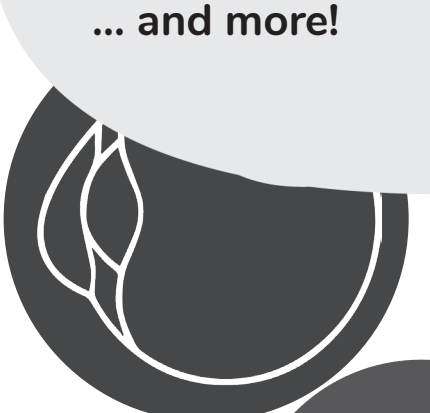
WISE Activity Booklets

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

Made by WISE Kid-Netic Energy

DIY Activities
Puzzles
Challenges
... and more!



Grade 8
MAY 2020

Cells & Systems - Optics
Fluids - Water Systems

University of Manitoba

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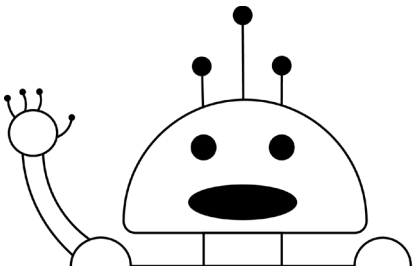


Hello there!

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 8 booklet, the science topics you will be exploring are: cells & systems, optics, fluids, water systems, 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!

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.

Huda

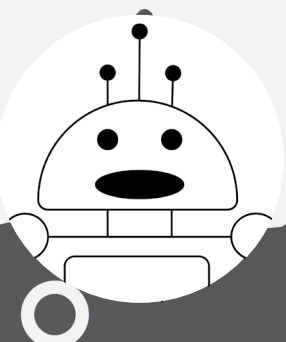
Huda is in her first year taking general science courses and she's trying to decide between a degree in Microbiology or Genetics. She enjoys baking and cooking and her favorite activity is watching videos on YouTube!

Brandi

Brandi just finished her first year in the Faculty of Science and plans to apply to the College of Pharmacy in the future. When she's not studying chemistry she loves to listen to music, hang with her cats, and nap!

Sophia

Sophia is in her second year of science and is planning on going into optometry in the future. She loves math and biology, and in her free time loves swimming, reading and trying new foods!

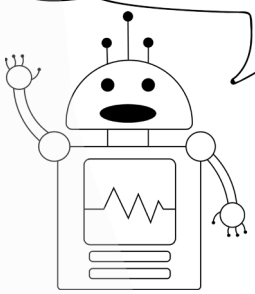


Esiw the Robot

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!

Erosion and Deposition in Our Communities

Below you will find a list of erosional land forms and a list of depositional land forms along with a number in its binary form. The binary number represents how many points the landform is worth. The rarer the landform, the higher the amount of points. Go out into your community and see if you can find any of these landforms. Once you have looked and found all the landforms you can, refer to the bottom of the page to learn how to convert binary to the number system we are used to (base ten) and add your points.



DEFINITIONS

EROSIONAL LANDFORM: Landforms that are created by erosion or gradual destruction.

DEPOSITIONAL LANDFORM: Landforms that are created through deposition or the buildup of sediment or rocks.

- ◯ Ditch – **001**
- ◯ Lake bay – **010**
- ◯ Large rock that looks like over time it was cut by waves – **100**
- ◯ Beach – **101**
- ◯ Twisty river – **011**
- ◯ Meandering stream – **100**
- ◯ Sand bar in a lake or river – **101**
- ◯ A large valley – **011**
- ◯ Glacier - **101**
- ◯ Rock with small hole or depression due to water droplets – **101**
- ◯ Pothole on your street – **001**
- ◯ Build-up of soil at the bottom of a hill – **100**
- ◯ Storm water runoff – **011**
- ◯ A structure in your community to reduce the effects of either erosion or deposition (eg. increased vegetation, supports on river banks) - **101**

BINARY	BASE 10
000	0
001	1
010	2
011	3
100	4
101	5

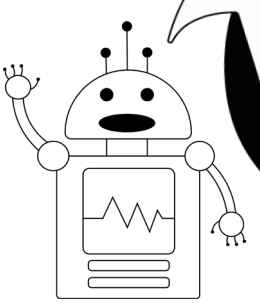
TOTAL POINTS

Get Creative With Colour

If you tell a friend that cherries are red, they'll most likely agree with you. But just because you both know it's red, does that mean that you are both seeing the same colour? What if what you see as "red" someone else sees as your "blue", but you both know it as red. How do you describe red to someone, without using visual cues? Is it possible?

This challenge is to describe a colour. You can try to be as descriptive as possible, or keep it simple. Be as creative or scientific as possible! When you're done, read it to someone and see if they can guess what colour you are describing!

The colour I am describing is: _____



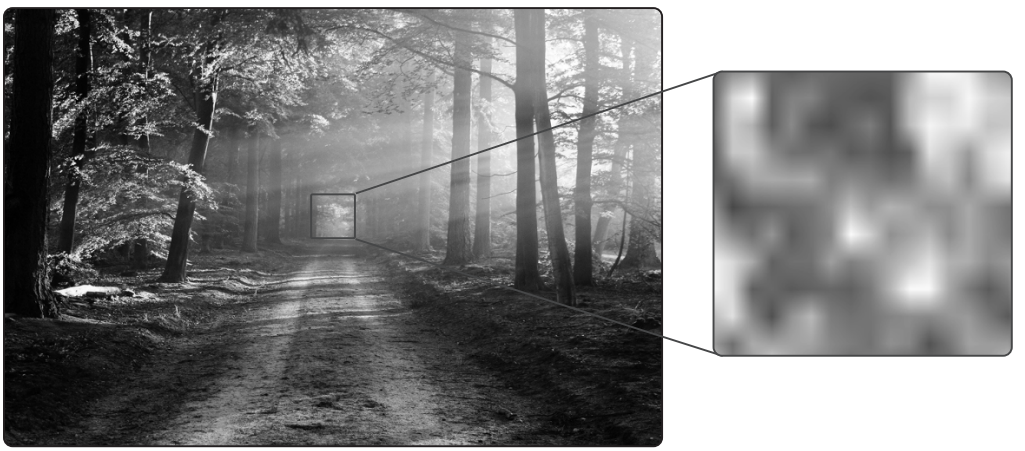
What is a colour code?

Colour codes are a system used to display and order colours, using letters or numbers. These are used for anything in coding, like websites and video games! There are many different formats, like HEX and RGB. HEX colour codes use a mix of six numbers and characters, and RGB uses three sets of three numbers, each with a range of 0 - 255. Think of this exercise as coding for the colour you choose, creating a new colour code system, using words!

Pixel Art

Ever wondered how digital images work? How can a camera take what we see with our eyes and turn it into a picture on our phones? The answer is... pixels (and a whole lot of code)!

Take a look at this picture:



This image can be so high quality because of the many many pixels (2,457,600 to be exact) that it is made up of. If we zoom in extremely close on a section of the picture, we can see individual pixels which each contain one solid colour.

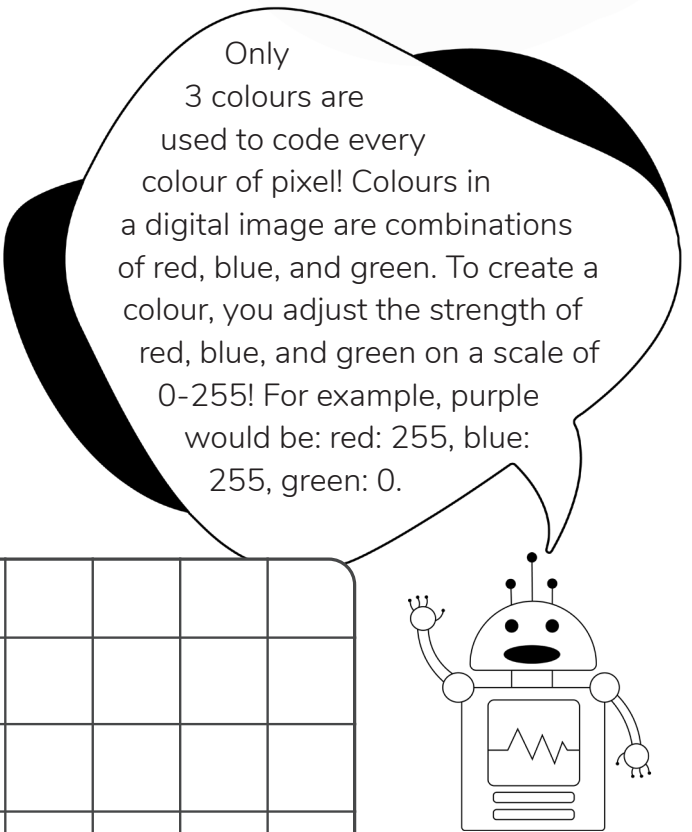
Draw an image of your choice in this rectangle. Make sure it's in color and fills most of the space. Ignore the square in the middle for now - we'll worry about that after.

SLO: 8-2-04, 8-2-08

Now it's time to remember that square! Attempt to redraw just that segment of your drawing that ended up inside the square. This time, imagine we are zooming in enough to see individual pixels within the square. Remember: each pixel can only contain one colour.

square from your drawing

magnified (pixellated) square



Diagnose Anna's Eyes (page 1 of 2)

Anna has been struggling with her sight lately. Help figure out the problem by reading what is going on from her point of view, familiarizing yourself with the signs and symptoms of some common vision problems, and reviewing a scan of her eye.

DEFINITIONS

Refractive Errors: The shape of the eye bends (refracts) light so that it stops before or after the retina instead of on, causing blurred vision.

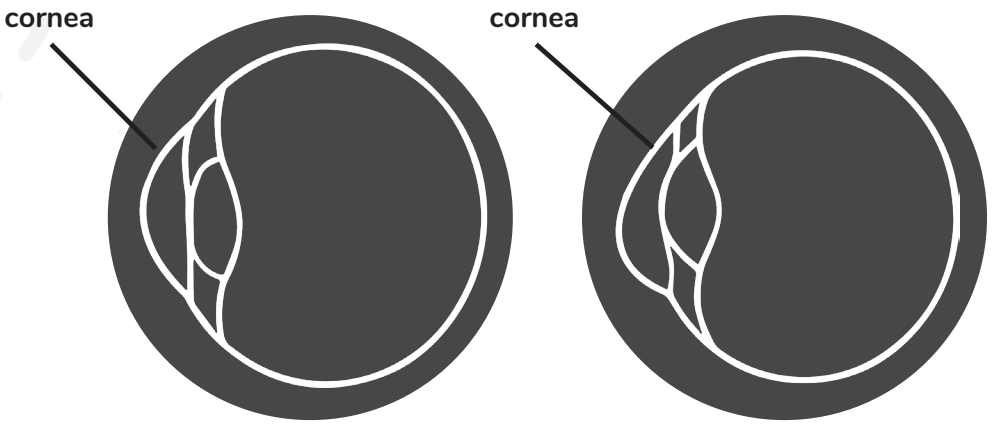
Nearsightedness (myopia): A refractive error in the eye that causes issues seeing far away, but objects up close are clear. Night myopia occurs when someone has trouble seeing while driving at night.

Farsightedness (hyperopia): A common refractive error in the eye that causes objects near to them to appear blurry, but those further away are clear.

Astigmatism: The eye cannot properly focus images near or far which occurs when either the lens or the cornea is curved like an egg instead of a ball. When one of these is curved, the eye creates two slightly different pictures instead of just one, resulting in a distorted or warped view.

Cataracts: Vision becomes cloudy and/or sensitive to light and glare. Often occurs in those ages 60 and older, but can occur in younger people because of eye injuries, diabetes, smoking, family history or exposure to ultraviolet light.

SLO: 8-2-12, 8-2-13, 8-2-14

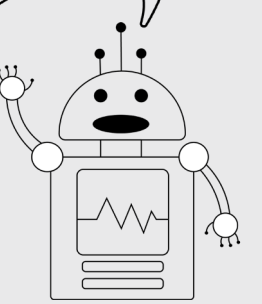


HEALTHY EYE

ANNA'S EYE

Diagnosis for Anna:

Esiw here! Thanks so much for helping Anna figure out what is wrong with her vision. In case you weren't aware, you used deduction, logical reasoning, and decomposition to do so. You took the bigger problem of "Anna can't see well' and broke it down to solve the problem. Good job!



This page was created by Brandi

Gummy Bear Osmosis

Osmosis the movement of water through a semi-permeable membrane, from an area of low solute concentration to high solute concentration. Gummy bears are like a solute (they are sugary, with a very low concentration of water inside) and have a semi-permeable membrane, which is why they work so great for this experiment!

MATERIALS

- 3 cups
- Gummy bears
- A spoon of salt
- Vinegar
- Water

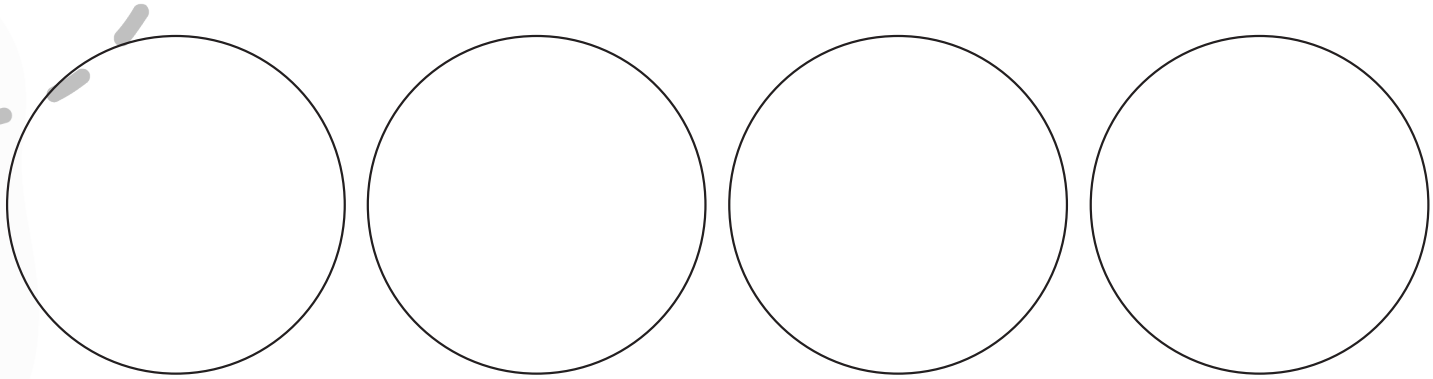
1. Prepare your mixtures. Fill one cup with water, one cup with water and salt, and one cup with vinegar. Place each cup on the paper attached below to keep the solutions separate so you know which solution is which.

2. Put one gummy bear in each solution, and leave one on the side for comparison afterwards (this is your control gummy bear).

3. Write down your hypothesis here. What do you think will happen to the gummy bears in each solution?

4. Leave the gummy bears in their solutions over night and check back in the morning.

5. Now you may take the bears out of their solutions and put them side by side to observe.



WATER **SALT WATER** **VINEGAR** **CONTROL**

Water Inequality Discussion

Did you know that not everyone in Canada has access to clean, running, drinking water?

Here in Manitoba, the First Nations community of Shoal Lake must drink bottled water or boil their water before drinking it to avoid getting sick from the cryptosporidiosis bacteria. Although, Winnipeg's drinking water comes from Shoal Lake. So how does this work? Winnipeg diverts water out of Shoal Lake and into the city, where it gets treated, but leaves behind dirty water with no effective water treatment facility for the community.

They now have an all-season road called "Freedom Road" which allowed for the delivery of jugs of clean water from Kenora, Ontario. Before it was built in 2019, they were under a boil-water advisory and had to cross an ice road to get clean water.

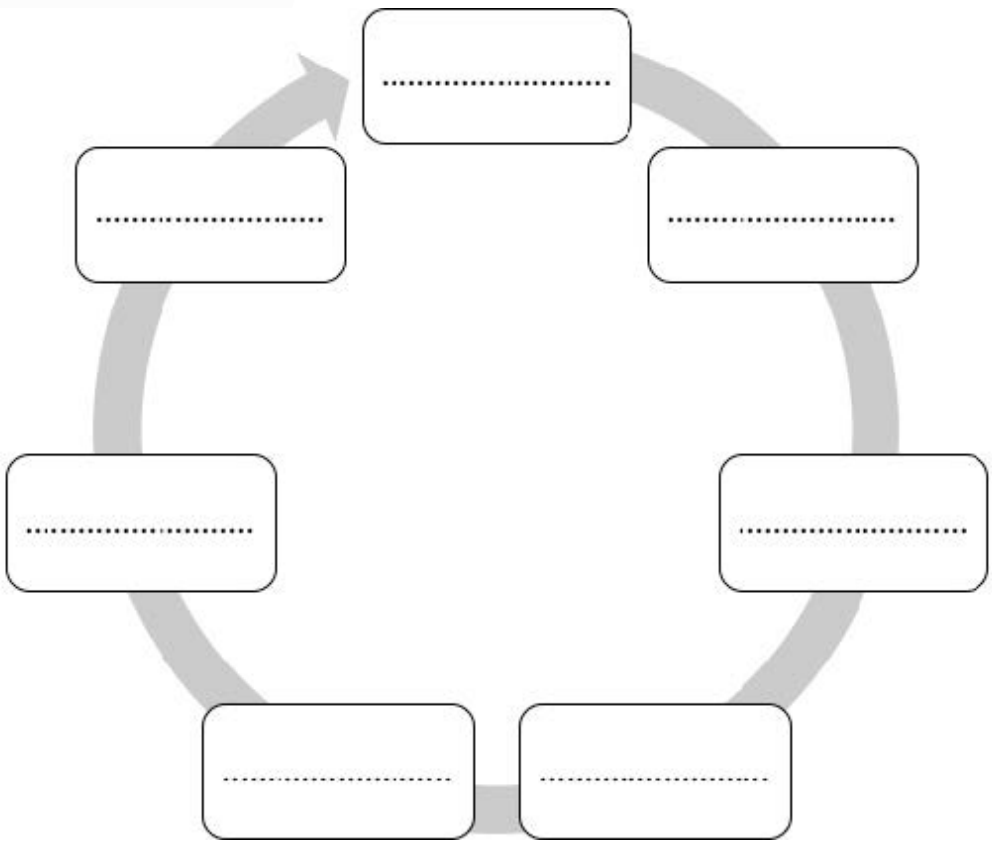
Why do you think it is important to drink clean water? Why do you think there are still communities in Canada without access to clean, running, drinking water?

How far back can you trace where your own water comes from? Starting with your tap, can you think backwards and draw the path it takes to get to you? (Use the knowledge you have, and fill in the gaps with your imagination!)

SLO: 8-4-14, 8-4-15

Water Treatment (page 1 of 2)

Try to arrange the steps of water treatment in the correct order. Use the descriptions of each step below to help you!



DESCRIPTIONS

FILTRATION: Filters remove any remaining particles in the water as well as dissolved organic matter and any parasites.

DISSOLVED AIR FILTRATION: Water is supersaturated with compressed air, making it frothy. Organic matter floats to the top and is removed.

PROCESSING: Clean water is pumped out for use. Clumps of particles that were removed from the water are pumped out, and filters are cleaned.

UV DISINFECTION: Ultraviolet light kills any remaining parasites or organisms.

OZONATION: Ozone is added to kill the most harmful bacteria. It also improves the taste and smell of the water.

COAGULATION: A coagulant is added to the water, which causes larger particles to clump together.

CHLORINE DISINFECTION: Chlorine is added to kill some of the bacteria and viruses in the water.

https://winnipeg.ca/waterandwaste/water/treatment/plant.stm

SLO: 8-4-15

Water Treatment: What Went Wrong?

Try to figure out what went wrong with the water treatment in each scenario and how it can be fixed.

As Jenny is filling her cup with water from the tap, she noticies small grey and black clumps in her water. Should she drink the water? What went wrong at the treatment plant?

The directors at the City of Winnipeg begin to notice something's wrong. The water contains small visible particles even though the water treatment process is being followed. The water is being coagulated and filtered. What are they doing wrong?

There have been multiple cases within the city of people getting sick of a parasite/ microorganism called cryptosporidium. What went wrong at the plant?

Cell Theory Scramble

Read the short story below of how Cell Theory was created and try to decipher the scrambled words that are in bold. Then, according to the story, put the number that corresponds to the proper scientist in the space beside their discovery or invention.

A vital tool that led to the discovery of cell theory was the **MCIPESROCO** which is believed to have been invented by Zacharias Janssen. The initial microscope consisted of two lenses: the objective lens, which was close to the specimen, and the eyepiece. They worked together to magnify a sample of a specimen in order to view smaller structures. A compound microscope was used and improved by Robert Hooke to view the first microorganisms which were microscopic fungi. He also was the first to view plant cells, saying they looked like individual rooms, and he named them "**LESCL**". A few years later, Anton van Leeuwenhoek made lenses of high magnification to view the first single-celled organisms and **TBIAEARC**. Because of this discovery, and his findings including the size and shape of red blood cells, he is often referred to as the "Father of Microbiology". Matthias Schleiden and Theodor Schwann together proposed Cell Theory, with Schleiden's finding that **TNLPSA** are made of many cells and Schwann's discovery that animals are also made of many cells. To add onto the findings of Schleiden and Schwann, Rudolf Virchow concluded that every cell comes from other cells. Together, these scientists' findings resulted in Cell Theory.

MCIPESROCO _____ **TBIAEARC** _____

LESCL _____ **TNLPSA** _____

Identified the cell as the basic unit of plants ◯

Made lenses of high magnification ◯

Concluded that all cells come from other cells ◯

Saw the first known microorganism ◯

Named "cells" ◯

Invented the microscope ◯

Known as the "Father of Microbiology" ◯

Discovered single-celled organisms and bacteria ◯

Identified that the cell is the basic unit of animals ◯

Determined the size and shape of red blood cells ◯

1. Zacharias Janssen
2. Robert Hooke
3. Anton van Leeuwenhoek
4. Matthias Schleiden
5. Theodor Schwann
6. Rudolf Virchow

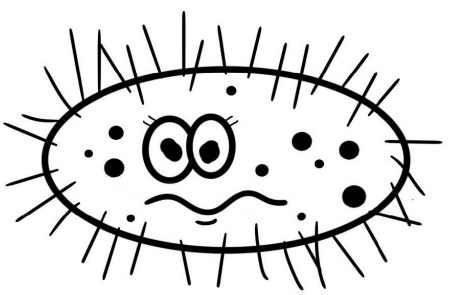
Stop the Bacteria

Your body is designed to keep you safe from pathogens (infectious organisms) like viruses and bacteria. Can you help it keep tabs on the bacteria that is trying to get in?

1. The bacteria encounters saliva.
What defense system is it in?

2. The bacteria has moved and is now surrounded by gastric juices. Where in the body is the bacteria?

3. The bacteria continues its journey and encounters cilia hairs.
What can they do to prevent the bacteria from causing an infection?



4. Oh no! The bacteria got past and is now establishing an infection in the body. What can cells do to fight the pathogen?

Design a Water Filter

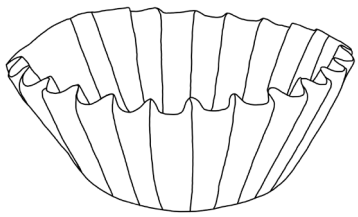
Create a water filtration system using only household items!

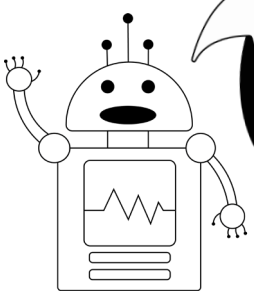
FILTER MATERIALS (SUGGESTIONS)

- Coffee filters
- Sponges
- Cheesecloth or thin fabric
- Sand
- Rocks

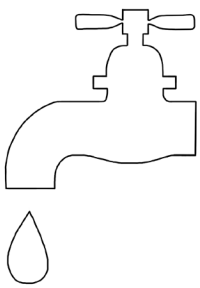
WATER MATERIALS

- 2 large cups or jars
- Water
- Food colouring
- Dirt / mud from outside





For this experiment, think of your filtration system like a program that converts dirty water to clean water. In this case, your **input** is dirty water, and the desired **output** is clean water. Your task is to create **"program"** in between - a series of functions that will filter the water. Then, you will **evaluate** how well it filters out the dirt.



1. Fill your first cup or jar 3/4 full with water.
2. Add in a scoop of dirt / mud.
3. Add in two drops of food colouring.
4. Stir the water together until everything is well mixed. The colour should be distributed throughout the water.
5. **Now it's time to design!**
   Using materials you have available (take a look at our suggested filter materials), try designing and building a filter that will clean the water! Try layering different materials or incorporating other ideas outside of the suggestions. The idea is to end up with a water filter that water can be poured through.
6. Test out your filter by pouring your dirty water through it (more than once if needed).
7. Evaluate your filter's effectiveness using the questions on the next page.

Draw a diagram of how your filtration system will look

SLO: 8-4-19, 8-4-15

Did your system look the way you envisioned it? Or did you have to make adjustments? (if you did, what adjustments did you make?)

Did you get perfectly clean water?

What was the most difficult thing to remove?

If you didn't get it all out, what do you think you could've done to remove the rest?

Was there anything you didn't have that you would've liked to use in your filtration system? (if so, what? And what would you have used it for?)

Filtration in the real world

Think of the food colouring as biological or chemical contamination, such as bacteria, viruses, or pollutants. These are things too small to be stopped by large filters. This is why in industrial filtration systems they use much more than just household items. Most filtration systems will use chemical or physical means to disinfect, like chlorine or UV heat.

This page was created by Sophia

Light Refraction Mini Experiment

Try looking at an object through each of the transparent materials below. You may find that the image will look different through one medium and not the others.

Draw what you see when looking at the item through water, air, and glass.

To test air, hold the item anywhere! This is the control variable of your experiment, compare the results of the other two materials to this one.

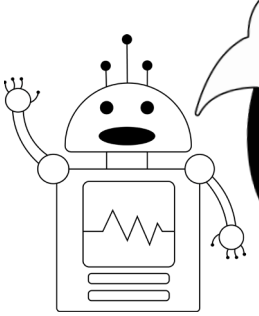
Air

To test glass, place the object in an empty glass so that it partially sticks up over the top. Draw what the top half (in the air) and the bottom half (in the glass) look like together.

Glass

To test water, place the object in a glass of water so that it partially sticks up over the top. Draw what the top half (in the air) and the bottom half (in the water) look like together.

Water



Did you know that inputs and outputs are a huge part of coding? An input is the informtion or data that a computer receives. An output is what the computer returns after processing that data. In this example, light is moving through different mediums (air, water, glass). Within each medium, the light acts differently, so that when the light exits it (the output) it might look different than what went in (the input).

Answers

8 - DIAGNOSE ANNA

Possible Answers:

- Nearsightedness (myopia) because she cannot see far away objects.
- Astigmatism because of the shape of her eye and statement of distorted placement of the soccer ball
- Possibly early stages of cataracts because of light sensitivity (rare in young people)

14 - CELL THEORY SCRAMBLE

MCIPESROCO = MICROSCOPE
LESCL = CELLS
TBIAEARC = BACTERIA
TNLPSA = PLANTS

Identified the cell as the basic unit of plants **4**

Made lenses of high magnification **3**

Concluded that all cells come from other cells **6**

Saw the first known microorganism **2**

Named “cells” **2**

Invented the microscope **1**

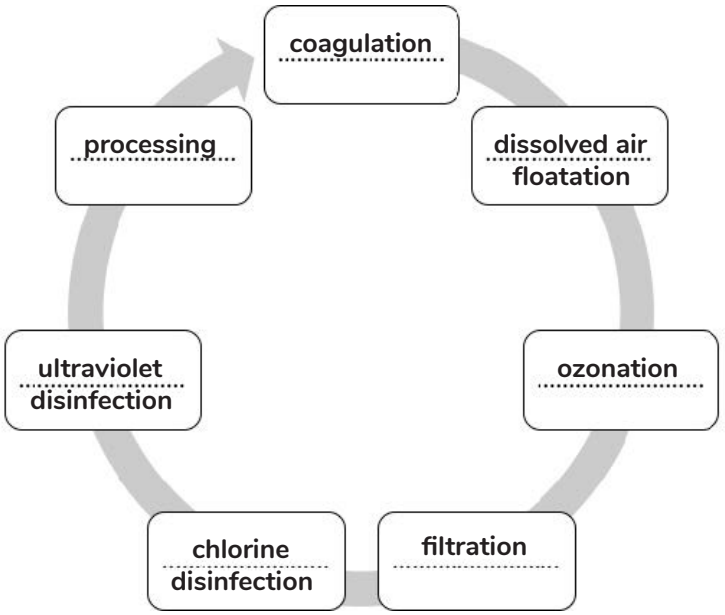
Known as the “Father of Microbiology” **3**

Discovered single-celled organisms and bacteria **3**

Identified that the cell is the basic unit of animals **5**

Determined the size and shape of red blood cells **3**

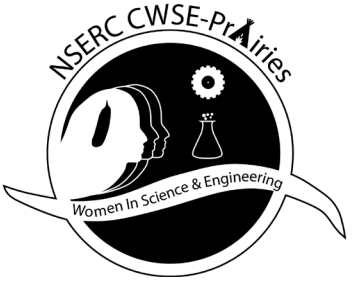
12 - WATER TREATMENT



15 - STOP THE BACTERIA

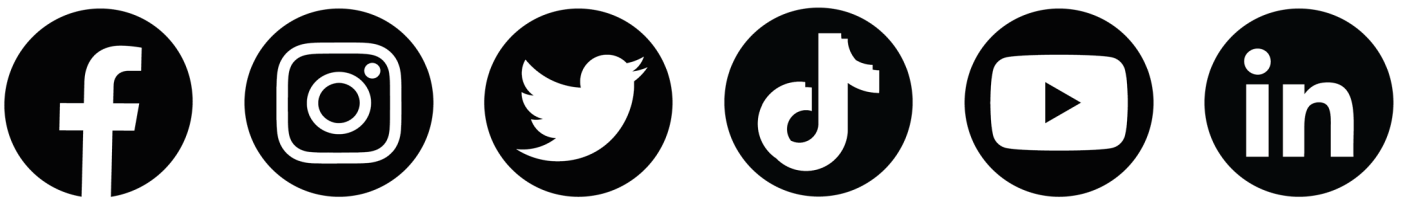
1. Saliva is part of the primary defense system. This is the initial defense against pathogens.
2. Gastric juices are located in the stomach. Its acidity kills many pathogens. This is part of the primary defense system.
3. Located in the gut and lungs, cilia trap pathogens with mucus. This is part of the primary defense system.
4. If pathogens make it past the primary defense system, the secondary defense system steps up. White blood cells can attack pathogens and create antibodies.

Thanks to our Amazing Sponsors!



WISE Kid-Netic Energy is a proud member of Actua.

For more fun, STEM content, visit us at wisekidenticenergy.ca and follow us on social media!



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