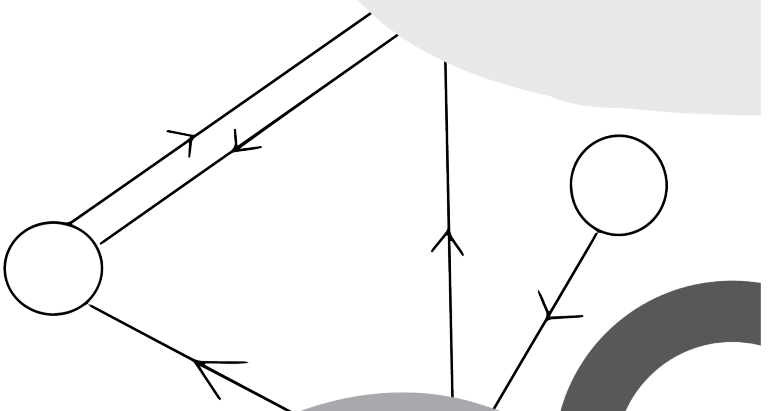
WISE Activity Booklets

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

DIY Activities
Puzzles
Challenges
... and more!



Grade 8
JUNE 2020

Cells & Systems - Optics
Fluids - Water Systems

University of Manitoba

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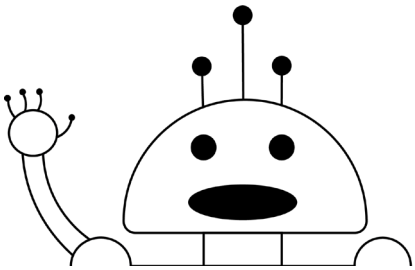


Hello there!

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!

Gagan

Gagan is a fourth-year BSc Honours Student in the Department of Psychology. She enjoys being creative and loves to learn! In her free time, she likes to try new things, read, and grow plants.

Habiba

Habiba is a second year computer engineering student. In her free time, Habiba loves to learn about everything computer and internet related, but in her free time she likes to draw, go outside as well as cook.

Kajal

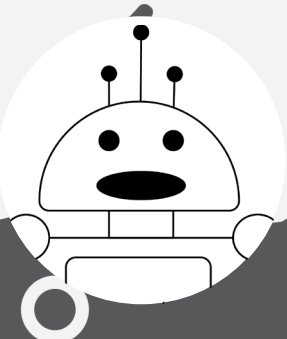
Kajal just finished her first year of Computer Science and is pursuing a Bachelors of Computer Science. She loves to read, sketch, and make things.

Toni

Toni just finished her final year of study as a social work student at the University of Manitoba and she hopes to one day work in community development. She loves learning and is excited to be part of the WISE team.

Victoria

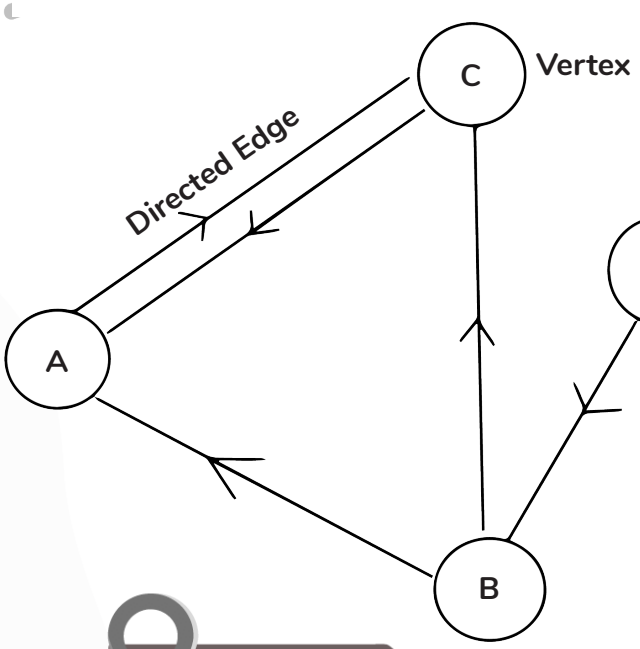
Victoria just finished her first year as a Science student at the University of Manitoba and is planning on becoming a nurse. She loves to cook, read and take care of plants in her free time!



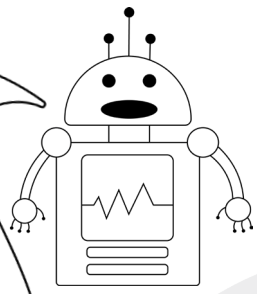
Esiw the Robot

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!

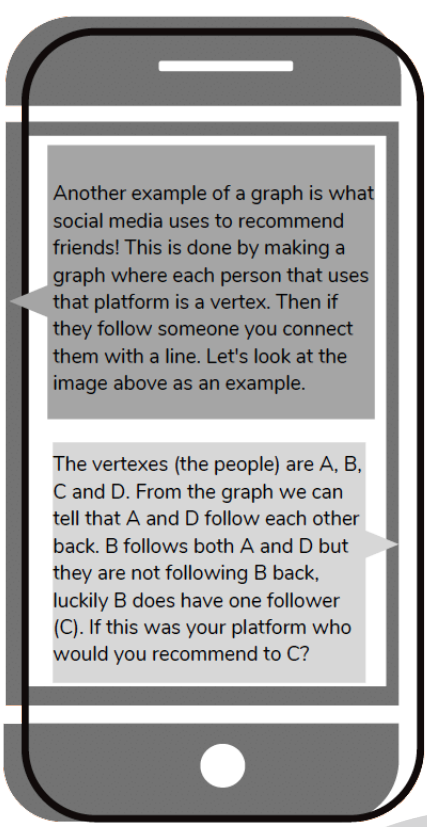
Your Heart is a Graph



A graph is a set of **vertices** connected by **edges**. It's like a map that connects a bunch of places. This is a **directed graph**. We can think of a directed graph as a map with only one way roads. Each destination is called a vertex and each road is called an edge.



Graphs are useful to be able to see how information relates to each other. A literal example is a map! A map is a graph that shows how different cities are connected. GPSs use graphs to figure out the fastest or most efficient routes. If we use the image above. What's the fastest way to get from point C to point A? Try making a graph of your neighborhood!

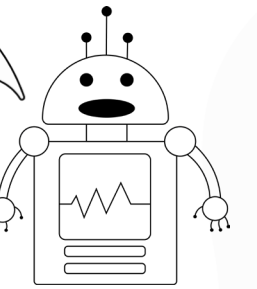


Draw a graph that shows who you have met in the last week. Then draw more vertices to guess who all those people met. Could we use a map like this to learn more about contagious viruses?

ME

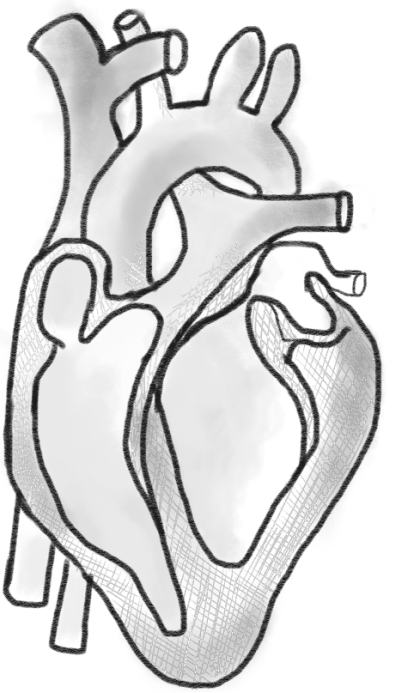
SLO: 8-1-11, 8-1-12

Your body also contains a graph that tells us where our blood travels. In our body, the capillaries and the heart are the vertices. The veins and arteries are like edges that connect the capillaries, lungs, and heart. Arteries carry blood away from the heart, veins carry blood to the heart. On its way to and from the heart, the blood also travels through capillaries. The capillaries supply cells with nutrients from the blood and take away waste. This is how blood is carried all throughout our body.



Can you draw a directed graph that shows how blood travels through our bodies? Use: atria, ventricles, septum, valves, aorta, pulmonary artery, pulmonary veins, superior and inferior vena cava.

Pulmonary Capillaries



Capillaries of the right lung

Capillaries of the left lung

Capillaries of the lower body

Light Obstacle Challenge

In this activity you will bend a ray of sunshine through an obstacle race. Use the materials listed below to complete the following levels! Be careful not to reflect light towards anyone's eyes as it can damage their eyes and be painful.

Pro tip: Closing the curtains allowing only a thin ray of sunshine pass through might help you to see its reflection more clearly.

Level 1 Place the target 90 degrees from the light source. Use the mirror to hit the target.

Level 2 Ask someone to place the target at a different / more complex angle. Use one mirror to hit the target.

Level 3 Use two mirrors to reflect light twice and hit the target.

Level 4 Place the target where light would naturally hit. Use two mirrors to bend the light ina way that it still hits the target

Level 5 Use a mirror to make the light hit a glass of water.

Level 6 Use a mirror to make the light hit a glass of water. Then use another mirror on the other side to bend the light that passes through the glass of water.

Level 7 Use a prism to create a rainbow. Sometimes depending on the shape, a glass of water will create a rainbow. Use mirrors to reflect the rainbow - see how many times can you reflect the rainbow.

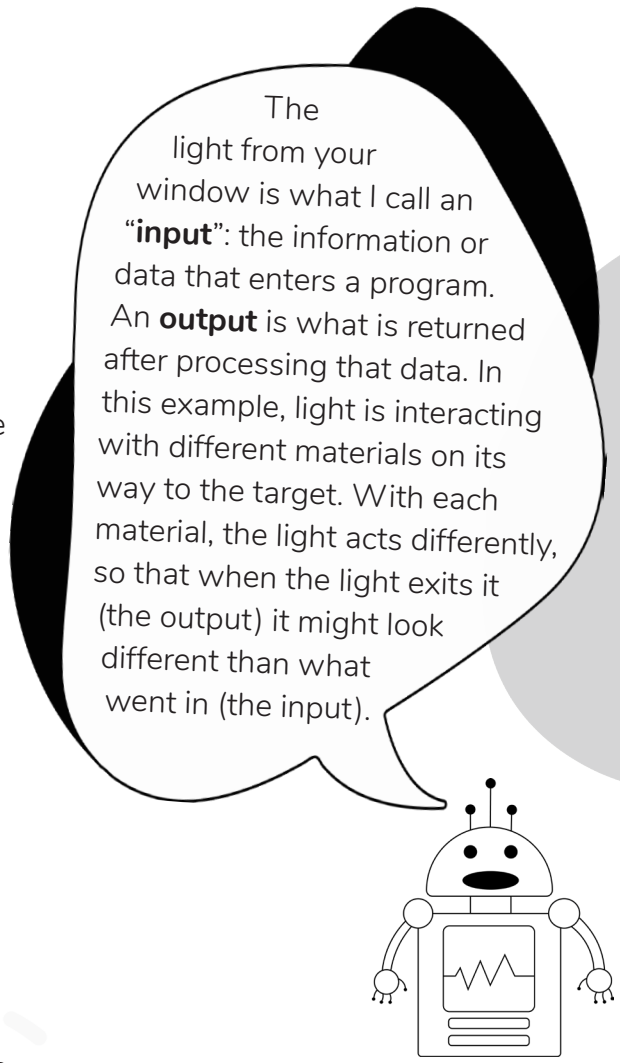
Level 8 Use an object that's NOT a mirror to reflect light to your ceiling

Level 9 Use your non mirror object to reflect light, then use a mirror to reflect it again so it passes through a glass of water.

Level 10 Use 3 objects to reflect light through a glass of water, then use 2 more on the other side to reflect the light that crosses the glass.

MATERIALS

- > 2 mirrors or light reflecting objects*
- Glass
- Water
- Prism. Depending on the shape, a glass of water can function as a prism and create a rainbow.
- A target. This can simply be a drawing taped to a wall or something that is already on your wall.



SLO: 8-2-03, 8-2-09, 8-2-10

Ocean Tides Experiment

Everything in the world with mass has a gravitational field. This means that anything that weighs something, has gravity acting on it so that it stays on earth.

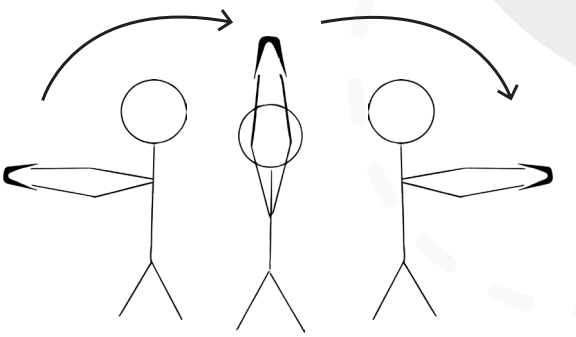
The moon also has a gravitational field - one that pulls on the Earth. Although the Earth is heavy enough not to move because of the moon's pull, water isn't. This means that twice a day, when the moon is closest and furthest from certain oceans, those oceans bulge. The water level of those areas rise, and flood onto the land that is closest to them. This is called a "high tide".

1. Take your scissors and make two small holes near the cup's rim, one on each side.
2. Tie each side of your string through a hole.
3. Fill your cup about halfway up with water.

   You now have your tide making machine! Take your water filled cup outside so that you have plenty of space to do your experiment.
4. Hold your string with both hands so that your cup of water is dangling close to the ground.
5. Start swinging your cup back and forth, making sure you don't spill any water. When you think you've gained enough speed and momentum, start swinging the cup in a large circle above you head and back towards your feet. If you go fast enough, the water will stay in the cup, even when it's upside down above your head!

MATERIALS

- One piece of string (2-3 feet long)
- One plastic or paper cup
- Scissors
- Water



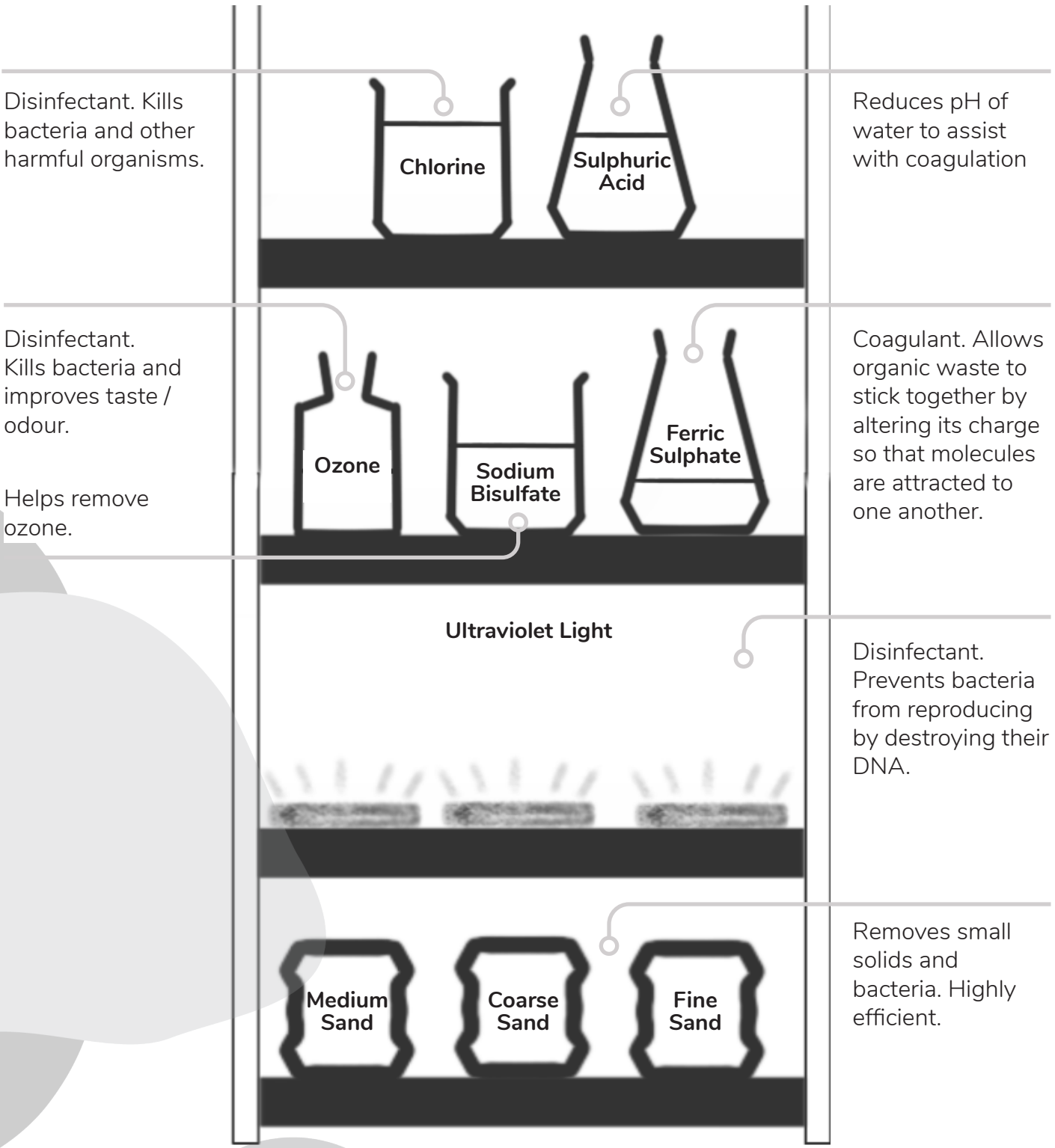
By swinging the cup at a certain speed, you were able to demonstrate how tides work. Let's look at what's happening inside the cup while you were swinging it.

Just like the oceans when they are being pulled by the moon's gravitational field, the force you created while swinging your cup caused the water the bulge at the sides.

SLO: 8-4-10, 8-4-12

Water Treatment Chemist

Using the ingredients and tools below, draw out what each step will look like in the water treatment process in the tanks on the next page. Is the water clean? What remains in the water at each step? Are there any microorganisms? Dirt? What tools and chemicals are being used?



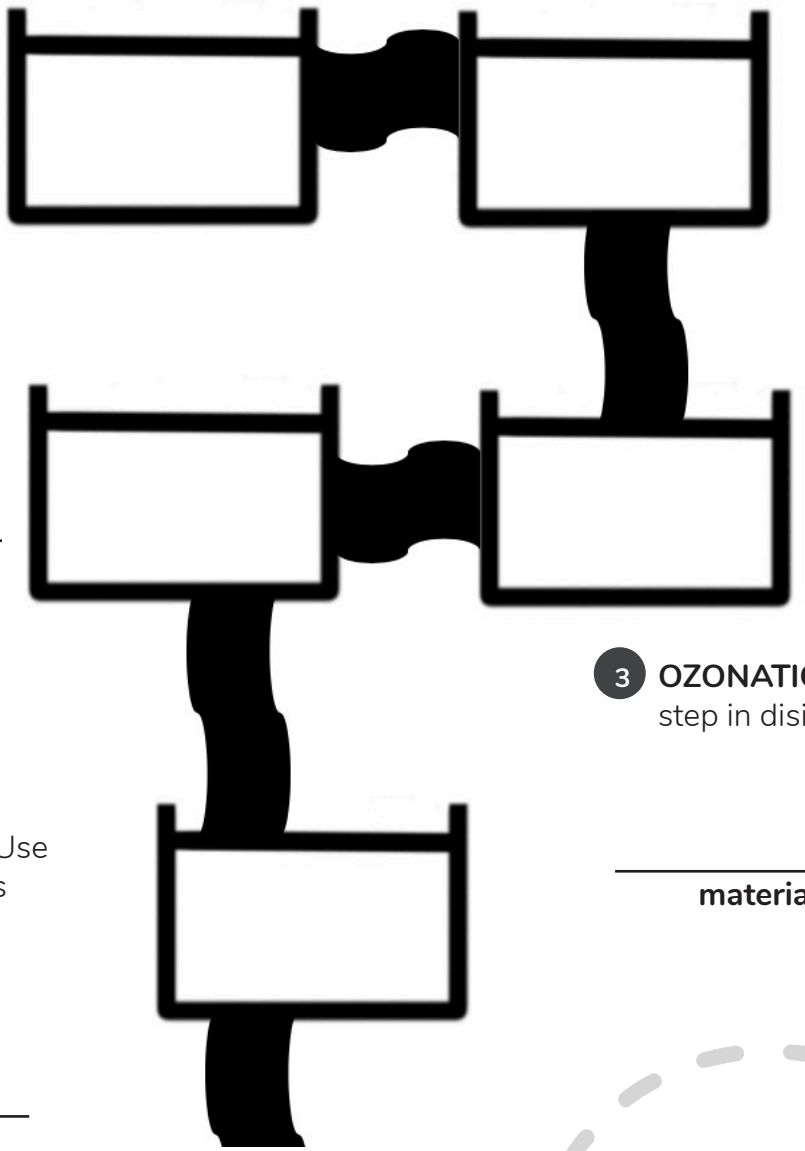
SLO: 8-4-15, 8-4-17

1 **COAGULATION** Hint: Dirty water first enters this phase with algae, sand, bacteria, wood all present in the water.

materials used

2 **SEDIMENTATION** Hint: Air is pumped into the bottom of the tank causing debris to rise to the top and is removed.

materials used



4 **FILTRATION** Hint: Removes small solids & bacteria.

materials used

3 **OZONATION** Hint: First step in disinfection.

materials used

5 **DISINFECTION** Hint: Use of chemicals and lights to remove and kill any remaining bacteria

materials used

Fluids Matching

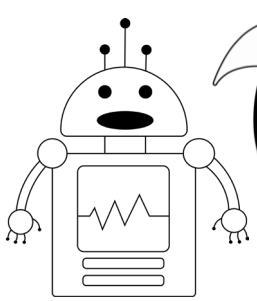
Draw a line from the definition in Column A to the correct answer in Column B.

COLUMN A

1. Having particles that easily move and change their relative position without a separation of the mass, and particules that easily yield to pressure. Capable of flowing.
2. The property of resistance to flow in any material with fluid properties.
3. The motion characteristic of fluids.
4. The distribution of a quantity (such as mass, electricity, or energy) per unit usually of space (such as length, area, or volume).
5. A theory that helps describe the behavior of matter. It has five parts.
6. The upward force exerted by any fluid upon a body placed in it.
7. The action of a force against an opposing force.
8. The ability of something (such as a fluid) to be reduced in volume or size under pressure.
9. Operated, moved, or effected by means of water.
10. Moved or worked by air pressure.

COLUMN B

- A PARTICLE THEORY OF MATTER
- B VISCOSITY
- C DENSITY
- D PRESSURE
- E FLUID
- F PNEUMATIC
- G COMPRESSIBILITY
- H BUOYANT FORCE
- I FLOW
- J HYDRAULIC



Most of the terms in column B are **variables** that we can use to describe a specific fluid. For example, a fluid might be described by its viscosity, density, and pressure - but each of these variables will have a specific **value** depending on the fluid in question.

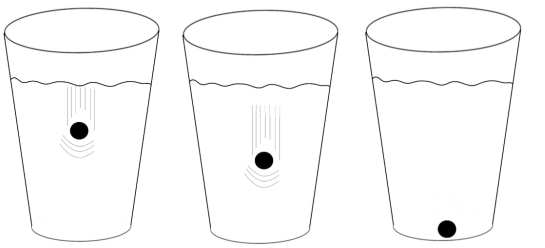
Viscosity Race

EXPERIMENT 1

See friction in action as a marble falls through different liquids.

MATERIALS

- As many liquids as you can think of. Eg. water, maple syrup, honey, oil, juice
- Cups that are the same size. You need one container per liquid
- One marble / stone for each liquid you have
- Phone to film (optional)
- Stopwatch (optional)



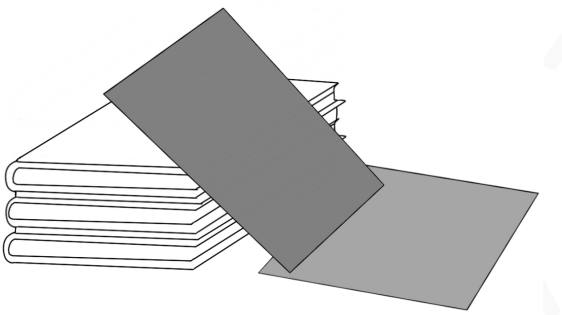
1. Fill each cup with the same amount of liquid.
2. If you are timing or filming the experiment, get your stopwatch/phone ready.
3. Drop the marbles in to the containers at and observe how fast the marble moves down the liquid. You can either drop them all at the same time, or time each one separately.

EXPERIMENT 2

See resistance in action as different fluids flow down an incline.

MATERIALS

- As many liquids as you can think of. Eg. water, maple syrup, honey, oil, juice
- Two trays
- Books or something to lay one of the trays in order to hold it up
- Stopwatch (optional)



1. Use your engineering powers to set up something like this image. The goal is to create a ramp for the liquids to flow and end in the second tray.
2. Measure approximately the same amount of liquids (feel free to eyeball it).
3. Pour the liquids down the ramp you have created and compare their viscosity based on how long it takes them to reach the bottom.

DEFINITIONS

VISCOSITY is the resistance of a fluid to flow or move. Viscosity happens because of the friction between the different molecules within the fluid. The higher the viscosity, the more energy and the more time is needed for the liquid to flow.

FRICTION is the force resisting a movement

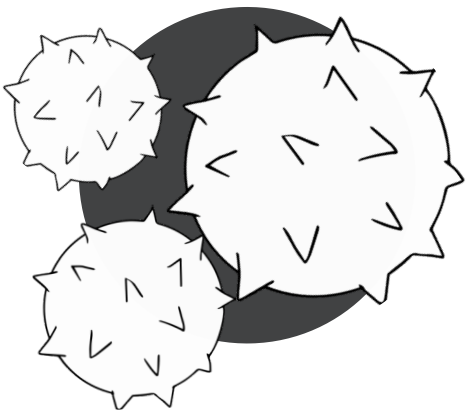
FLUIDITY is the opposite of viscosity. It measures the ease of flow

SLO: 8-3-03, 8-3-04, 8-3-05

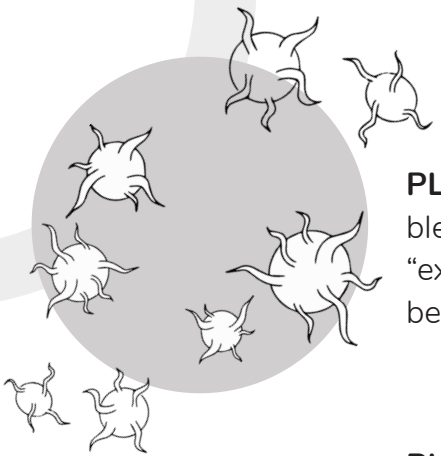
Blood Flow Chart

Have you ever wondered how your body heals? How do cuts go from open and bleeding, to closed and covered in new skin? The answer is in your blood. Blood contains different components that help your body heal from an injury, such as a cut. There are four major components:

RED BLOOD CELLS bring oxygen to different parts of your body, so that those areas have energy to function properly. Sometimes, this means helping give the area more energy to recover from an injury.



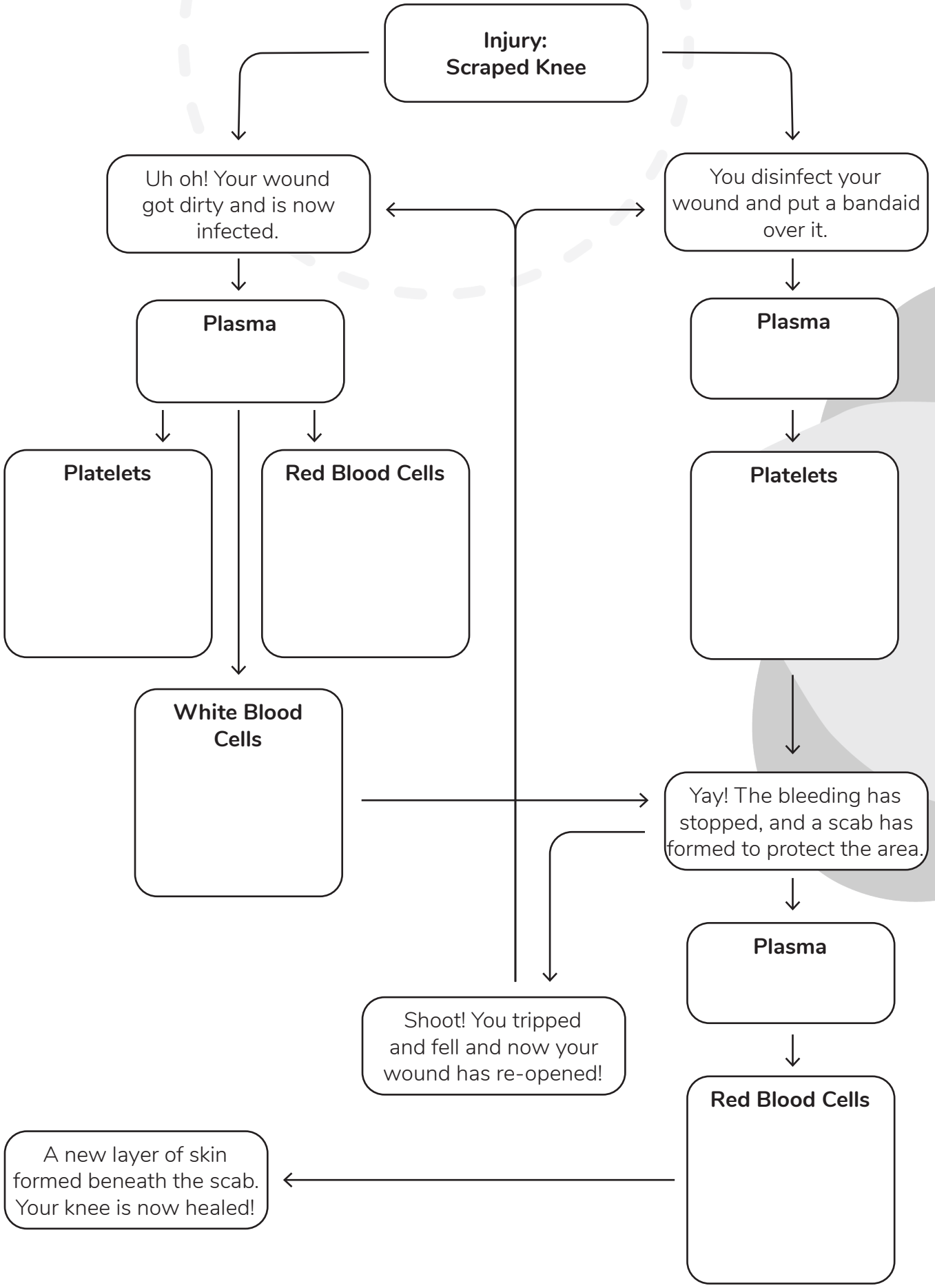
WHITE BLOOD CELLS are like soldiers. They work to fight off illness and infection in the body and protect your body from being unhealthy.



PLATELETS are like a plug in a drain. When you get a cut, you bleed. A platelet's job is to stop the bleeding by clogging the "exit". Platelets come together in one area to create a barrier between the inside of your body and the outside world.

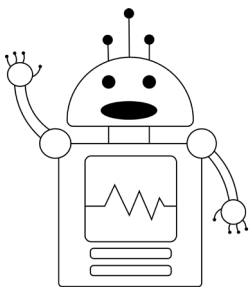
PLASMA is like your body's bussing or train system. It is responsible for transporting blood cells, nutrients, and waste throughout the body. Without plasma to carry them, red bloods cells wouldn't be able to bring oxygen and energy to your body, white blood cells wouldn't be able to reach the sites of infections and illnesses, and platelets wouldn't be able to get to a wound to stop it from bleeding.

Imagine you've scraped your knee. Look at the flow chart on the next page. Fill in the blank spaces with one of the four components you've just learned. How do you think those components are working to heal you? Do you notice any patterns?


Injury:
Scraped Knee
Uh oh! Your wound got dirty and is now infected.
You disinfect your wound and put a bandaid over it.
Plasma
Plasma
Platelets
Red Blood Cells
Platelets
White Blood Cells
Yay! The bleeding has stopped, and a scab has formed to protect the area.
Plasma
Shoot! You tripped and fell and now your wound has re-opened!
Red Blood Cells
A new layer of skin formed beneath the scab. Your knee is now healed!

Flood Predictor

We are going to build a program to help predict the likelihood of a flood, based on the probabilities of conditions that lead to floods. These conditions vary from year to year, but let's imagine that on average they have the probabilities indicated below.



PROBABILITIES

EVENT	
Broken dams	5%
Melting snow and ice	20%
Overflowing rivers	5%
Hurricanes and strong winds	2%
Heavy snow pack	20%
Quick thaw	10%
Heavy rain in spring	10%
Lack of vegetation to take up water	3%
Frozen ground preventing absorption	10%
Agricultural drainage systems	5%
Urbanization	10%

The probability of events A **and** B means the probability of two independent events both happening. Mathematically this looks like:
p(A and B) = p(A) x p(B)

The probability of events A **or** B means the probability of one event happening, but not the other. Mathematically, this looks like:
p(A or B) = p(A) + p(B)

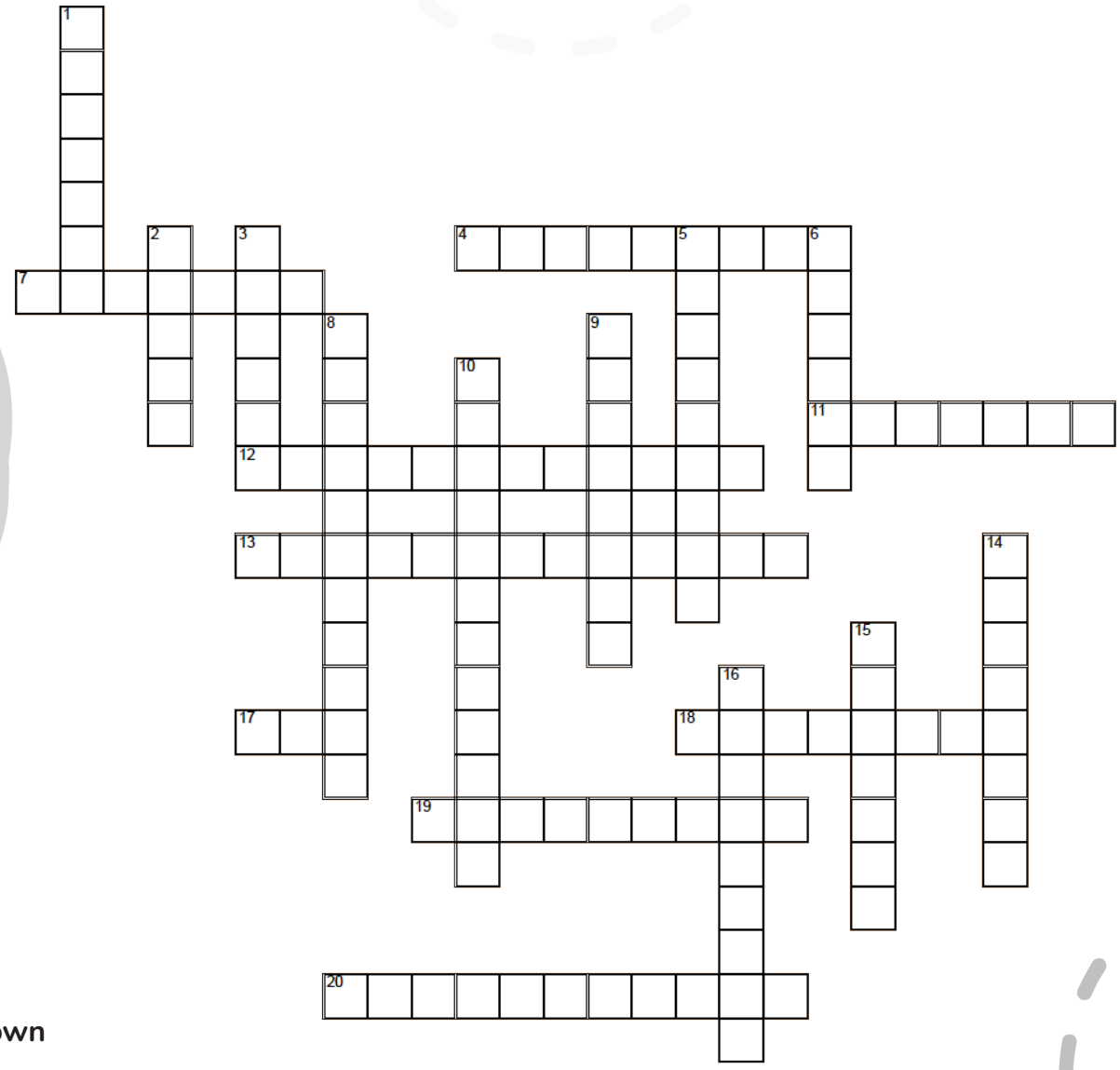
Now fill in the blanks in the following program to determine the probability that different flood-inducing factors will occur. The more flood-inducing factors that occur at once, the higher the probability of a flood - but what IS the probability of many flood-inducing factors occurring at once?

```
probabilityOfFloodFactors = 0
predictFactors = input ("what are the factors you want to predict for?")

# fill in the following blanks

if predictFactors == "heavy rain in spring"
     probabilityOfFloodFactors =
else if predictFactors ==  "broken dams" and  "melting snow and ice"
     probabilityOfFloodFactors =
else if predictFactors ==  "broken dams" or  "melting snow and ice"
     probabilityOfFloodFactors =
```

Try out more combinations of flood-inducing events! What is the probability of all of them occurring at once? What is the probability of at least one of them occurring? Where you live, which flood-inducing factors do you think have a higher probability?

SLO: Science: 8-4-01, 8-4-12, 8-4-13, Math: 8.N.3., 8.N.5., 8.SP.2.

Cells Crossword



Down

1. Stores genetic information
2. Packages / modifies / transports proteins
3. Hair-like structure on some cells
5. Compartments within the cell
6. Reproduction using gametes
8. Single-celled organism
9. Stores water in plants
10. Organelle produces ATP
14. Used for cell movement
15. Help condense DNA
16. Fluid that fills the cell

Across

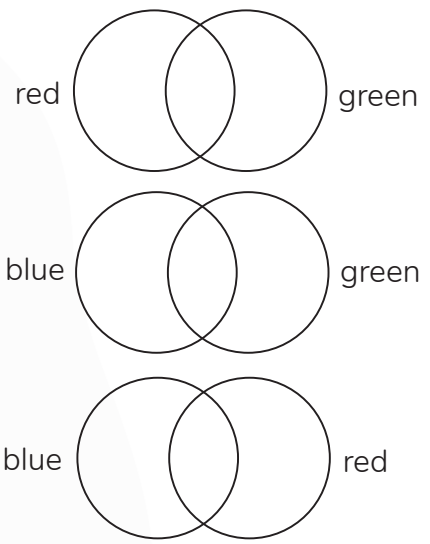
4. Makes proteins
7. Diffusion of water
11. Reproduction without change in DNA
12. Gives cell structure and shape
13. Made of many cells
17. Genetic information
18. Organelle digests large molecules
19. Movement from high to low concentration
20. Produces energy via photosynthesis

SLO: 8-1-01, 8-1-05

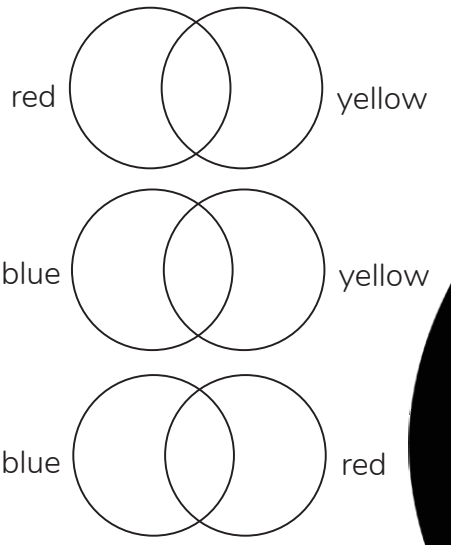
Code a Colour Mixer

Using the **additive colour theory** and **subtractive colour theory**, color in the colours of light or pigment below, as well as the resulting shade of each mix. Then fill in the blanks in the code below to make your own colour mixing algorithm!

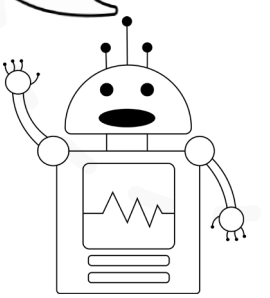
LIGHT



PIGMENT



The way a computer displays colour on a screen is different than the way colour works on a printed page. On a screen, pixels use **additive colour**: starting from black, light is added to produce colour (more light = lighter colours). In print, inks and pigments are an example of **subtractive colour** - starting from a white page, inks filter out some of the white light hitting the page (more ink = darker colours)



```
colour1 = input("Enter the first colour")
colour2 = input("Enter the second colour")
colourType = input("Enter whether LIGHT or PIGMENT")

if (colourType == "LIGHT")
     additiveColour (colour1, colour2)

else if (colourType == "PIGMENT")
     subtractiveColour (colour1, colour2)

additiveColour {

if (colour1 == "green" and colour2 == "red") or (colour1 == "red" and
colour2 == "green")
     newColour =

else if (colour1 == "green" and colour2 == "blue") or (colour1 == "blue"
and colour2 == "green")
     newColour =

else if (colour1 == "blue" and colour2 == "red") or (colour1 == "red" and
colour2 == "blue")
     newColour =
}
```


SLO: 8-2-04, 8-2-05

Answer Keys

8 - Water Treatment Chemist

1 COAGULATION

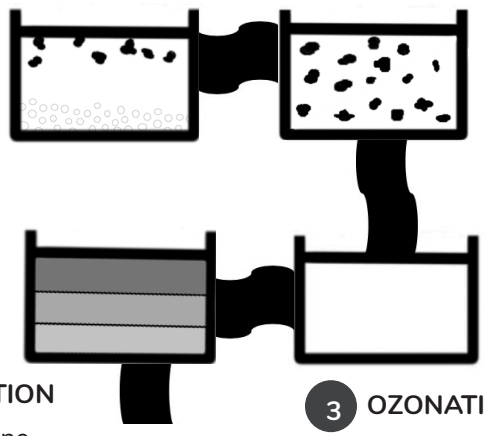
sulphuric acid, ferric sulphate

materials used

2 SEDIMENTATION

nothing added (just air)

materials used



4 FILTRATION

sand filters (fine, medium, coarse)

materials used

3 OZONATION

ozone, sodium bisulphate

materials used

5 DISINFECTION

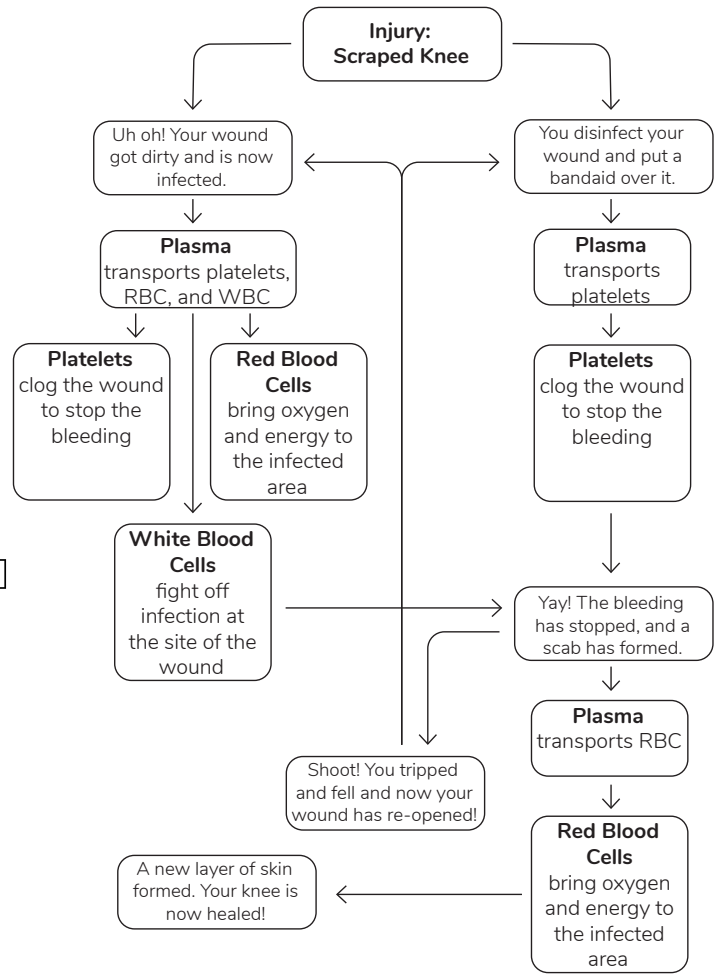
chlorine, ultraviolet light

materials used

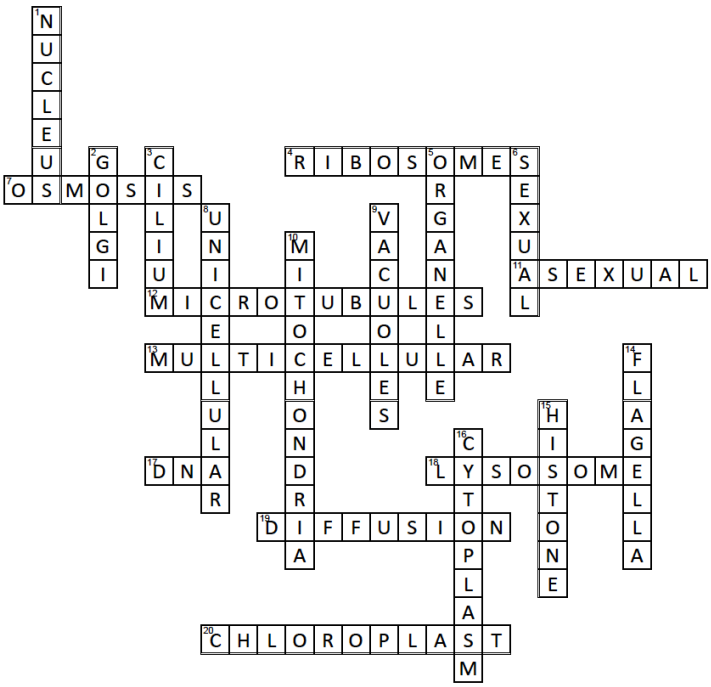
10 - Fluids Matching

1. E
2. B
3. I
4. C
5. A
6. H
8. D
8. G
9. J
10. F

12 - Blood Flow Chart



15 - Cells Crossword



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