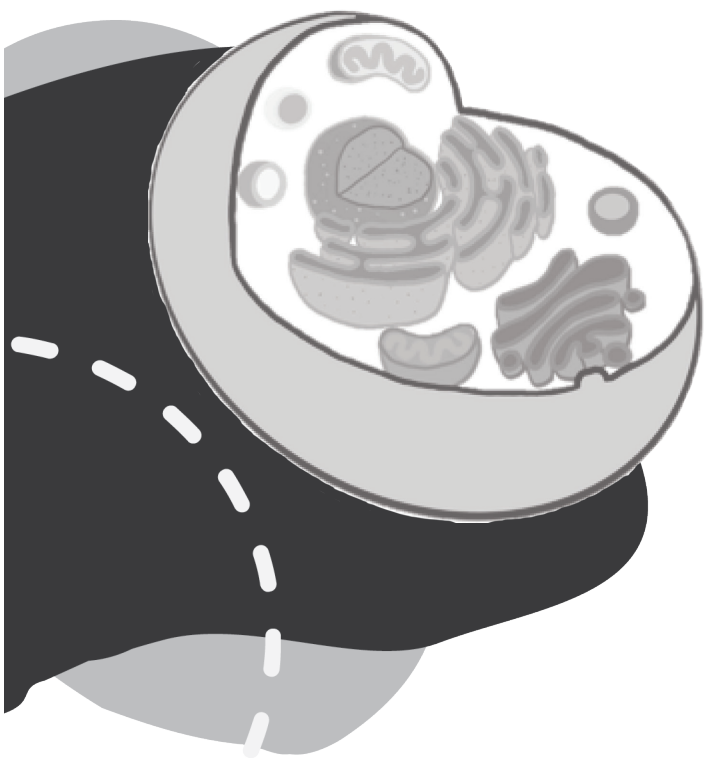
WISE Activity Booklets

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

Made by WISE Kid-Netic Energy

DIY Activities
Puzzles
Challenges
... and more!



Grade 7
JUNE 2020

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

University of Manitoba

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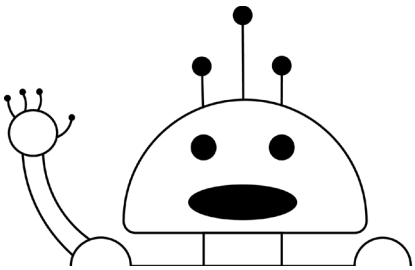


Hello there!

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

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

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

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

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

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

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

Best of luck, and until we see you again,

the WISE Kid-Netic Energy Crew

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

Meet our Amazing Authors!

Katy

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

Olivia

Olivia is going into 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 playing the piano.

Robyn

Robyn is going into her forth year of civil Engineering at the University of Manitoba. She enjoys riding her bike, soaking up sunshine and watching live music. Robyn also loves all things science and is pumped about a summer filled with STEM fun.

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!

How to code a plant

Plants grow because of a process called photosynthesis. The process of photosynthesis follows an algorithm, conditionals, loops, uses data and often encounters bugs... and we are not talking about the buzzing kind. These are all prominent words within coding language.

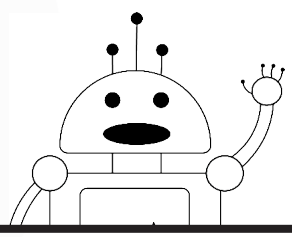
Algorithm: A sequence of instructions that is intended to solve a larger problem.a

Conditionals: A sentence of instructions that allows the algorithm or program to make choices depending on conditions.

Loops: A sentence of instructions that repeats a certain part of the algorithm or program.

Data: Information or knowledge.

Bug: An error in the algorithm or program.



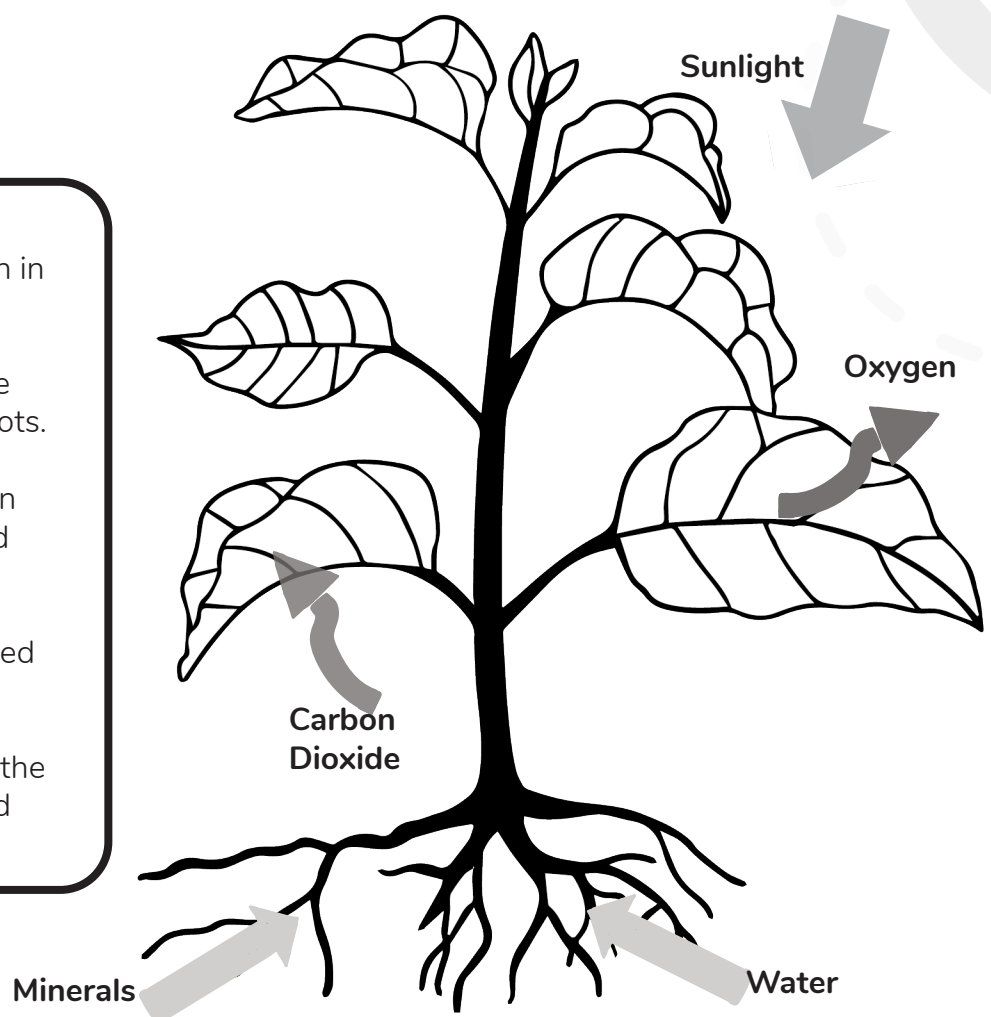
The process of photosynthesis as shown in the graphic:

1. Minerals and water are drawn up through the roots.

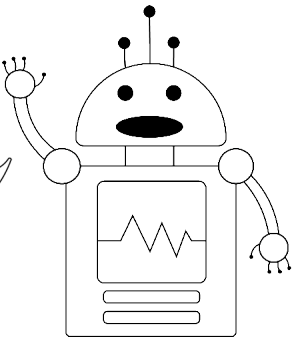
2. Carbon dioxide is taken in through the leaves and oxygen is released.

3. The sunlight is absorbed into the plant.

4. Through this process, the plant produces sugar and continues to grow.



Can you sort the main concepts of photosynthesis into their corresponding coding concept? Use the words from the word bank below.



Algorithm	Conditional	Loop	Data	Bug

WORD BANK

Overwatering	Shade	Nutrients in the soil
Insects	Dryness	Location
Photosynthesis Process	Deepness of the roots	Carbon dioxide
Watering of the plant	Amount of water needed	Amount of oxygen released
Flood	Type of plant	

Biotic Bingo

Biotic means living. An example we can see in our ecosystems and within our daily lives is food that originates from plants or animals.

Go on a walk within your ecosystem - your ecosystem is your community - and make X's on the squares you find! Try and get a horizontal, vertical or diagonal line.

Squirrel	Birch Tree	Moose	Robin	Algae
A Friend	White-tailed deer	Squirrel	Tulips	Earthworm
Pine Tree	Moss	Free Space!	Puppy	Skunk
Blue Jay	Fish Fly	Fungi	Bumble Bee	Minnow
Mouse	Garter Snake	Saskatoon Bush	Dandelion	Owl

After you get a Bingo, try and make your own Abiotic Bingo! Abiotic means physical or non-living, or coming from living things. An example we can see in our ecosystems and within our daily lives is shelter or soil!

Ecosystem Interactions

As humans, we interact with ecosystems around us every single day. But what effects do we have on our natural environment, and are they positive or negative? Let's investigate the effects of humans on an ecosystem.

Think about the natural state of an ecosystem, and how human activity can change biological conditions, habitats, and natural balance. Now think about a specific ecosystem in your environment. What are the effects of humans on this ecosystem, and is the system being changed by human activity?

Answer the following questions about your ecosystem.

Where is your ecosystem located?

_____

What type of ecosystem is it? (Wetland, grassland, desert, tundra, etc.)

_____

_____

What type of human activity exists in this ecosystem? (Housing, roads, transportation, businesses, parks, etc.)

_____

_____

_____

What do you think the effects of this human activity are on the ecosystem?

_____

_____

_____

_____

_____

Appearance of an Ecosystem

In the first space below, draw a picture of how your ecosystem looks right now.

Now think about what your ecosystem would look like if there was no human activity. How would the appearance change? In the space below draw a picture of your ecosystem without human activity.

This activity continues on the next page.

Human Interventions in Ecosystems

An intervention is an action taken in attempt to make a positive change. Human interventions come in many different forms, but unfortunately can at times be more harmful than helpful. When humans designate protected habitats, or reintroduce species to an environment, that has a positive effect on the ecosystem. But what if humans introduce non-indigenous species into a region? The natural balance of an ecosystem can be easily disrupted.

Think about human interventions present in your ecosystem and the differences between your two ecosystem drawings to answer the questions below.

Are there any positive human interventions in this ecosystem?

_____

_____

_____

Are there any negative human interventions in this ecosystem?

_____

_____

_____

What can you do to reduce your impact on the ecosystem?

_____

_____

_____

_____

_____

Force diagrams

Investigating the forces that act on objects allows us to identify where the **Center of Gravity** is on any given object. Investigating forces that act on objects also allow engineers to make huge structures that we use every day.

We investigate these forces using force diagrams. Force diagrams use arrows, often referred to as **vectors**, to indicate direction and magnitude of a force.

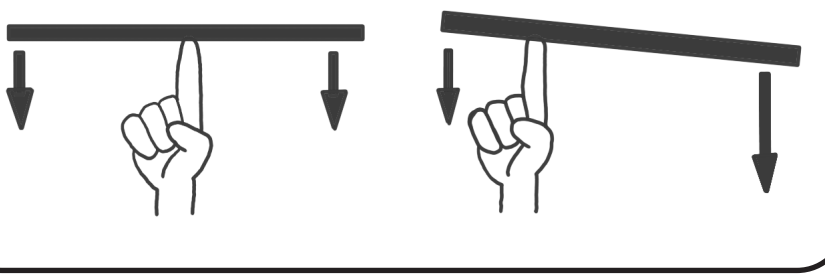
Center of Gravity:
An imaginary point on an object or body that the total weight is concentrated to.

Vectors:
Arrows that represent the direction and strength of a force. A longer arrow represents a stronger force. The point of the arrow shows the direction in which the force is being applied.

Direction:
Direction of a vector indicates the way in which the vector is moving or pointing.

Magnitude:
Magnitude of the vector indicates the size or strength of the vector.

Example:



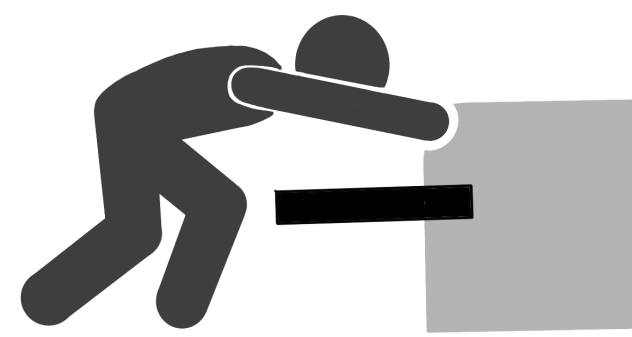
Try this example out with your finger and a ruler!

Below and on the following page there are several objects that have forces acting on them, or have internal forces acting on other objects.

On some objects the vectors have arrows but no direction and on others, the vectors have directions but no magnitude, and SOME have neither.

Complete and/or draw the vectors - and check your answers!

LEVEL 1:
Draw the arrow head to indicate direction of the force on the black vector

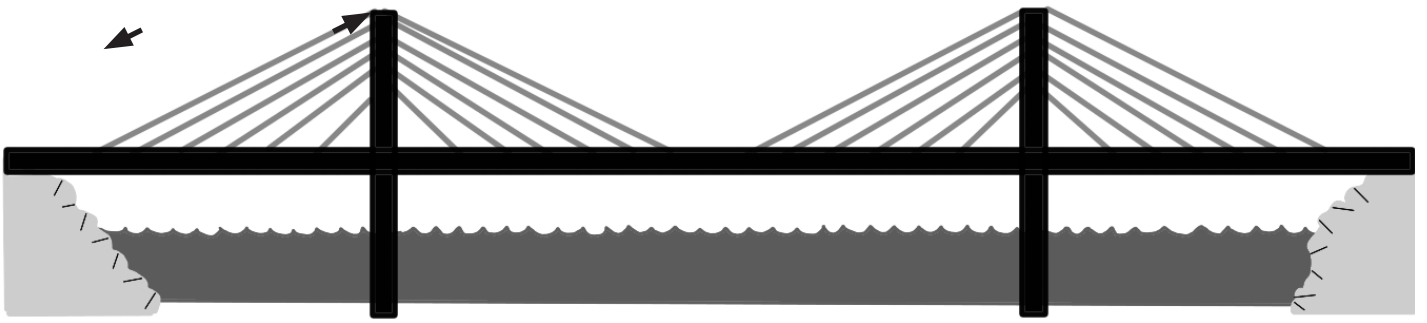


This activity continues on the next page.

SLO : 7-3-01, 7-3-03, 7-3-04

LEVEL 2:
Draw the vectors.
Hint: Refer back to the example on the previous page

LEVEL 3:
Draw the vectors on the cables of this cable bridge. There is one example drawn for you. Do you think they will all be the same?



LEVEL 4:
Draw the vectors on this suspended climber. Think about the forces within the rope (refer to cable forces in level 3) and think about the forces pulling the climber down (refer to balance forces in level 2).

This activity was created by Robyn.

Cell Theory

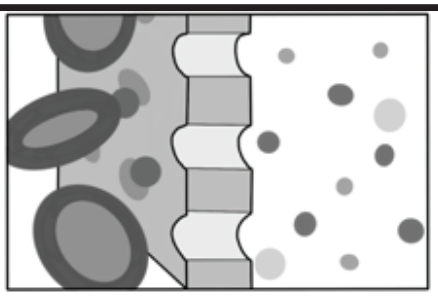
There are three main points to the cell theory:

1. Living things are composed of one or more cells
2. Cells are the basic units of life
3. New cells arise from existing cells

Human bodies are made up of cells. Single human cells have membranes that are selectively permeable, with a single nucleus.

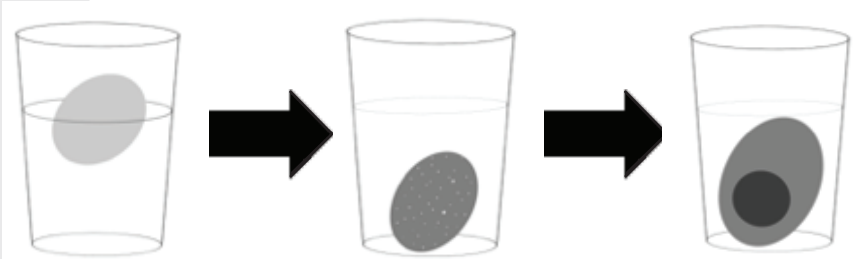
An experiment can be done with a single egg and acidic liquid to represent a single human cell. By following the instructions and making observations along the way, you will be able to see with your own eyes how a selectively permeable membrane works. You will be able to see how the nuclease acts in the fluids of the cell. Placing the egg in the acidic liquid will dissolve the hard-outer shell of the egg and thus represent the selectively permeable membrane.

Here is an example of a selectively permeable membrance.



Eggs-periment Time!

1. Fill a glass with vinegar, 3/4 full.
2. Put egg in glass of vinegar.
3. Monitor egg for 12-24 hours, watch for bubbles around the shell.
4. After the 12-24 hours has passed, make observations on the egg and vinegar experiment, try taking the egg out and holding it.
5. Let the egg sit in the vinegar bath for an extended period of time- maybe even a week!



What happened to the size of the egg? Why did this happen?

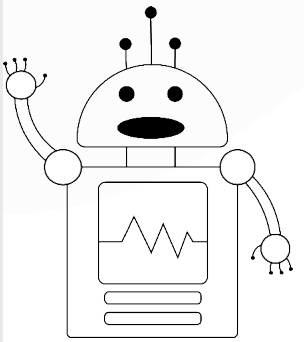
What other liquids could you use to dissolve the shell of the egg? Use the same process and try it out!

Try using soda or isopropanol.

SLO : 7-2-01, 7-2-05

Ice Box Challenge

It's yet another warm summer in Manitoba! Because it's so hot out, you decide to build a device that will keep your ice cubes or popsicles cold during the hot summer day.



Requirements: Your device needs to be able to slow how quickly the ice melts. However, you cannot use electricity to do it. The device must be portable. Try to use as few materials as possible for your design, because as an engineer, you have to keep in mind how much money you spend and every material you would use as an engineer costs money. You also need to be able to either open the container or to include a see-through port so you can check on the ice.

Something to consider:
What kind of materials are good insulators? Insulators are materials that do not easily allow energy to pass through them.

Go around you house and find materials that would be considered an insulator. Think about what materials are used in coolers, fridges, and freezers. List them below.

List the insulating materials here:

_____ _____

_____ _____

_____ _____

_____ _____

Design: Time to draw out your plan! Make sure to include labels to show what materials you use. Draw a few designs out, and test them out to see which one works better!

Design 1 drawing

Design 2 drawing

Test: When it's time to try out your design, take an ice cube or popsicle and place it inside your container. Check the time you put it in at and time how long it takes before the ice cube melts. Another thing you can do is to time how long a regular ice cube takes to melt outside of the cooler. This will let you compare how successful your cooler actually is!

If your ice cube or popsicle is still frozen after 5 hours, congratulations! If not, you can always try re-evaluating your design and try to redo it! After all, the only way you can fail is by giving up.

After testing, answer the following questions:

Which design worked the best? _____

What materials did you use? _____

_____

_____

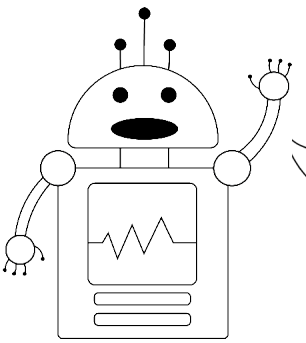
If you try this design challenge again, what would you do differently? _____

_____

_____

_____

Substance Descramble



Your task is to descramble the following substances that are written in binary code and write the answers in the space below. The substances are sorted into categories, which are Pure Substances, Solutions, or Mechanical Mixtures.

A = 01000001	B = 01000010	C = 01000011	D = 01000100
E = 01000101	F = 01000110	G = 01000111	H = 01001000
I = 01001001	J = 01001010	K = 01001011	L = 01001100
M = 01001101	N = 01001110	O = 01001111	P = 01010000
Q = 01010001	R = 01010010	S = 01010011	T = 01010100
U = 01010101	V = 01010110	W = 01010111	X = 01011000
Y = 01011001	Z = 01011010		

00 - Pure Substances	01 - Solutions	10 - Mechanical Mixtures
01010111 01000001 01010100 01000101 01010010 Answer: _____	01010011 01000101 01000001 01010111 01000001 01010100 01000101 01010010 Answer: _____	01010011 01001111 01001001 01001100 Answer: _____
01000100 01001001 01000001 01001101 01001111 01001110 01000100 Answer: _____	01010110 01001001 01001110 01000101 01000111 01000001 01010010 Answer: _____	01000010 01001100 01001111 01001111 01000100 Answer: _____
01000010 01000001 01001011 01001001 01001110 01000111 00100000 01010011 01001111 01000100 01000001 Answer: _____	01010011 01010100 01000101 01000101 01001100 Answer: _____	01001110 01001111 01001111 01000100 01001100 01000101 00100000 01010011 01001111 01010101 01010000 Answer: _____

What's Inside the Earth

Have you ever thought about what the earth looks like on the inside? The earth is divided into four main layers, as explained below.

The Crust:
The outermost layer is the crust, on which we live! The crust ranges from 5-75 kilometers, with an average thickness of 35 kilometers. Mountains, forests, valleys, and the ocean are all on the crust, as well as plants, animals, and human beings! The crust is composed of mineral and rock, including igneous, metamorphic, and sedimentary rock.

The Mantle:
Under the crust is the mantle. This layer is approximately 2900 kilometers thick, and is composed of mostly solid rock. In some places the rock is molten, or melted, and it moves as a viscous fluid. The mantle layer is responsible for volcanic and seismic activity. We see volcanoes and earthquakes on the earth's surface as a result of this activity within the mantle.

The Outer Core:
The outer core is approximately 2200 km thick, and is the outer layer of the earth's core, located under the mantle. The outer core is composed mainly of iron, nickel, and sulfur, and is extremely dense.

The Inner Core:
The spherical inner core of the earth is the most dense part of the planet, and is composed primarily of iron. Although the inner core of the earth is the hottest, the iron is solid, because of the intense pressure from the mass of the rest of the planet. The inner core of the earth is estimated to be 6000 degrees celsius!

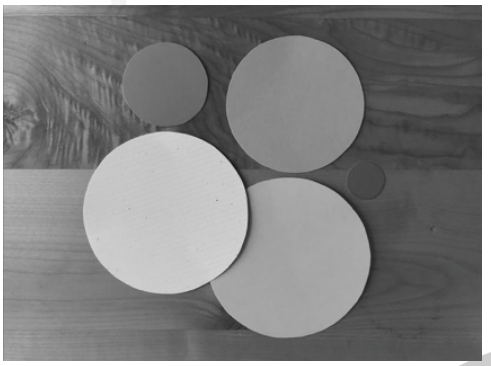
SUPPLES

- Coloured paper (brown, yellow, orange, red, blue and green). If you don't have coloured paper, use white paper and colour them!
- Science notebook or blank piece of white paper
- Scissors
- Glue
- Circular objects to trace
- a black marker

This activity continues on the next page.

STEP 1

Trace and cut out 4 circles with the following colours and approximate diameters:
Brown = 12 cm, Yellow = 10 cm, Orange = 6 cm, Red = 3 cm



STEP 2

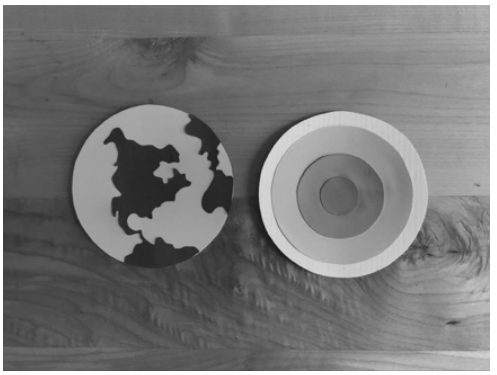
Glue the circles together to mimic the layers of the earth. Start by gluing the yellow circle on top of the center of the brown circle, then the orange on top of the yellow, and the red on top of the orange. Your bottom circle should be brown, and your top circle should be red, so all colours and circles are partially visible.

STEP 3

Label the layers of the earth on the edge of each layer. Starting with the brown circle, include the following titles: (crust, mantle, outer core, inner core)

STEP 4

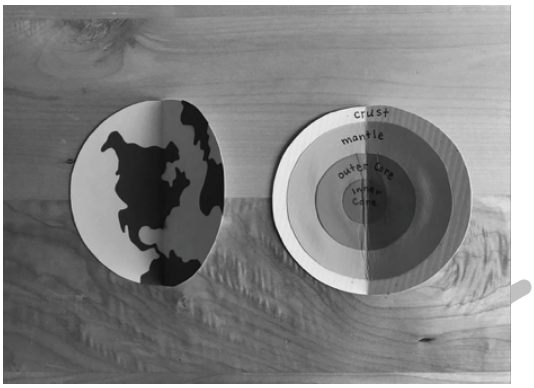
Trace and cut out a circle with the following colour and approximate diameter:
Blue = 12 cm
This blue circle will represent the water on the earth's crust. You can cut out pieces of green paper and glue them onto the water to represent the land, or use a marker to draw landforms.



Turn the page to continue this activity!

STEP 5

Fold your circle with earth's layers in half, and repeat with your blue and green circle, so both circles have a fold line down the center.



STEP 6

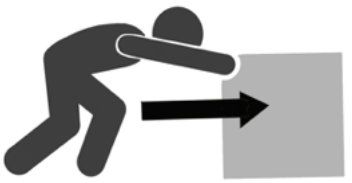
Glue half of each circle together, so you have the glued sides in the center, and you can fold the earth to show either the blue and green circle, or the layers of the earth diagram. To finish, glue your 3D diagram onto a white piece of paper or into a science notebook, and label your diagram 'Earth's Layers.'

Your final product will look something like this!

Answer Key

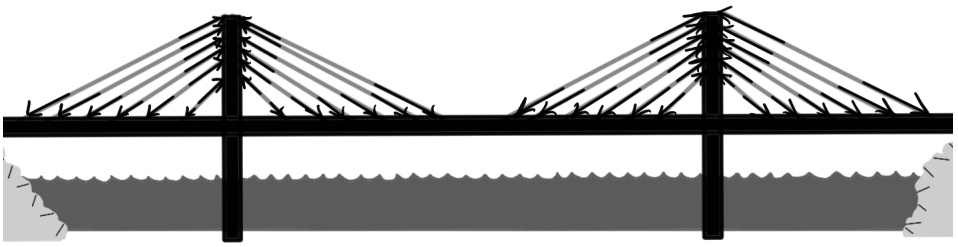
Page 5: Algorithm: Photosynthesis process; **Conditional:** Nutrients in the soil, Deepness of the roots, Amount of oxygen released; **Loop:** Photosynthesis, Watering the plant; **Data:** Amount of water needed, Carbon dioxide, Type of plant, Location; **Bug:** Overwatering, Flood, Dryness, Insects.

Page 10: Level 1



Page 11: Level 2

Level 3



Level 4

Page 15:

Water	Seawater	Soil
Diamond	Vinegar	Blood
Baking Soda	Steel	Noodle Soup

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