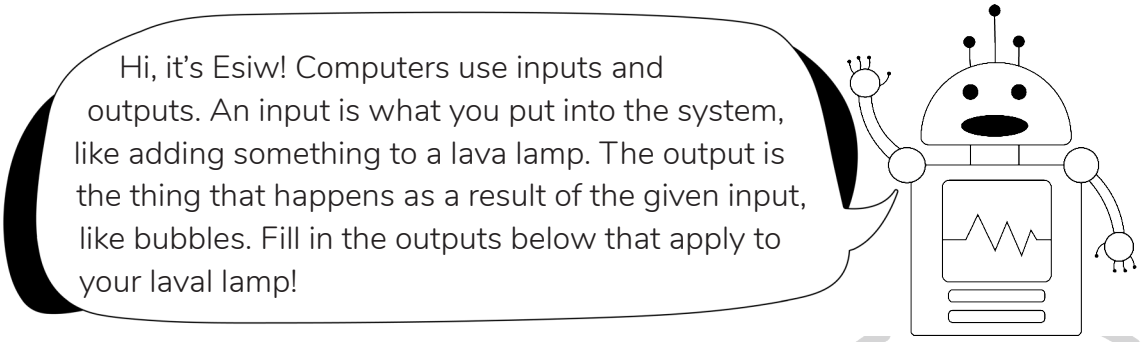
1. Add 3 tablespoons of baking soda to the bottom of the jar.

2. Fill the rest of the jar with oil.

3. Add 6 drops of food colouring to the jar.

4. Add 3 drops of vinegar to the jar and watch the reaction!

Notice how the water and the oil do not mix, and the particles stay separate. The water and food colouring, on the other hand, are attracted to each other and form a solution where the food colour is mixed into the water layer.



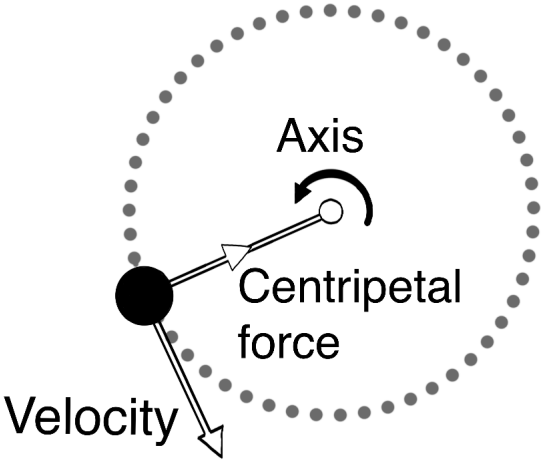
Inputs and Outputs of your Lava Lamp

{ **input** = food_colouring ; **output** = _____ }
{ **input** = alka_seltzer_tablet ; **output** = _____ }
{ **input** = asprin_tablet ; **output** = _____ }
{ **input** = baking_soda_and_vinegar ; **output** = _____ }

Gravity vs Centripetal Force

What is Centripetal Force?

Velocity is the *speed* of something moving in a specific *direction*.
The **Axis** is the point that an object revolves around.
Centripetal Force is the force that keeps the object moving in a circle. Without it, the object would fly in a straight line from where it is released.



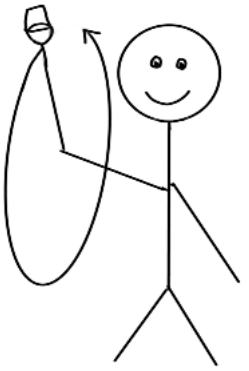
The Activity:

Supplies

- Sturdy bucket
- Water
- Rope (at least 1 meter in length)

Steps

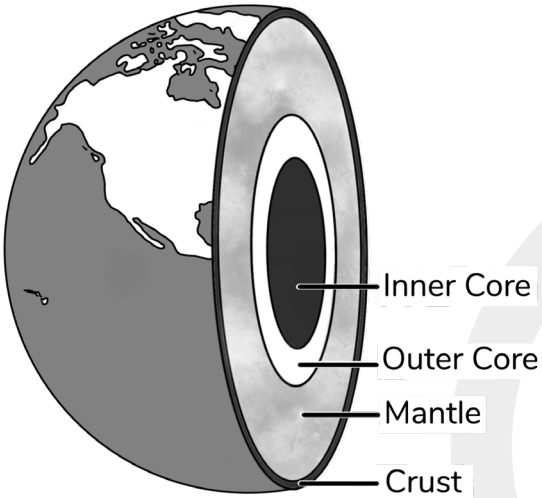
1. Fill 1/2 of your bucket with water.
2. Attach the handle of the bucket to the rope, make sure it's secure.
3. Take the other end of the rope in your hand and spin the bucket of water vertically. Does the water fall out when the bucket is upside down?



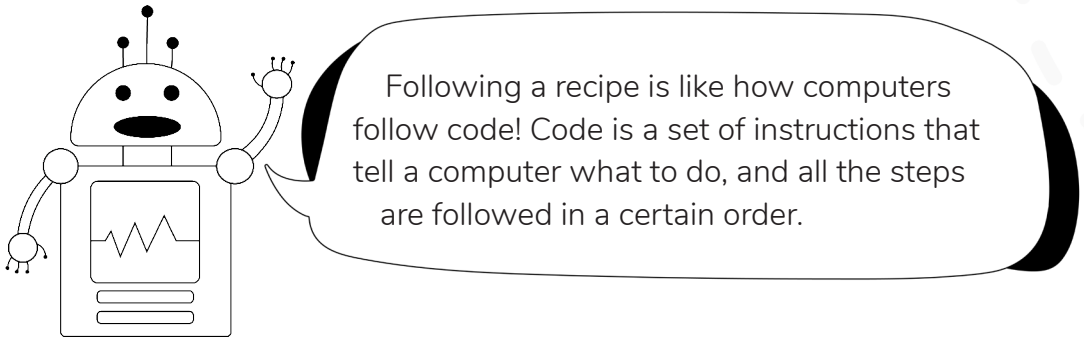
The water stays in the bucket because of **inertia**, which means the bucket wants to stay moving in a straight line but is kept in a circle because of the centripital force. When the water is moving, it also wants to stay in a straight line which would cause it to fly away. But since it is in a bucket, the water has nowhere to go but into the bottom of the bucket.

A Recipe of Our Planet

Did you know that Earth is made of different layers? Scientists have studied our planet and discovered that there are 4 main layers - the crust, mantle, outer core, and inner core. The crust is the thin and hard shell made of materials including silica and aluminum. This is the layer we live on and can see, and everything from cities to oceans sit on top of the crust. Below the crust is the mantle, which is a big thick layer made of solid and semi-solid hot materials like iron, magnesium and silicon. Then there is the iron and nickel outer core, which is super hot liquid metal! And finally, at the very center of the Earth there is the inner core, which is a big dense ball of solid iron and nickel metal.



Follow the dessert recipe below to make a model of the Earth! Each part represents a different layer, and you can put them all together to see what our planet is like.



Ingredients and Supplies

- 27 chocolate and creme cookies (one package of Oreos or similar)
- 6 Tbsp melted butter
- Approximately 4 cups of ice cream, flavour of your choice
- Approximately 1 cup of a fruit pie filling
- 1 package of brownie mix
- 9 inch pie dish

Let's get started! We will be making one layer at a time.

SLO : 7-4-01, 7-4-02

This activity continues on the next page!

For the Earth's dense and solid inner core:

Steps

1. Bake the brownie mix according to the package's directions.
2. Allow to fully cool, then crumble into chunks.
3. While waiting for the brownie to bake and cool, you can prepare the crust.

For the Earth's thin and hard crust:

Steps

1. Crush the cookies (including the filling) into a fine mixture using a food processor or sealed plastic bag and rolling pin.
2. Mix in the melted butter. You may want to adjust the amount of butter depending on the brand of cookies used; the mixture should have a texture similar to damp sand.
3. Press the mixture into the bottom and up the sides of a pie dish. Use a spatula, spoon, or the bottom of a cup to pack it in firmly.
4. Refrigerate the crust for at least 30 minutes.

For the Earth's solid mantle:

Steps

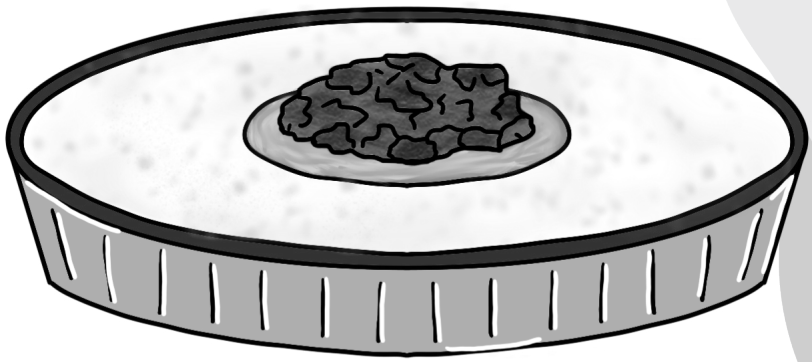
1. Allow your ice cream to soften for a few minutes at room temperature.
2. Use a spoon or spatula to spread the ice cream into the prepared crust.
3. Create a shallow dip in the center of the ice cream layer - this is where the outer core and inner core of the Earth will go.

This activity continues on the next page!

For the Earth's core:

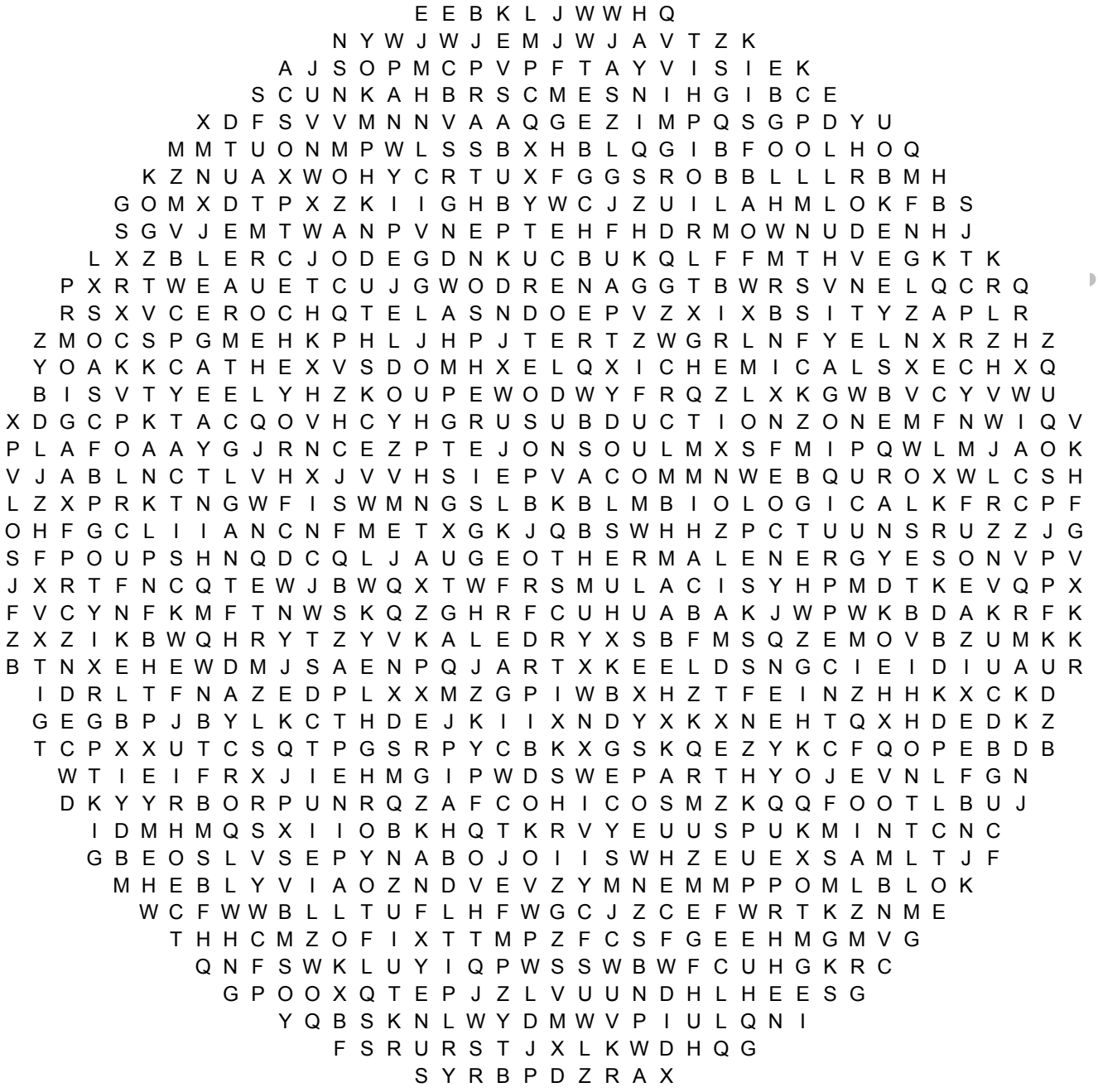
Steps

1. Spoon the pie filling into the shallow dip in the mantle layer. This represents the Earth's liquid outer core.
2. Pile the chunks of baked brownie at the very center of your dessert for the inner core.
3. Now you have a delicious model of Earth! Keep this dessert in the freezer so the ice cream doesn't melt. Before eating, let it sit out at room temperature for a few minutes to soften.



Tip: If you are having a hard time cutting through your dessert, run hot water over the knife. This will help cut through your dessert! Becareful with sharp knives and we hope you enjoy this dessert!

The Earth's Crust



Word List:

Alfred Wegener
Asthenosphere
Biological
Chemical
Continential Drift
Core
Crust
Erosion
Fossil Fuels
Geologist
Geothermal Energy
Lithosphere
Mantle
Physical
Plate Tectonics
Rock Cycle
Seismotologist
Subduction Zone
Theories
Weathering

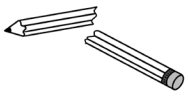
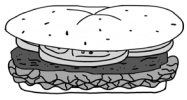
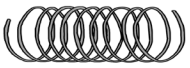
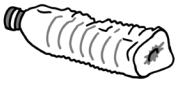
SLO : 7-4-01

Answer Key

Page 6:

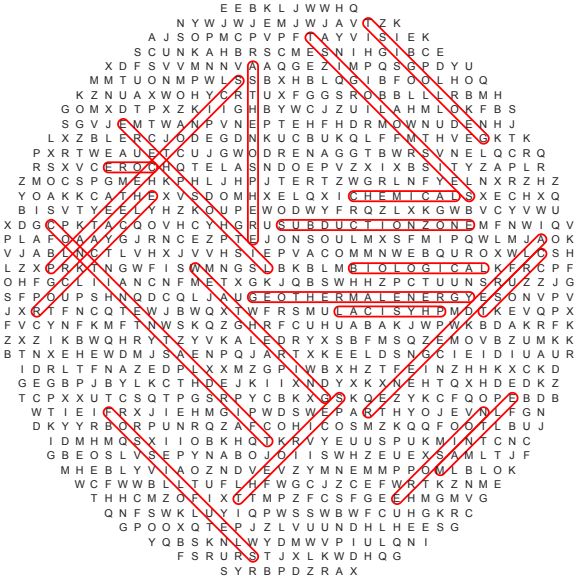
1. Reintroducing native species back **helps** the forest because it restores the animal population and establish a healthy, diverse ecosystem. Animals such as Gray wolves and Bald eagles have been saved from endangerment this way.
2. Removing plastics and other pollutants from river **helps** the environment because it prevents animals from becoming sick and cleaning up preserves their habitat.
3. Preventing natural fires: naturally occurring wildfires may have beneficial effects on native vegetation, animals, and ecosystems. So stopping natural fires often **hurts** the forest.
4. Introducing non-native species **hurts** the forest because they can change habitats and alter ecosystem function and ecosystem services, crowd out or replace native species, and damage human activities. The purple loosestrife plant can destroy the native plants that make up the habitats where fish, birds and animals feed, seek shelter and rear their young.
5. Draining wet lands for human use **hurts** the forest because it destroys the habitat of animals and can hurt the overall ecosystem.

Page 7-9:

1. Torsion
2. Tension
3. Shear
4. Bending
5. Shear
6. 
7. 
8. 
9. 
10. 

Page 18:

The Earth's Crust



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