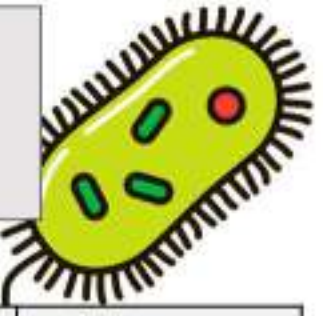
Grade 8 Science Unit

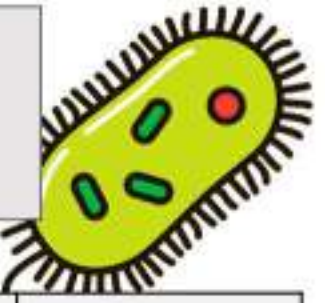
Cluster 1: Cells and Systems



	Curriculum Expectations	Pages
1	Use appropriate vocabulary related to their investigations of cells and systems.	8 - 100
2	Identify characteristics of living things, and describe how different living things exhibit these characteristics.	8 – 9
3	Describe cell theory.	10 – 11
4		
5		
6	Demonstrate proper use and care of the microscope to observe the general structure of plant and animal cells.	14 – 15, 64 - 65
7	Describe the movement of nutrients and wastes across cell membranes and explain its importance.	33 - 47
8	Differentiate between unicellular and multicellular organisms.	48 – 55
9	Describe why cells and tissues are specialized in multicellular organisms, and observe examples.	52 – 55
10	Describe structural and functional relationships among cells, tissues, organs, and systems.	56 - 60

Grade 8 Science Unit

Cluster 1: Cells and Systems



	Curriculum Expectations	Pages
11	Describe the structure and function of the heart and the path of blood to and from the heart through its four cha[illegible]s.	77 – 79
12	C[illegible]d [illegible]ntrast the structure and function of [illegible]apillaries.	78 – 79
13	Identify [illegible]ts of [illegible]nd describe the function of each.	80 – 81
14	Describe, using examp[illegible]w i[illegible]stems in the human body function interdepe[illegible]	84 – 90
15	Compare heart rate and respiratory ra[illegible]re, d[illegible] and after various physical activities; exp[illegible]he[illegible] variations; and discuss implications for ove[illegible]	82 – 83, 86
16	Identify components of the primary and secondary [illegible]enc[illegible] systems of the human body, and describe their roles.	[illegible]
17	Identify medical advances that enhance the human body's defence mechanisms and describe their effects on society.	66 – 75, 95 – 96
18	Research and describe disorders/diseases that affect body systems, and identify possible preventative measures.	97 - 100
19	Describe functional similarities and differences of comparable structures and systems in different groups of living things.	48 - 55

NAME: _____

CELLS AND SYSTEMS

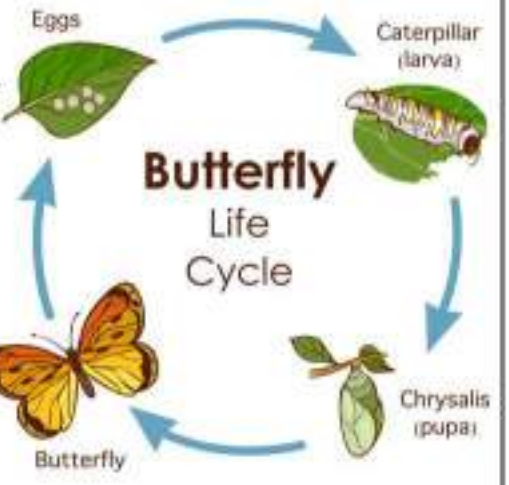
Name: _____ 8

Curriculum Connection
2

Characteristics of Living Things

Characteristics of Living Things

Living things, also known as organisms, possess certain characteristics that distinguish them from nonliving things. These characteristics include:



Organization: Living things are highly organized and have a complex structure. They are composed of cells, which are the basic unit of life, and have specialized tissues and organs that perform specific functions.

Metabolism: All living things have the ability to carry out chemical reactions, such as converting energy from food and eliminating waste products, in order to maintain homeostasis.
Homeostasis is the ability of all body systems to work together to function and survive. Since we need energy from food, we need to be able to get rid of waste at an equal rate to ensure homeostasis.

Growth and development: Living things have the ability to grow and change over time. They undergo development from a single cell (in the case of animals) or a spore (in the case of plants) into a complex organism with a variety of specialized cells, tissues, and organs.

Lifespan: All living things have a life span, which is the period of time between the birth and death of the living thing. A mayfly has the shortest lifespan, only lasting hours. The ocean quahog is a species of clam that has the longest lifespan, living for hundreds of years.

Reproduction: Living things have the ability to reproduce in order to create offspring and ensure the continuation of their species.

Response to stimuli: Living things can sense and respond to stimuli in their environment, such as changes in temperature, light, or the presence of food or predators.

Adaptation: Living things can adapt to their environment in order to survive and thrive. This can include physical adaptations, such as changes in body structure, or behavioral adaptations, such as changing the way they search for food or avoid predators.

Evolution: Living things have the ability to evolve over time through the process of natural selection. This allows them to adapt to changing environments and ensures the survival of the fittest individuals.

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Curriculum Connection
2

Characteristics of Living Things

Paraphrase Explain the characteristics below that all living things have

Organization	
Metaboli	
Growth and Development	
Lifespan	
Reproduction	
Response to Stimuli	
Adaption	
Evolution	

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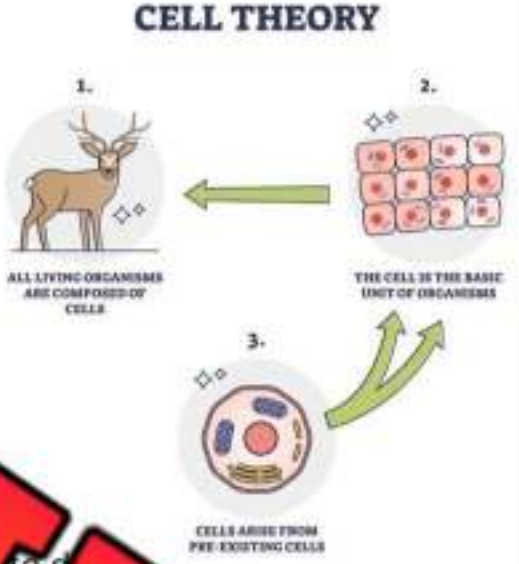
Curriculum Connection
3

Cell Theory

What are Cells?

Cells are the smallest unit that can live on their own and that make up all living organisms and the tissues of the body. Cells are the basic building blocks of all living things.

The human body is composed of trillions of cells. They provide structure for the body, take in nutrients from food, convert those nutrients into energy, and carry out specialized functions.



Cell Theory

In the mid- century, **cell theory** was first formula ann and Matthias Schleid parts to the theory, that explained life.

1) The cell is the it of l
2) All cells come fro lls
3) All living things are m one o lls

The Cell Is The Basic Unit Of Life

The word **cell** in Latin translates to 'sma Cells like little rooms with important compone that all to its function. Cells make up the smallest level of and a ey are the smallest unit of life that provide the building bloc livi

All Cells Come From Pre-Existing Cells

All life comes from pre-existing life through the process of duc that living things are needed to create more living things. For exam seeds that then grow into living things.

Since cells are alive, cells too must have a reproductive mechanism allows them to make new cells. Scientists now understand that cells do create new cells through cell division. Through mitosis, a parent cell divides to produce two identical daughter cells. For example, when you skin your knee, cells divide to replace old, dead, and damaged cells.

All Living Things Are Made Up Of One Or More Cells

All living organisms are composed of at least one cell. A living organism that is made of just one cell is called a unicellular organism. Examples of these include bacteria, protists, and yeast. Scientists estimate that humans are made of over 37 trillion cells. Humans are complex organisms that have many different organs each with their own structure and function.

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Curriculum Connection
3

Cell Theory

Questions

Use information from the text to support your answer

1) What are cells? What do cells make up?

2) What is t[illegible]nce between humans and unicellular organisms?

Summarize

W[illegible]e each [illegible]f the cell theory mean?

The Cell Is The Basic Unit Of Life	
All Cells Come From Pre-Existing Cells	
All Living Things Are Made Up Of One Or More Cells	

True or False

Circle whether the statement is true or false

1) Humans are unicellular organisms	True	False
2) All things, including non-living things are made of cells	True	False
3) Cells can be made from machines	True	False
4) Only living things can reproduce new living things	True	False
5) Cells are the smallest living thing making them the smallest unit of life	True	False

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Curriculum Connection
4

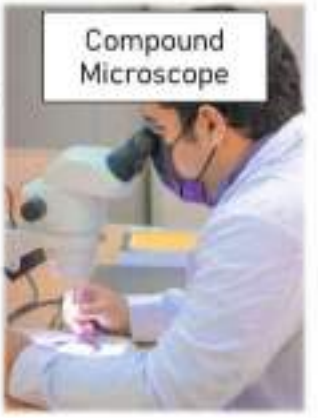
Microscopes

Microscope

In the first century, Romans made glass and noticed that objects appeared larger under glass. In the 12th century, Salvino D'Armate made a piece of glass fit over one eye, creating a magnification effect to examine things closeup. Eyeglasses became more popular in the 13th century because of this invention.

In the 13th century, a magnifying tube was invented. Two lenses were placed at opposite ends of a tube to provide a small magnification effect. It wasn't until 1609 that Galileo Galilei invented the first microscope. Zacharias Janssen is also credited with making one of the earliest compound microscopes around the year 1600. A **compound microscope** uses two lenses. These early microscopes could magnify an object up to 20 or 30 times its size.

Antonie van Leeuwenhoek made microscopes by grinding his own lenses. His simple microscopes were more like magnifying glasses, as they only had one lens. The high-quality lenses could magnify an object by up to 270 times. This allowed Leeuwenhoek to observe animal and plant tissue, blood cells, and fossils. It allowed him to see things no one had ever seen before.


Compound Microscope

Today, modern microscopes provide a magnification of 1000x. An **optical microscope** uses light and a system of lenses to generate magnified images of small objects. The eyepiece provides a slight magnification, say 10x and the objective lens provides a magnification of 100x, which gives a total magnification of 1,000x. Higher magnification could be created, but the power of the light becomes limiting and the higher magnification does not show any more details.

Importance of the Microscope

Microscopes have created an entirely new dimension of science. Before, no one knew about cells because we couldn't zoom in and magnify our vision enough. Robert Hooke discovered cells. He first examined thin slices of bottle cork. He saw tiny pores that he named "cells". Hooke was unable to magnify his vision enough to notice any movement, meaning he couldn't see the living cells in action.


Electron Microscope

In 1676, Leeuwenhoek first saw life in cells when he observed blood cells and bacteria. His microscope provided a magnification of 270 times. In 1804, Karl Rudolphi and J.H.F. Link proved that cells had independent cell walls. This meant cells were the basic unit of life.

Microscopes have given scientists the ability to understand the basic unit of life. They are still being innovated, providing even more magnification. An **electron microscope** uses electrons instead of light waves. Electron microscopes can provide a magnified image up to 50 million times the objects true size!

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Microscopes

Questions

Use information from the text to support your answer

1) What is a microscope? Why are they important?

2) Why is th ication of a microscope important? How has the magnification increased as microscopes have been innovated?

Summarize

Describ olu icroscope

True or False

Circle whether the statement is true or false

1) A compound microscope uses just one lens	True	False
2) Light becomes the limiting factor when magnifying over 1000 times	True	False
3) Early microscopes could magnify only 20-30 times	True	False
4) An electron microscope can magnify up to 50 million times	True	False
5) Leeuwenhoek was the first to see a cell under a microscope	True	False

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Microscope Diagram

Diagram Label the parts of the diagram using the word bank

Ocular Lenses	Objective Lens	Carrying Handle	Stage
Revolving Nosepiece	Coarse Adjustment	Slide Holder	Fine Adjustment
Li ensity Control		Light	

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Curriculum Connection
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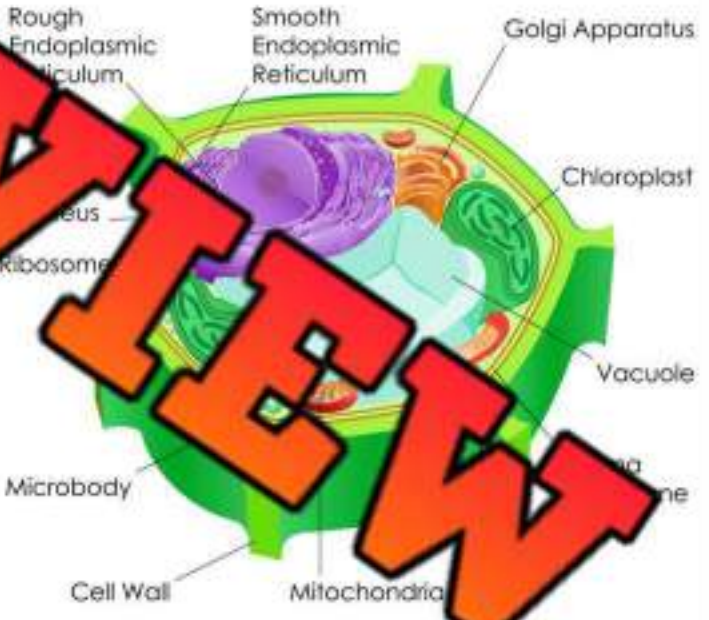
Organelles in Cells

What is an Organelle?
An **organelle** is a specialized part of the cell that has a specific function. Organelles do a job for the cell they are in just like organs do a job for the body system they are in. Plant and animal cells have many of the same organelles, but not all.

Nucleus
The **nucleus** is the command centre of the cell that stores the cell's DNA and controls all the cell's activities. These activities include growth of the cell, metabolism, protein synthesis, and reproduction (cell division).

Cell Membrane / Plasma Membrane
The **cell membrane** provides protection for the cell. It provides a fixed environment inside the cell and holds the organelles. The cell membrane has many functions, including importing into the cell and transporting toxic substances out of the cell. The cell membrane is also called the plasma membrane, hence why it is often called the plasma membrane.



Cell Wall
The **cell wall** surrounds the cell membrane and provides the cell with shape, support, and protection. A cell wall is **semi-permeable**, meaning molecules can pass in and out of the cell. Cell walls are only in plant cells.

Chloroplasts
Only plant cells have chloroplasts, which are organelles that are responsible for photosynthesis. **Chloroplasts** take in light energy and convert it into chemical energy via the photosynthetic process.

Vacuole
Vacuoles are sacs that take in waste products, like harmful toxins, and get rid of these waste products. Often, the waste is water, so the vacuole works to maintain the balance of water inside and outside the cell.

Mitochondria
The **mitochondria** are the powerhouses of the cell that work to transform molecules like glucose and turn them into energy that the cell needs. When the mitochondria converts the glucose, it is stored as chemical energy called adenosine triphosphate (ATP).

Cytoplasm
The **cytoplasm** is the gel-like fluid inside the cell that is responsible for holding the organelles and protecting them from damage.

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Organelles in Cells

Questions

Use information from the text to support your answer

1) What is an organelle? What do they do?

2) Do plants and animals have the same organelles? Explain.

Explain

What is the function of each of the organelles below?

Organelle	Function
Nucleus	
Cell Membrane	
Cell Wall	
Chloroplasts	
Vacuole	
Mitochondria	
Cytoplasm	

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Plant Cell - Diagram

Diagram Label the plant cell using the word bank

Rough Endoplasmic Reticulum	Smooth Endoplasmic Reticulum	Chloroplast	Vacuole
Plasma Membrane	Mitochondria	Cell Wall	Microbody
Ribosome	Nucleus	Golgi Apparatus	

Name: _____

Curriculum Connection
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Animal Cell - Diagram

Ribosome	Cytoplasm	Cell Membrane
Golgi Apparatus	Nucleus	Nucleolus
Mitochondria	Lysosom	Endoplasmic Reticulum

Anatomy of an Animal Cell

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Curriculum Connection 5

Matching Activity - Organelles

Matching Match the function/description to the organelle

Answer	Organelle	Function/Description
	Cytoplasm	A) Made of plasma and provides protection for the cells. Also allows nutrients and toxins in and out of the cell.
	eus	B) Found inside the nucleus and is responsible for making the cell's ribosomes.
	olgi A	C) Only found in plant cells. Surrounds the cell membrane a rovides the cell with shape.
	Cell Memb e	nd centre of the cell that stores the cell's and co all the cell's activities
	Nucleolus	E) Transp yste the cell
	Mitochondria	F) Gel-like fluid i e cel ponsible for holding the organe nd from damage.
	Cell Wall	G) Sacs that take in waste pr lik s. and get rid of these waste prod ts
	Lysosome	H) The powerhouses of the cell that work t orm molecules like glucose and turn them into gy that the cell needs
	Endoplasmic Reticulum	I) Prepares proteins and lipid (fat) molecules for use in other places inside and outside the cell
	Vacuole	J) Takes in light energy and converts it into chemical energy via photosynthesis
	Chloroplast	K) Contains digestive enzymes and breaks down excess or worn-out cell parts

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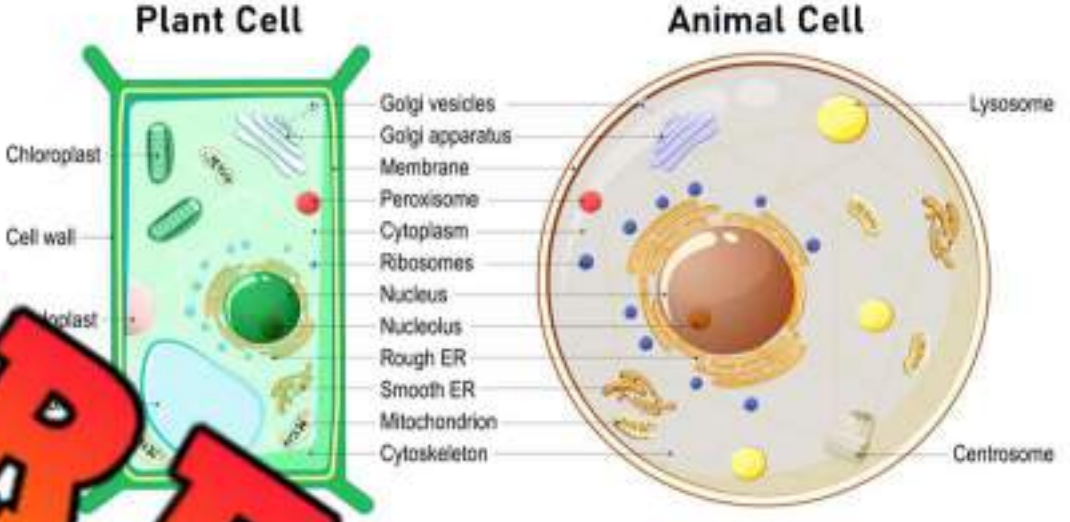
Plant and Animal Cells

Plant and Animal Cells

All living things are made up of the basic building blocks of life, called cells. Plants and animals are both living things, which means they are both made of cells. The cells that make up plants are similar to the cells that make up animals, but there are some differences in the organelles they contain.



Similarities Between Plant and Animal Cells

Both plant and animal cells contain the following organelles:

- Nucleus
- Mitochondria
- Endoplasmic reticulum
- Golgi apparatus
- Lysosomes
- Have a cell membrane
- Contain cytoplasm

Differences Between Plant and Animal Cells

Animal cells have:

- No cell wall
- No chloroplasts
- Many small vacuoles
- An irregular shape that is rounded
- A nucleus in the centre of the cell
- Are between 10-30 micrometres in length

Plant cells have:

- Chloroplasts
- A cell wall
- A large central vacuole
- A definite shape that is usually rectangular or cubic
- A nucleus that is usually pushed to the side
- A larger size of 10 to 100 micrometres in length

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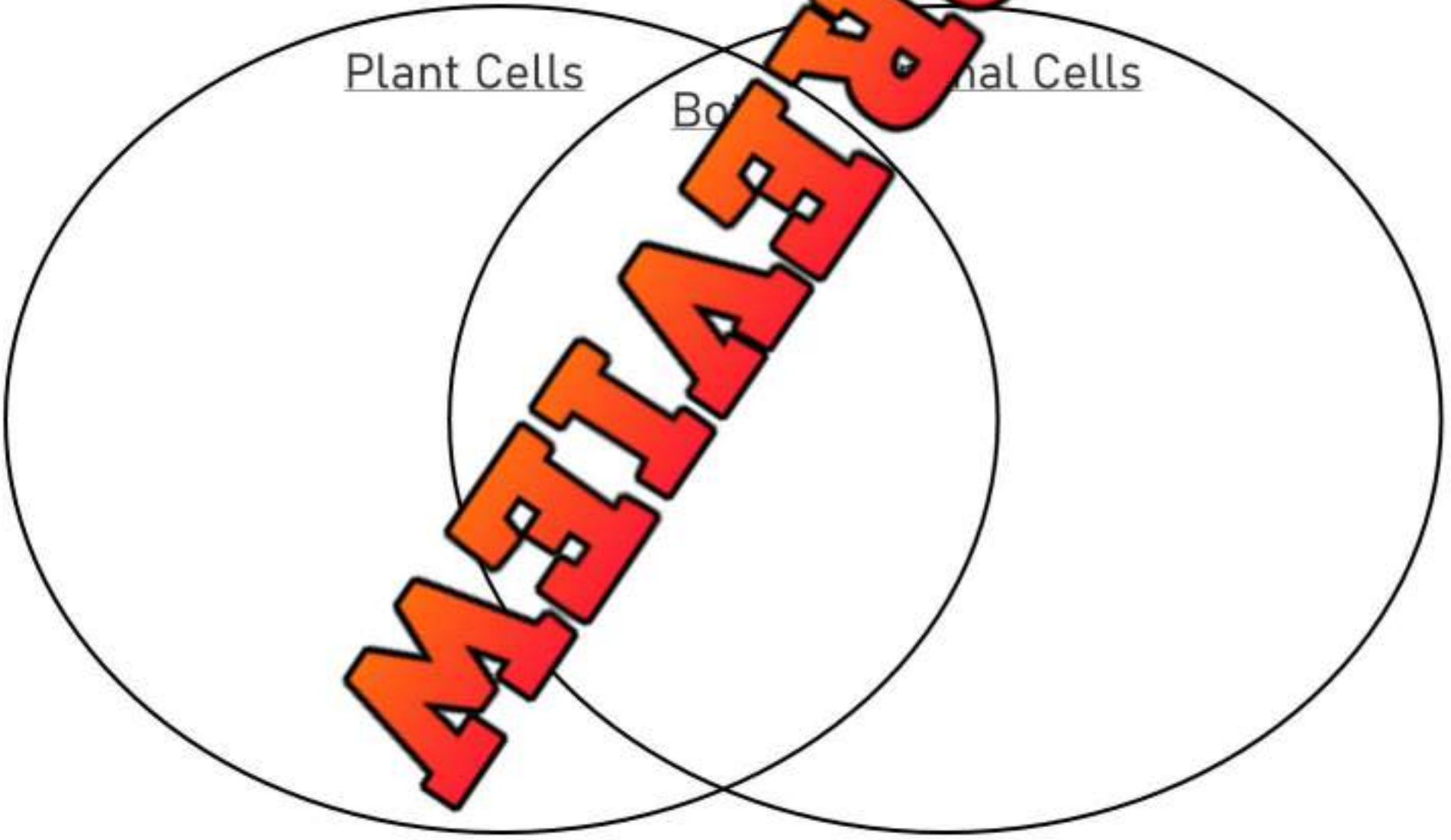
Plant and Animal Cells

Venn Diagram Fill in the Venn diagram showing the similarities and differences between plant and animal cells



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5

Plant and Animal Cells

Table Fill in the table by explaining the feature for plant and animal cells

Feature	Animal Cell	Plant Cell
Cell Size		
Cell Sha		
Vacu		
Cell Wall		
Chloroplasts		
Nucleus Location		

Summarize Write a summary of the differences between a nal lls

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5

Plant or Animal Cell?

Examine Judging by the picture of the cell, is it a plant or animal cell? Explain.

Picture	Type of Cell	Explanation
	Plant Cell Animal Cell	
	Plant Cell Animal Cell	
	Plant Cell Animal Cell	
	Plant Cell Animal Cell	

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Activity - Plant and Animal Cell Model

Background — Information before you begin

Create a 3D model of a plant or animal cell by choosing some of the materials below. There are so many options for materials, including edible options. Verify with your teacher whether you can use food options before choosing those materials.

Materials — Ideas you could use for your model

- ❑ Bas… shoe box, clay or playdo… felt… crispy, brownie
- ❑ Organelles: pipe c… ers… y, felt, candy
- ❑ Labels: small pieces of paper and t… picks

Procedure — How you will complete the m…

1) Decide if you will make a plant or animal cell
2) Will you create an edible model or a model out of craft materials?
3) Choose the materials you will use. Choose a base as well as the materials for the organelles
4) Construct the model by considering the shape and location of the organelles

5) Label each organelle using strips of paper with handwritten or typed labels. Use toothpicks if your model is soft or tape/glue if your model is hard to attach the labels to the model

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Curriculum Connection
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Activity - Plant and Animal Cell Model

Questions | Answer the questions below

1) Which type of cell did you choose?

2) Which organelles did you include in your model?

3) Where did you put the nucleus?

4) Describe the vacuole you included.

5) Which organelles did you include that are not in the other type of cell? If you chose an animal cell, which organelles did you include that are not in a plant cell?

6) Describe the shape of the model cell you made. Why did you make it this shape?

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Activities - Cell Theory and Cell Organelles

Word Search

Find the words from the word bank

Cell	Theory	Organelles	Chloroplasts	Vacuole
Mitochondria	Cytoplasm	Wall	Membrane	Nucleus
Lysosome	Centriole	Plant	Animal	Golgi

L	S	T	[illegible]	N	A	R	B	M	E	M	B	E	A	V	K	Y	G	J	S
K	S	[illegible]			V	N	M	C	P	F	J	E	P	J	P	J	A	U
I	[illegible]				N	Q	S	A	W	L	I	X	Z	X	A	N	E	
A	S	[illegible]				V	A	O	G	U	W	T	T	W	I	L		
G	H	C	L	[illegible]		A			I	L	H	V	Y	K	N	Z	M	C
Q	N	U	T	R	[illegible]				C	P	I	J	I	L	A	A	U	
E	R	O	M	O	L	M	[illegible]				O	S	O	M	E	L	N	
V	Q	L	G	P	L	T	N	G	[illegible]			T	P	F	Y	I	P	
X	Q	E	U	L	E	E	J	K	R	A	[illegible]	C	[illegible]	Y	P	B	I	
D	Y	N	B	A	C	B	C	W	E	O	[illegible]			W	W	H		
X	H	E	U	S	V	I	Y	D	S	R	V	[illegible]	E	[illegible]	G			
X	K	M	I	T	O	C	H	O	N	D	R	I	A	S	[illegible]			
K	V	T	U	S	D	M	R	W	C	Y	R	O	E	H	[illegible]	X		

Word Scramble

Unscramble the words from the word bank

GNLEERAOLS		NIHIAMDOOCRT	
OELETNCRI		LCLE	
ANBEEMRM		SLOSOMEY	
ETHYOR		LIAANM	
LSUUNEC		OCOSATRLHPSL	

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Curriculum Connection
7

Diffusion and Osmosis in Cells

What is Diffusion and Osmosis in Cells?

Both diffusion and osmosis are transport processes that move molecules from an area of higher concentration to an area of lower concentration. Cells require these processes as they need nutrients to be transported into cells and harmful materials out of cells.

Plasma membranes need to allow certain substances to enter and leave a cell. They also need to prevent harmful material from entering and essential material from leaving. This means plasma membranes are **semipermeable**, as they allow some molecules through but not others.

The tra[illegible]orting of these substances is passive. **Passive transport** is a naturally occurring pr[illegible]at does not require the cell to use energy to accomplish the movement.

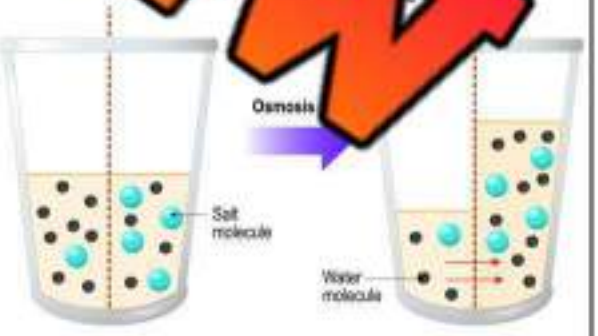
What is

Diffusion [illegible] move[illegible]lecules from areas of higher c[illegible]o a[illegible]f lower concentration so t[illegible]egion[illegible] throughout. An examp[illegible]iffu[illegible] when we spray perfume. [illegible]ation perfume is highest in the bott[illegible]est edges of the room. The perfume [illegible]wi[illegible] or spread out from the bottle and gradual[illegible]peop[illegible]er from the bottle will smell the scent as it spreads.

Diffusion helps in the movement of substances [illegible]d ou[illegible]. For example, when our blood becomes oxygenated, oxygen is diffusi[illegible]he b[illegible]od needs oxygen so it can deliver oxygen to cells throughout the body. [illegible]e moving from high concentrations in the blood, to low concentrati[illegible]n the [illegible]roughout the body.

What is Osmosis?

Osmosis is the movement of water molecules through a semipermeable cell membrane from areas of high concentration to areas of low concentrations. For example, plants take in water and minerals from roots with the help of osmosis. Whereas diffusion transports material across membranes and within cells, osmosis only transports water.



Water will move from areas of high concentration to areas of lower concentration. In the diagram, you'll notice the first glass has a higher concentration of water molecules on the left side as the right side has more salt molecules. Through osmosis, the water molecules move through the semipermeable membrane into the area of lower concentration. The second glass shows the result, which is a balanced amount of water molecules compared to salt molecules.

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Diffusion and Osmosis in Cells

Questions

Use information from the text to support your answer

1) Define the terms below.

Term	Definition
Semipermeable Membra	
Diff	
Osmosis	

2) Give an example of whe e exp d diffusion.

3) Why do cells require diffusion? Does it require

True or False

Circle whether the statement is true or false

1) Diffusion is the movement of only water through a membrane	True	False
2) Osmosis is the movement of water from low to high concentrations	True	False
3) Diffusion is the movement of molecules from high to low concentrations	True	False
4) Oxygen is diffused into blood cells	True	False
5) Plants use osmosis to get water from their roots	True	False

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Curriculum Connection
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Factors Affecting Diffusion

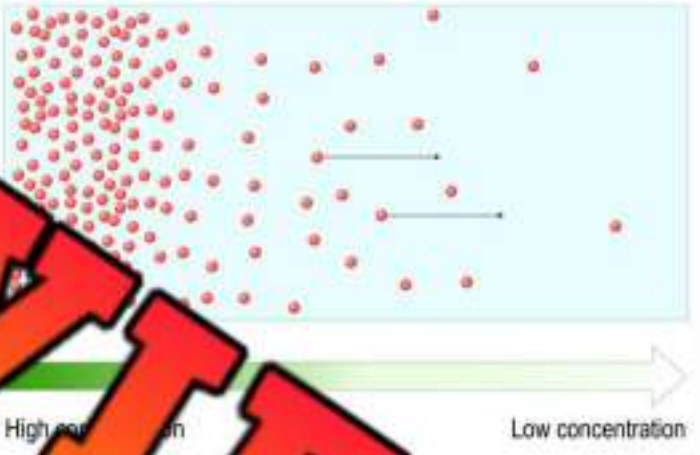
What Factors Affect Diffusion?

The **rate of diffusion** is how fast molecules are transported in and out of cells. There are three factors that affect the rate of diffusion.

1) The concentration gradient
2) The temperature
3) The surface area of the cell membrane separating the different regions

1) The Concentration Gradient

The greater the difference between concentrations, the faster the rate of diffusion. For example, if you drop food colouring into water, the particles of food colouring diffuse in the water. The food colouring is highly concentrated and the water has no concentration of the colouring. So, the diffusion causes the food colouring particles spread throughout the water. The food colouring will be light in colour once its particles are spread out.



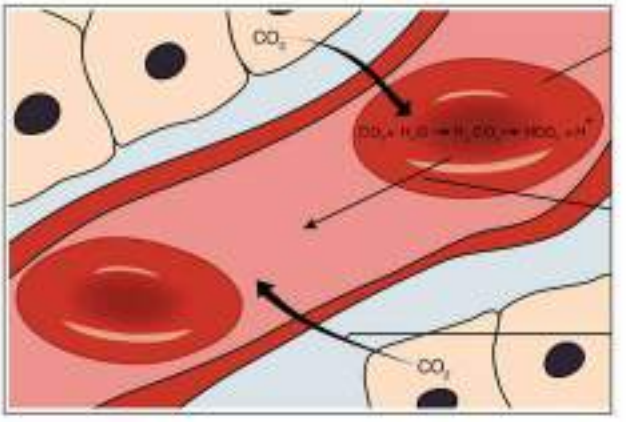
If you pour a lot of food colouring into a small amount of water, the difference between concentrations will be even greater, causing faster diffusion.

2) The Temperature

The higher the temperature, the more kinetic energy the molecules have. Therefore, they will move faster and have a faster rate of diffusion. If you drop a tea bag into cold water, the diffusion of the tea bag molecules will be slower than if you drop a tea bag into hot water.

3) Surface Area of Cell Membranes

When substances are moving through semipermeable membranes, the greater the surface area between the two regions, the faster the rate of diffusion will be. In the picture, you'll notice carbon dioxide is being diffused from the cells and into the blood cells. The greater the surface area of the cells and blood cells will speed up diffusion.



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Factors Affecting Diffusion

Questions

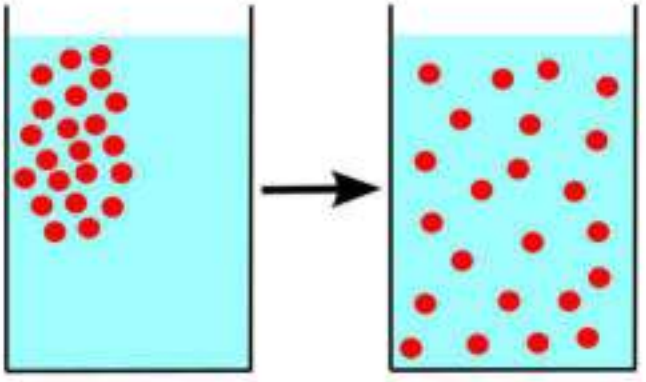
Use information from the text to support your answer

1) What does diffusion rate mean? Give an example of diffusion and describe the diffusion rate.

2) How d emper e ct the diffusion rate?

Diagram

Describe the diagram



True or False

Circle whether the statement is true or false

1) The greater the surface area between cells, the slower the diffusion	True	False
2) The greater the temperature, the faster the rate of diffusion	True	False
3) If one concentration is high and the other is low, the diffusion will be fast	True	False
4) A tea bag in boiling water will diffuse slowly	True	False
5) Carbon dioxide is diffused from blood cells into cells throughout the body	True	False

Diffusion in Cells

Diffusion in the Human Body

The process of diffusion is critical to the survival of the human body. Diffusion happens when we breathe and eat. Diffusion is also the process that ensures our body has the right amount of nutrients. Our blood is an important part of diffusion as it is used to send nutrients and receive waste.

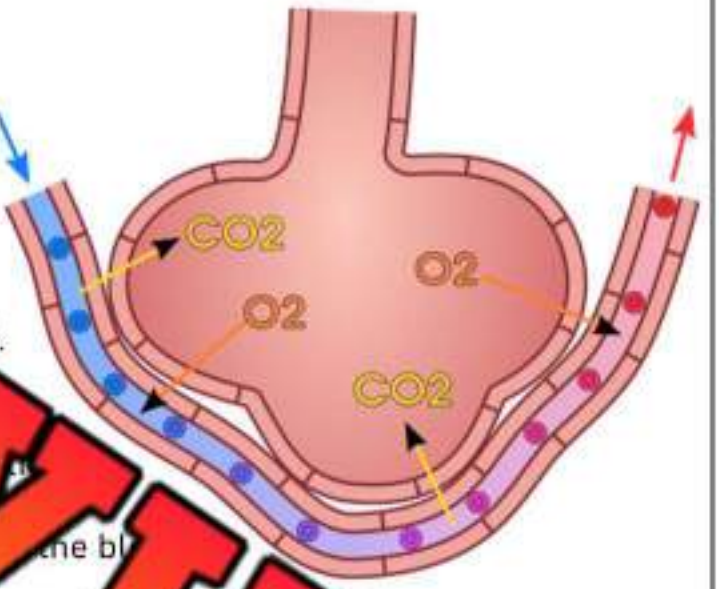
Read below about 5 ways diffusion is used by cells in our body.

Examples of Diffusion in the Human Body

1) Breathing

When you tak[illegible]ath, thank diffusion! When you breathe[illegible] only gets into your bloodstr[illegible]n molecules are diffuse[illegible] blood.

The g[illegible] excha[illegible]s b[illegible]ause the air in the lungs h[illegible]nce[illegible]n of oxygen than that o[illegible]gen-d[illegible]od. The blood also has a hi[illegible]con[illegible] carbon dioxide, and the lung[illegible] lower concentration of carbon dioxid[illegible]nce[illegible] gradient allows for a gas exchange[illegible] diff[illegible] carbon dioxide exits the blood and oxygen[illegible]the bl[illegible]



2) Calcium

We need calcium for many reasons, not just for ou[illegible]s. Wh[illegible] have enough calcium in our bloodstream, our thyroid gland secre[illegible]ch[illegible]r bones to release calcium. The calcium released is diffused into ou[illegible]ls.

3) Kidneys

Our kidneys filter dangerous chemicals from our bloodstream th[illegible]ugh[illegible] called nephrons. These nephrons separate blood from waste chemica[illegible]e toxins and waste chemicals cannot pass through the cell membranes, so th[illegible]collected and removed in our urine.

The remaining good nutrients in our blood are reabsorbed by our bodies through diffusion. The amount that is reabsorbed depends on how much of that nutrient is in our blood already. For example, if you have had a lot of iron already in your diet today, the extra iron in your blood will not be diffused because the concentration amounts are the same. The extra iron becomes waste and will end up in our urine.

4) Liver

Our liver has an important job of synthesizing proteins, which we need because our body is made of them. In the process, a dangerous waste product is made called urea. The good news is that the urea is diffused into the bloodstream just upstream from the kidneys. The kidneys are able to filter the urea, so it ends up in our waste.

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Curriculum Connection
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Diffusion in Cells

Questions

Use information from the text to support your answer

1) Why is diffusion important in our bodies?

2) If we [illegible] tion of a nutrient in our cells, will our blood diffuse more of that nut[illegible] to our [illegible] ain why or why not. Where does the excess nutrient go?

3) How do our kidneys and liver use diffus[illegible]

Kidney	
Liver	

True or False

Circle whether the statement is true or false

1) Without diffusion, humans could not survive	True	False
2) The gas exchange in the lungs uses diffusion	True	False
3) Waste that is not diffused is removed in our urine	True	False
4) We only need calcium for our bones	True	False
5) Extra nutrients that our body doesn't need is considered waste	True	False

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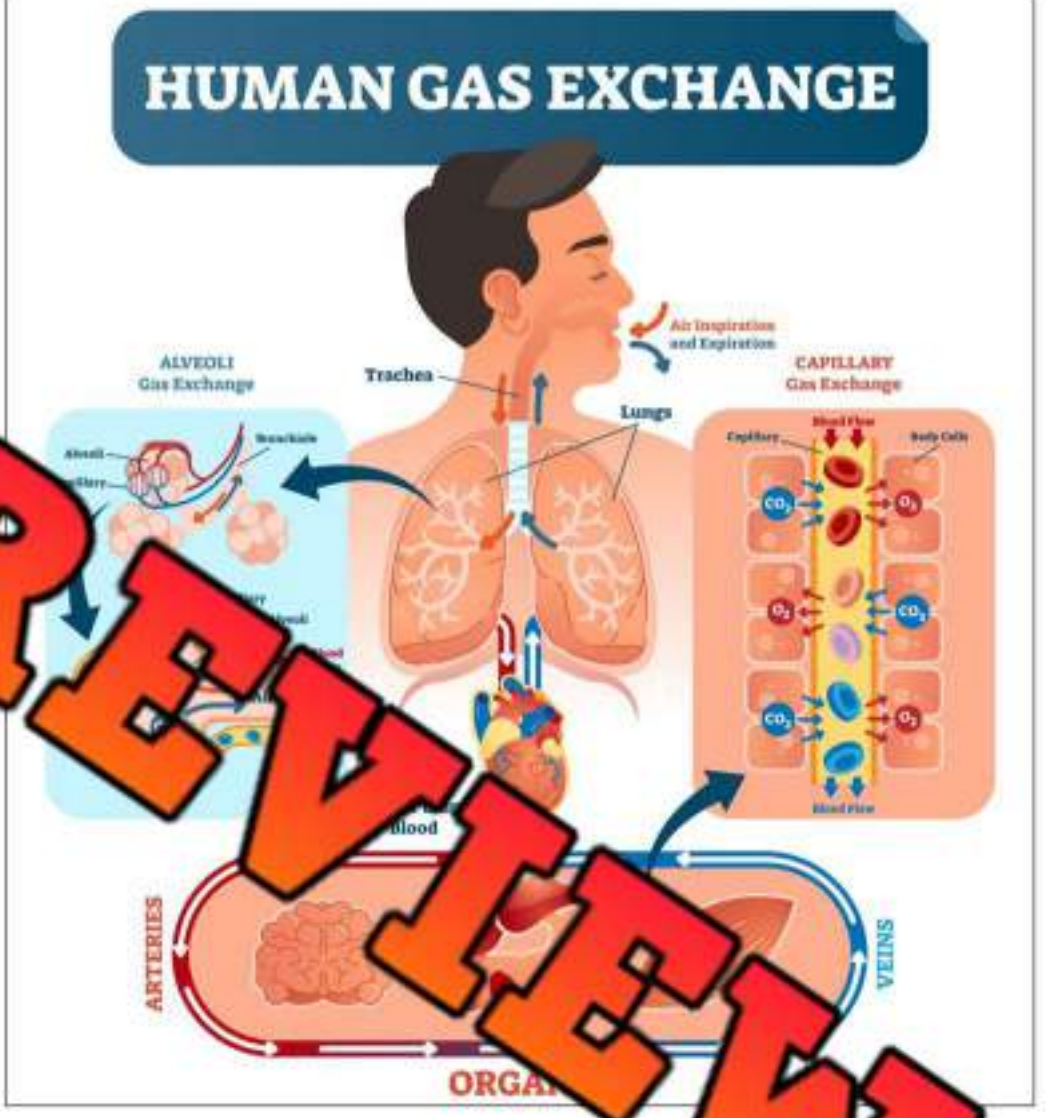
Diffusion in our Respiratory System

Diffusion in our Respiratory System
The respiratory system works with the circulatory system to complete the human gas exchange.

The **human gas exchange** is t ital process of th taking in o our cell removi on dioxide wast that cells produce. Th human gas exchang relies on diffusion to move the oxygen and carbon dioxide in and out of the cells.



Summarize Summarize the human gas exchange by describ t am

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Curriculum Connection
7

Diffusion - Hot and Cold Water

Background

Information before you begin

Have you ever smelled someone's lunch who just opened their lunch box? Or smelled someone's perfume after the person was gone? If so, you have experienced diffusion. **Diffusion** is the movement of particles from an area of high concentration to an area of low concentration.

Materials

at you will need for the experiment

- ❑ Two glass
- ❑ Hot and col u us g water or near boiling wat well from the tap, the experimen
- ❑ Food colouring – two colou rk t You could use red for the hot water de for cold but the colours aren't important

Procedure

How you will complete the experimen

1) Fill both glasses with water. In one glass, add the hot water and in the other, add the cold water

2) Add a few drops of food colouring in each glass. Use about 3-4 drops. If you put too much, the concentration of food colouring will be too large which will cause the diffusion to happen too quickly

3) Watch closely as the food colouring spreads in the water. Notice if the food colouring diffuses faster in the hot or cold water

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Curriculum Connection
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Diffusion - Hot and Cold Water

Results	Answer the questions below

1) What is diffusion?

2) Which type of water did the food colouring diffuse in faster?

3) Why did the food colouring diffused faster in the hot water?

4) What happened when the diffusion process stopped?

5) How could you have sped up the diffusion process both?

6) Which liquid is more concentrated – the water or the food colouring? Explain.

7) If you add another 3-4 drops of food colouring into the glass, will the diffusion be slower or faster than when you mixed the food colouring with just water? Explain by referring to the differences in concentrations (concentration gradient)

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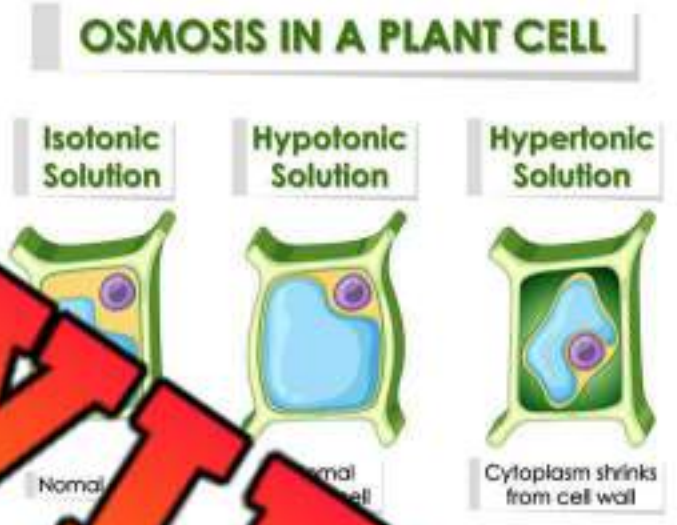
Osmosis in Cells

Osmosis in Plant Cells
Osmosis is a type of diffusion that happens when water flows into or out of a cell depending on the concentration of a solute, such as salt. Osmosis is a passive transport process, meaning it happens naturally without the need of energy from the cell.

Solute vs Solvent
Osmosis deals with chemical solutions. A solution has two parts, a solute and a solvent. A **solute** is a substance, like salt or sugar that dissolves into the solvent. A **solvent** is a substance, li ter, that is able to dissolve solutes. For example, saltwater is a solution of salt (solut ater (solvent).



Types of
There a e types ns that cells can be in: (1) Isoton oni (3) Hypertonic.

1) Isotonic Solution
An isotonic solution is one h concentration of solutes is the inside and outside of the cell. For ple a cell that has the same concentration of salt inside as salt that is in the water (solvent) outside is in an isotonic solution. This would result in the same amount of water ent nd e 's membrane.

The optimal conditions for animal cells to be in is because there is equal amounts of water entering and leaving the e wa ered the cell than existed, the animal cells will burst.

2) Hypotonic Solution
In a hypotonic solution, there is a higher concentration of solutes inside the n outside. As a result, more solvent will enter the cell compared to the amoun water leaving it in order to balance the concentration levels.

The optimal conditions for a plant cell to be in is a hypotonic solution. This is because more water will enter the plant cell, which allows it to complete the process of photosynthesis. Plant cells will not burst as easily because they have strong, thick cell walls.

3) Hypertonic Solution
A hypertonic solution is the opposite of a hypotonic solution as there is more solute outside the cell than inside it. This causes more solvent to exist in the cell because it is trying to lower the concentration of solute outside the cell. This is not an ideal condition for either plant or animal cells as water rushes out of the cells causing them to dry up and die.

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Curriculum Connection
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Osmosis in Cells

Questions

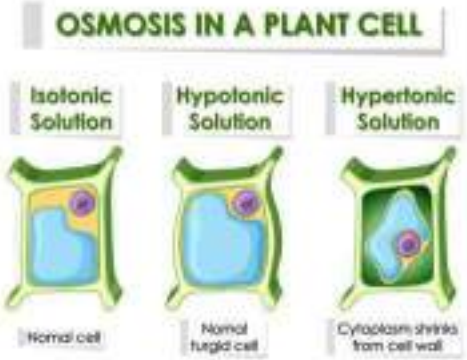
Use information from the text to support your answer

1) What is the optimal conditions for an animal cell to be in? Why?

2) What is th conditions for a plant cell to be in? Why?

Explain

What is hap to the ll in the different solutions?



Isotonic	
Hypotonic	
Hypertonic	

True or False

Circle whether the statement is true or false

1) A solution has a solute and a solvent	True	False
2) In a saltwater solution, the solvent is salt	True	False
3) In an isotonic solution, water moves in and out equally	True	False
4) In an hypotonic solution, more water moves out of the cell making it dry	True	False
5) The ideal condition for an animal cell is to be in a hypotonic solution	True	False

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Experiment - Osmosis

Background
Information before you begin

Osmosis is the diffusion of water across a semi-permeable membrane from an area of a high concentration of water, to an area of lower concentration. Salt will play a role in how water moves. Water always moves from an area of less salt to more salt. Let's test this principle.

Materials
...at you will need for the experiment

- ❑ A potato
- ❑ Salt
- ❑ Water
- ❑ 2 clear drinking glasses

Procedure
How you will complete the exp...nt

1) Fill both glasses with water
2) In one of the glasses, add 2-3 tablespoons of salt and
3) Slice up a potato into French fry sized pieces
4) Split the potato pieces up and put half in each glass. Make sure they are totally submerged in the water
5) Write a hypothesis, predicting which potato slices will turn brown and which will stay white. Also, decide which potato slices will be flexible (bendy) and which will stay firm.
6) Wait 24-hours and dump out the fries onto a plate
7) Which fries are still firm? Which fries are all dried out? Which fries turned brown and which kept their colour?

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Experiment - Osmosis

Hypothesis

What do you think will happen?

Describe what will happen to the fries in both types of water – colour, firmness

Water	Saltwater

Observations

W[illegible]pened?

Describe what happened to [illegible] both [illegible] of water – colour, firmness

Water	Saltwater

Results

Answer the questions below

1) What is osmosis?

2) Why did the French fries in saltwater become bendy and brown?

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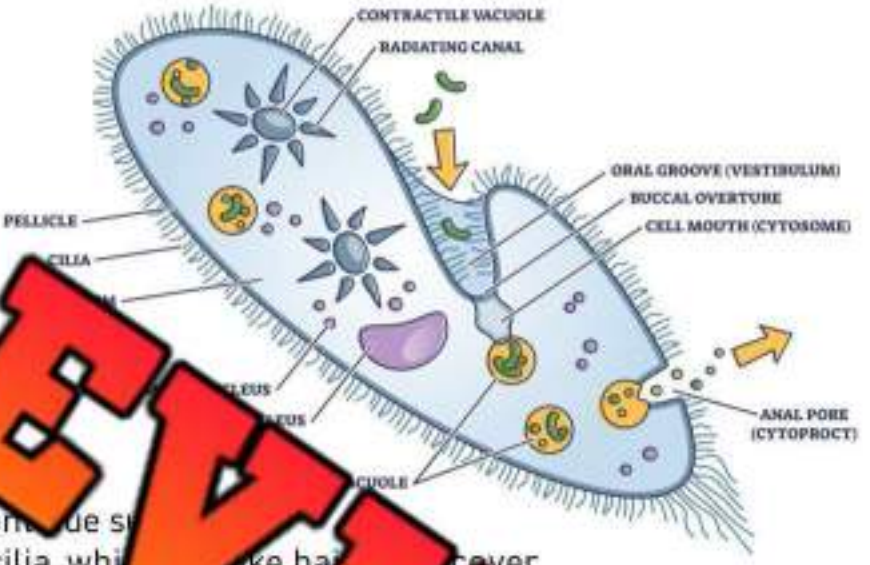
Curriculum Connection
8, 19

Unicellular Organisms

What are Unicellular Organisms?
A **unicellular organism** is a single-celled organism that consists of just a single cell. Examples of unicellular organisms are bacteria, protists, amoebas, yeast, and paramecium.

PARAMECIUM



Paramecium

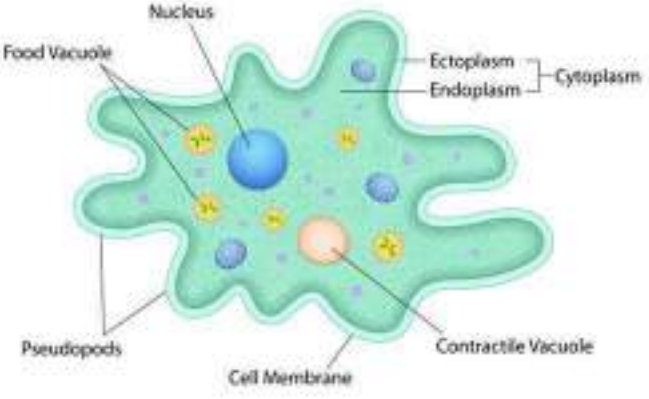
A paramecium is a slipper-shaped organism that has only one [illegible] that is found in pond wate[illegible]icellular organism h[illegible]le that help it m[illegible] it can s[illegible]lt takes from the po[illegible]d wat[illegible] digests it in orga[illegible] food vacuoles. Nutri[illegible]m the food then travel thr[illegible] cytoplasm to the other orga[illegible] which gives them energy so the[illegible] function. This allows the cell to con[illegible]ue s[illegible]

The outside of the cell has cilia, whi[illegible]ke ha[illegible]cover the paramecium cell. The cilia help move th[illegible]ell by w[illegible]ng l[illegible]nd forth in ponds to propel the organism through its surroundings.

Amoeba

An amoeba is a unicellular organism that we cannot see, bu[illegible] ev[illegible]here, including in soil, ponds, lakes, forests and rivers. They can usually be fou[illegible] bo[illegible] freshwater.

AMOEBA



Amoebas have a cell [illegible]at encloses its organelles inside. Th[illegible]ve a nucleus that has their DNA packaged inside. To eat, an amoeba stretches out a pseudopod, surrounds a piece of food, and pulls it into the rest of the amoeba's body. Amoebas eat algae, bacteria, other protozoans, and tiny particles of dead plant or animal matter. After the food particle is in the cell, a food vacuole forms around it.

Amoebas crawl to move around. They use their pseudopods to reach out and grab some surface and pull themselves forward.

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Unicellular Organisms

Questions

Use information from the text to support your answer

1) What is a unicellular organism? Give some examples.

2) Fill in the [illegible] to explain how the cells meet their needs.

	[illegible]eba	Paramecium
Eat		
Move		

Questioning

Write 2 questions you have a[illegible] readi[illegible]

1)	
2)	

True or False

Circle whether the statement is true or false

1) Amoebas have cilia that help them move	True	False
2) Unicellular organisms have organelles that help the cell meet their needs	True	False
3) A food vacuole forms around food when it enters the cell	True	False
4) A paramecium uses cilia to help them move	True	False
5) Amoebas can be found in warm freshwater bodies of water, like ponds	True	False

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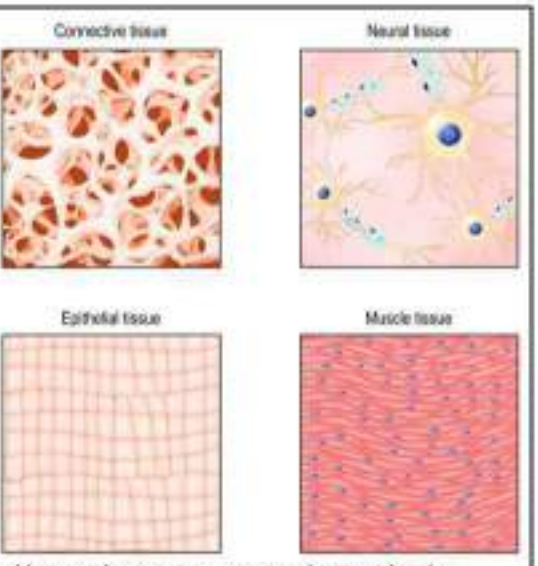
Curriculum Connection
8, 9, 19

Multicellular Organisms - Humans and Worms

What are Multicellular Organisms?

Multicellular organisms are composed of more than one cell. These organisms have groups of cells that differentiate to be able to do different tasks. In humans, cells differentiate early in development so they can become hair cells, muscle cells, nerve cells, blood cells and many other types of cells.



Groups of cells that work together are called tissues. Our b[illegible]s have four main types of tissues – muscle (skel[illegible]ue, nervous (brain) tissue, connective [illegible]u[illegible] and epithelial (skin) tissue.

Th[illegible]ion of these different groups of cells [illegible]fferent [illegible]ture is related to their function be[illegible]use so[illegible]ed t[illegible]e a certain shape to allow them to complete their task. For exampl[illegible] skin [illegible]e flattened so they can protect the body from the environment. In ado[illegible]r mu[illegible]e thin so they can be bundled together for muscle contraction.

In multicellular organ[illegible]fferent g[illegible] cells may have different amounts of organelles as well. For exampl[illegible] ce[illegible] mitochondria than most other cells to help them produce energy [illegible] mov[illegible]es allow us to move, so these extra mitochondria are needed.

Worms – Multicellular Organisms

Worms are invertebrates as they have no backbone[illegible]arth[illegible]icellular organism. The cells of an earthworm are organized into [illegible]t do s[illegible]obs.

Earthworms live in damp environments. On a normal[illegible]da[illegible]will find worms in the soil where it is damp. On rainy days, you'll find w[illegible]abo[illegible]e it isn't too wet. In the soil, it is too wet on rainy days, which is why they c[illegible] underground.

Worms breathe in a unique way. They need oxygen, just like humans, t[illegible]ey don't have lungs. They have special skin that allows them to "breathe" oxygen right through it. Diffusion allows an earthworm to get the oxygen it needs to survive. The amount of oxygen inside the earthworm will always be less than the area outside of the earthworm. This means the lower concentration of oxygen inside causes the oxygen from the higher concentration outside to diffuse into the earthworm's skin cells.

At the same time, diffusion is occurring when the higher concentration of carbon dioxide inside the worm is diffusing outside of the cell, to a region of lower concentration.

Earthworms eat in a similar manner to humans. Worms have a digestive system where food moves into the intestines and is digested. The intestinal wall contains blood vessels that allow the nutrients in the food to be diffused into the bloodstream. The nutrients are circulated by the movement of the blood to the rest of the cells in the body.

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Multicellular Organisms - Humans and Worms

Questions

Use information from the text to support your answer

1) What is a multicellular organism? How are their cells organized?

2) How does [illegible] eat and breathe?

Eat	
Breathe	

True or False

Circle whether the statement is tr[illegible]e

1) A multicellular organism has one or more cells	[illegible]	[illegible]alse
2) Humans and worms are unicellular organisms	[illegible]e	False
3) There are four types of cell tissue that cells are organized into	True	False
4) The cells that makeup muscle have more mitochondria	True	False
5) Worms need oxygen but do not produce carbon dioxide	True	False
6) Worms perform a gas exchange using diffusion	True	False
7) A worm always has higher levels of oxygen inside its cells	True	False
8) A worm has intestines that digest food and prepare nutrients for the blood	True	False
9) Blood carries nutrients and diffuses them into cells low in the nutrients	True	False
10) Worms need a wet environment so they stay underground on rainy days	True	False

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Multicellular Organisms - Frogs

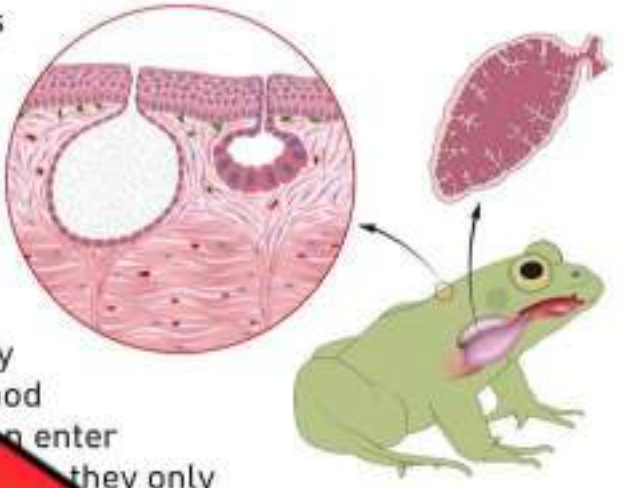
Frogs – Multicellular Organisms

A frog is a multicellular organism with more than one cell. Frogs are vertebrates as they have backbones. Frogs have many groups of cells that work together to perform certain functions that allow the frog to meet its basic needs.

Respiration

One of the basic needs for frogs is breathing. Frogs have a unique way of exchanging gas, as they can perform this in different ways.

The Respiratory System of Frog



1) Lungs

The gas exchange can like humans, by using their lungs. In s, they can breathe in oxyge and into their lungs. The lu like h are they oxygenate blood throu blood is circulated throughout th hat ox enter the cells in the rest of the bod um they only breathe when necessary, not cont sly.

2) Skin

Frogs can actually breathe through their skin. In fa t of t hing a frog does is through their skin. A frog's moist skin is thin and r with ls and capillaries that are close to the surface. The oxygen in the air an the frog get diffused into the blood because the skin is so thin.

When frogs are in the water, this process works effortl e f has oxygen available to it through the water. However, frogs can still reat in on land because they have glands in their skin that produces mucus, k ist. If you've ever touched a frog, you've probably noticed they always feel slimy.

3) Mouth

Yes, humans can breathe through their mouths as well, but we breathe oxygen through our mouths and into our lungs. So, we only use our lungs to breathe. Frogs on the other hand, actually breathe through their mouth without the use of lungs.

Inside a frog's mouth is a surface where oxygen can be diffused directly into the bloodstream. When they breathe into their mouths, the oxygen diffuses through the cell membrane and into the bloodstream, where the oxygen concentration levels are lower than the oxygen concentration levels inside the mouth. During this process, carbon dioxide is diffused from the heavy concentration in the blood, into the mouth, so it can be exhaled out into the environment.

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8, 9, 19

Multicellular Organisms - Frogs

Explain How does a frog breathe through each of the three respiration surfaces?

Lungs	
Skin	
Mouth	

True or False Circle whether the statement is true or false

1) Frogs breathe through their mouths and into their lungs	True	False
2) Humans perform a gas exchange in their mouths and nose	True	False
3) Frogs breathe through their nostrils and into their lungs	True	False
4) Frogs need to keep moist skin so they can breathe through their skin	True	False
5) Frogs produce mucus through skin glands	True	False
6) Gas exchange in frogs involves oxygen and nitrogen mainly	True	False
7) Frogs breathe mainly through their nostrils and lungs	True	False

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Curriculum Connection
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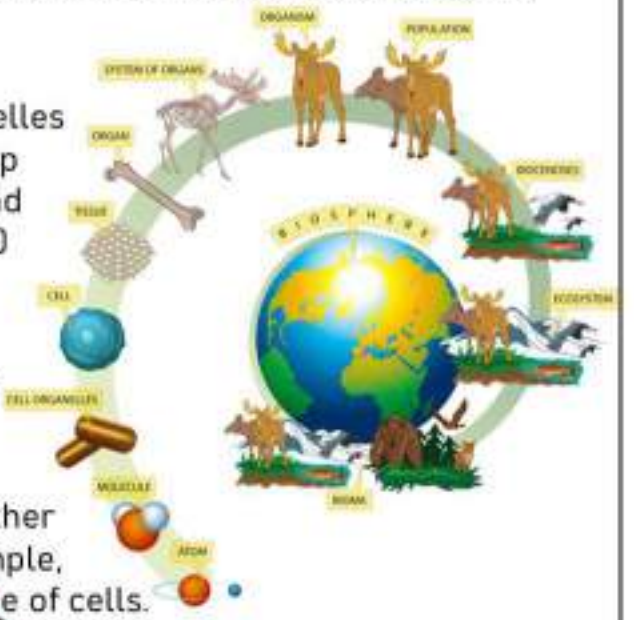
Levels of Organization – Cells, Tissues, Organs

Levels of Organization – Cells, Tissues, Organs, and Organ Systems
There are 4 levels of organization for living things. Starting from the most basic unit of living things to the systems that keep living things alive, there are cells, tissues, organs, and organ systems.



1) Cells
Cells are the most basic unit of life. They have organelles that function to keep the cells alive. Cells are made up of molecules. In a typical human cell, there are around 42 million mo les. Even more, there are around 30 trillion cells man body.

2) Tissue
Tissues ells of the same origin that have ame s tion. Humans have four different typ

- Connective (Bo ue – c ork together to bind the organs bo example, tendons and ligaments a tive t de of cells.
- Epithelial (Skin) Tissue – sh ells xterior surfaces of the body, line the interior cavities and passag ays, glands.
- Nervous (Brain) Tissue – found in the pinal c erves. The cells are excitable, meaning they allow electroch nical sig o c icate to different regions of the body.
- Muscle Tissue – have cells that are also excitabl the ulation and contract to provide movement.

3) Organ
An **organ** is a structure made up of different tissues that work toge c functions for the body.

The heart is made of all four types of tissue. First, it has muscle tissue the cardiac muscle. This muscle contracts when your heart beats. Secondly, The rt also has connective tissue that acts as a thin layer around the heart that provides extra protection. Thirdly, the heart also has nerve endings, which is nervous tissue. These nerve endings communicate with the brain, so the heart and brain are in sync. Lastly, the brain also has epithelial tissue that form a thin layer around the heart.

Examples of organs are lungs, the brain, a muscle, a bone, the liver, and the heart.

4) Organ Systems
An **organ system** is a collection of organs that work together to perform a similar function. Some examples of organ systems are the digestive system, circulatory system, muscular system and the respiratory system. In the digestive system, there are many organs, like the mouth, esophagus, stomach, and the small and large intestines.

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Levels of Organization - Cells, Tissues, Organs

Define What do the terms below mean? Provide examples.

	Definitions	Examples
Cell		
Tissue		
Organ		
Organ System		

Question What is the relationship between ce sues organ systems?

True or False Circle whether the statement is true or false

1) The heart is an organ system	True	False
2) Tissues are a collection of similar cells that have the same function	True	False
3) Organs are made of just one type of tissue	True	False
4) The heart has all four types of tissue	True	False
5) The brain is made primarily of muscle tissue	True	False

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Curriculum Connection
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Levels of Organization - Cells, Tissues, Organs

Directions Circle what the image is in the pictures below

1)

Cell Tissue Organ Organ System

2)

Cell Tissue Organ Organ System

3)

Cell Tissue Organ Organ System

4)

Cell Tissue Organ Organ System

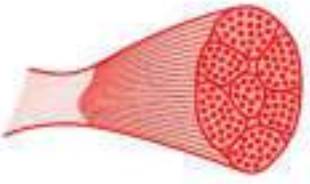
5)

Cell Tissue Organ Organ System

6)

Cell Tissue Organ Organ System

7)



Cell Tissue Organ Organ System

8)

Cell Tissue Organ Organ System

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Technologies - Electron Microscope

Microscopes

Without the use of microscopes, our sight is limited to seeing small things like dust particles, tiny hairs, and a grain of sand. But, if we had electron microscopes for eyes, we'd be able to see things 100 million times smaller! We could see bacteria, viruses, molecules, and even atoms clearly.

Ordinary optical microscopes use light and glass to magnify vision, but we often only see a magnification of up to 1000 times. Electron microscopes are much more powerful, allowing us to see much smaller things.

Electron M

Instead of light, electron **microscopes** use a stream of electrons to bounce off the specimen that is being examined. Unlike light, we are using **photons** that are part of the spectrum so that we can see it.

The problem is that photons are bigger than an electron. A photon is roughly 400–700 nanometres, which means using photons works well to see very small things, like human hair, which is 50–100 micrometres in diameter.

An electron has a wavelength of only 1 nanometre so it is 400–700 times smaller than a photon. Bacteria has a size of 200 nanometres and proteins are just 10 nanometres long. Using the electron microscope means we can see these things in more detail, allowing us to understand their structure and processes.

What We've Learned Using Electron Microscopes

Using the electron microscope has enabled scientists to learn about the structures and processes of organelles inside of cells. Cells can be seen using a regular microscope, but not all organelles are visible. Also, the organelles that can be seen are studied in detail because their size is close to the limit of resolution of the light microscope.

The electron microscope has allowed scientists to learn the complex structures of organelles. In addition, these microscopes can view viruses, bacteria, and even atoms! Atoms are the smallest unit of matter.

Electron microscopes are helping the health care system. Viruses are studied so scientists and health professionals can learn more about them. Moreover, diagnosing cancerous tumors cells can be done using electron microscopes. Having the ability to see our cells close-up gives doctors options to treat patients and keep them healthy.

Disadvantages of Electron Microscopes

There are disadvantages to electron microscopes. First, we cannot view living things, as the specimen needs to be put into a vacuum to be seen and this kills the living specimen. Secondly, we can only see black and white. Third, they are very expensive, so not all hospitals have access to them, causing inequality in healthcare. Lastly, they are large and bulky, so they require a lot of space.

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Curriculum Connection
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Technologies - Electron Microscope

Questions

Use information from the text to support your answer

1) How are electron microscopes different from optical microscopes?

2) How [illegible]scopes helped humanity?

3) What are the disadvantages of electr[illegible]osco[illegible]

True or False

Circle whether the statement is true or false

1) Electron microscopes use a beam of photons	True	False
2) A photon is larger than an electron	True	False
3) Electrons are smaller than bacteria, viruses, and proteins	True	False
4) Photons are smaller than bacteria, viruses, and proteins	True	False
5) We can use an optical microscope to see viruses	True	False
6) Electron microscopes have saved lives	True	False
7) Electron microscopes allow us to see living things close-up	True	False

Name: _____ 64

Curriculum Connection
6

Microscope Experiment - Onion

Background

Information before you begin

Performing the experiment below will allow you to view plant cells under a microscope. A single layer of cell membrane will be stained so that we can see some cell structures, including the nucleus and cell membrane/wall.

Materials

What you will need for the experiment

- ❑ On
- ❑ Knife
- ❑ Glass micros es
- ❑ Cover slides
- ❑ Iodine solution
- ❑ Dropper
- ❑ Microscope
- ❑ Paper towel

Procedure

How you will complete the experimen

1) Set aside a clean microscope slide
2) Cut a small piece of onion so that you have one single layer
3) Carefully peel the thin layer of membrane from the inside of the piece of onion
4) Place the section of membrane carefully on the microscope slide. Try to keep it as flat as possible.
5) Apply 2-3 drops of iodine to the section. Wait 2 minutes before putting the cover slide over the section
6) Place the slide under a 40x magnifying lens. Observe!

Name: _____ 65

Curriculum Connection
6

Microscope Experiment - Onion

Observations

What did you see?

Draw what you see under the microscope. Label the cell wall and the nucleus in your drawing.

Results

Answer the questions below.

1) How many cells did you draw above?

2) What did each cell have?

3) Approximately how many cells do you think are in the small section you were examining?

4) Why can't you see more cell components?

Name: _____ 68

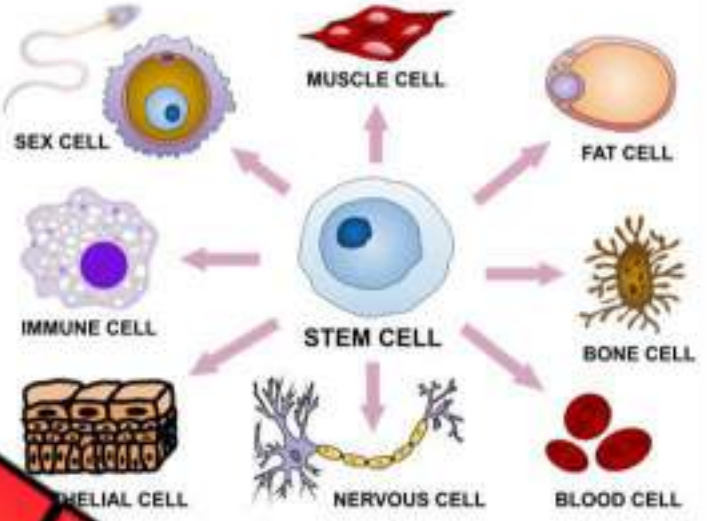
Curriculum Connection
17

Stem Cell Technologies Treating Disease

What Are Stem Cells?

Stem cells are cells that have not differentiated or become specialized. They are special human cells that are able to develop into many different cell types, including muscle cells and brain cells. Stem cells are found within plants and animals. They can renew themselves again and again through cell division.

There are two main types of stem cells: embryonic stem cells and adult stem cells.



Embryonic S…lls

Scientists g…nic stem cells from embryos … mammals. An embryo… …nborn a… …bryonic stem cells are ta…n whe… …ive days old and has only 150… …stem… …will be able to be used … …any c… body.

Adult Stem Cells

Scientist can get adult stem cells … eas… …e have tissues that are constantly forming new cells to replace old ones. The… …s co… …small number of stem cells. When scientists take these stem cells, it is …ved tha… …a… …nly be used to form the organ that it is taken from.

Stem Cells Treating Disease

When someone has a disease, like Alzheimer's disease, th… …ssue i… …brain that is damaged. To treat Alzheimer's, stem cells can be taken s… …sp… …e int… new brain tissue in a laboratory. Once the brain tissue has mature c… …t ca… replace the damaged tissue in the brain.

In 2016, Kristopher Boesen was in a car accident that left him pa…yz… …the neck down. After the incident, Kris could barely breathe due to his injuries, … …e was told he may never move his body again. Doctors gave Kris the options of a stem cell trial, or a surgery that will help his breathing, but not his movement. Kris chose the stem cell option.

Doctors injected Kris with embryonic stem cells into his spinal cord. The plan was for the stem cells to stimulate nerve cell growth and produce blood vessels that would bring oxygen and healing to the injured site.

After just two weeks, Kris could move his arms and hands in small motions. In three months, he was able to write his name with pen and paper and accomplish a good deal of other normal daily tasks. Kris went from being completely paralyzed and immobile to being able to function on his own again.

Stem cells have been used with millions of patients globally. Their rate of effectiveness has been estimated at 82.2%. Their use in healthcare is continuing to grow.

Name: _____ 69

Stem Cell Technologies Treating Disease

Questions

Use information from the text to support your answer

1) What are stem cells? What are the two kinds of stem cells?

2) How [illegible]sed in healthcare?

Questioning

Write 2 questi[illegible] have [illegible]the reading

1)	
2)	

True or False

Circle whether the statement is true or false

1) Adult stem cells can be used to create any type of cell	True	False
2) Embryotic stem cells can be used to create any type of cell	True	False
3) Stem cells are used to form healthy tissue that replaces damaged tissue	True	False
4) Stem cells are helping people with diseases like Alzheimer's disease	True	False
5) The use of stem cells always works in healthcare	True	False
6) Adult stem cells were used to heal Kristopher's spinal cord	True	False
7) Stem cells renew themselves through cell division	True	False

Name: _____ 72

Curriculum Connection
17

Cellular Agriculture - Cultured Meats

What is Cellular Agriculture?

Cellular agriculture is the field of agriculture that produces animal products like meat, dairy and even products like leather, directly from cells instead of raising animals for these exact same products.

Ahmed Khan is the owner of the Canadian non-profit organization named CellAgri. Ahmed sums up the science behind cellular agriculture:

"Instead of raising, let's say – a cow, from birth for the meat, dairy and leather, you take cells and train those cells to produce the same products. One of the products that can be made through cellular agriculture is meat. The way that works is you take a biopsy, a small injection from an animal, say a cow, and from that biopsy there are cells in that called stem cells, and they have the ability to divide into more cells, as well as specialize – becoming different types of cells, like muscle cells and fat cells and other types you find in meat products. Those stem cells are then put into a nutrient formulation, the cell culture media and, at scale – the stems cells and the cell culture media in a large bio-reactor, and the output that would be a cell-cultured product or what I call cell-based meat."

Use of Cell Cultured Meat

As of 2022, lab-grown meat is not for sale in grocery stores in Canada. However, the cultured meat has been approved in Singapore, and is being sold successfully there. Experts believe cell cultured meat will be sold in Canadian stores by 2025, and it could be much sooner than that.

Disadvantages of Cell Cultured Meat

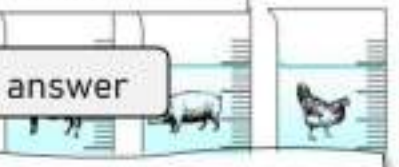
- It is costly to complete the process, which means the meat will be more expensive
- It is very time consuming as the stem cells need time to divide repeatedly to become substantial muscle tissue
- Quality control could be problematic as this is a new technology and the process has not been perfected yet, which means changes to the process could lead to poorer quality meats

Advantages of Cell Cultured Meat

- We will not need to kill animals for human consumption
- It is more sustainable, as livestock farming contributes massive amounts of greenhouse gases that are causing global warming
- Farms take up a lot more space than laboratories. It is estimated that the same amount of meat could be made in laboratories using 1% of the land needed for livestock farming.

Name: _____ 73

Cellular Agriculture - Cultured Meats



Questions

Use information from the text to support your answer

1) What is cellular agriculture and cultured meat?

2) How i[illegible]ade?

Explain

What are the advanta[illegible] disa[illegible]es of cultured meats?

Advantages	[illegible]ges

Name: _____ 74

Curriculum Connection
17

Using Cultured Meats - Multiple Perspectives

When new technologies arise, there are always different opinions on how the technologies will impact society and the environment. Read about the new technologies below and explain what you think the point of view would be of the different groups.

Explain What would be the perspective of each group below?

Cultured meat will be sold in grocery stores in Canada soon.	
An (Pigs, Cows and Chickens)	
Livestock Farmers	
Environmentalist (People who care a lot about the environment)	
Average Person in Canada	

Name: _____ 75

Curriculum Connection
17

Using Stem Cells - Multiple Perspectives

Explain What would be the perspective of each person below?

Stem cell treatments are free for Canadians, but cost us in our taxes. In the USA and around the world, treatments cost people $25,000 per treatment or more.

Sick patie… Cana…	
Sick patients in the USA or in other countries without free healthcare	
People who will never use stem cell treatments and pay high taxes	
People who oppose using Embryotic Cells	

Name: _____ 79

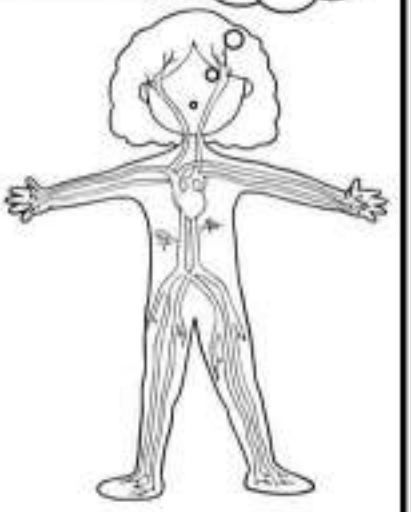
Curriculum Connection
11, 12

Circulatory System

Matching

Write the letter from the description beside the matching term

Colour Me



_____ 1. Arteries	a) Pumps blood throughout the body
_____ 2. Veins	b) Movement of a liquid through a system
_____ 3. Capillaries	c) Carries blood rich in oxygen and nutrients away from the heart to the cells in the body
_____ 4. H	d) Carries blood full of waste materials from the cells to the heart
_____ 5. lation	onnects arteries and veins

Fill in the Bla

Use t ank vocabulary to fill in the blanks below

Wo			
Circulation	Ox	od	Waste
Heart	Veins	Cap	Arteries

1. The movement of blood throughout a system is _____
2. The _____ is the main organ of the circu onsible for circulating the blood.
3. The 3 types of blood vessels are _____, _____ _____.
4. Arteries carry _____ rich blood away from the heart.
5. Our bodies are constantly circulating _____ throughout our body.
6. Veins carry _____ in our blood to our heart.

Question

Answer the question below using evidence from the text

Blood is used to circulate nutrients and oxygen to our bodies. Can you infer how the food we eat affects the nutrients our cells get? What do you think?

_____

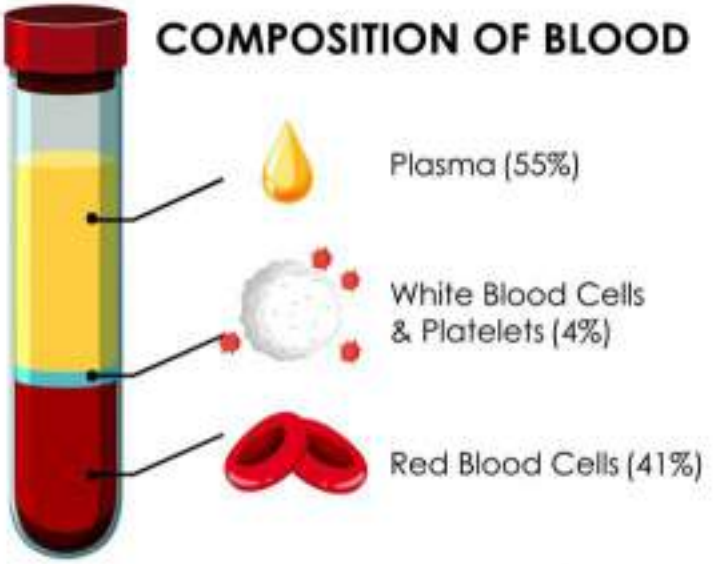
_____

Name: _____ 80

Curriculum Connection
13

Components of our Blood

What are the Components of our Blood?
Our blood is made up of cells and a liquid called plasma. The cells in blood include red blood cells, white blood cells, and platelets.



Red Blood Cells
Red blood cells transport oxygen from the lungs to the body's tissues. They contain the protein hemo[illegible]bin, which binds to oxygen molecules ar[illegible]s them through the bloodstrea[illegible]ll[illegible] and tissues that need the[illegible].

In[illegible]on to ca[illegible]ygen, red blood cells[illegible]so hel[illegible] car[illegible]on dioxide from the[illegible]l[illegible] to thi[illegible]king up carbon dioxide from the tissues and bringing it back to t[illegible], whe[illegible]led.

White Blood Cells
White blood cells are an impo[illegible] of t[illegible] system. They help the body fight infection and disease by attacking [illegible]dest[illegible]ubstances, such as bacteria, viruses, and other invaders.

There are five types of white blood [illegible]neutro[illegible]ym[illegible]cytes, monocytes, basophils, and eosinophils. Their jobs include maki[illegible]odie[illegible]alling our allergic responses, and killing bacteria, viruses, and fungi[illegible].

Platelets
Platelets, also known as thrombocytes, are small, disk-shap[illegible] tha[illegible] im[illegible]rtant part of the blood clotting process. They are produced in the bo[illegible] arr[illegible]ed into the bloodstream when a blood vessel is damaged.

When a blood vessel is damaged, platelets stick to the damaged [illegible]ea[illegible]n a plug to stop the bleeding. They also release chemicals that help to activate other [illegible]eins in the blood, which contribute to the formation of a blood clot.

Platelets are essential for preventing excessive bleeding, but they can also play a role in the development of blood clots that can block a blood vessel and cause a heart attack or stroke.

Plasma
Plasma is the liquid portion of the blood and has several important functions in the body. It is responsible for transporting blood cells, nutrients, hormones, dissolved material, and waste throughout the body. For example, it carries glucose, the main source of energy for the body's cells, to the tissues that need it.

It also helps with blood clotting, and it contains antibodies that fight infection and disease.

Name: _____ 81

Curriculum Connection
13

Components of our Blood

Questions After learning what our blood is made of, what does it do for us?

Paragraph What does each component of our blood do for us?

Red Blood Cells	
White Blood Cells	
Platelets	
Plasma	

True or False Circle whether the statement is true or false

1) Our blood is made up mostly of red blood cells	True	False
2) We have more white blood cells than red blood cells	True	False
3) White blood cells fight infection	True	False
4) Plasma is the liquid part of the blood that is clear	True	False
5) Platelets help with blood clotting, which stops us from bleeding	True	False

Name: _____ 82

Curriculum Connection
15

Lab Experiment - Heart Rate

Research Question

What are we trying to answer?

How many times will your heartbeat in 1 minute when resting, walking, and running? Will there be a big difference?

Hypothesis

Answer the research questions below before you do the experiment

1) How many times do you think your heart will beat in one minute while you are:

Resting: _____ Beats Per Minute (BPM)

Walking: _____ Per Minute (BPM)

Running: _____ Minute (BPM)

2) Will there be a difference between your resting heart rate and your running heart rate? Explain your answer.

_____

_____

Materials

What you will need for the experiment

1) Stopwatch or clock
2) This paper/Writing Utensil
3) Heart rate monitor (optional)

Procedure

Instructions – How to complete the experiment

1) If you do not have a heart rate monitor, you can find your heartbeat by using two fingers on your wrist
2) Count each thump as a beat
3) Find your resting heart rate by sitting in your chair and rest for approximately 1-2 minutes. Then have your partner time 20 seconds while you count the number of beats.
4) Multiply this number by 3 to get your beats per minute. Record this as your resting heart rate.
5) To find your walking heart rate, go walk around at a normal pace for 1 minute. Then have your partner time 20 seconds again while you count the number of beats. You can do this while you are walking, or you can stop to count.
6) To find your running heart rate, complete step number 5, but this time after running for 1 minute.

Name: _____ 83

Curriculum Connection
15

Lab Experiment - Heart Rate

Observations

Fill in the table below as your complete the experiment

Heart Rate Type	What was your heart rate for each type?
Resting Heart Rate	
Walking Heart Rate	
g Heart Rate	

Results

Answ ions now that you have completed the experiment

1) Did anything su ou? W othesis correct?

2) Why do you think your heart rate was when g and lowest when resting?

3) Does everyone have the same heart rate? How do you thi hin (muscle) can help you perform in sports?

4) How can you keep your heart strong and healthy? What are things that you do to exercise your heart? What could you start doing?

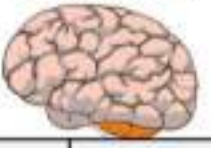
Name: _____ 88

Curriculum Connection 14

Interrelations Between Systems

Interrelations Between Body Systems

None of our life systems work independently on their own. Each system relies on other systems in order to complete the jobs they need to do. Check out some of the relationships between systems below.



Nervous System – Relationship with the Systems Below

Muscular/Skeletal	Digestive	Circulatory
Sends sign[illegible] nerves to our mus[illegible]ey can move[illegible]	Our automatic nervous system controls digestion by making our digestive muscles work (esophagus, intestines)	Our automatic nervous system controls our heartbeat

Skeletal System – R[illegible]wi[illegible]he Systems Below

Muscula[illegible]	[illegible]rvous	Circulatory
Connects with the musc[illegible] system so we can move ou[illegible] bodies	[illegible]ct[illegible]n and [illegible] cor[illegible]	Protects the heart. Bone marrow produces white and red blood cells

Muscular System – Relationship with the [illegible]s Belo[illegible]

Skeletal	Circulat[illegible]	Digestive
Skeletal muscles move our bones. Bones are connected to muscle with tendons.	The heart is a cardi[illegible]asc[illegible] There are also smooth m[illegible] in veins and arteries	[illegible]uscles in the esoph[illegible]tomach, d i[illegible]

Digestive System – Relationship with the Systems Below

Circulatory	Muscular	Sk[illegible]
Provides nutrients for the circulatory system to send to the cells throughout our bodies	Provides nutrients and energy for our muscles (for repair and to do work)	Provides nutrients for bone growth and repair

Respiratory System – Relationship with the Systems Below

Circulatory	Nervous	Muscular
Provides the oxygen that is carried by red blood cells to all cells in the body. Removes carbon dioxide as well.	Provides oxygen to the brain to avoid a stroke	Provides muscles with oxygen and removes carbon dioxide (waste) from muscle

Name: _____ 89

Curriculum Connection
14

Interrelations Between Systems - Questions

True or False

Circle whether the statement is true or false

1) The nervous system has an automatic system that controls things we don't have to think about	True	False
2) The digestive system provides nutrients to the other systems	True	False
3) The respiratory system's only job is to provide oxygen to the other systems	True	False
4) Our life systems can do their jobs without the help from other systems	True	False
5) The skeleta[illegible] protects many of our other systems	True	False

Ques[illegible]

[illegible]formation from the text to support your answer

1. What would ha[illegible] sy[illegible]s if the digestive system stopped working? Be specific?

2. What would happen to other systems if the respi[illegible] sy[illegible] [illegible]rking? Be specific.

Questioning

Write 2 questions you have about the relationship between systems

1)	
2)	

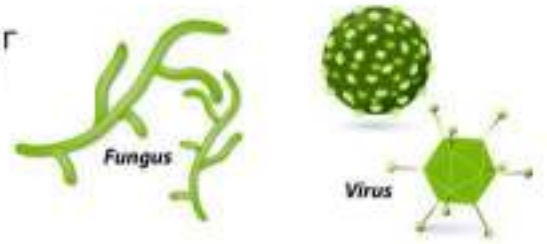
Name: _____ 93

Curriculum Connection
16

Immune System - Fighting Microbes

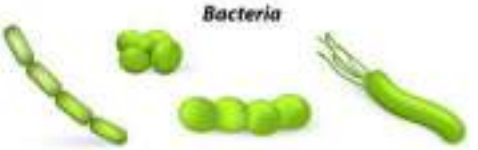
What is Your Immune System?

Being immune means you are protected. That means your bodies **immune system** is designed to fight off infections and sicknesses. The immune system protects us against microbes.



What are Microbes?

Microbes are microorganisms that we cannot see that enter our bodies and cause diseases and illnesses. Microbes live in soil, and in the air. The five main groups of microbes are bacteria, fungi, viruses, algae, and protozoa. Many of the germs we get that cause cold symptoms such as coughs and runny noses are viruses. Bacteria that enter our body.



How Your Immune System Fights

Primary Defense System – Skin, Tears, Gastric Juices, and Cilia

The first line of defence is our skin. Microbes cannot enter our skin unless it is cut. That is why we wash our cuts and keep them clean. Wax, mucus, and saliva are in your nose, mouth, and/or ears. They contain enzymes that break down the cell wall of many bacteria.

Cilia are small hairs lining our windpipe. They move mucus and trapped particles away from our lungs. The particles can be bacteria or harmful substances like dust or smoke. Gastric juices in our stomach will also kill bacteria.

Secondary Defense System – White Blood Cells and Antibodies

If microbes get into our bodies, the second line of defence is activated. There are white blood cells that fight against microbes. **Phagocytes** are a type of white blood cell that chew up invading microbes. **Lymphocytes** are the other type of white blood cells that allow the body to remember and recognize previously invading microbes so they can know how to destroy them.

White blood cells are found in many different places in your body, including your spleen. Your **spleen** is an organ found in your stomach that works to filter blood and fight infections. White blood cells are also found in bone marrow, which is a thick and spongy jelly that is found inside your bones.

Antibodies are proteins produced by the immune system to help fight off infections and other diseases. They are produced in response to the presence of a foreign substance, called an antigen, in the body. When an antigen enters the body, the immune system recognizes it as something that does not belong and triggers the production of antibodies to attack and neutralize it.

Name: _____ 94

Curriculum Connection
16

Immune System - Fighting Microbes - Questions

True or False

Circle the correct answer

1. There are two types of microbes: viruses and bacteria	True	False
2. Many colds we get are from viruses or bacteria	True	False
3. Our immune system protects us from microbes	True	False
4. Our spleen is an organ that filters blood and fights infections	True	False
5. White blood [illegible] are part of your primary defense system	True	False

Questi[illegible] the questions below using evidence from the text

1. How does your [illegible] protect you against microbes?

2. How does your secondary defense system protect [illegible] microbes?

Visualize

What were you visualizing when you were rea[illegible]

Medical Advances - Vaccines and Antibiotics

Vaccines

Vaccines work by helping the body to develop immunity to a particular disease. They do this by introducing a small, harmless dose of a specific virus or bacteria into the body. This triggers the immune system to produce antibodies to fight off the infection.

After the immune system has successfully fought off the infection, it "remembers" how to defend against that particular pathogen in the future. If the pathogen enters the body again, the immune system will recognize it and quickly produce the necessary antibodies to fight it off, protecting the individual from getting sick.

There are several different types of vaccines, including inactivated vaccines, live attenuated vaccines, and subunit vaccines. Inactivated vaccines are made from a killed version of the bacteria, while live attenuated vaccines are made from a weakened version of the virus. Subunit vaccines, on the other hand, contain only a specific part of the pathogen, such as a protein, rather than the whole organism.

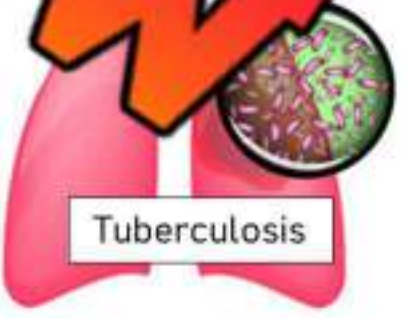
Vaccines are important tools in preventing the spread of infectious diseases and protecting public health. They have been responsible for the eradication of smallpox and the near-eradication of polio and measles, and have reduced the incidence of many other infectious diseases, such as tetanus and rubella.

Antibiotics

Antibiotics are medications that are used to treat infections caused by bacteria. They work by either killing the bacteria or inhibiting their growth, allowing the body's immune system to clear the infection.

There are several different types of antibiotics, each with a specific way to target certain types of bacteria. For example, penicillin antibiotics work by stopping the bacteria's ability to form a cell wall, which is necessary for their survival. Tetracycline antibiotics, on the other hand, inhibit the bacteria's ability to produce proteins, which is also necessary for their growth and reproduction.

It is important to note that antibiotics do not work against infections caused by viruses, such as the common cold or flu. In these cases, antiviral medications may be used instead.



Tuberculosis

Before the discovery of antibiotics, bacterial infections were a leading cause of death. Many common infections that are easily treatable today could once again become serious or even life-threatening. Pneumonia, tuberculosis, and urinary tract infections would once again be deadly diseases.

Since the first vaccine and antibiotics were used, tuberculosis has become a non-existent disease. In Canada in 2022, 0.3 people out of 100,000 people died of tuberculosis. Before vaccines and antibiotics, tuberculosis killed 900 people out of 100,000. These medical advances have lessened the death rate of tuberculosis by a factor of 3000.

Name: _____ 96

Curriculum Connection
17

Medical Advances - Vaccines and Antibiotics

Questions Use information from the text to support your answer

1) How do vaccines work? Why are they important?

2) How do a[illegible]s work? Why are they important?

Explain How wou[illegible] diffe[illegible]out vaccines and antibiotics?

True or False Circle whether the statement is true or false

1) Vaccines have eradicated smallpox	True	False
2) Without antibiotics, diseases like tuberculosis would kill more people	True	False
3) Antibiotics are good at helping people with viruses (viral illnesses)	True	False
4) Inactivated vaccines are made from a killed version of the virus/bacteria	True	False
5) Subunit vaccines are made from a killed version of the virus/bacteria	True	False

Name: _____ 97

Curriculum Connection
18

Common Disease - Stroke

What is a Stroke?

A stroke is sometimes called a "brain attack" as it happens when blood flow to the brain stops, even for just a second. Since blood carries oxygen, a stroke leads to the brain not having oxygen, which causes brain cells to die.

Sometimes a person who had a stroke will have permanent brain damage, which may cause their body to stop working as it should. If a stroke is treated quickly by calling 911 and getting medical attention, the person can have a full recovery with no permanent brain damage.

When to Call

The acrony[illegible] us know when to call 911.

F		Speech	Time
Is it drooping	[illegible] bo	Is it slurred or jumbled?	To call 911 right away

Questions

Use [illegible] to support your answer

1. What is a stroke? What happens [illegible]

2. How do you know if someone is having a stroke?

True or False

Is the statement true or false?

1) A stroke affects the heart mainly	True	False
2) A stroke is a brain organ disease	True	False
3) Kids shouldn't call 911 if they think an adult around them is having a stroke	True	False
4) A stroke happens when the brain doesn't receive oxygen	True	False
5) A stroke always leads to permanent brain damage	True	False

Name: _____ 100

Curriculum Connection
18

Common Disease - Epilepsy

What is Epilepsy?

Epilepsy is one of the most common diseases of the nervous system. **Epilepsy** is a disease that causes seizures because of unusual electrical activity in the brain. Our brains are constantly sending electrical signals that travel through our nerves to the rest of our bodies.

When these electrical signals are interrupted, they can cause a seizure. A seizure will have different results depending on where in the brain the electrical signals fail. Someone with epilepsy may have a seizure that causes them to shake, pass out, fall down, stiffen up or [illegible] into space.

What Caus[illegible]

Seizure[illegible]d most often happen without warning. For some people though, t[illegible]ay hav[illegible]eeling, upset stomach, or a weird smell or taste before a seizure. Most sei[illegible]wee[illegible] seconds to two minutes.

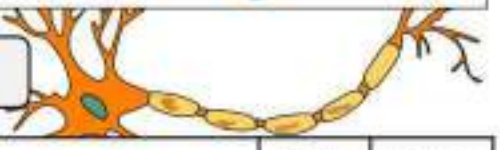
Some peop[illegible]lepsy [illegible]rience seizures when they play too many video g[illegible] or w[illegible]'t get enough sleep.

Questions

Use infor[illegible]m [illegible]pport your answer

1. What is epilepsy? Why do seizures hap[illegible]

2. What does it look like for some people having a seizure?



True or False

Is the statement true or false?

1) Epilepsy is a disease that affects the brain	True	False
2) Epilepsy causes seizures because of failed electrical signals in the brain	True	False
3) Seizures are the same for everyone with epilepsy	True	False
4) Seizures can be caused by video games and not sleeping enough	True	False
5) Seizures usually last 5 minutes	True	False

Name: _____ Date: _____

Unit Test - Cells and Systems

Multiple Choice /10

1) Which is smallest? a) Organs b) Cells c) Tissues d) Organ Syste	2) Cells are... a) Living b) Non-living c) Minerals d) Vitamins
3) Which orga he powerhouse of the cell? a) Cyto b) Vacuole c) Nucleus d) Mitochondria	4) Which organelle is the command centre of the cell? a) Cytoplasm b) Vacuole c) Nucleus d) Mitochondria
5) Which type of solution does ell prefer? a) Isotonic solution b) Hypertonic solution c) Hypotonic solution d) None of the above	h type of solution does a plant cell otoni n b) Hyp c sol c) ic sol d) None
7) In an animal cell, the nucleus is located... a) Near the centre b) On the top c) Near the edge d) On the bottom	8) Vacuoles are .... a) Plant cells b) Stem cells c) Animal Cells d) None of the above
9) Plant cells have which organelle that animal cells do not have a) Cytoplasm b) Nucleus c) Cell wall d) Mitochondria	10) In diffusion, molecules move from areas of ___ concentration to areas of ___ concentration a) High to low b) Low to high c) High to high d) Low to low

Short Answer Questions (2 marks each) /10

1. How does exercise affect our respiratory and circulatory rate?

2. Describe cell theory.

3. What four things make up

4. Describe the primary system of defense our bodies have for

5. Describe the secondary system of defense our bodies have for fighting infection.

Definitions – What does the term mean (1 mark each) /4

Term	Definition (what does it mean)
Cell	
Unicellular Organism	
Cell Tiss	
Organelle	

Label the diagram of the animal cell b ow

Ribosome	plasm	Membrane
Golgi Apparatus	Nucleus	us
Mitochondria	Lysosome	lum

Grade 8 Science

Cluster 2: Optics

	Curriculum Expectations	Pages
1	Use appropriate vocabulary related to their investigations of optics.	9 – 58
2	Differentiate between incandescent and luminescent sources of light.	9 – 10
3	Demonstrate that light is a form of energy, that light travels in a straight line, and can be separated into the visible light spectrum.	7 – 8, 11 – 12, 29 – 30
4	Explain, using the additive theory, how colours are produced, and identify applications of this theory in daily life.	39 – 40
5	Explain how the human eye detects colour, and how the ability to perceive colour may vary from person to person.	31 – 48, 53 – 46
6		
7		
8		
9	Conduct experiments to determine the law of reflection, and provide examples of the use of reflection in daily life	13 – 20
10	Conduct experiments to compare the refraction of light through substances of different densities.	21 – 28
11	Explain how reflection and refraction produce natural phenomena	41 – 44
12	Investigate to determine how light interacts with concave and convex mirrors and lenses, and provide examples of their use in various optical instruments and systems.	47 – 50
13	Demonstrate the formation of images using a double convex lens, and predict the effects of changes in lens position on the size and location of the image.	51 – 52
14	Compare the functional operation of the human eye to that of a camera in focusing an image.	57 – 58

NAME: _____

LIGHT AND OPTICAL SYSTEMS

Name: _____ 9

Curriculum Connection 2

Different Sources of Light

Difference Sources of Light

There are many different sources of light, including natural sources such as the sun and artificial sources such as light bulbs. Some common sources of light include:

The Sun: The sun is the primary source of light on Earth, and it emits a broad spectrum of electromagnetic radiation, including visible light.

Incandescent bulbs: These bulbs produce light by heating a filament wire until it glows. They are relatively inexpensive and easy to produce, but they are also relatively inefficient, as much of the energy they use is converted into heat rather than light.

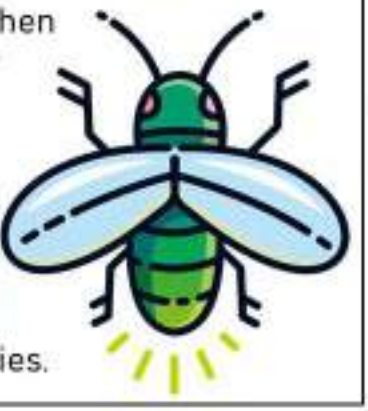
Fluorescent lamps: These lamps produce light through a chemical reaction in which mercury vapor is excited by an electric current, causing it to emit ultraviolet (UV) light. The UV light is then absorbed by a phosphor coating on the inside of the lamp, which fluoresces, or emits visible light.

Neon Lights: These lights produce light through an electrical discharge through a gas, such as neon or argon. The gas molecules emits light as it returns to its normal state.

Light-Emitting Diodes (LEDs): These devices produce light through the movement of electrons in a semiconductor material. They are very efficient and have a long lifespan, making them a popular choice for a wide range of applications.

Phosphorescent Light: Light that continues to be emitted for a short time after the source of energy that caused it to be emitted has been removed. This is known as phosphorescence. Some phosphorescent materials can emit light for hours or even days after the source of energy has been removed. Phosphorescent light is used in a variety of applications, including glow-in-the-dark toys, watch dials, and safety signs

Chemiluminescence: The production of light by chemical means. When certain chemicals are mixed or exposed to certain conditions, they can react with one another in a way that produces light as a byproduct. We see chemiluminescence light used in glow sticks.



Bioluminescence: Is the production of light by living things. Many different types of organisms, including bacteria, fungi, and some animals, are able to produce light through chemical reactions that take place within their bodies. Examples include jellyfish and fireflies.

Name: _____ 10

Curriculum Connection
2

Different Sources of Light

True or False

Circle whether the statement is true or false

1) Fluorescent lights are the most efficient source of lightbulb	True	False
2) LED lightbulbs are the most efficient	True	False
3) Incandescent lightbulbs do not waste energy	True	False
4) Phosphorescent light can continue for hours and even days	True	False
5) Neon lights use gases like neon or argon	True	False

Question

Answer the questions below using evidence from the text

1) Which source of light uses chemical reactions to produce light?

2) Which source of light do living things make? Give examples of living things that emit this type of light.

Making Connection

Which light(s) have you used before? Explain.

Name: _____ 11

Curriculum Connection
3

Visible Light Spectrum

Electromagnetic Waves

The **visible light spectrum** is the segment of the electromagnetic spectrum the human eye can see. It is the range of wavelengths humans can see. Typically, the human eye can detect wavelengths from 380 to 700 nanometres.

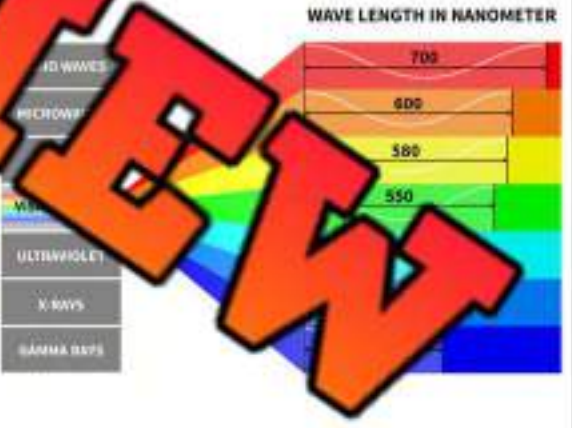
Electromagnetic waves can travel through the emptiness of space, at the speed of light. They ar itted by the electromagnetic radiation that comes from atoms, the building blo matter. Some of the particles that make up atoms have an electric charge ve around. Their motion produces energy that travel as waves.

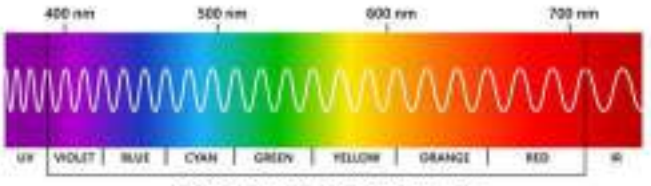
We cannot are emitted by matter. In fact, you are emitting radiation right now. Yo rel frared radiation, which is electromagnetic radiation with a longer wave an vis However, some animals, like mosquitos can see infrared light. for body heat released by humans.

Visible Light Spectrum

When you look around, you likely see matter in co

This is because all material objects emit electromagnetic radiation. The energy is sent in waves through magnetic fields in the form of photons. Each photon has a wavelength and a frequency.





VISIBLE SPECTRUM

There is a visible light spectrum that we can see. Depending on the wavelength of a photon, our eyes will interpret a colour. If the wavelength is around 700 nanometres, the matter will be red. If it is around 600, the matter will be orange. If it is between 600 and 700, the colour will be a reddish orange. Since the electromagnetic waves are a spectrum, there is a continuum of colours that blend together.

Name: _____ 12

Curriculum Connection 3

Visible Light Spectrum

True or False

Circle whether the statement is true or false

1) Humans can only see wavelengths from 380 to 700 nanometres	True	False
2) Mosquitos can see infrared light, which have longer wavelengths than 700	True	False
3) If you see a wavelength of 400, the colour will be yellow	True	False
4) A blue-gre (cyan) colour would have a wavelength around 470 nm	True	False
5) Violet has test wavelength we can see	True	False

Quest

An questions below using evidence from the text

1) What are pho the t what colours we see?

2) How do we see differently than a mosquito? Ex sing ight spectrum.

Colours

Fill in the table showing what colours we would see at the given wavelengths

550	
450	
700	
580	
400	

650	
500	
460	
425	
590	

Name: _____ 13

Curriculum Connection
9

Properties of Light

Four Properties of Light

The properties of light explain how light works and provides us with important information about how we can use light for different purposes.

1. Light Travels in a Straight Path

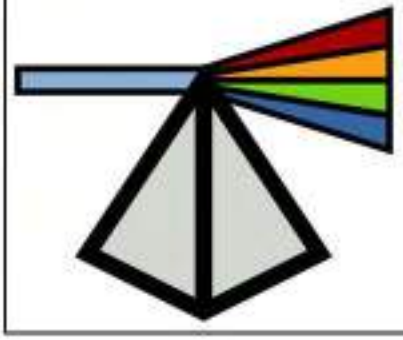
Once light has been produced, it will travel in a straight line[illegible] hits something else. We can witness thi[illegible] by examining a shadow. An object [illegible] so[illegible] n't reach the surface wh[illegible]e we s[illegible]ow[illegible] light could bend, it would go around the object.

2. Light Can Be Abso[illegible]

When light hits an object, it[illegible] es a[illegible], which means the material does not reflect the light. Wood is an exa[illegible] ma[illegible] l absorb light instead of reflect light. When the light waves are absorbed [illegible] erial, [illegible]s the electrons in the light energy are captured by the matter in the object. Dark [illegible]lour[illegible]rb light while lighter colours reflect light.

3. Light Can Be Reflected

Light will reflect off some materials like the Earth. This is why the sky is blue, as the light from the Sun hits the Earth's surface and the blue light is reflected more than the other colours because it travels in shorter, smaller waves. The angle of the light hitting a material affects its ability to bounce off the material.



4. Light Can Be Refracted

When light hits an object, it can sometimes go through the object and bend at an angle. An example of this is when light hits a diamond or water. The light will go through the material and bend out of the other side.

Name: _____ 14

Curriculum Connection
9

Properties of Light

True or False

Circle whether the statement is true or false

1. When light bounces off a material it means it is refracted	True	False
2. Light will reflect off a surface depending on the angle it hits at	True	False
3. Light always travels in a straight path	True	False
4. Light neve[illegible] moving – it continues forever	True	False
5. When ligh[illegible]nd or water, it reflects off the surface	True	False

Questio[illegible]

Ans[illegible]estions below using evidence from the text

1) Which colours ab[illegible]ht ar[illegible]ect it? When would you want to reflect light?

2) What does it mean for light to be refracted? W[illegible]e yo[illegible]n your life?

Visualizing

Draw what you were picturing while you were reading. Explain the picture

Name: _____ 15

Curriculum Connection
9

Experiment - Light Maze

Research Question

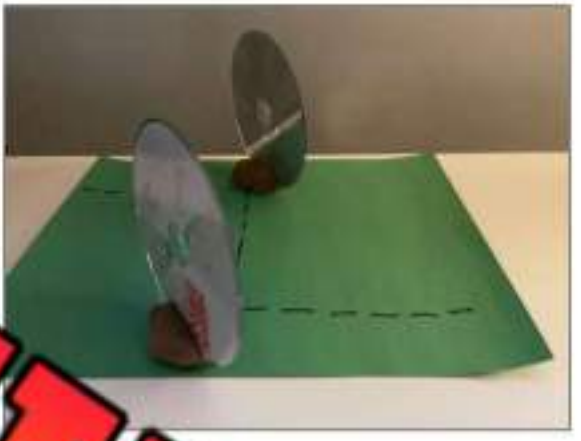
What are we learning more about?

Light travels in straight lines and it reflects on certain materials. Can we reflect light off multiple surfaces?

Materials

What do we need for our experiment?

1) 2 or [illegible]'s or materials th[illegible]
2) Play dough [illegible]old [illegible]mirrors up
3) Marker
4) Paper to draw the maz[illegible]
5) A flashlight



Method

How do we complete the e[illegible]ment?

1) Make a maze using the paper and markers. Make two turns if you have two mirrors and 3 turns if you have 3 mirrors
2) Make a ball of play dough for the mirror to sit in
3) Put the mirrors on the corners of the turns
4) Angle the mirrors so the light will reflect off one another
5) Turn off the lights so you can test your light maze. You might need to adjust the position of your mirrors in order for the light to travel through the maze.

Name: _____ 16

Curriculum Connection
9

Experiment - Light Maze

Observations	What happened?

What happened? Write down what you observed as you tested your mirrors.

Resu[illegible] the questions below

1) Does light bend[illegible] mo[illegible]t bend when it reflects off a surface?

2) Even if you had trouble with your maze, exp[illegible]ny i[illegible]he light maze should work.

3) Draw a diagram of your light maze. Label the mirrors and the beams of light.

Name: _____ 17

Curriculum Connection
9

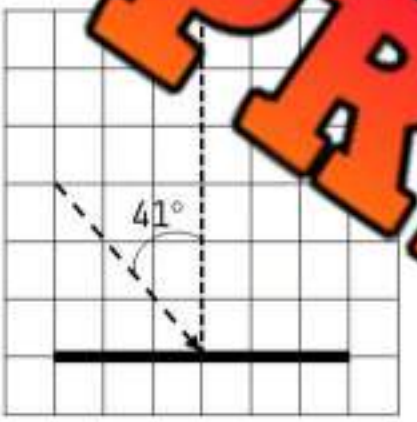
Measuring Reflected Light

How to Measure Reflected Light Rays

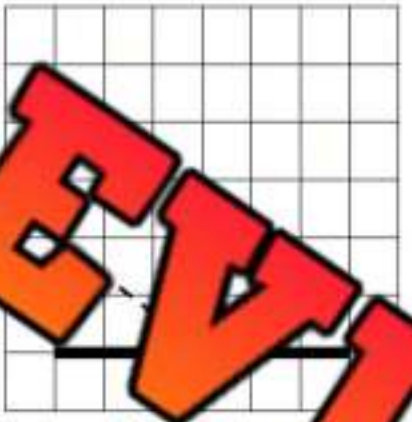
When measuring the angle of a reflected ray, you need to understand the Law of Reflection. The **Law of Reflection** states that the angle of reflection equals the angle of incidence— $\theta r = \theta i$. The **incidence ray** is the ray of light that reflects off a surface. The **reflected ray** is the ray of light that has reflected off the surface. Therefore, if you know the angle of the incidence ray, then you know the angle of the reflected ray.

If you don't know the angle of incidence ray, then you can use the normal line, which is a line that is perpendicular to the surface.

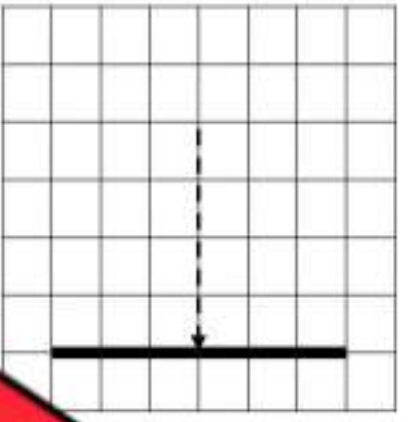
Questions Use a protractor to find the angle of incidence and reflection



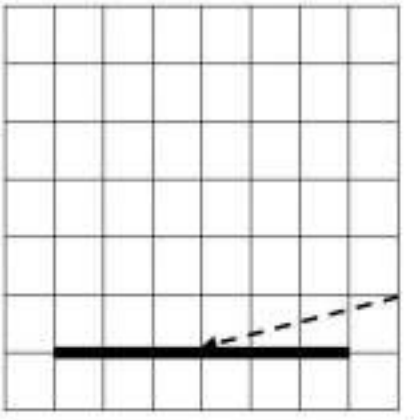
Angle of Incidence	Angle of Reflection



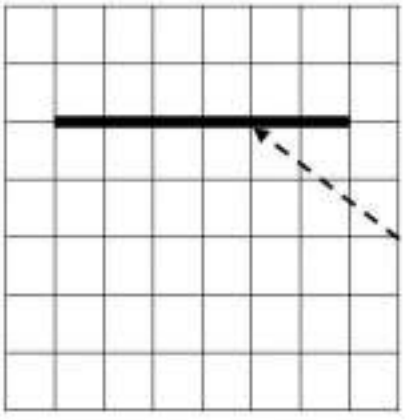
Angle of Incidence	Angle of Reflection



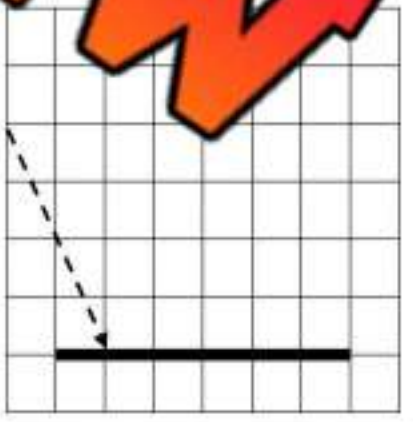
Angle of Incidence	Angle of Reflection



Angle of Incidence	Angle of Reflection



Angle of Incidence	Angle of Reflection



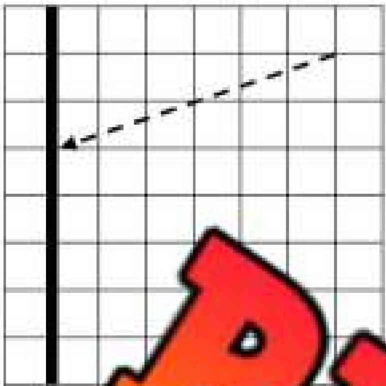
Angle of Incidence	Angle of Reflection

Name: ______________________________ 18

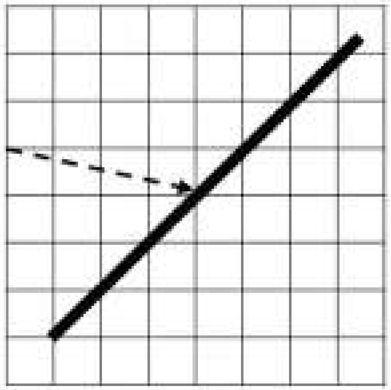
Curriculum Connection
9

Measuring Reflected Light

Questions Use a protractor to find the angle of incidence and reflection



∠ of I	∠ of R



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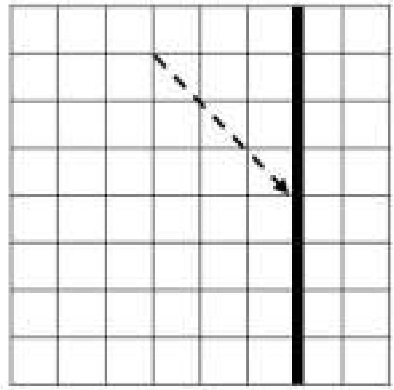

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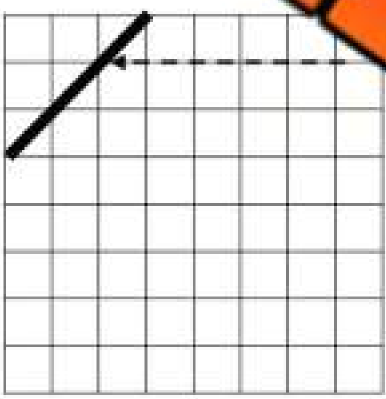
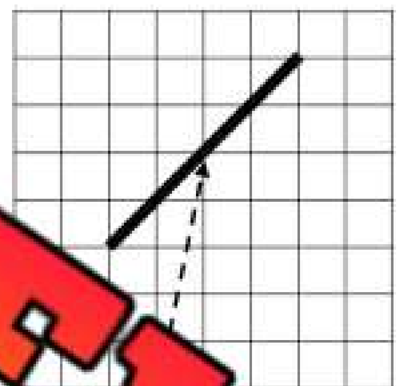
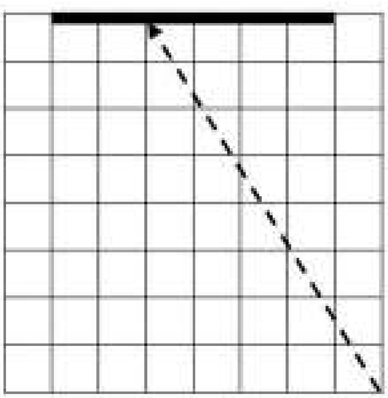


∠ of I	∠ of R

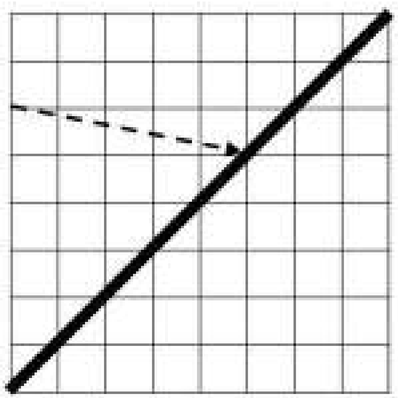
∠ of I	∠ of R



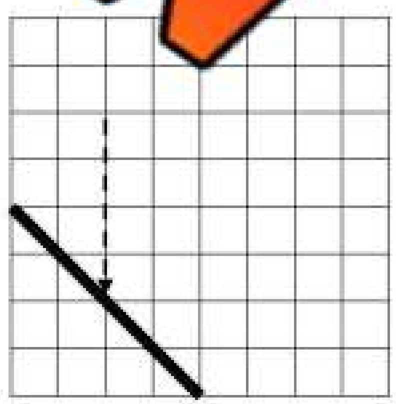
∠ of I	∠ of R



∠ of I	∠ of R



∠ of I	∠ of R



∠ of I	∠ of R

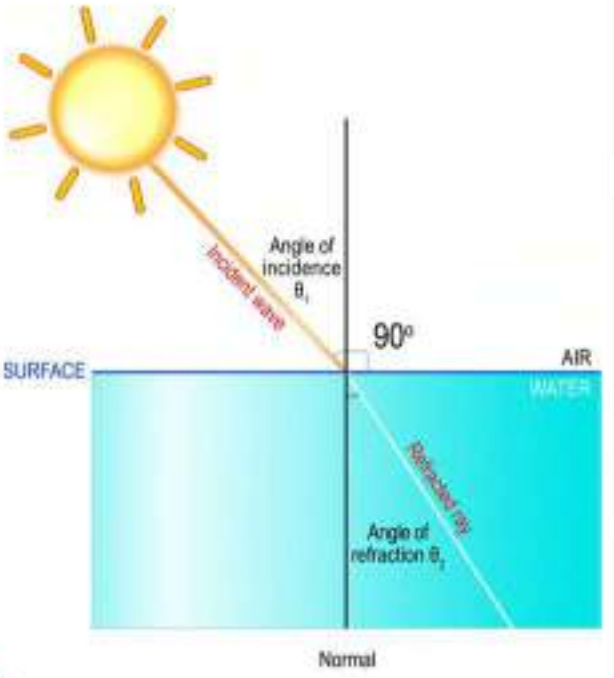
Name: _____ 21

Curriculum Connection
10

Light Refraction

Refraction of Light

Light refraction is the bending of light as it passes from one transparent substance into another. Light refracts whenever it travels at an angle into a new transparent substance because the light changes speed as it enters the new substance. For example, when light travels through air and into water, it slows down, which changes the angle or direction of the light ra



In A ident ray (wave) is trave aight t e air. When it hits the t spare ter it slows down, changing the dir e of y. The new path of the ray is th ed ra

The amount of bending depe

1) Change of speed – Depe e s ht travels through the substances, the bending will be stronger lig n or speed up more.
2) Angle of incident ray – If the light ent ew s e at a greater angle, the amount of refraction will be stronger. e light bstance straight on, there will be no refraction, even though the li slow speed up.

Refractive Index of Transparent Substances

Substance	Refractive Index	Speed of Light in Substance	Angle of acti enters sub
Air	1.00	300	20
Water	1.33	226	14.9
Glass	1.5	200	13.2
Diamond	2.4	125	8.2

Refractive index – A higher refractive index means the light slows down and the light will bend towards the normal line. A lower refractive index means the light speeds up and the light bends away from the normal line. A higher refractive index shows that light will slow down and change direction more as it enters the substance.

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Curriculum Connection
10

Light Refraction

Questions

Answer the questions below using evidence from the text

1) What is light refraction? What causes light to refract?

2) Des... ...n light travels through air and into water. Use the informa... ...om th... ...fraction index and speed to support your answer.

Making Connections

When have yo... ...n lig... ...?

True or False

Circle whether the statement is true or false

1) A higher refractive index means the light slows down	True	False
2) A higher refractive index means the light will change direction more	True	False
3) When light travels through air into a diamond, it speeds up	True	False
4) When light travels through a diamond into water, it speeds up	True	False
5) If light went through glass into water, it would bend towards the normal line	True	False

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Curriculum Connection
10

Experiment - Refracting Light

Research Question

What are we learning more about?

When light passes through a transparent (clear) material, it bends as it comes out the other side. The cause of refraction is because light travels at different speeds in different materials. What will happen to light as it passes through a glass jar with water in it?

Materials

do we need for our experiment?

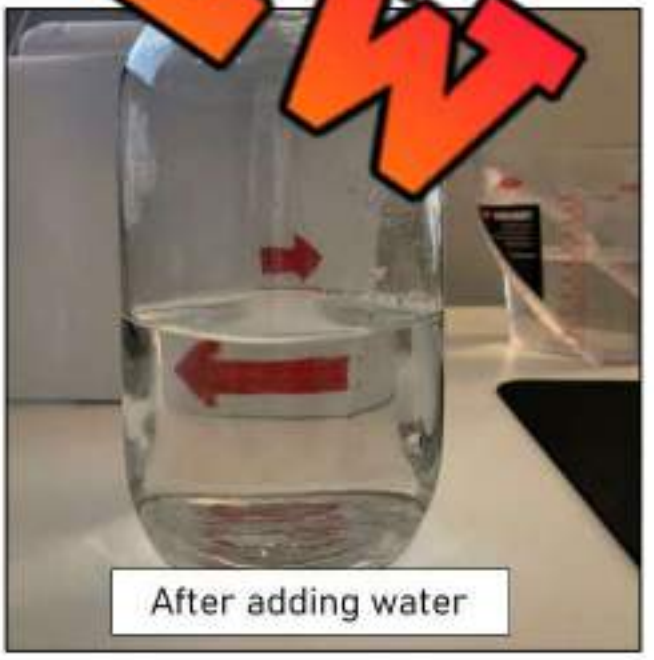
1) G… r – Cir… …ks the best
2) Water
3) Paper with desig…
4) Measuring cup full of wa… …hou… almost fill the jar

…ding water

Method

How do we complete the experim…

1) Get your paper ready with the designs you want to see change. We used red arrows drawn in the same direction.
2) Stand the paper up by leaning it against a wall or a book
3) Place the jar in front of the paper
4) Slowly add the water to the jar. You will might need to rotate the jar to show the effect.
5) Record your observation.



After adding water

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Curriculum Connection
10

Experiment - Refracting Light

Observations	What happened?

What happened? Write down what you observed as you added water.

Results — Answer the questions below

1) What is refraction?

2) Why did the designs move as you added water? Explain the speeds that light travels through each substance.

3) What might happen if you added salt to the water? Do you think the speed of light would travel faster or slower? How would this impact the light refraction?

Name: _____ 25

Curriculum Connection
10

Experiment - Light Refraction Different Substances

Research Question

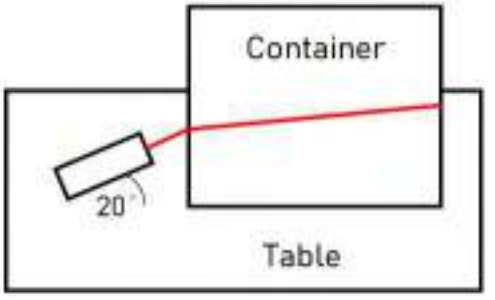
What are we learning more about?

How does light refract differently in water versus saltwater? Does the angle of refraction increase or decrease as you add more salt to the water (stronger concentration of salt)?

Materials

What do we need for our experiment?

1) Laser p
2) Blank
3) S
4) Water 500 m
5) Glass contai erable ectangular
6) Protractor
7) Marker
8) Tape
9) Spoon or something to stir with



Method

How do we complete the experime

1) Fill the container with the amount of water you decided
2) Tape the page to the side of the container
3) In a dark room, point the laser pointer at the container with water. Usi protractor, track the angle you decide to point your laser pointer at. A 2 degree angle will work. The protractor should be flat on the surface you are using.
4) Once the laser hits the water, use a marker to mark the angle at the end of the light ray (where it exists the container of water). You can use any point, but you will need to be consistent when you do your next trials. Mark this spot with a W for water.
5) Add the 500 grams of salt to the container and stir. You will need the salt to dissolve, so you will need to stir until it is a solution (completely mixed).
6) Complete steps 3 and 4 and mark the spot with an S.
7) Measure the angle of the dot using the protractor

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Curriculum Connection
10

Experiment - Light Refraction Different Substances

Observations	What happened?

Angle of Refraction of Water	Angle of Refraction of Saltwater

Resul[illegible]swer the questions below

1) What substa[illegible] tr[illegible]faster through?

2) Did the angle of refracti[illegible]e o[illegible] when you added salt to the water? Explain why this happe[illegible]

3) If you added 1000 grams of salt to the water, what do you predi[illegible] w[illegible]ave happened? Explain.

4) If you added only 250 grams of salt to the water, what do you predict would have happened? Explain.

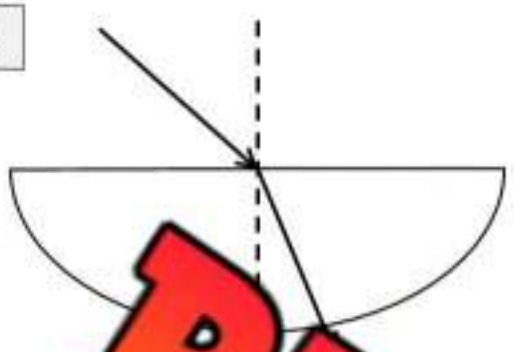
Name: _____ 27

Curriculum Connection
10

Light Refraction - Measuring Angles

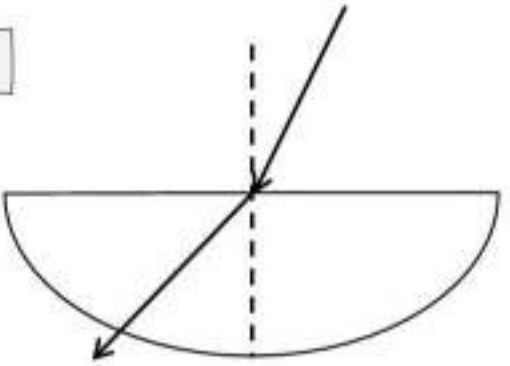
Questions Measure the angles of refraction for the light ray as it enters the glass bowl

1)



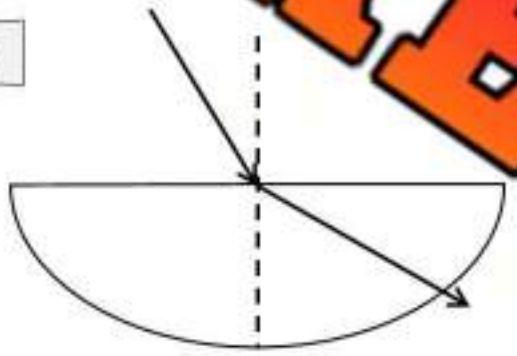
∠ of Incidence	∠ of Refraction

2)



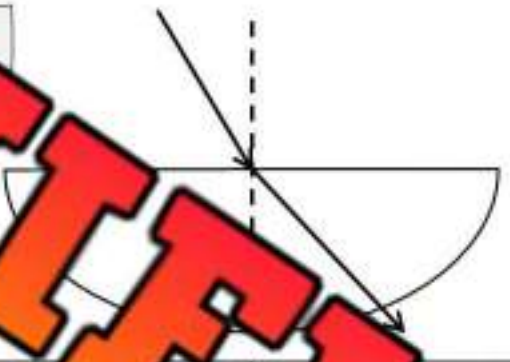
∠ of Incidence	∠ of Refraction

3)



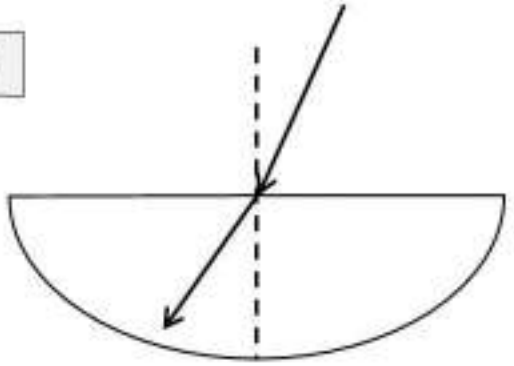
∠ of Incidence	∠ of Refraction

4)



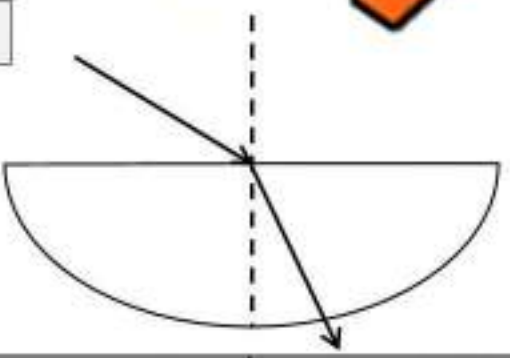
∠ of Incidence	∠ of Refraction

5)



∠ of Incidence	∠ of Refraction

6)



∠ of Incidence	∠ of Refraction

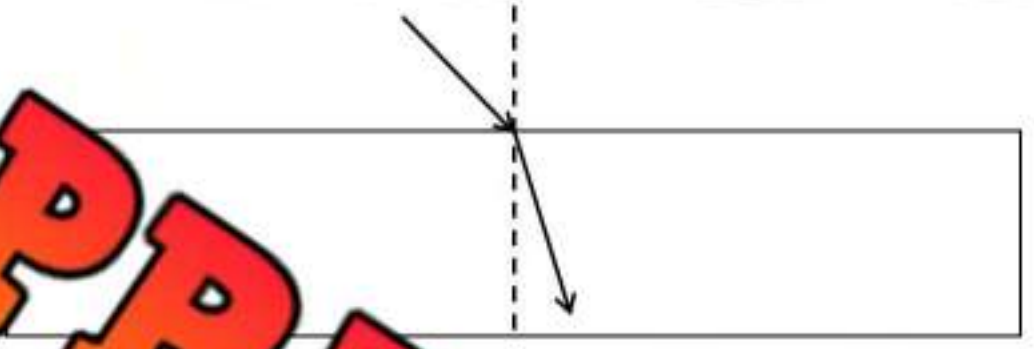
Name: _____ 28

Curriculum Connection
10

Light Refraction - Measuring Angles

Questions	Answer the questions below

1) A ray of light travels through air and refracts into water. A diagram is shown that represents the ray of light.



1) What is the ang cide	
2) What is the angle of re	
3) Did the light speed up or slow down ent water?	

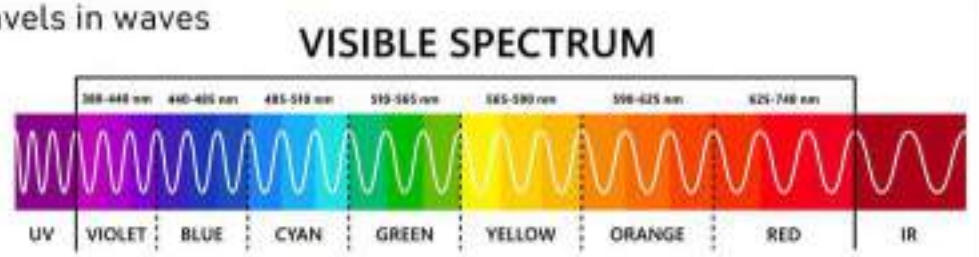
2) A ray of light travels through the air and re into a diagram like the one above using the measurements shown be

1) What is the angle of incidence?	52
2) What is the angle of refraction?	30
3) Did the light speed up or slow down when it went in the water?	

Coherent vs Incoherent Light

Frequency, Wavelength and Phase

We have learned that light travels in waves that differ in frequency, wavelength, and phase.



Frequency – The number of waves that pass a point in space during a time interval.

Wavelength means less frequency as the waves are longer, so there are less frequency of waves passing a point.

Phase – We use phase to compare two or more waves. Two waves will have the same phase if they have the same frequency and wavelength. If the two waves are offset, meaning one happens before the other, there is a phase difference.

Coherent vs Incoherent Light

Coherent light is a beam of photons that have the same frequency and are all at the same frequency. The wavelengths are also in phase, meaning they happen at the same time. Coherent light does not spread out or diffuse. The waves travel together, which produces a straight beam of light that does not light up the room, rather it can be seen where its beam is reflected.

Incoherent light is light from normal sources, like a flashlight or a lightbulb. It is made up of waves with different frequencies, wavelengths, and phase. The result is not a beam of light, but rather light that will diffuse and spread out, lighting up a room (if the source is strong enough).

What are Lasers?

Lasers generate coherent light in many wavelengths, both visible and invisible, depending on the type of lasers. The coherent light produced by lasers can make them very useful, and dangerous at the same time.

The coherent light produced by lasers can damage skin and eyes. Depending on the wavelength, the beam of light can penetrate the epidermis of skin. They can also damage the retina by shooting a powerful light current into the eye. The eye's protective blink reflex is not fast enough to shut out the laser beam. In fact, laser eye surgery uses a laser with a wavelength of 193 nm to cut a thin layer of corneal tissue that corrects eye issues.

Name: _____ 30

Curriculum Connection 3

Coherent vs Incoherent Light

Compare

Fill in the table to compare coherent and incoherent light

	Coherent Light	Incoherent Light
Describe the wavelengths, frequency and phase		
Give examples of both types		
Draw coherent and incoherent light waves		

Making Connections

Describe a coherent light source you have seen

True or False

Circle whether the statement is true or false

1) Coherent light has the same wavelength, frequency and phase	True	False
2) Incoherent light is used in laser eye surgery	True	False
3) A long wavelength results in a high frequency	True	False
4) A high frequency results in a short wavelength	True	False
5) Laser eye surgery uses a laser with a wavelength of 193 nm (ultraviolet)	True	False

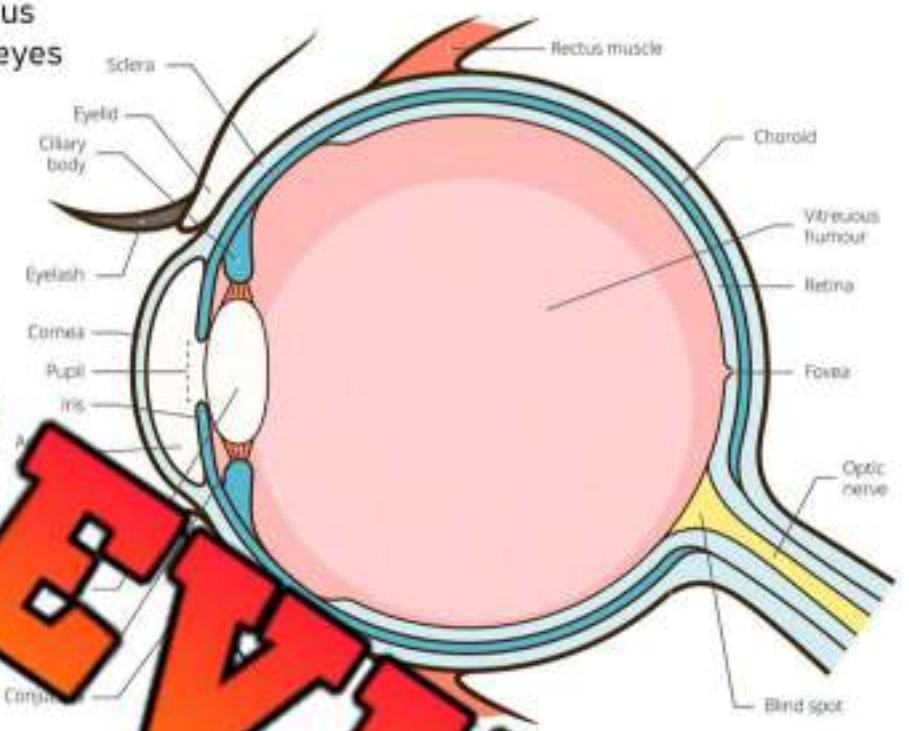
Name: _____ 31

Curriculum Connection
5

Vision

How Do Our Eyes Work?

The different parts of our eyes work together with our brain to allow us to see the world around us. The eyes work in the following steps.



1) Light passes through the cornea. The cornea is shaped like a dome and bends light to help the eye focus.

2) Some of the light enters the eye through an opening called the pupil. The iris is the colored part of your eye. It controls how much light passes through. The pupil automatically gets bigger or smaller, depending on the intensity of the light.

3) From there, the light hits the lens. The lens is a structure behind the eye. It is responsible for bending and focusing the light so we see a clear image.

   At this point, the light has been bent twice as it moved from the cornea to the lens, and from the lens to the retina. This double bending has flipped the image upside down!

4) The light now passes through a jelly-like substance called the vitreous humour. This substance keeps our eyes round in shape.

5) Lastly, the light reaches the retina. The retina is the light-sensitive nerve layer that lines the back of the eye. The retina has special cells called photoreceptors that turn the light into electrical signals. The photoreceptors are made of rods and cones that are responsible for transforming the light rays into electrical impulses.

6) These electrical signals now travel from the retina through the optic nerve to the brain. The brain takes these signals and turns them into the images we see. Your brain takes the upside-down images from both eyes and turns it right-side up.

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Curriculum Connection
5

Vision

Explain What is the function of each part of the eye?

Term	Function – What It Does
Cornea	
Pupil	
[illegible]	
Retina	
Optic Nerve	
Brain	

Summarize How do the eyes work? Provide a [illegible]

Name: _____ 33

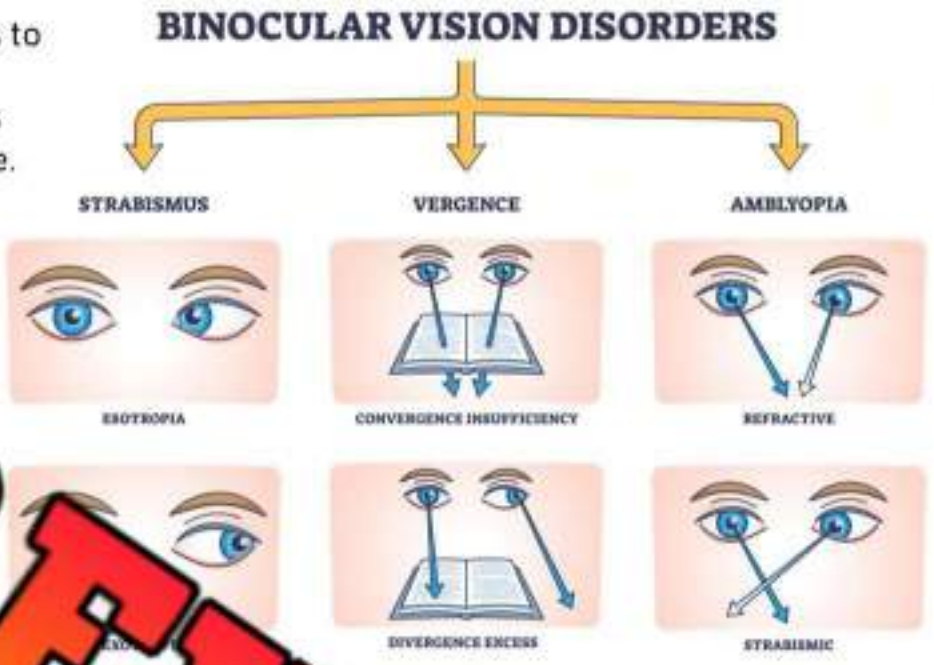
Curriculum Connection
5

Binocular Vision

Binocular Vision

The term **binocular vision** refers to the way the two eyes work together to put together images seen by each eye into one image. Both the left and right eye have their own line of vision. Having two ey[illegible] separated on our face a[illegible]s to see in three-dim[illegible]nd also gives us th[illegible] depth p[illegible]

Whe[illegible]r eye[illegible] work together as[illegible] is hard for the brai[illegible] produce a single, clea[illegible]e of our surroundings. **Binocu[illegible] vision dysfunction (BVD)** is wh[illegible]s h[illegible]nment errors.



Strabismus (Crossed Eyes) – Caused by w[illegible]cles that move our eyes. The result is a cross-eyed look as the person [illegible]lign t[illegible] in the same direction at the same time. Symptoms are eyes that don't l[illegible] in the [illegible] dire[illegible]t the same time or eyes that don't move together.

Vergence – To see an object close to us, our eyes co[illegible]r. To see objects further away, our eyes diverge or rotate away fro[illegible]her. V[illegible]e eye movements means the eyes do not rotate properly, which lea[illegible]sue[illegible] nearby or far away. Symptoms of vergence are blurred vision, ey[illegible]fatig[illegible]s.

Amblyopia (Lazy Eye) – A type of poor vision that usually happens in j[illegible]o[illegible] Symptoms are an eye that wanders inward or outward. It develops when on[illegible] becomes weaker than the other during childhood. The brain favours the better eye, allowing the weaker eye to get worse over time.

Depth Perception

We have two eyes that allow us to see the world around us. Our eyes work together, allowing us to see three-dimensional images and giving us depth perception. **Depth perception** is the ability to see things in three dimensions (including length, width and depth), and to judge how far away an object is.

Our eyes are set about 6 cm apart, allowing each eye to see slightly different images. This difference is called **binocular disparity**. The brain combines the clear images from each eye and processes the two images as a single, 3-D image. This is called **stereopsis**.

Name: _____ 34

Curriculum Connection
5

Binocular Vision

Question What is binocular vision? How does it allow us to see 3-D images?

Defin ...at do the terms below mean?

Term	...finition – What Does The Term Mean?
Binocular Vision Dysfunction	
Strabismus	
Vergence	
Amblyopia	
Depth Perception	
Binocular Disparity	
Stereopsis	

Name: _____ 35

Curriculum Connection
5

White Light

White Light

Did you know that all of the colours we can see come from white light? **White light** is defined as the complete mixture of all of the wavelengths that are visible to us.

Think about it, we can see many things in our environment because of the natural light coming from the sun. It is only sunlight allow us to see different colours, not just white light. The reason is because that white light is made up of all the colours mixed together.

How Do We See Colour

When the sunlight shines on a tomato, the part of the sunlight is reflected off the tomato while all the other colours are absorbed and soaked into the tomato, which is why we don't see them.

The same goes for a brown book. Light from sunlight or lightbulbs begins its journey as white, but is reflected in different colours.

So why is a tomato red and why is that book brown? It's because of the atoms inside each object. A tomato is red because when the light shines on the tomato's skin, the atoms inside the tomato get excited and produce photons.

Photons are a form of energy that our eyes can see as light. Our eyes are complex devices that figure out what colour different photons are. That is why some people see different colours and why some people can't see certain colours. It's because some people's eyes don't process certain photons the same way other people do.

Name: _____ 36

Curriculum Connection
5

White Light

True or False

Circle whether the statement is true or false

1. All the colours we can see come from white light	True	False
2. Sunlight comes in more than one colour, not just white	True	False
3. We see colour because our eyes can see photons in objects	True	False
4. Everyone s olour the same way because our eyes all work the same	True	False
5. All light s it light as white light, not coloured light	True	False

Questio

Ans estions below using evidence from the text

1) What is white ligh

2) Why is a tomato red and not blue?

Summarize

Summarize the reading by writing the important information

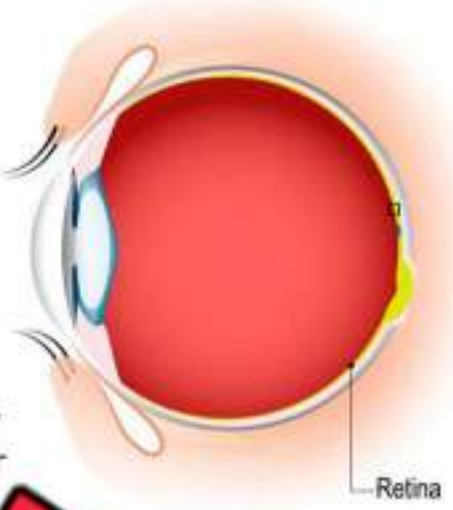
Name: _____ 37

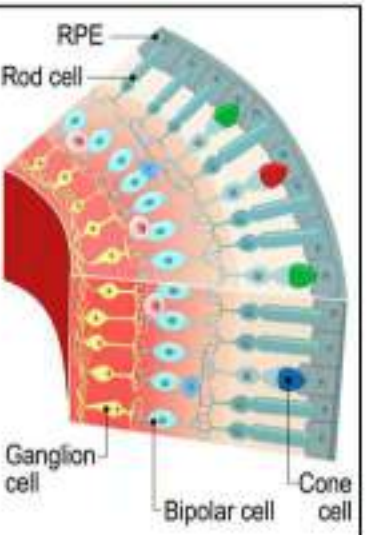
Curriculum Connection 5

Cones and Rods

What are Cones and Rods?

The back of the eye is lined with a thin layer called the retina. The retina has photoreceptors that detect light and convert the light into electrical signals that the brain can process. There are two types of photoreceptors: rods and cones.





Rods

The rod very low leve ght. W for night vision becaus ll amount of light (acti od. Rods do not help with colour vision. This is why at night, we see hing i We do not see colour because rods only work in low light environmen colour. One eye has over 100 million rod cells.

Cones

Cones need a lot more light than rods. The d to lour. We have three types of cones – blue, green, and red. The human e only nes, which is far less than the number of rods we have.

How Do Cones Help Us See Colour?

Since rods only allow us to see in low light, cones are re for se lour. The three types of cones are red, green, and blue.

Most of our cones are red cones (64%), while about a thir e gr About 2% of our cones are blue.

Each type of cone responds to different wavelengths of light. If the wa th is long, the red cones will be stimulated. Short wavelengths stimulate blue co hile medium wavelengths stimulate green cones. If the wavelengths are in between, more than one type of cone will be stimulated and you will see a different colour.

Example

When light hits a banana, some of the light is absorbed and some is reflected. For a ripe banana, wavelengths of about 570 nanometres are sent to the cones. The cones are stimulated in varying degrees, producing a yellow colour.

Cones – Humans and Other Animals

Humans are better at figuring out colours than most other mammals. However, birds and fish have four types of cones, allowing them to see ultraviolet light, which is light with wavelengths shorter than what the human eye can perceive.

Name: _____ 38

Curriculum Connection
5

Cones and Rods

Questions

Answer the questions below using evidence from the text

1) What is the difference between cones and rods?

2) How [illegible] ee?

Questioning

Write 2 que[illegible]ns you [illegible]ab[illegible]be reading

1)	
2)	

True or False

Circle whether the statement is true or false

1) Cones allow us to see in the dark	True	False
2) Rods are only activated in low light environments	True	False
3) We have many more cones than rods	True	False
4) Birds and fish have more types of cones than humans do	True	False
5) Most of our cones are blue	True	False

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Curriculum Connection
4, 6

Additive and Subtractive Theories

Additive and Subtractive Theory of Seeing Light

Both the additive theory of seeing color and the subtractive theory of seeing color are correct in their own way and are used to explain different aspects of how we perceive color.

The Additive Theory

Cameras, te[illegible]ns, phones, and computer monitors use the additiv[illegible]odel. It describes how light produces colour[illegible]urs are red, green, and blue. These[illegible]re ref[illegible]RGB.

Additive co[illegible]s as bl[illegible]dds red, green, and blue to ma[illegible]colour is added, we see a lighter co[illegible]all [illegible]urs are combined equally, we see white light.

Digital devices that use the additiv[illegible]et have[illegible]or blue elements that are activated by an electrical charge. These eleme[illegible]call[illegible]xels. When they are activated by the charge, they glow. By combinin[illegible]th[illegible]orrect colour is created in one pixel. The pixels are then put together to[illegible]nictu[illegible]ormal computer monitor is 1920 by 1080, which means there are 2,07[illegible]00 p[illegible]

The Subtractive Theory

The subtractive colour theory is used in printing and painting. The subtractive colours are cyan, yellow, magenta, and black – also known as CMYK. Subtractive colour starts with white and ends with black, as colour is added.

Printers use cyan, magenta, and yellow inks in different percentages to control the amount of red, green, and blue light reflected from the white paper. If you add equal amounts of cyan, yellow, and magenta, you will produce black.

Name: _____ 40

Curriculum Connection
4, 6

Additive and Subtractive Theories

Questions

Answer the questions below using evidence from the text

1) When is the additive theory used and when is the subtractive theory used?

2) What ... ween the two theories?

Diagram

Draw diagram... two ... low

RGB	

True or False

Circle whether the statement is true or false

1) The additive theory uses red, green, and blue	True	False
2) The subtractive theory uses red, green, and blue	True	False
3) The subtractive theory starts with white	True	False
4) The additive theory states that adding colour makes the colour lighter	True	False
5) Adding equal amounts of cyan, yellow, and magenta will make white	True	False

Name: _____ 41

Curriculum Connection
11

Optical Illusions

What is an Optical Illusion?
An **optical illusion** is when we see something differently than what actually exists. Illusions trick us into perceiving something else is there when it is not. Our brain interprets the signals from our senses (eyesight), but sometimes our nervous system makes mistakes in those interpretations.

Why Do Optical Illusions Happen?
An **optical illusion** is caused by how the brain and the structure of the eye work together. The lens of the eyeball focuses the light back onto the retina, where rods and cones are affected by th velength of the light. The information about the light that entered the eye travels throu tic nerve, where it is interpreted by the brain. The brain uses our memory to the light so we know what we're seeing. Sometimes our brain makes rpreting the raw data from the eye. Our brain can be tricked by certa s of im e.

What d e?

When y uick age, your brain is tricked into seeing the line his ve see movement even though the ima not mo alled a **physiological illusion** because our brai cessi ulated to deceive us to see movement.

What do you see?

At first glance, we see a normal elephant. Then we notice that the feet are in the wrong places. This is a **literal illusion** as we see an image that is different than what is there.

What do you see?

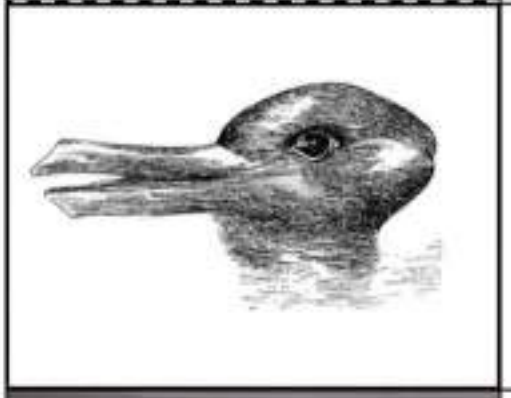
Some will see reversible figures (person looking at another person), while others will see a vase. This is a **cognitive illusion** as different people see different things. Our brain and our own thinking determine what we see!

Name: _____ 42

Curriculum Connection
11

Optical Illusions

Activity Fill in the table below about the following optical illusions

Image	What do you see?	What type of optical illusion is it? Why?
	Hint: Young or Old Lady?	
		
	Hint: Duck or Rabbit?	
		

Name: _____ 45

Curriculum Connection
7, 8

Technologies Using Electromagnetic Radiation

How is Electromagnetic Radiation Used?

Electromagnetic radiation, also known as EM radiation, is a type of energy that travels through the air or through space at the speed of light. It is a form of energy that is emitted by charged particles, such as electrons, and is characterized by its wavelength and frequency.

Electromagnetic radiation encompasses a wide range of wavelengths and frequencies, including radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays.

There are ma hnologies that use electromagnetic radiation, including:

Radio and t dcasting: Radio and television broadcasting uses EM radiation in the form nsmit audio and video signals over long distances.

Wireless c munica logies such as cell phones, Wi-Fi, and Bluetooth use EM radiation in the f wav ansmit data wirelessly.

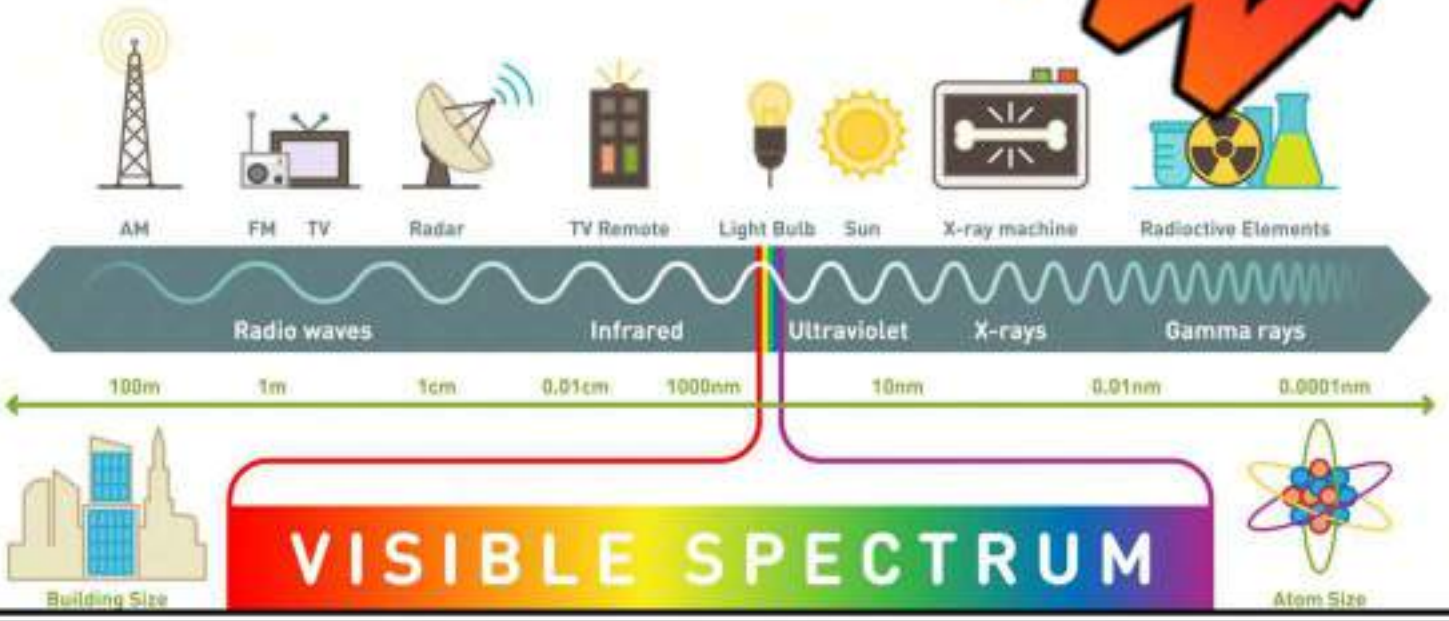
Radar: Radar uses EM tion f radio waves to detect the presence and distance of objects.

Medical imaging: Medical imag olo X-rays and CT scans use EM radiation in the form of X-rays to p uce f the inside of the body.

Solar power: Solar panels use EM radiati e form to generate electricity.

Cooking: Microwave ovens use EM radiation in the f mic cook and heat food.

Lighting: Some types of lighting, such as fluorescent lamp t-em iodes (LEDs), use EM radiation to produce light.



Name: _____ 46

Curriculum Connection
8

Technologies Using Electromagnetic Radiation

Explain Which technologies use the different wavelengths shown below

Radio Waves	
Infrared	
Ultraviolet	
X-Rays	

True or False Circle whether the statement is true or false

1) Radio waves are as long as buildings	True	False
2) X-rays have long wavelengths	True	False
3) Infrared wavelengths are too long for our eyes to see	True	False
4) Gamma rays have short wavelengths with high frequencies	True	False
5) CT scans use X-ray wavelengths	True	False
6) TV remotes use infrared wavelengths	True	False
7) We can see radio waves because they are long	True	False

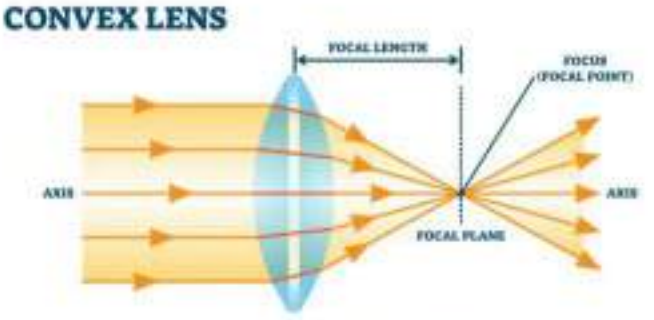
Concave vs Convex Lenses

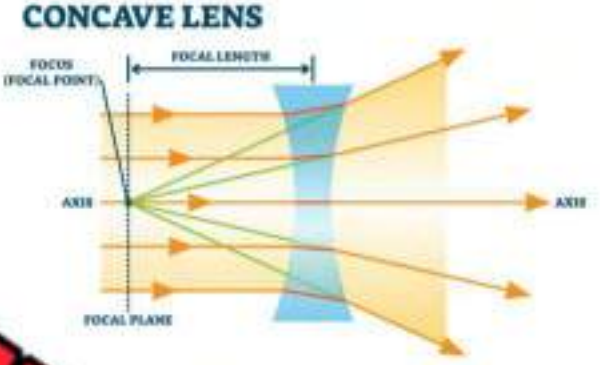
What are Lenses?

A **lens** is a transmissive optical device that focuses or disperses a light beam by refraction. When the light beam passes through a lens, it either converges and focuses the light in a smaller area, or it disperses the light beam, spreading it out.

When the light passes through the lens, its direction c[illegible]ges because of refraction. Depending o[illegible]e of lens, the light will either conc[illegible]a smaller focus point, or dispe[illegible]

L[illegible] are usee[illegible] optical devices, inc[illegible]ding gl[illegible]oscopes, telescopes, and c[illegible]a.





Concave Lenses

A **concave lens** is thicker a[illegible]es than in middle. When light transmits t[illegible]ens[illegible]ccurs and the angle the light travels changes. The incident rays c[illegible]erge[illegible]ay from the normal line.

The image formed is an upright and [illegible]sized[illegible] of the object. Therefore, concave lenses are used to treat near-sigh[illegible]ness (sh[illegible]ight[illegible]ss). Someone who is **near-sighted** can see objects nearby clearly, but ob[illegible]urthe[illegible]ok blurry.

Rays from distant objects need to spread ou[illegible]re th[illegible]ns. Using concave lenses diverges the light rays, allowing them [illegible]bef[illegible]enter the eye. This helps near-sighted people see objects that are fa[illegible]y. To[illegible]se the refraction of light, thicker lenses are worn.

Convex Lens

A **convex lens** is thinner at the sides and thicker in the middle. They work by[illegible]cting light inward, towards a focal point. Convex lenses are used to correct farsighted vision, where someone can not see nearby objects clearly, but can see objects far away clearly.

Convex lenses converge the incident rays towards the axis. This means the rays bend towards each other, allowing them to meet on the other side of the lens. This magnifies objects, making them look larger.

A magnifying glass uses convex lenses to magnify an object. Eyeglasses with convex lenses solve long-sightedness by bending the light ray that shortens the focal length, and thus, properly focusing the light ray on the retina.

Microscopes also use convex lenses. In fact, modern microscopes use more than just one set of lenses. They have an objective lens that sits near the object and an ocular lens that sits closer to the user's eye. Using a system with more than one lens is called a compound lens. It allows for stronger magnification – 40x or more.

Name: _____ 48

Curriculum Connection
12

Concave vs Convex Lenses

Compare Fill in the table below by answering the questions

Questions	Concave	Convex
1) Appearance – What do the lenses look like?		
2) Does [illegible] converge or disperse		
3) What type of sight issues does the lens fix?		
4) What are these glasses used for?		
5) Draw a picture of both lenses.		

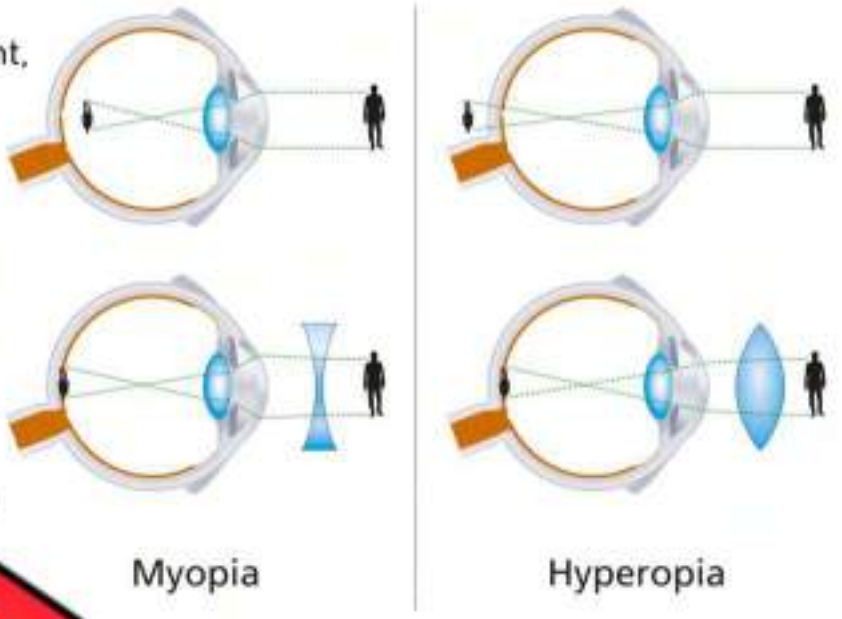
True or False Circle whether the statement is true or false

1) Concave lenses are thicker on the outside and thinner in the middle	True	False
2) Convex lenses correct near-sightedness	True	False
3) Convex lenses are used in magnifying glasses	True	False
4) Concave lenses are used to make images large	True	False
5) Concave lenses help people with far-sightedness issues	True	False

Using Convex and Concave Lenses

Use of Concave Lenses

Concave lenses are used to diverge light, which means they cause light rays to spread out after passing through the lens. This can be useful in a variety of applications, including:



Correcting vision problems: Concave lens[illegible]re often used in eyeglasses t[illegible]t myopia, also known as n[illegible]s. As you can see [illegible]ncave lens div[illegible]the ligh[illegible]ns. The light spread[illegible]out so[illegible]t r[illegible] can focus directl[illegible]a.

Projecting images: Co[illegible]len[illegible]to project images onto a screen or other surface. The lens diverges [illegible]om the [illegible]source, such as a slide projector or movie projector, and the imag[illegible]focu[illegible]screen.

Lighting: Concave lenses can be used to s[illegible]t fr[illegible]ource, such as a flashlight or car headlight, over a wider area. This can [illegible]ful in a[illegible]o[illegible]where a wide beam of light is needed, such as in floodlights or searchlights.

Use of Convex Lenses

Convex lenses are used in the following technologies:

Correcting vision problems: Convex lenses are often used in ey[illegible]sses farsightedness (hyperopia). The lens converges the light through the l[illegible] focus directly on the retina.

Imaging and optics: Convex lenses are used in cameras, telescopes, and other optical instruments to focus light and form images. The lens converges the light from the object being viewed, and the image is then focused onto a film or electronic sensor.

Medical equipment: Convex lenses are used in medical devices such as endoscopes, which are used to visualize the inside of the body. The lens converges the light from the object being viewed, and the image is then transmitted to a display or video monitor.

Laser technology: Convex lenses are used to focus laser beams in a variety of applications, including laser cutting, welding, and marking. The lens converges the laser beam to a small, highly focused spot, which allows the laser to cut or vaporize materials with high precision.

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Curriculum Connection
12

Using Convex and Concave Lenses

Questions Answer the questions below using evidence from the text

1) Why do people use concave lenses in their glasses? How does it help them?

2) Why do p convex lenses in their glasses? How does it help them?

Diagram Draw diagrams e ssing t convex and concave lenses in a technology. Draw a co nd a projector for concave lenses.

Concave Lens – Movie Projector	v Lens – Laser

True or False Circle whether the statement is true or false

1) Convex lenses diverge light	True	False
2) Concave lenses converge light by spreading the light out	True	False
3) Cameras use convex lenses to focus the light on the electronic sensor	True	False
4) Flashlights use convex lenses	True	False
5) Concave lenses fix nearsightedness issues	True	False

Adjusting the Magnification

Adjusting the Magnification of an Image

The magnification of an image formed by a lens is determined by the ratio of the size of the image to the size of the object.

The magnification can be increased by:

- ☑ Moving the lens closer to the object
- ☑ Using a lens with a shorter focal length
- ☑ Using a [illegible] with a larger diameter

Converse[illegible]tion can be decreased by:

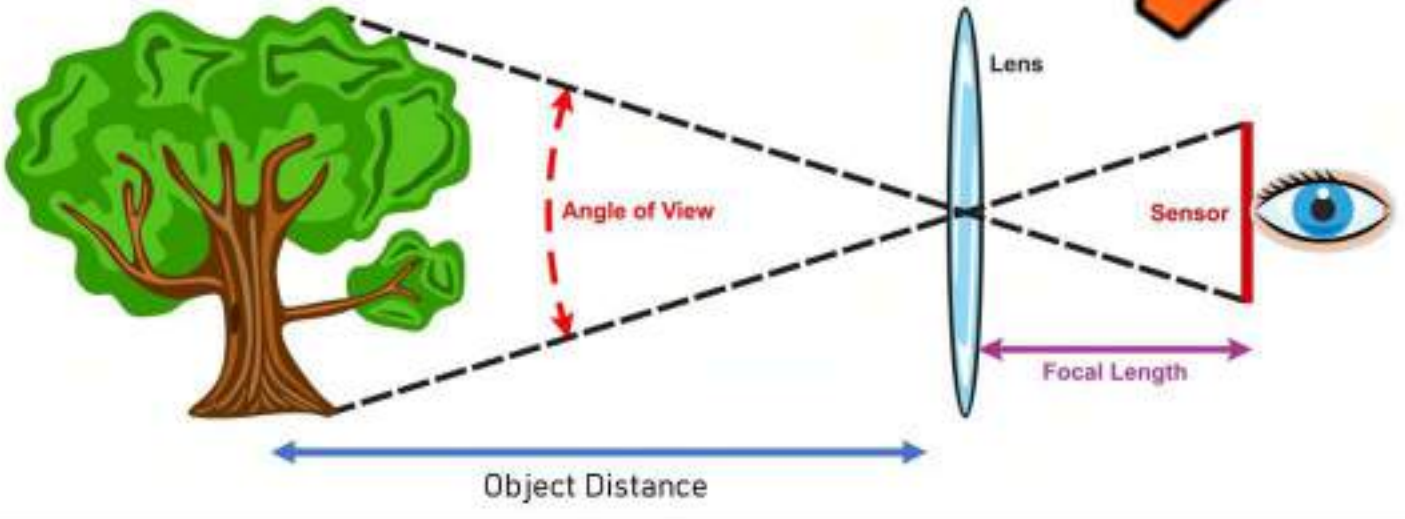
- ☑ Mo[illegible] from the object
- ☑ Using [illegible] focal length
- ☑ Using a len[illegible] ter.

If you are using a len[illegible]th, the magnification will be determined by the object [illegible] As th[illegible] distance increases, the magnification will decrease.

If you are using a lens with a vari[illegible] you can adjust the focal length to change the magnification. In[illegible]ng the [illegible]th will decrease the magnification, while decreasing the focal length [illegible]ncre[illegible] magnification.

The size of the lens will also affect the m[illegible]icati[illegible] lens will have a greater ability to gather light and form a large[illegible] [illegible]lt in a higher magnification. A smaller lens will have a lowe[illegible] to ga[illegible]ght and form a smaller image, which will result in a lower magni[illegible]n.

Focal Length and Angle of View



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Curriculum Connection
13

Adjusting the Magnification

Questions

Answer the questions below using evidence from the text

1) If you are using a magnifying glass to see something up close, how will you position your eye, the magnifying glass, and the object so that you maximize the magnification?

2) How do[illegible] lens affect the magnification it produces?

Draw

Draw a diagram of a ma[illegible]gla[illegible] an object with a strong magnification and a weak m[illegible]nific[illegible] [illegible]ject, magnifying glass, and eye

Strong Magnification	Wea[illegible]ification

True or False

Circle whether the statement is true or false

1) The closer the lens is to the object, the weaker the magnification	True	False
2) The longer the focal length, the weaker the magnification	True	False
3) If your eye is far away from a magnifying glass, the focal length is long	True	False
4) A larger magnifying glass can gather more light, increasing the magnification	True	False
5) The angle of view is smaller if you are closer to the magnifying glass	True	False

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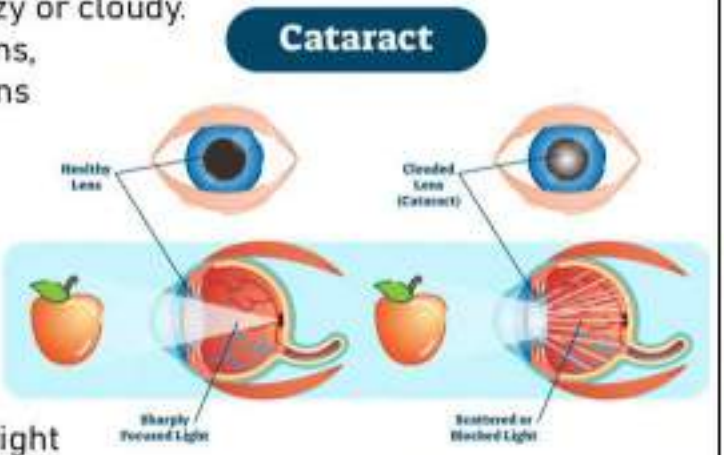
Curriculum Connection
5

Light Technologies - LASIK and Cataracts

What are Cataracts?

A **cataract** is a cloudy area in the lens of your eye. They develop when aging or injury changes the tissue that makes up the eye's lens. Proteins and fibres that make up the lens get broken down, causing vision to become hazy or cloudy.

When light passes through the cloudy lens, the light gets scattered or blocked, which means it cannot be focussed on the retina.



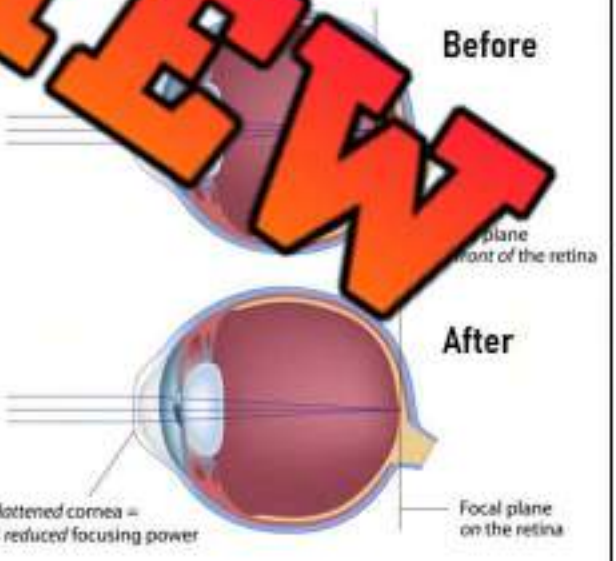
Symptoms of cataracts include:

- Blurred vision
- Colours appear dull
- You need more light to read
- You see halos around lights
- You see double
- Lamps, sunlight, or headlights are too bright

Cataract Surgery

To solve cataract issues, surgery is the best treatment. Cataract surgery is quick, lasting about 15 minutes. The following are the steps:

1) A small incision (cut) about 2 mm is made in the cornea and lens capsule. This can be done using a handheld device or with a computer-guided laser.
2) The clouded lens will be suctioned out. This means the cataract is removed and the eye now has no lens to focus the light.
3) The doctor then inserts a small, rolled-up lens that will slowly and gently unfold in your eye. The new artificial lens will restore your vision.



LASIK

To correct refractive errors leading to nearsightedness or farsightedness, LASIK surgery is a common procedure. LASIK corrects the corneal shape that causes these refractive errors so that light can focus directly on the retina. You can see in the diagram that the cornea in the before image extends out further. This causes the light to focus in front of the retina and not on the retina.

LASIK uses a laser beam to reshape parts of your cornea. The patient is first given eye-drop anaesthesia. Next, the eye surgeon cuts a flap in the cornea. Then the surgeon uses a laser to reshape the cornea, pulsing the laser to cut tiny parts of the cornea. Once it is the proper shape, the flap is released back down to the eye, where it naturally adheres.

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Curriculum Connection
5

Light Technologies - LASIK and Cataracts

Questions

Answer the questions below using evidence from the text

1) What are cataracts? How are they fixed by surgery?

2) What [illegible] surgery fix? How is the surgery performed.

Making Connections

Do you know [illegible] either surgery? Explain their vision [illegible] recovery time.

True or False

Circle whether the statement is true or false

1) Cataracts are cloudy spots on the lens in an eye	True	False
2) LASIK corrects issues with misshaped corneas	True	False
3) If your cornea is extends out too far, light will not focus on the retina	True	False
4) Cataract surgery takes 2 hours to complete	True	False
5) Surgeons do all eye surgeries using their hands and cutting tools	True	False

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Curriculum Connection
5

Assignment - Optical Systems in Animals

Choose an animal with unique eyesight. Create an infographic that teaches the reader about how the animal's vision works. Examples of animals with unique eyesight are listed below.

Dragonflies	Geckos	Reindeer	Four-eyed Fish	Ostrich	Mosquitos

Research Answer the questions below to find information for your infographic

1) Which anim[illegible]id you choose?

2) How [illegible]na[illegible]/rite a step-by-step explanation. Summarize the steps by only inclu[illegible]the im[illegible]rmation. Remember, this is a poster, so there should not be too much text.

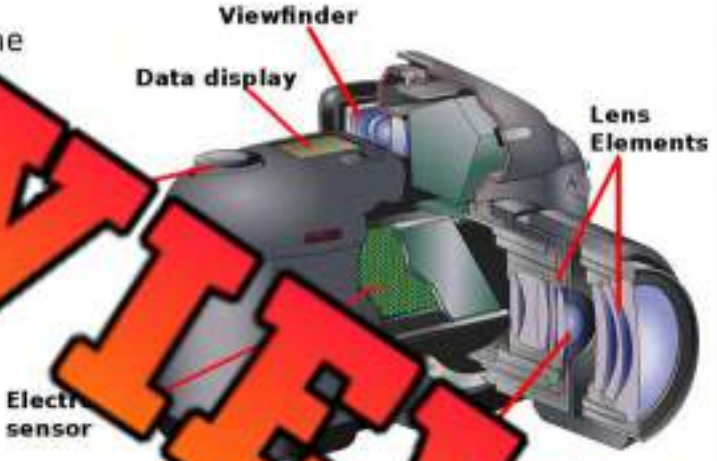
3) What is unique about your animal's vision? (ex. night vision, ability to see different wavelengths – UV or infrared, extra eye, etc.)

Comparing Eyes And Cameras

Comparing Our Eyes and Cameras

Cameras have the ability to see the world around us, and capture it in still photos or videos. Our eyes work with our brain to produce a running video of our environment. Many of the parts in our eyes are replicated in cameras. Check out some examples below.

- The cornea in your eye is like the front lens element of a lens on a camera. The cornea works with the lens of your eye to focus the light, providing clear images. The lens of a camera also allow the camera to focus the image, making pictures clearer.
- Your iris and pupil act like the aperture of a camera. On a camera, the aperture is an adjustable hole that allows light in so that it can pass through the lens. Our eyes have an iris that determines how much light will pass through the pupil and through the lens. The iris and pupil are holes. The iris is what changes the size of the hole. Cameras have an iris, which is a ring around the outside of the camera lens that you use to change the aperture.
- The retina is the layer of tissue at the back of your eyes. It is like the film in a camera. The retina has millions of receptor nerves that change the light into electrical impulses. These impulses are sent through the optic nerve and into the brain. With a camera, the film records the image. On a digital camera, the imaging sensor chip records the picture so that it can be accessed digitally as a file.



Differences

- Eyes cannot record an image, while cameras can
- The human eye is much more complicated than a camera. Since it works with the brain, it is constantly changing and adjusting to ensure we see things correctly. We don't need to do anything, our eyes and brain know how to work in harmony to create a clear image. Cameras are different. They need to be adjusted to focus the image and to allow the correct amount of light into the lens. This is why some photos we take are blurry, while we always see clear images.
- A camera sees in 2 dimensions while the eye sees in 3 dimensions. When we see with our eyes, we see height, width, and depth. With a camera, we only see height and width. In a flat picture taken by a camera, there is no way to have depth.
- Eyes have blinds spots called scotoma, but cameras do not
- Eyes can adjust to see in the dark in a few seconds. Most cameras cannot operate in the dark.

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Curriculum Connection
14

Comparing Eyes And Cameras

Compare How are the parts below the same

Parts	How Are The Parts The Same?
Cornea and Front Lens	
Pupil/Iris - Aper	
Retina and Film	

Compare How are eye different?

True or False Circle whether the statement is true or false

1) A camera is a much more complex system than our eyes	True	False
2) Our eyes are more accurate in their adjustments than cameras	True	False
3) Our eyes will adjust to the dark, allowing us to see a bit better	True	False
4) Cameras print in 3-D while our eyes only see in 2-D	True	False
5) Our eyes cannot print images, while cameras can	True	False

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Activities - Optics

Word Search

Find the word bank words in the puzzle!

Word Bank

- ❑ Light
- ❑ Optical
- ❑ System
- ❑ Microscope
- ❑ Beam
- ❑ Laser
- ❑ Refraction
- ❑ Reflection
- ❑ Absorb
- ❑ Materials
- ❑ Diverge
- ❑ Converge
- ❑ Coherent
- ❑ Transmit
- ❑ Convex
- ❑ Concave
- ❑ Magnified

Word Scramble

Unscramble the word bank words from above

OELNTRIFCE		YSSETM	
IPMECCOSRO		FRACINORTE	
ASLRE		THLGI	
CALOTIP		REGOVENC	
MITANTRS		AMBE	
NECTOREH		NEOVCCA	

Name: _____ Date: _____

Unit Test - Optics

Multiple Choice /10

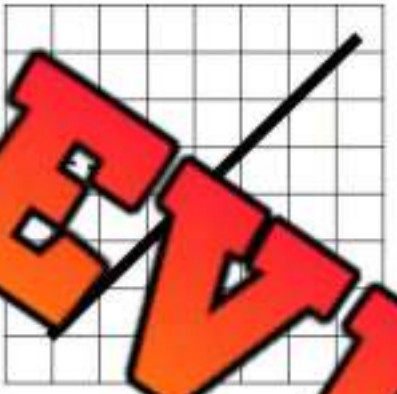
1) Typically, humans can see what range of wavelength? a) 100 – 200 nm b) 240 – 620 nm c) 380 – 700 nm 4) 450 – 920 nm	2) When light bends as it transmits through a new substance, it is called... a) Reflection b) Refraction c) Transmission d) Absorption
3) If you are b… …oundproof room, you want materi… a) Reflec… b) Refract light c) Transmit light d) Absorb light	4) Light from the sun travels in which colour? a) White b) Red c) Blue …Black
5) The additive colour model usi… colours? a) Red, Green, Orange b) Magenta, Cyan, Yellow, Black c) Red, Yellow, Green d) Red, Green, Blue	…ubstance does light travel fastest in? …Water b) Gla… c) Di… d) Air
7) A laser provides which type of light? a) Coherent light b) Incoherent light c) Red light d) Black light	8) Which eye par… …ole… a) Retina b) Iris c) Pupil d) Cornea
9) Which photoreceptors do you have more of? a) Rods b) Retina c) Cones d) Lenses	10) Which lens is used to make objects appear larger? a) Concave b) Optical c) Element d) Convex

Definitions (1 marks each) /2

Term	Definition (what does it mean)
Binocular Vision	
Refraction	

Questions Use a protractor to find the angle of incidence and reflection

∠ of I	∠ of R



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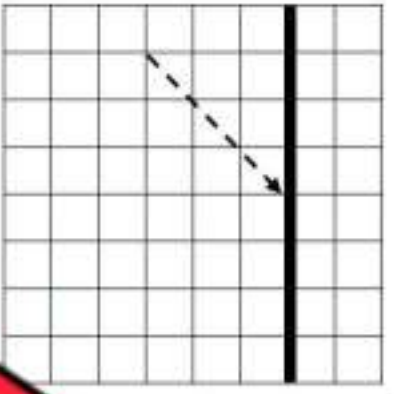


	∠ of R

Short Answer Questions (3 marks each) /6

1. What is the difference between rods and cones?

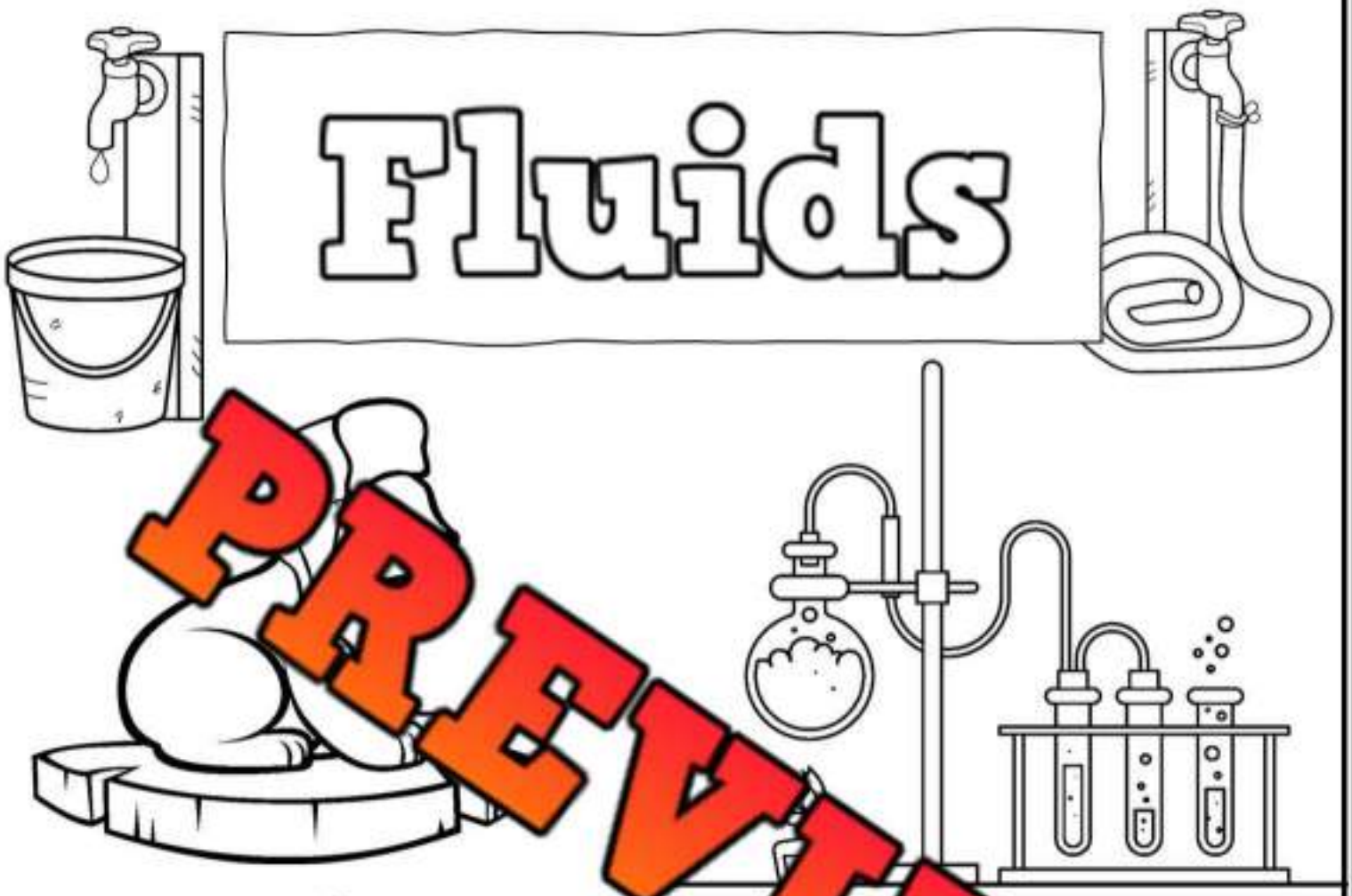
2. Why do we see rainbows?

Grade 8 Science Unit
Cluster 3: Fluids

	Curriculum Expectations	Pages
1	Use appropriate vocabulary related to their investigations of fluids.	7 - 83
2	Distinguish between fluids and non-fluids	7
3	Explore and compare the viscosity of various liquids.	8 – 9, 15 – 17
4	Identify products in which viscosity is an important property, and evaluate different brands of the same product, using the design process.	10 – 14
5	Plan and conduct experiments to determine factors that affect flow within a given system	18 – 21
6	Measure, calculate, and compare densities of solids, liquids, and	22 – 35
7		
8		
9		
10	Explain, using the particle theory of matter, the relationships among pressure, volume, and temperature of liquid and gaseous fluids	52 – 55
11	Compare the relative compressibility of water and air, and relate this property to their ability to transmit force in hydraulic and pneumatic systems	56 – 57
12	Identify a variety of natural and constructed hydraulic and pneumatic systems and describe how they function.	56 – 59, 62 – 67, 76 - 81
13	Compare hydraulic and pneumatic systems, and identify advantages and disadvantages of each	58 – 59, 66 – 67, 82 - 83
14	Use the design process to construct a prototype that uses a pneumatic or hydraulic system to perform a given task.	60 – 61

NAME: _____

Fluids



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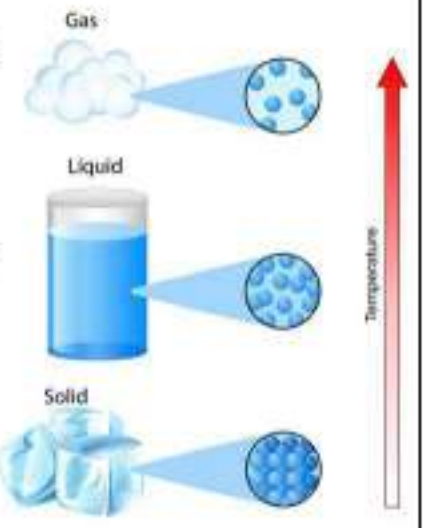
Curriculum Connection
2

What is a Fluid?

What is a Fluid?

A **fluid** is a substance that is either a liquid or a gas that can flow. Fluids take the shape of their container because they flow and spread out easily. Water, a liquid is a fluid because it flows and takes the shape of its container, often a cup or bottle to drink from. Helium is a gas that is also a fluid, as it flows to fill its container. A helium tank will have helium gas inside that spreads throughout the container. If we open the valve to the tank, the helium gas will flow to fill the container, or space it is in.



Solids are not fluids because solids cannot flow. Solids have a definite volume because the particles that make up a solid are held closely together. This means that if a solid remains tightly packed particles will keep its volume the same.

A liquid has a definite volume but does not have a definite shape. This means that 200mL of water in a cup will have a volume if you pour that water into a new cup even though the shape of the water will be different if the shape of the cup is different.

Fluid or Not?

Circle yes if the item is a fluid and no if it isn't

1) Honey	Yes	No
2) Blood	Yes	No
3) Toothpaste	Yes	No
4) Cement	Yes	No
5) One grain of sand	Yes	No
6) [illegible]	Yes	No
7) [illegible]	Yes	No
8) Ketchup	Yes	No
9) Brick	[illegible]	[illegible]
10) Wood	[illegible]	No

Examples

Write your own examples of fluids and non-fluids

Fluids	Non-Fluids

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Curriculum Connection
3

Understanding Viscosity

What is Viscosity?

Viscosity is a measure of a fluid's resistance to flow. A fluid with a high viscosity will resist flow more than a fluid with a low viscosity. For example, honey is more viscous than water as it pours slower than water does.

A more complete definition of viscosity includes a fluid's internal friction. In a highly viscous fluid, the properties of the fluid create more internal friction, which means the fluid does not flow as well. Inside honey, the particles create more friction as they rub against each other, causing the honey to flow slowly.

Examples of fluids with high viscosities are molasses, olive oil, peanut butter, and maple syrup. Examples of fluids with low viscosities are air, water, gasoline, and milk.

Factors Affecting Viscosity

There are four factors that affect the viscosity of fluids. Each of the fluids listed above will be affected by these factors, changing their viscosity.

1) **Temperature** – The viscosity of liquids decreases by about 2% for each degree Celsius increase in temperature. This means the higher the temperature of a liquid, the less viscous it is. For example, hot olive oil in a pan is much less viscous than cold olive oil. For a gas, the opposite. If we heat a gas, it will become more viscous.

2) **Pressure** – If we increase the pressure of a fluid, we change its viscosity. Liquids cannot be compressed, but gases can. When a gas is compressed, the increased pressure increases the viscosity of the gas.

3) **Suspended Particles** – A fluid with suspended particles in it will have a higher viscosity. For example, spoiled milk has a higher viscosity than fresh milk because it has suspended particles in it.

4) **Chemical Composition** – The chemical makeup of a fluid will affect its viscosity. Fluids with large molecules flow faster, meaning they are less viscous than fluids with small molecules.

Measuring Viscosity

We can measure the viscosity of a fluid by determining its volumetric flow rate. The **volumetric flow rate** is the volume of a fluid passing a point in a system per unit time. In other words, we are measuring the movement of a fluid through a device over time. A fluid with a fast flow rate will have a low viscosity.

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Curriculum Connection
3

Understanding Viscosity

Questions

Use information from the text to support your answer

1) What is viscosity? Name two high viscous and two low viscous fluids.

2) What [illegible] of fluids?

Making Connections

Have you ever h[illegible]quid [illegible]ticed it becomes less viscous? Explai[illegible]

True or False

Circle whether the statement is true or false

1) As the temperature of a gas increases, its viscosity decreases	True	False
2) A highly viscous fluid will flow faster than a low viscous fluid	True	False
3) There is more internal friction in low viscous fluids	True	False
4) We measure viscosity by determining the flow rate of a fluid	True	False
5) Molasses has a low viscosity	True	False

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Curriculum Connection
4

Fluids With Different Viscosities

Fluids With Different Viscosities

Many of the fluids we use in our lives come in different viscosities. For example, a barbeque sauce might have a high viscosity, allowing it to be used as a dipping sauce. Some people might prefer a sauce with a low viscosity, as it can coat a food item easier.

Lotions, hair gels, and paints are other examples of fluids that come in different viscosities. Depending on your personal preference, or how you plan on using the fl[illegible] can likely find different brands offering the viscosity you are looking for.

Lubric[illegible]es

Oils for ca[illegible] come[illegible] viscosities because differe[illegible] equ[illegible]erent levels of lubricatio[illegible]osity[illegible]re of an oil's resistance to f[illegible] with a higher viscosity, suc[illegible]-30, thicker and flow more slowly. [illegible]oils lower viscosity, such as 5W-20, are thi[illegible] flow more easily.

The first number is how fast the oil flow[illegible] during engine start-up. It signifies the viscosity [illegible]tures, like before you start your engine. The lower the number, [illegible] it flo[illegible]e W stands for winter, meaning it will work in cold temperatures. Th[illegible]um[illegible]r[illegible] the viscosity at normal operating temperatures when the engine is ru[illegible] the number, the thinner the oil. At high temperatures, you may n[illegible] number as the oil will be thin and might not protect the engine as wel[illegible]

The viscosity of an oil is important because it determines how well the oil can lubricate the moving parts of an engine. If an oil is too thick, it may not flow easily and may not provide adequate lubrication, which can lead to engine wear. On the other hand, if an oil is too thin, it may not provide sufficient protection against wear and may allow metal-to-metal contact, which can also lead to engine damage.

The viscosity of an oil is affected by temperature. Oils tend to thin out as they get warmer and thicken as they get cooler. For this reason, multi-grade oils, such as 10W-30, are formulated to maintain a suitable viscosity over a wide range of temperatures.

Name: _____ 11

Curriculum Connection
4

Fluids With Different Viscosities

Questions

Use information from the text to support your answer

1) Why do fluids come in different viscosities?

2) What [illegible] between motor oil viscosities?

Making Connections

If you need mo[illegible]n the [illegible]hich type would you get?

True or False

Circle whether the statement is true or false

1) A thin barbeque sauce has a high viscosity	True	False
2) You should always just use motor oil with low numbers	True	False
3) In the winter, oils with low numbers mean the oil will move easier	True	False
4) Using an oil with a low number in the winter means the oil won't spread	True	False
5) 10W-30 oil is a multi-grade oil that works in most conditions	True	False

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Curriculum Connection
4

Activity - Advertising Motor Oil

Create a motor oil product that will work for Canadians. Decide on the viscosity of the oil and the design of the oil bottle. Why should your customers buy your oil? Be persuasive in your advertisement copy (text that goes with your advertising graphic)

Planning Plan your oil product by answering the questions below

1) What will [illegible]ame of your oil company be?

2) Wha[illegible]will [illegible]be? Example: 10W-40

3) Why is this visco[illegible]best [illegible]s?

4) Why should Canadians buy your oil? Why is it better than the comp[illegible] celebrities use it? Be persuasive.

Name: _____ 13

Curriculum Connection
4

Activity - Advertising Motor Oil

Planning Plan your oil product by answering the questions below

5) How much will you sell your oil for? How big will the bottle be?

6) How much will it cost for you to make the bottle of oil?

7) If you s… …w much profit will you earn?

8) If you sell 1 m… …how … …ofit will you earn?

9) Draw a rough copy picture … …ttle … …ill sell.

10) Write the advertising copy (the text that goes with the picture). Don't us… …much text – just include the important information (cost, why customers should buy)

Name of Company: _____

Check it out at www._____.com

Shop Now

Headline: _____

Name: _____ 15

Curriculum Connection
3

Viscosities of Various Fluids

The standard unit of viscosity is the pascal-second (Pa·s). The only problem with using this unit of measurement is that one pascal-second is better for measuring high viscous fluids, like honey and not as good as measuring low viscous fluids, like water. For example, honey has a Pa·s of 2-10 while water has a Pa·s of 0.000894 or 8.94×10^{-4}.

For numbers that are easier to work with, we can use mPa·s, which are millipascal-seconds. Honey has a viscosity of 2000-10000 mPa·s and water has a viscosity of 0.894 mPa·s.

When the measurements for these fluids are taken, the temperature is also noted. This is because the temperature has a direct impact on the viscosity. There is a big difference in viscosity between honey that is boiling versus honey that is almost frozen. In most cases, the measurement for viscosity is taken at room temperature (about 20 °C).

Research the viscosity of the fluids below by researching them online

	Fluid	mPa·s	Describe the Viscosity (Low, Average, High)
1)	Air		
2)	Olive Oil		
3)	Corn Syrup		
4)	Molten Glass		
5)	Mercury		
6)	Yogurt		
7)	Shortening		
8)	Toothpaste		
9)	Worcester Sauce		
10)	Engine Oil		
11)			
12)			

Name: _____ 16

Curriculum Connection
3

Experiment - Comparing Viscosities

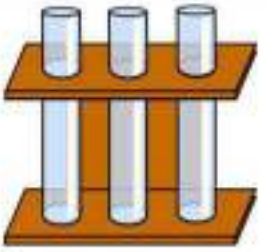
Hypothesis Rank the fluids in order from highest viscosity to lowest viscosity

Water	Honey	Molasses	Milk	Oil	Dish Soap

1)	2)	3)
4)	5)	6)

Materia l need for the experiment

- ❑ Stopwatch
- ❑ Graduated cylinder (th r he be
- ❑ Marble – about half the size o the linder
- ❑ Enough fluid to fill the cylinder for each fluid ab ater, honey, molasses, milk, oil, dish soap. You can subs the f ch out the fluids from the hypothesis and write in the fluids yo



Procedure How you will complete the experiment

1) Fill the cylinder with the first fluid you will measure.
2) Have a stopwatch ready, especially with the fluids that have a low viscosity.
3) Drop the marble into the cylinder and start the stopwatch.
4) Write down how long it took for the marble to fall to the bottom.
5) Repeat with another fluid until you have measurements for each fluid. You could share fluids to minimize waste.
6) Answer the questions on the back of this page.

Observations

What did you notice as you completed the experiment

Fluid	Time To Fall

Results

e questions below

1) Was your hypothe rect? surprise you? Explain.

2) Viscosity measures a fluid's resistance to flow. es th ent help explain the viscosity of these fluids?

3) Rank the fluids in order from which the marble fell the fastest to slowest

1)	2)	3)
4)	5)	6)

4) How could you have decreased the viscosity of these fluids?

Name: _____ 18

Curriculum Connection
5

Factors Affecting the Flow of Fluids

What is the Flow of a Fluid?

The **fluid flow** is the motion of a fluid that happens because of unbalanced forces. For example, in a river, the water flows downhill, due to gravity. Therefore, the current in a river will flow downhill because the force of gravity is pulling the water towards a level surface.

The flow of a fluid is affected by many factors, including the temperature, pressure, viscosity, and density.

1) Temperat

The temper fluid affects how a fluid will flow. As the temperature of a fluid increase ve faster, meaning they have more kinetic energy. An increase ces the forces of intermolecular attraction, which means the molecu are f t. F example, when you heat oil in a pan, it will pour slowly, but once oil w hinner and will spread out mo ot oi uch faster throughout the p

2) Pressure

Fluids are under constant pressure. A flu more pressure at greater depths. This is se the deeper the fluid, the more fluid there is on top pushing down on top. In the diagram, you can se that the hole in the bottom creates the strongest flow because it is under the highest pressure. The water at the bottom has more weight pressing down on it. This theory also explains why the current in a stream or river is stronger at the bottom than on the surface.

3) Viscosity

The viscosity of the fluid measures how the fluid resists flow. A high viscous fluid will flow slowly, while a low viscosity fluid flows faster. The viscosity of a fluid is affected by the temperature of the fluid.

4) Density

The density of a fluid also affects its flow. Fluids that have more mass per unit volume are heavier, having more density. They require more energy to flow, which causes them to be more viscous, resisting flow. Thick and dense fluids flow slower than thin, less dense fluids. For example, honey is dense and thick, and flows slowly. Water is thin and less dense, causing it to flow quickly.

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Curriculum Connection
5

Factors Affecting the Flow of Fluids

Questions

Use information from the text to support your answer

1) What does fluid flow mean?

2) Why is th in a river or stream stronger on the bottom than on the surface?

Explain

How do t s beto the flow of fluids?

Temperature	
Pressure	
Viscosity	
Density	

True or False

Circle whether the statement is true or false

1) The denser a fluid, the faster it will flow	True	False
2) The flow of fluids is caused by unbalanced forces	True	False
3) Gravity pulls the water in a river downhill	True	False
4) A liquid usually gets thicker when it is heated	True	False
5) Temperature affects the viscosity and density of a fluid	True	False

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Curriculum Connection
5

Experiment - Flow Using Different Tubes

Background

What are we learning more about?

Viscosity is how much a fluid resists flow. Therefore, if we can determine the flow rate of a liquid, we can describe its viscosity. If a fluid flows quickly, it has a low viscosity. But how does the system a fluid is in affect its ability to flow? Today, you will test the flow of different fluids through different sized tubes.

Materials

What you will need for the experiment

- ❑ 3 di[illegible] small, medium, and large diameters
- ❑ 3 different fl[illegible]s: [illegible]r, syrup, dish soap, honey, oil, milk
- ❑ 2 clear measuri[illegible]s pe[illegible]
- ❑ Paper towel to clean up [illegible]
- ❑ Stopwatch

Procedure

How you will complete the exp[illegible]nt

1) Mark a line on one of your clear measuring cups that you will time how long it takes for the fluid to fill to. If you are pouring 150 ml, you might time how long it takes for the cup to fill to 100 ml.

2) Pour your first liquid carefully through the smallest straw. Time how long it takes for the fluid to reach the line you marked. Record the time.

3) Complete the step above for the two other straws.

4) Perform steps 2 and 3 for the other two fluids.

5) Compare your results on the back of this page.

Curriculum Connection
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Observations Write down how much time it took for the fluid to flow through the straw

	Fluid 1:	Fluid 2:	Fluid 3:
Small Straw			
Medium Straw			
Large St			

Result e questions below

1) Which fluid had t st vis ch had the lowest?

Highes	Lowest

2) How did the diameter of the straw affe low ra

3) If you were drinking a fluid with a high viscosity, which straw would
Explain a drink that fits this example.

4) If you were draining your pool, how would the diameter of the tube affect the flow rate?

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Curriculum Connection
6

Relationship Between Mass, Volume, and Density

What is Mass?

Mass is a measurement of the amount of matter in an object. Mass is measured in grams (g). There are three states of matter – solid, liquid, and gas.

Mass and weight are similar measurements that are most often the same. Weight is a measure of how the force of gravity acts upon the mass of an object. Therefore, weight and mass will be the same on Earth unless you are weighing yourself far from the Earth's surface, like at the top of Mount Everest.

What is Volu

Volume is a ment of the amount of space and object takes up. Volume is measured), or centimetres cubed (cm^3).

What is D y?

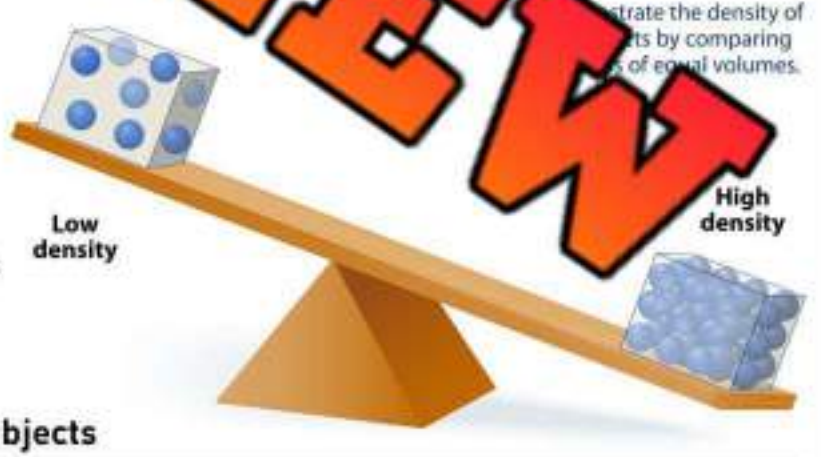
Density is a mea ght sked and how heavy the molecules are in an object. Therefore, s the matter within a certain volume. We can measure density using gra tre (kg/m^3) or gram per centimetre cubed.

Relationship Between Mass, V nd

To understand the density of an o t, w nd volume. When we know the mass and volume, we use the following for d

Density = $\frac{mass}{volume}$ or p = $\frac{m}{v}$ where p equals density als m equals volume.

If an object has a small mass but a large volume, it will have a low density. On the contrary, if the object has a large mass but a small volume, the mass is packed in tightly, meaning the object has a high density. This would tell us that the object's matter is very compact within it.



Examples of High- and Low-Density Objects

High Density Objects	Low Density Objects
Steel	Sponge
Brick	Basketball
Hard Rubber	Cork

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Curriculum Connection
6

Relationship Between Mass, Volume, and Density

Questions

Use information from the text to support your answer

1) Define the terms below.

Mass	
Volume	
Den	

2) What is the r[illegible] between mass, volume, and density?

_____

_____

_____

Draw

Draw circles to add mass to the box[illegible] at a[illegible] the same volume

Low Density	Medium Density	H[illegible]sity

Brainstorm

Write 5 examples of high density objects and low density objects

Low Density Objects	High Density Objects

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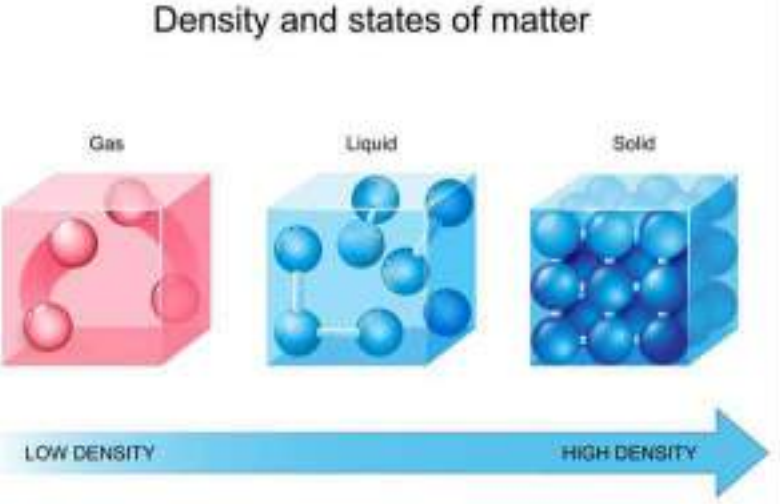
Curriculum Connection
6

Density of Gases, Liquids, and Solids

Densities and States of Matter

We can calculate the density of gases, liquids, and solids. The difference between the densities of solids, liquids, and gases has to do with the distance between the particles in each state.



Gases

In a gas, the [illegible]es are moving rapidly bec[illegible] have a lot of room to move i[illegible] This means gases h[illegible] l[illegible], as there is no[illegible] much m[illegible] pa[illegible] that is occupied.

All gases hav[illegible] dens[illegible] quids and solids, but there is a difference between the densities [illegible]se[illegible] [illegible]erfluoropentane is a gas used in fire extinguishers that has a hig[illegible]ty of [illegible]. On the other hand, methane gas has a density of 0.657 kg/m^3.

Liquids

The particles in a liquid move less as they have less [illegible]me ([illegible]) to move around in. This means that compared to a [illegible]ere a[illegible] particles packed into the space they occupy. There [illegible]li[illegible] higher densities than gases.

Not all liquids have the same density. In fact, we can [illegible]in action when we pour different liquids into a cup. For example, [illegible]you pour oil and water into a cup and let it settle for awhile, eventually you will observe two separate layers with the oil being on top of the wate[illegible]s because water has a higher density than oil. Since it has a larger mass an[illegible]e same volume (container), it sinks below the oil. Water has a density of 997 kg/m^3, which means solids and liquids that have a density less than that will float to the top.

Solids

The particles in a solid are tightly compact. The density of solids varies depending on the solid. If a solid has less density than the liquid it is in, it will float. If it has a higher density than the liquid, it will sink.

For example, stainless steel has a density of 7850 kg/m^3, while the average piece of wood has a density of 780 kg/m^3. This means the steel will sink in water and the wood will float. Wood densities do vary as not all woods float in water.

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Curriculum Connection
6

Density of Gases, Liquids, and Solids

Questions

Use information from the text to support your answer

1) Describe the densities of each state of matter.

Gas	
Liquid	
Solid	

2) What happens when [illegible] ed into the same cup? Explain.

3) Why does stainless steel sink and most wood [illegible] in [illegible]?

True or False

Circle whether the statement is true or false

1) Oil has a higher density than water	True	False
2) Stainless steel has a higher density than water	True	False
3) Gases have a much lower density than liquids and solids	True	False
4) The particles in liquids are packed tighter than in solids	True	False
5) The density of matter depends on its mass and volume	True	False
6) Density can be measured in kg/m^3 or g/cm^3	True	False

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Curriculum Connection
6

Calculating Density

Calculating Density

To calculate the density of matter, we need to know the mass and volume of the matter. We can use the following formula with a gas, liquid, or solid to determine its density.

$$\text{Density} = \frac{mass}{volume}$$

For example, if a phone has a mass of 200 g and a volume of 75 cm^3, we input these values into our equation to determine the volume.

$$\text{Density of phone} = \frac{200}{75} = 2.66 \text{ g/cm}^3 \text{ or } 2660 \text{ kg/m}^3$$

Calculat ... the density using the formula above to two decimal places

		Volume	Density
1)		100 cm^3	
2)	120	... m^3	
3)	250 g		
4)	485 kg	... m^3	
5)	626 g	1485 cm^3	
6)	224 g	68 cm^3	
7)		854 m^3	2 ... m^3
8)	1680 kg		
9)		2285 cm^3	1.68
10)	1020 g		4.2 g/cm^3

Word Problem Answer the questions below

1) A plastic toy car has a mass of 220 grams and a volume of 315 cm^3.	
a) What is the density of the toy?	
b) Water has a density of 1 g/cm^3. Will the toy float in the water or sink to the bottom? Explain.	

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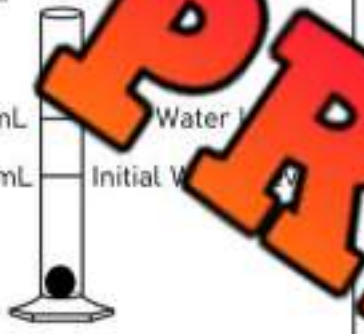
Calculating Density and Volume

Calculating Volume and Density
To calculate the volume of an irregular object, we can put it into water to see how much water is displaced. We do this by measuring the initial water level and subtract it from the water level after the object has been placed. Every 1 mL of water equals 1 cm^3 of volume.

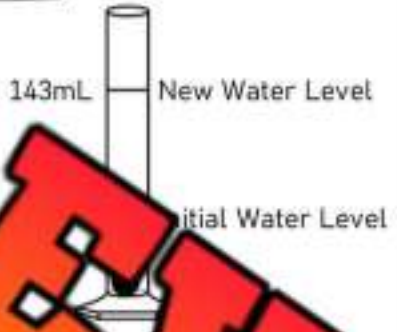
Calculate Calculate the density using the formula above to two decimal places

1)



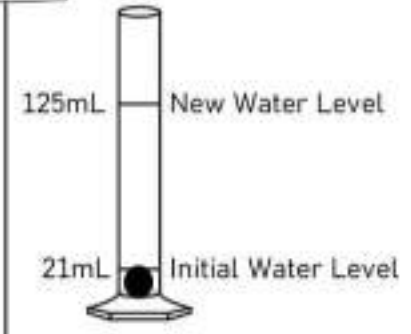
Volume	
Mass	40 g
Density	

2)



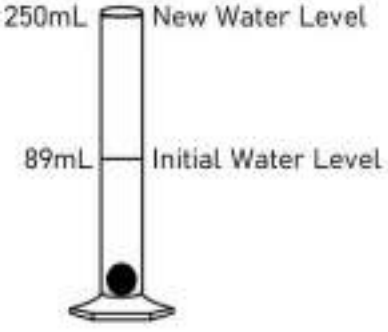
Volum	
Mass	110
Density	

3)



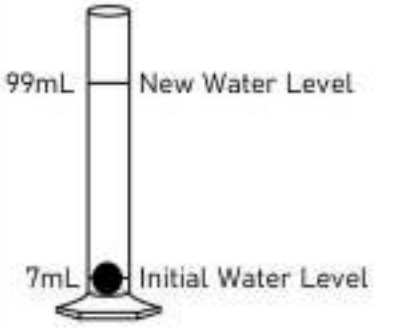
Volume	
Mass	260 g
Density	

4)



Volume	
Mass	
Density	0.5 g/cm^3

5)



Volume	
Mass	
Density	1.3 g/cm^3

Volume	
Mass	
Density	3.5 g/cm^3

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Curriculum Connection
6

Experiment - Densities of Solids

Hypothesis

Rank the solids in order from highest density to lowest density

1)	2)	3)
4)	5)	6)

Materials

you need for the experiment

- ❑ Scale to test m… ice… digital scale
- ❑ Cylinder wit… if… surem… measure displacement
- ❑ 6 solids to test … le, w… …ck, eraser, paper clip, ping pong ball, etc.
- ❑ Optional – if using so… …oat, y… need to use a sinker. A **sinker** is a heavy/dense object that … …ie … object. You will need to determine the volume of the …ker … …t it from the total volume of the sinker and the floating object t… …e vol… …just the floating object.

Procedure

How will you complete the e… …ent

1) Complete the hypothesis by writing the solids yo… …t in t… …es at the top of the page.
2) Rank them in order of which solids you think will be most de… …e.

Calculating the volume of the solids – Use backside of the paper to re… …sults.

1) Fill the cylinder up with water to a measurable line
2) Drop a solid into the cylinder
3) Measure in mL how much water is displaced by calculating the difference between the starting water level by the current water level. Note: 1mL is the same as 1 cm^3 volume.
4) Write down the volume in cm^3.

Calculating the mass of the solids – Use backside of the paper to record results.

1) Use the scale or balance to measure how much mass the solids have

Calculate the density of the solids

1) Fill in the table on the back side of this page using the formula: density = $\frac{mass}{volume}$

Curriculum Connection
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Observations

Fill in your measurements below

Solid	Volume – cm^3	Mass – g	Density – g/cm^3

Results

Answer the

1) Was your hypothesis correct? Did anyth urprise Ex

2) Why do you think the water level goes up when the solid is put into w

3) Why would you need a sinker if you used a floating object?

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Curriculum Connection
7

How Temperature Affects Density

Temperature Affects Solids and Liquids

Temperature can affect the density of a solid or liquid through thermal expansion. Most substances expand when they are heated and contract when they are cooled. This means that the volume of a substance increases as it is heated and decreases as it is cooled. If the mass of a substance remains constant, an increase in volume will lead to a decrease in density. Conversely, a decrease in volume will lead to an increase in density.

For example, if you heat a block of metal, the metal will expand, causing its volume to increase. If the mass of the metal does not change, the increase in volume will cause the density of the metal to decrease. Similarly, if you cool the metal, it will contract, causing its volume to decrease and its density to increase.

One liquid that expands significantly when it is heated is mercury. Mercury has a relatively high coefficient of thermal expansion, which means that it expands significantly when the temperature increases. This can be observed by looking at a mercury thermometer, in which the expansion of the mercury as it is heated causes the temperature to be increased on the thermometer's scale.

Temperature Affects Gases

The temperature of a gas will affect its density. If you increase the temperature of a gas, its density will decrease as the gas molecules spread out. The result will be an increase in volume.

One example of a gas that expands significantly when it is heated is air. Air is composed of a mixture of gases, including nitrogen, oxygen, and small amounts of other gases. When air is heated, the molecules of the gases in the mixture move more quickly and exert more pressure on the walls of the container they are in. This leads to an increase in the volume of the gas. This expansion can be observed by looking at a gas thermometer, in which the expansion of the gas as it is heated causes the temperature to go up, as is shown on the thermometer's scale.

Application

The expansion of solids, liquids, and gases are important to understand. The expansion of gases and liquids that travel through pipelines could cause explosions if the pressure becomes too strong.

For solids, we see the expansion and contraction of our doors and door frames when the seasons change. You may have experienced an expanding door when struggling to shut it in the winter temperatures.

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Curriculum Connection
7

How Temperature Affects Density

Questions

Use information from the text to support your answer

1) How does temperature affect the density of gases, liquids, and solids?

2) Why is it important that we understand the thermal expansion/contraction of fluids?

Draw

Draw dots to show the molecules in solids, liquids, and gases in cold and warm temperatures

	Solids	Liquids	Gases
Cold Temperatures			
Warm Temperatures			

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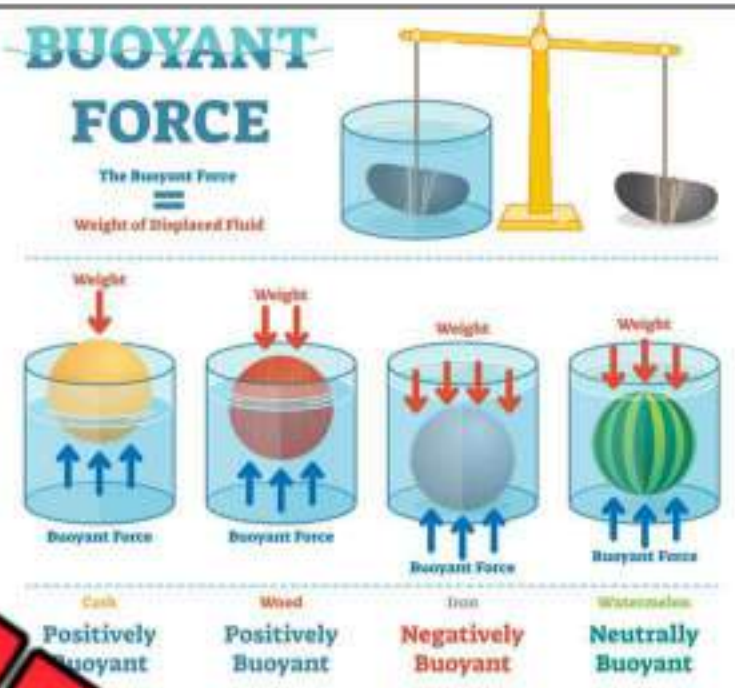
Curriculum Connection
8

Buoyancy

What is Buoyancy?

Buoyancy is an upward force created by a fluid that opposes the weight of an object. Buoyancy is why an object sinks or floats when put into a fluid, like water. All objects in water have some buoyant force pushing up against the g ity that is pulling that object down. uoyant force is not strong push the object out of th



Types of Bu yant F

Positively Buoya

An object, like cork, tively buoyant if its density is th fluid it is in. The result will the obje in the fluid. In the diagram, cork is more positively buoyant than w t b e water, meaning they rest at the surface because their density is les than re both said to be positively buoyant.

Negatively Buoyant

An object is negatively buoyant if it sinks in wate mea ct has a higher density than the fluid, it will be negatively buoyant. oy ts vary, meaning some negatively buoyant objects will take time while negatively buoyant objects will sink right away, like a large rock. This is use ve different densities.

Neutrally Buoyant

A neutrally buoyant object does not sink or float. Instead, it remains bala at the same level in a fluid. Scuba divers aim to be neutrally buoyant so they cannot feel the force of gravity or buoyancy while they explore underwater. They do this by wearing scuba gear that balances these forces. They use equipment to balance their density so that it is equal to the water's density of 997 kg/m^3.

Buoyancy of Humans

Some humans have an easier time floating than others. Bone density and body fat percentage affects buoyancy in humans. This is because bone is denser than water, so the thicker the bones someone has, the more they will be negatively buoyant. In addition, fat is less dense than water, so the more body fat someone has, the more they will be positively buoyant.

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Curriculum Connection
8

Buoyancy

Questions

Use information from the text to support your answer

1) Define the buoyancy terms below.

Positively Buoyant	
Negative Buoya	
Neu Buoyan	

2) How does density the an object?

Examples

What objects are positively, buoyant?

Positively Buoyant	
Negatively Buoyant	
Neutrally Buoyant	

True or False

Circle whether the statement is true or false

1) Steel is positively buoyant	True	False
2) A good life preserver will be positively buoyant	True	False
3) Boats are negatively buoyant	True	False
4) A scuba diver aims to be neutrally buoyant so that can move easier	True	False
5) A neutrally buoyant object floats for awhile and then sinks	True	False

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Curriculum Connection
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Determining Buoyancy of Objects

Determining Buoyancy of Objects
We can determine if an object will be positively, negatively, or neutrally buoyant by understanding the density of the object and the fluid it is in. If the object has a higher density than the fluid, it will be negatively buoyant (not buoyant). Some objects will float in water but not in other fluids that have higher densities.

Buoyancy

Is the object buoyant in the fluid?

	Object			Fluid			Buoyancy	
	Mass	Volume	Density	Mass	Volume	Density		
1)	120 g			200 g	110 cm^3		Yes	No
2)	250 g	325			600 cm^3		Yes	No
3)	1.3 kg	3.2 m^3			m^3		Yes	No
4)	480 g	110 cm^3		900 g	cm^3		Yes	No
5)	12.5 kg	18.55 m^3		22.2 kg			s	No

Word Problem

Answer the questions below

1) Jill is measuring the density of ketchup. The ketchup has a volume of 400 cm^3 and a mass of 592 g.	
a) What is the density of the ketchup?	
b) Water has a density of 1 g/cm^3. Could an object float in ketchup and sink in water? Explain.	
c) A crayon has a mass of 12 g and a volume is 11 cm^3. Is the crayon buoyant in water? Is the crayon buoyant in ketchup?	

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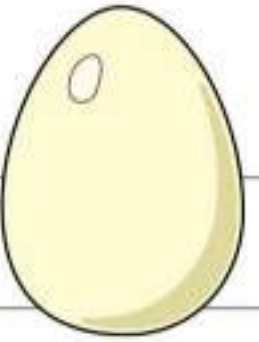
Experiment - Buoyancy of Water

Materials
What will you need for the experiment

- ❑ 3 clear cups or glasses that can fit an egg
- ❑ 1-3 eggs – one will work if you take the egg out each time to test the water
- ❑ 8 tablespoons of salt and sugar
- ❑ Water
- ❑ Spoon t[illegible]h



Proceo[illegible]
H[illegible]u complete the experiment

1) Fill the 3 cu[illegible]ater
2) Label the cups o[illegible]ng labels – saltwater, control, and sugar water
3) Put the 8 tablespoons of [illegible] t[illegible]d saltwater. Stir well to dissolve the salt into the water.
4) Put the 8 tablespoons of sugar int[illegible] cup la[illegible] water. Stir well to dissolve the sugar into the water.
5) Put the egg in the control glass of water a[illegible]d. Is the egg buoyant in the water?
6) Put the egg in the sugar water and record what happ[illegible]nt in the sugar water?
7) Put the egg in the saltwater and record what happened. Is th[illegible]t in the saltwater?

Hypothesis
Will the egg be buoyant in water, saltwater, sugar water? Rank the types of water providing the most buoyancy to least buoyancy.

Fluid	Buoyant	
Water	Yes	No
Sugar Water	Yes	No
Saltwater	Yes	No

Fluid	Rank 1 = most buoyant, 3 = least buoyant
Water	
Sugar Water	
Saltwater	

Curriculum Connection
8

Observations

Fill in the tables below based on your observations

Fluid	Buoyant	
Water	Yes	No
Sugar Water	Yes	No
Saltwater	Yes	No

Fluid	Rank 1 = most buoyant, 3 = least buoyant
Water	
Sugar Water	
Saltwater	

Results

Answer the questions below

1) Was y… s… ct? Did anything surprise you? Explain.

2) Why was the egg buoyant i… and … r? Explain using the terms density, volume, and mass.

3) Could someone using the same amount of salt and sugar but differe… …er get different results? Explain.

4) If you wanted to increase the buoyancy of the water, what could you do? How could you increase the buoyancy of the water so that the egg barely sinks at all.

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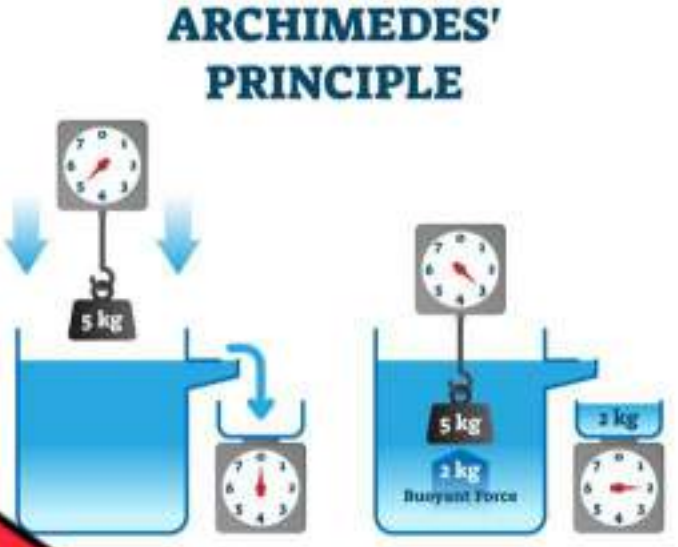
Archimedes' Principle

What is Archimedes' Principle?

Archimedes' principle is that the buoyant force (upward force) is equal to the weight of the displaced water. Looking at the diagram, you'll notice that in the first image, the 5 kg weight is not yet in the water. Therefore, no water has spilled onto the scale yet.



In the second image, you can see that the 5 kg weight has entered the water and caused water to spill out onto the scale. The water has caused 2 kg to be displaced. The weight of the displaced water is the force or the upward force that causes some objects to float.

Sink or Float?

If the object's weight is heavier than the water that was displaced, the object will sink. In our example, the 5 kg weight is heavier than the weight of the water that was displaced, therefore this object will sink. In other words, the weight (downward force) is heavier than the buoyant (upward force), causing it to sink to the bottom.

On the other hand, if the object displaced water that weighed more than its weight, the object would float. The buoyant force would be greater than the weight, causing it to move upwards.

Importance of Archimedes' Principle

Boats need to understand Archimedes' principle because boats need to be submerged in the water in order to generate energy to propel it forward. Boats also need to be strong, which is why they are made of strong, heavy materials. Heavy materials are often dense, causing them to sink. For example, a screw will sink because the weight of the water displaced by the screw is less than its own weight.

Luckily, ship engineers know that to make a strong and buoyant ship, they need to make sure the ship displaces more water than its weight. This means making their ship less dense. They accomplish this by keeping most of the ship hollow. If they filled in the ship or had too many containers on board, the density of the ship could cause the displacement to be less than the weight of the ship itself. This would cause it to sink.

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8

Archimedes' Principle

Questions

Use information from the text to support your answer

1) What is Archimedes' principle? Explain how it works.

2) How [illegible] be built so that it can be buoyant in water? Explain.

Diagram

Draw your ow[illegible]am [illegible]rchimedes' principle

True or False

Circle whether the statement is true or false

1) If an object displaces more weight than its weight, it will sink	True	False
2) A ship needs to be built hollow so it can be positively buoyant	True	False
3) If a ship displaced less water than its weight, it will sink	True	False
4) Archimedes' principle explains why water levels rise when we enter water	True	False
5) The buoyant force is always the same as the downward force of the object	True	False

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Curriculum Connection
8

Research - Fish's Bladder vs Ballast Water

Research | Answer the questions below

1) What is ballast water?

2) Why do [illegible] ballast water?

3) Draw two diagrams of a ships that uses ballast [illegible]

Cargo ship that is empty	Cargo ship that is full

4) What is a fish's swim bladder? What does it do?

5) Draw a fish that uses their swim bladder.

Fish floating up	Fish staying at the same depth	

6) How is a fish's swim bladder similar to a ship's use of ballast water?

Name: _____ 49

Curriculum Connection
7

Lighter-Than-Air Flying Devices

Lighter-Than-Air Flying Devices

A **lighter-than-air flying device** is an airship that generates lift because they use gases that are lighter than air. Most commonly, these airships use helium as the gas because its density is significantly less than air, and it is cheaper to buy than other gases. The density of air is 1.225 kg/m^3. The density of helium is 1.114 kg/m^3.

How Airships [illegible] – Helium Balloons

An airship c[illegible] flying altitude the same way a submarine does, through buoyancy. [illegible]ncy is the ability to float. Airships use helium to fill their [illegible]ts, making the air in these huge holding tanks less dense [illegible] the a[illegible]e of them. When the air is less dense, it rises [illegible]osphere that is heavier. This makes the airship positively buoyant, a[illegible] will

When the pilot needs to go u[illegible] ballonet. When they need to go down, they pump air into the ballonet to m[illegible]em ne[illegible]oyant. When they are at an cruising altitude, they balance the amount of ai[illegible]elium [illegible]llonet to stay at the same altitude.

Hot Air Balloons

A hot air balloon is another lighter-than-air flying device that use[illegible] the same principle as the helium airships. They both need the air in the balloon to be less dense than the air outside of the balloon. This allows them to achieve buoyancy in the air, which gives them lift.

A hot air balloon uses heated air inside the balloon. Heated air is less dense than the surrounding air in the atmosphere. This is because when air is warmed, the molecules move faster and further apart. This causes the warmer air to expand and spread out, making it less dense. Less dense things float, like the ice in a glass of ice-water. To go up in a hot air balloon, the pilot will heat the air using a torch. To go down, the pilot stops heating the air, which causes the air to cool and gravity to pull the balloon down.

Name: _____ 50

Curriculum Connection
7

Lighter-Than-Air Flying Devices

Scenarios How do you achieve the results below when flying a lighter-than-air device?

1) In an airship, you want to go down.
2) In an airship, you want to go up.
3) In a hot air [illegible] you want to go down.
4) In a hot [illegible] balloon [illegible] to go up.

True or False Circle [illegible] the statement is true or false

1. Helium is rarely used in airships because [illegible] flammable	True	False
2. Air can be heated to make it less dense	True	False
3. An airship is a lighter than air flying device	True	False
4. When an airship is negatively buoyant, it will rise	True	False
5. To go down in a hot air balloon, you need to add ice to the [illegible]	True	False

Questions Use information from the text to support your answer

1. What is a lighter-than-air flying device? How do they use buoyancy to fly?

2. How does a lighter-than-air flying device achieve lift?

Name: _____ 51

Activities - Flow and Buoyancy

Word Search

Find the words from the word bank

Flow	Fluid	Viscosity	Temperature	Particles
Rate	Container	Mass	Volume	Density
Buoyancy	Sink	Float	Archimedes	Displaced

O	Z	M		T	V	R	Y	C	J	V	I	S	C	O	S	I	T	Y
D	L				R	R	G	D	T	P	Z	W	J	K	B	G	A	V
H	R			K		F	G	E	H	Z	O	H	B	S	E	S	K	M
T	D	A	I					V	O	L	U	M	E	N	C	E	M	B
Q	Q	E	T	P					L	Y	M	Y	Y	O	D	F	I	
S	S	Y	C	E	C					D	V	N	W	N	E	O	K	
S	S	J	P	A	R	T	I	C			O	A	T	M	Y	N		
D	A	B	F	A	L	S	J	W		X	R		F		W	A	I	H	I
S	M	A	T	X	N	P	B	U	O	Y						H	Y	S
L	K	U	B	E	R	A	S	L	W	M	C				Q		C	F	H
Q	R	M	D	I	U	L	F	I	G	Y	H	B	I					F
E	Y	M	I	E	M	T	I	R	D	W	O	M	Q	Y			I	T

Word Scramble

Unscramble the words from the word bank

ETUERMRETAP		TVSOCYSII	
TYSNDEI		MVOLEU	
CADRSEMHIE		WOLF	
UDILF		TFAOL	
OANECNTRI		ITEPARCSL	

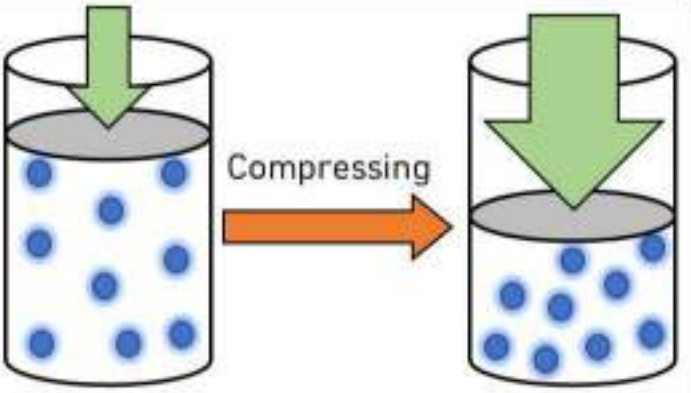
Name: _____ 52

Curriculum Connection
7, 10

Compressing Gases

What is Compressed Gas?

Compressed gas is a gas that has had its pressure increased by the reduction of its volume. Compressed gas is stored in strong containers that can support the pressure created by the shrinking of the volume of the gas.



The dia m shows how gas can be compressed the particles of the gas are forced a maller volume due to the compressive forces.

G d because its particles are spread out. It is nearly impossi compr d because its particles are already tightly compacted. Some liquids can b ed, t most cannot. A liquid has particles that are closer together than a g ther a n a solid.

Temperature of Compr d G

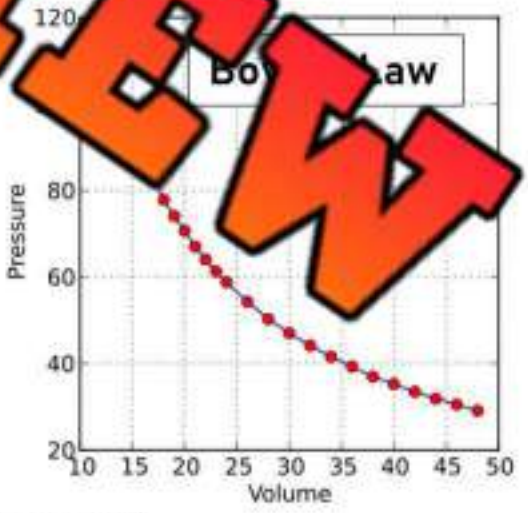
To compress a gas, we nee echa rgy to reduce the volume of the gas particles. By doing so, the ener d a g the compression of the gas results in an increase in temperatu and

This happens because as we comp e gas, ller space makes the molecules bounce off each other faster, ca sing mo netic y and more heat.

Gas Laws

1) Boyle's Law - 1662 by Robert Boyle

If we reduce the volume of the space containing a gas, the pressure increases as long as the temperature stays the same.



2) Charles' Law – Published in 1802

When the volume of a gas is divided by its temperature, it equals its pressure. When you increase the temperature, you will need to proportionally increase the volume to maintain the same pressure. Therefore, there is a constant relationship between a gas' temperature, volume, and pressure.

3) Combination Law – Puts both ideas together

When air is compressed, the pressure and temperature of the air increases, as the volume of the space containing the air decreases. If we increase the temperature of a gas without increasing the volume, the pressure will increase.

Name: _____ 53

Curriculum Connection
7, 10

Compressing Gases

Questions

Use information from the text to support your answer

1) What happens when we compress a gas?

2) How [illegible] a gas affected when we compress it? Explain.

Scenarios

What will happen [illegible] sce[illegible]
An increase/decrease in te[illegible]e, p[illegible]ce and/or volume?

1) The volume of a gas is reduced	
2) The volume of a gas is expanded	
3) The pressure of a gas is increased	
4) The temperature of a gas has increased	
5) A gas is compressed in an air compressor	

True or False

Circle whether the statement is true or false

1) When the volume of a gas is reduced, the pressure is also reduced	True	False
2) When we reduce the volume of a gas, the temperature of the gas rises	True	False
3) Temperature of gases increases due to the extra kinetic energy	True	False
4) Compressing gas means we increase a gas' volume	True	False
5) Increasing the temperature of a gas will increase the pressure	True	False

Name: _____ 56

Curriculum Connection
11, 12

Compressing Liquids - Hydraulics

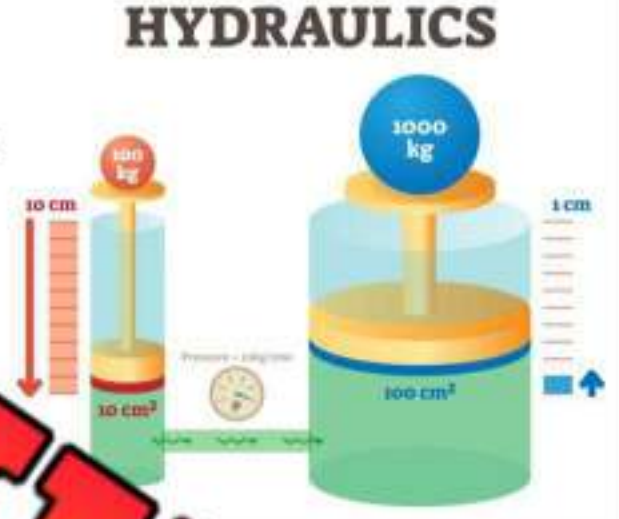
Compressibility of Liquids vs Gases

Liquids can be compressed, but not as easily as gases. Gases are more compressible because most of the volume of a gas is composed of large amounts of empty space between gas particles. Therefore, there is room to move the gas particles closer together.

Liquids have less room than gases, but more room than solids. As a result, liquids can be compressed but it takes a lot of pressure to accomplish a little compression. Liquids are often described as being uncompressible due to the amount of pressure required to compress them.

Hydraulic Sy

A **hydraulic** d to make work easier by taking a created by pressurized fluid. H c syste ecause force is applied at o point lic stem and that force is transmit r po g an incompressible fluid s a ba ow they work:



1) An incompressible liquid tain system that has pressure put fro In the diagram, 100 kg of force is pres down on one side.

2) The pressure acts against a piston on the oth side of the container as the fluid acts on the wa of the container equally and the piston on the other side is the only wall that will move.

3) This transfers the energy into the piston, forcing it upwards. In the kg of force is pressurized through the tube which creates 1000 kg of ther side (10 times).

4) The ratio of 10 times was created because of a mechanical advantage or multiplication factor. The **multiplication factor** is based on the size differences of the two pistons (area). In the diagram, the size difference is $10cm^2$ to $100cm^2$. The second piston is 10 times larger, meaning the downward force creates an upward force that is 10 times greater.

5) The trade-off to this multiplication factor is distance. The energy needs to come from somewhere, so we use distance to make this work easier. In the diagram, we move 100 kg of force 10 cm to generate 1000 kg of force for 1 cm. This might not sound like a great advantage, but it is! It allows us to lift equipment and materials that we would have no chance at lifting without the mechanical advantage.

Name: _____ 57

Curriculum Connection
11, 12

Compressing Liquids - Hydraulics

Questions Use information from the text to support your answer

1) Is liquid compressible? Is it easy to compress? Explain.

2) Why [illegible] hydraulic system uses incompressible liquids? Explain.

Calculate What is the multiplic[illegible]actor [illegible]tput force created?

	Area of Master Piston	Area of Slave Piston	Multiplication Factor	[illegible]ut [illegible]	[illegible]	[illegible]put [illegible]	Output Distance
1)	10 cm^2	100 cm^2		5 kg			
2)	3 cm^2	15 cm^2		2 kg		10	
3)	8 cm^2	56 cm^2		10 kg		21 cm	
4)	15 cm^2	60 cm^2		20 kg		16 cm	
5)	50 cm^2	125 cm^2		120kg		25 cm	
6)	18 cm^2	117 cm^2		250kg		78 cm	

Name: _____ 58

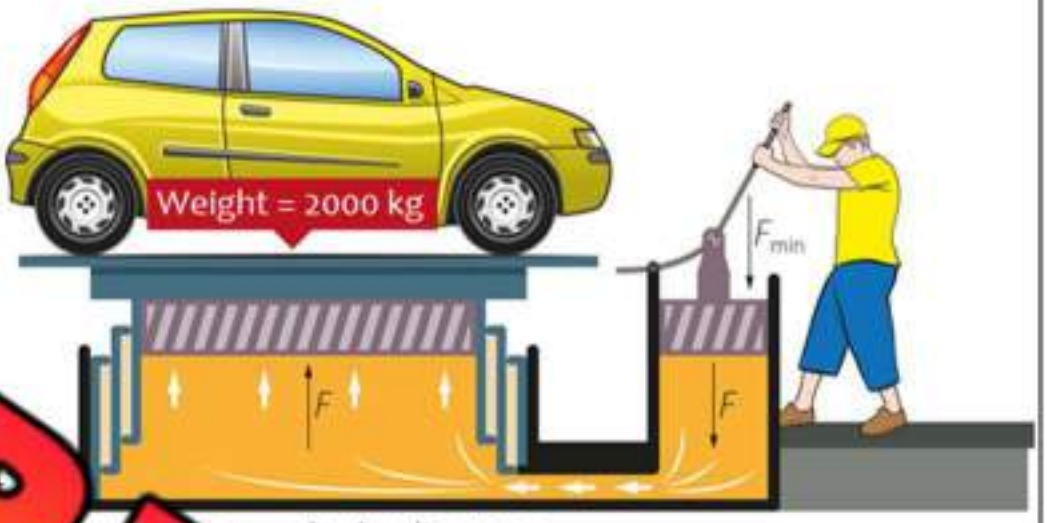
Curriculum Connection
12, 13

Pascal's Law - Hydraulics

What is Pascal's Law?

Pascal's Law states that a pressure change at any point in a confined incompressible fluid is transmitted throughout the fluid and acts on the walls of the container equally.

Pascal's Laws explains why hydraulic systems can apply pressure to one piston of an incompressible fluid, the fluid acts on every piston of the enclosed container. If the pressure is great enough, it will move container walls, like the slave piston in a hydraulic system.



hydraulic crane

The multiplication factor is the amount more force is done. Pascal's principle states that if the slave piston has an area 5 times greater than the first piston (master), the force will be 5 times greater on the slave piston.

In the diagram, the worker mechanically uses to lift a car. This would be impossible without a mechanical advantage. Let's assume the multiplication factor is 10, guessing that the area of the slave piston is 10 times greater than the master piston. In this case, we can use the following equation to determine the force:

$$\text{Force} = \frac{weight}{multiplication\ factor}, \text{ therefore, Force} = \frac{2000}{10} = 200$$

Use of Hydraulic Systems

Hydraulic systems are used in heavy equipment, like forklifts, backhoes, and excavators.

Advantages

- Simple and safe due to using less parts than mechanical systems
- Great control as push buttons can make it easy to start, stop, accelerate or decelerate
- The most powerful option for creating force

Disadvantages

- Hydraulic fluids can be messy and can leak if a valve or pipe is damaged
- Hydraulic fluids can be corrosive and are flammable
- The fluids in a hydraulic system can freeze. Most hydraulic fluids have a freezing point of -12 degrees Celsius, so using these systems in the winter can be problematic

Name: _____ 59

Curriculum Connection
12.13

Pascal's Law - Hydraulics

Questions

Use information from the text to support your answer

1) What is Pascal's Law? Explain how it relates to hydraulic systems.

2) How [illegible] work?

Word Problems

Answer th[illegible] prob[illegible]

1)	Shane is using a hydraulic system to lift a ca[illegible] wei[illegible] area of the slave piston is 120 cm^2 and the area of the maste[illegible]0 cm^2[illegible] much force does he need to put into the handle?
2)	Sheena pushes on the breaks to stop her car. She applies 20kg of force to the pedal, which is connected to a master piston that is 35 cm^2. The brake pads are connected to a slave piston that has an area of 280 cm^2. How much force did she apply into the brake pads? 

Name: _____ 60

Activity - Building a Hydraulic Model

Research

Find a method for building a hydraulic system online

There are many ways to build a hydraulic system, using different materials. Some common examples use syringes, tubes, cardboard, and of course, a fluid. Find your own method for making a hydraulic model by researching different versions online. Try typing in, "hydraulic lift model experiment." Your model should be able to perform work by lifting an object in the air.

Materials

What materials will you need for your model?

1	
2	
3	
4	
5	
6	
7	
8	

Method

How will you build your model? Write a step by step guide on what you need and to do

1	
2	
3	
4	
5	

Name: _____ 61

Curriculum Connection
14

Activity - Building a Hydraulic Model

Explain Answer the questions below

1) How will your hydraulic system work?

2) Use your hydr[illegible] work. The work could be lifting something in the air. Explain how y[illegible] Was it successful in completing work?

3) How much weight can your hydraulic system lif[illegible]

4) Why can't your hydraulic system lift more? What is holding it back? [illegible]t stronger?

5) Why is the fluid needed for your system to work? What would happen without the fluid?

Name: _____ 62

Curriculum Connection
12

Pneumatic Systems

What is a Pneumatic System?
A **pneumatic system** is like a hydraulic system, but they use compressed air instead of liquids to transmit forces. Pneumatic systems work by using pressurized air to create forces that can perform work.

How Do Pneumatic Systems Work?
Pneumatic systems take in air into the compressor. The air is compressed by a piston that reduces the volume of the air. The pressurized air is sent to the receiver where it is stored in the larger tank. The air is now available for the user to use.

The user opens valves to stop and change the direction of the air. For example, the user opens a valve that sends the air to the actuator. An actuator is a device that converts the energy of compressed air into mechanical motion.

Mechanical Motion
Pneumatic devices are used for many different purposes. The simplest pneumatic circuit is one that sends compressed air into a valve. Pneumatic systems can also be used for spraying, painting, washing, paintball guns, and nail guns.

Nail Gun
A nail gun uses compressed air to produce a force strong enough to drive in a nail with a pull of a trigger. Below is how a nail gun works.

1) The nail gun is connected to an air compressor using an air hose

2) Once the air compressor is full of compressed air, it now wants to escape with a lot of force.

3) When the trigger is pulled, the valve to the gun is opened, allowing compressed air to flow into the gun's chamber.

4) As a safety mechanism, the nail will not be released by pulling the trigger. This is because inside the chamber, there is another plunger at the end of the gun that needs to be pressed before the compressed air can reach the hammer.

5) When you put the gun's end on the material you are nailing and pull the trigger, the air will now reach the hammer and create enough force to fire the nail through the barrel and into your material.

Name: _____ 63

Curriculum Connection
12

Pneumatic Systems

Questions

Use information from the text to support your answer

1) How does a pneumatic system work?

2) How [illegible] gun work?

Questioning

Write 3 questi[illegible]ou hav[illegible] reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1) A pneumatic system uses pressurized air to generate power	True	False
2) Air is not a fluid, so it can't be used to transmit force	True	False
3) Compressed air wants to escape its container, creating potential energy	True	False
4) When the trigger is pulled on a nail gun, the nail is fired into the material	True	False
5) Compressed air can perform work because of its potential energy	True	False

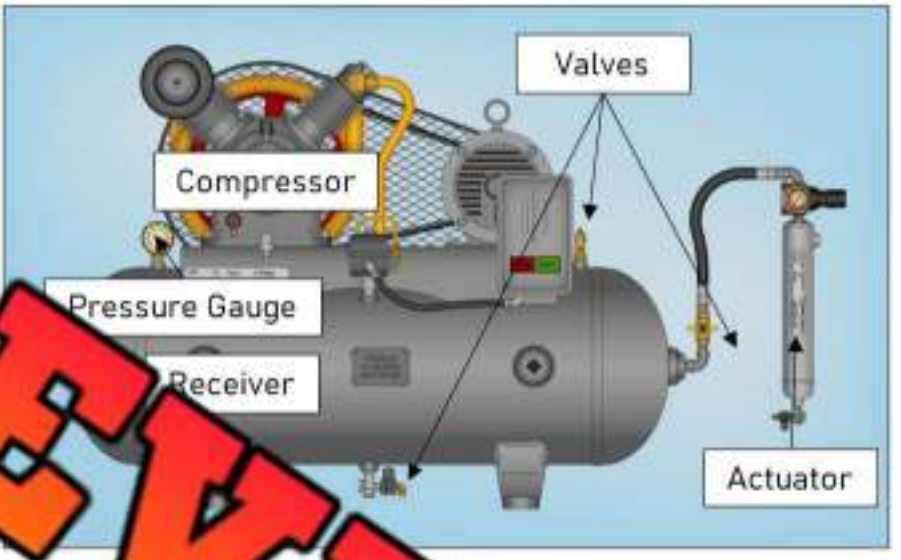
Name: _____ 64

Curriculum Connection
12

Pneumatic System - Air Compressor

What is a Pneumatic System?
A **pneumatic system** is like a hydraulic system, but they use compressed air instead of fluid to transmit forces. Pneumatic systems work by using pressurized air to create forces that can perform work. A pneumatic system has the components below.

1) Air Compressor
An air compressor is a pneumatic t[illegible]t converts the air in the at[illegible] into compress[illegible] the compre[illegible] th[illegible] compress[illegible]y a pi[illegible] reduces the volu[illegible] The pressurized a[illegible] ready to leave the tank and [illegible] the receiver. Air compressors a[illegible] often fueled by a gas tank or [illegible] electricity.



2) Receiver
The receiver stores the pressurized air from the [illegible]essor[illegible]s it in a bigger tank. An air receiver is able to smooth the flow o[illegible]d k[illegible] it enters the tank. This is because a larger tank can dissipate heat [illegible]er tha[illegible]aller tank. The air receiver stores the compressed air at an even hig[illegible]ure [illegible]needs to compensate for the cooling air that reduces its pressure.

3) Air Valves
Air valves stop and change the direction of the air. They control the direc[illegible] of the airflow so that the system can deliver the air to the correct cylinders, actuators, and nozzles. These valves can be manual, requiring the user to open and close a valve. They can also be electrical, allowing the user to press a button to open and close a valve.

4) Pneumatic Actuators
Pneumatic actuators are the devices that convert the energy of compressed air or gas into mechanical motion. When pressurized gas enters a chamber, it results in the kinetic movement of a device, such as a piston or gear. The piston will create linear (straight line) motion, while the gear will create rotary motion. We can then use this mechanical motion to perform work, like moving a robotic arm that lifts heavy equipment.

Name: _____ 65

Curriculum Connection
12

Pneumatic System - Air Compressor

Questions

Use information from the text to support your answer

1) What is a pneumatic system? How is it different than a hydraulic system?

2) How [illegible] linear and rotary motion?

Questioning

Write 3 questi[illegible]ou hav[illegible] reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1) The air pressure in the receiving tank is lower than outside the tank	True	False
2) Air compressors are large tanks that store pressurized air	True	False
3) A receiving tank cools the temperature of the pressurized air	True	False
4) When pressurized air is cooled, it increases its pressure	True	False
5) A gear creates linear motion that can be used for straight line work	True	False

Name: _____ 66

Curriculum Connection
12.13

Research - Pneumatic Systems

Research Answer the questions below

1) What is a pneumatic system?

2) What are some ever[illegible] systems?

3) When have you ever used, or seen someone else use a pneumatic sy[illegible] Explain the work that was done.

4) What are the advantages and disadvantages of a pneumatic system?

Advantages	
Disadvantages	

5) In freezing temperatures below 12 degrees C... w... uld be better – hydraulic or pneumatic?

6) Research the use of a pneumatic system. Explain how it works.

Name: _____ 68

Curriculum Connection
9

Calculating the Pressure of Fluids

Pressure is defined as the force exerted on or against an object by something in contact with it. With regards to fluid pressure, it is the force the fluid exerts on an object or something in contact with it. Pressure can be calculated by using the following formula:
$P = \frac{F}{A}$ where pressure equals force divided by area.

The unit for pressure in the metric system is pascals (Pa) or one Newton per square metre (N/m^2). One pascal equals 1 N/m^2, but a more common unit for measuring pressure is using kilopascals. One kPa is equal to 1000 newtons per square metre. We use kilopascals to keep our numbers smaller. To convert your units from Pa to kPa, divide by 1000.

When you fill a vehicle's tires with air, you need to know the air pressure to know how full the tire

For example, a tire's surface has a force of 900 000 N exerted over 3 square metres. Therefore,
$P = \frac{900\,000}{3}$

$P = 300\,000\ N/m^2$ or 300 000 Pa

Calculate Find the pressure using kilopascals

	Force – N	Area – m^2	Pressure – N/m^2	Pressure – Pa	Pressure kPa
1)	4000	2			
2)	6300	3			
3)	4400	4			
4)	5500	5			
5)	24000	6			
6)	510 000	5			
7)	670 000	10			
8)	94 000	2			
9)	62 500	5			
10)	980 000	4			

Name: _____ 69

Curriculum Connection
9

Pressure Word Problems

Calculate Solve the word problems below

1)	Nicole is wearing high heeled shoes. When she steps down on her heel, she exerts 100 N of force on the tiny heel, measured at 0.0004 metres squared (4 cm^2). a) How much pressure does she apply to the ground below the heel in Pa? b) How much pressure does she apply to the ground below the heel in kPa?
2)	Nicole switches shoes and is now wearing a flat-bottomed shoe. She now exerts 250 N of force on the entire shoe which has an area of 0.01 metres squared (100 cm^2). a) How much pressure does she apply to the ground below her shoe in Pa? b) How much pressure does she apply to the ground below her shoe in kPa?
3)	A crocodile bite exerts 17 500 newtons of force over an area of 0.007 metres squared. a) How much pressure is applied by the crocodile in Pa? b) How much pressure is applied by the crocodile in kPa?
4)	A human bite can produce about 500 Newtons of force over an area of 0.0005 metres squared. a) How much pressure is applied by a human bite in Pa? b) How much pressure is applied by a human bite in kPa?

Name: _____ 70

Curriculum Connection
9

Calculating the Pressure of Fluids

The imperial systems uses different units for measuring pressure. In the United States, they use pound-force per square inch (psi). It is common in Canada to hear psi recommendations.

For example, a tire's air pressure has a force of 120 pounds exerted over 4 square inches. Therefore,

$P = \frac{120}{4}$ P = 30 PSI

Calculate d the pressure using pounds per square inch (PSI)

		Area	Pressure in PSI
1)		9	
2)		4	
3)	156		
4)	456		
5)	494	26	
6)	880	4	
7)	1850	50	
8)	910	65	
9)	2232	72	
10)	5472	144	

Solve Answer the word problem below

A basketball has air exerting 88 pounds of force acting on 11 square inches of space. What is the air pressure in PSI?

Name: _____ 71

Curriculum Connection
9

Calculating the Pressure of Fluids

Calculate Answer the word problems below

1)	The PSI of a bike tire is 90. If the area the air is exerting on is 6 inches, what is the force of the air? 
2)	want ... pressure of water to flow out of your shower. You turn your s... at ... a PSI of 80. If the force the water is exerting on an area ... unds, ... area in square inches? 
3)	A fire extinguisher has carbon dioxide pr... zed ... exerts a force of 3300 pounds over 4 square inches. Wh... SI?
4)	A football has a PSI of 12. The area of the football is 24 inches. What force in pounds does the air exert on the football? 

Name: _____ 74

Curriculum Connection
9

Experiment - Air Compression

Background

Can we squeeze air and compress it?

Air is all around us. We can't see it, but it is actually a fluid that we live in. There are tiny gas particles floating around us all the time. Open your hand and grab some air. Squeeze the air in your hands. Did you feel anything? No, because the air escapes out of your hand. But can we squeeze air and compress it? Let's try!

Research Question

Can we compress air?

Can we com air inside a reusable water bottle by squeezing the end of the bottle while th amount of air will still be in the bottle, but the bottle will be smaller we release the bottle's lid?

Hypothesis

ompressed? What will happen with the lid?

Materials

What you need for experim

- Empty plastic water bottle (reusable bottle that

Procedure

What to do

1. Make sure the bottle is empty and o r.
2. Tighten the lid so no air can escape. We w make sure the air inside gets compressed, instead of escaping out of the lid.
3. Twist the bottle's larger end on the opposite side of the lid. Twist until the bottle is about half of the size that it was before
4. CAREFULLY loosen the lid. MAKE SURE NO ONE IS NEAR THE BOTTLE'S LID. DO NOT POINT THE BOTTLE AT ANYONE.
5. If nothing happened, try again by blowing air back into the bottle, inflating it again, and restarting.

Name: _____ 75

Curriculum Connection
9

Experiment - Air Compression

Diagram

Draw two diagrams:
1. The squeezed bottle with the lid on. Label the compressed air
2. The opened bottle. Label the lid flying, the air direction using arrows

Results

What [illegible] experiment?

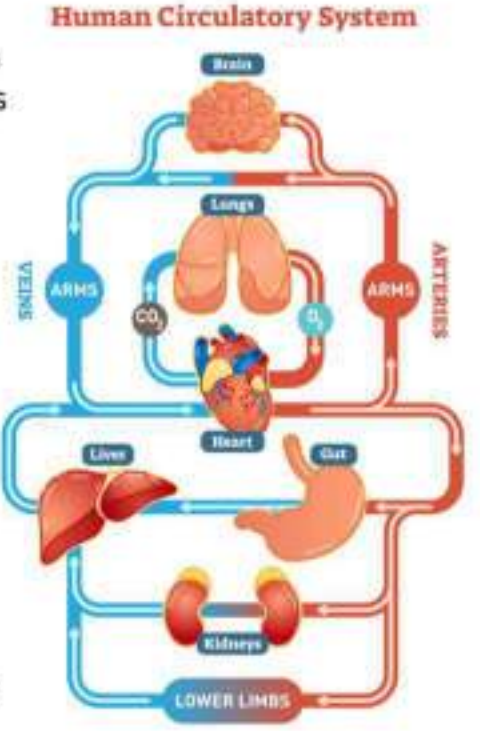
1) What is air compression? What does it m[illegible] compr[illegible]

2) Was your hypothesis correct? Was the air compressed inside o[illegible]e b[illegible] know?

3) Why did the bottle lid go flying through the air? If you squeezed the bottle more, would the lid have flown further?

Life Systems as Pneumatic/Hydraulic Systems

The Circulatory System



The circulatory system can be thought of as a hydraulic system because it uses the movement of fluids to transport substances throughout the body. Specifically, the circulatory system uses liquid blood to perform its functions.

The circulatory system consists of the heart, blood vessels, and blood. The heart pumps the blood, which is a liquid fluid, through the blood vessels, which are like the pipes in a hyd ic system. The blood vessels carry the blood to all t s and organs in the body, providing them with o ts, and other substances they need to funct

O d pres pressure of the circulating blood agai the w ood essels. Just like a hydraulic system st app he walls of the system. As the blood it mo reas of least resistance. This allows t ut our bodies, so that it can spread nutrien lect c xide.

The Respiratory System

The respiratory system can be thought of eumat because it uses the movement of air to perfe m its fu ns. The respiratory system consists of the nasal pass ache bronchi, and lungs. These structures are involved in process of respiration, which is the exchange of oxygen and carbon dioxide between the body and the environment.

In the pneumatic system, air is used to transfer energy and perform work. Similarly, the respiratory system uses the movement of air to transport oxygen from the environment into the body, and to remove carbon dioxide from the body.

When we inhale, air is drawn into the body through the nasal passages and trachea, and then into the bronchi and lungs. The alveoli, which are tiny air sacs in the lungs, are lined with capillaries that carry blood. Oxygen from the inhaled air diffuses across the walls of the alveoli and into the blood in the capillaries, where it is carried to the body's cells.

At the same time, carbon dioxide, which is a waste product of cellular metabolism, diffuses from the blood into the alveoli, where it is exhaled out of the body when we exhale.

Overall, the respiratory system can be considered a pneumatic system because it uses the movement of air to perform the vital function of exchanging oxygen and carbon dioxide with the environment.

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Curriculum Connection
12

Life Systems as Pneumatic/Hydraulic Systems

Questions

Use information from the text to support your answer

1) How is the circulatory system a hydraulic system? How does it function?

2) How is the respiratory system a pneumatic system? How does it function?

Questioning

Write 3 questions you have about the reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1) The circulatory system uses a gas to send nutrients throughout the body	True	False
2) The respiratory system takes in oxygen and sends out carbon dioxide	True	False
3) The heart is the pump for the hydraulic system	True	False
4) There is pressure in the blood as it flows through the circulatory system	True	False
5) Blood pressure is the pressure of the blood inside the heart	True	False

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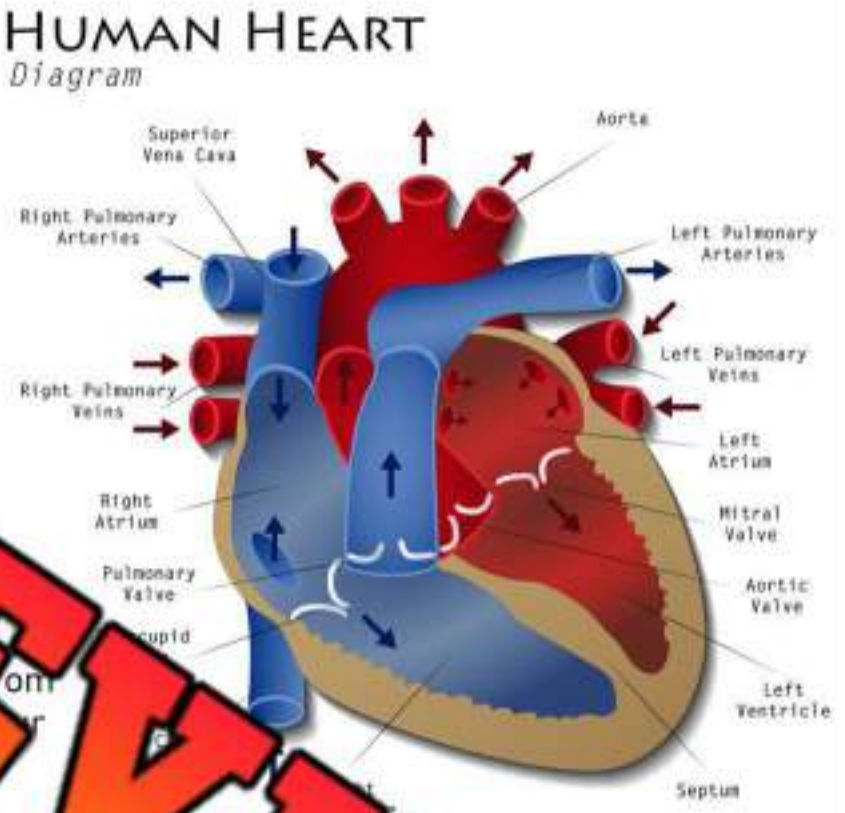
Curriculum Connection
12

Regulating Fluid in the Circulatory System

The Heart

The heart is a muscle that pumps blood throughout the circulatory system. The heart is divided into two separate pumping systems, the right side and the left side.



- The right side receives oxygen-poor blood from your veins. The body needs oxygen, so it is sent to the lungs where it becomes oxygenated and when it gets rid of carbon dioxide.
- The left side of your heart receives the oxygen-rich blood from your lungs. It pumps it through your arteries to the rest of your body.

Regulating Blood Flow - Valves

Blood flows through your heart and lungs in four steps.

1) The right atrium receives the oxygen-poor blood from the body and pumps it to the right ventricle through the tricuspid valve. The **tricuspid valve** has three flaps that open and close to ensure that blood flows in the correct direction. The valve is designed to ensure that no blood flows backwards between these two chambers. It opens and closes with every heartbeat, allowing blood to continue to flow.

2) The right ventricle pumps the oxygen-poor blood to the lungs through the pulmonary valve. The **pulmonary valve** regulates the flow of the oxygen-poor blood into the lungs, so that it can become oxygenated.

3) The left atrium receives the oxygen-rich blood from the lungs. It pumps the blood through the **mitral valve** where it ends up in the left ventricle.

4) The left ventricle pumps the oxygen-rich blood through the **aortic valve** where it is then sent in multiple directions through the body.

The heart is pumping with every beat, usually around 50+ a minute. These valves work to ensure that the flowing blood does not flow backwards. There is only one direction for the blood to flow in a functioning heart and that is because of our heart valves.

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Curriculum Connection
12

Regulating Fluid in the Circulatory System

Questions

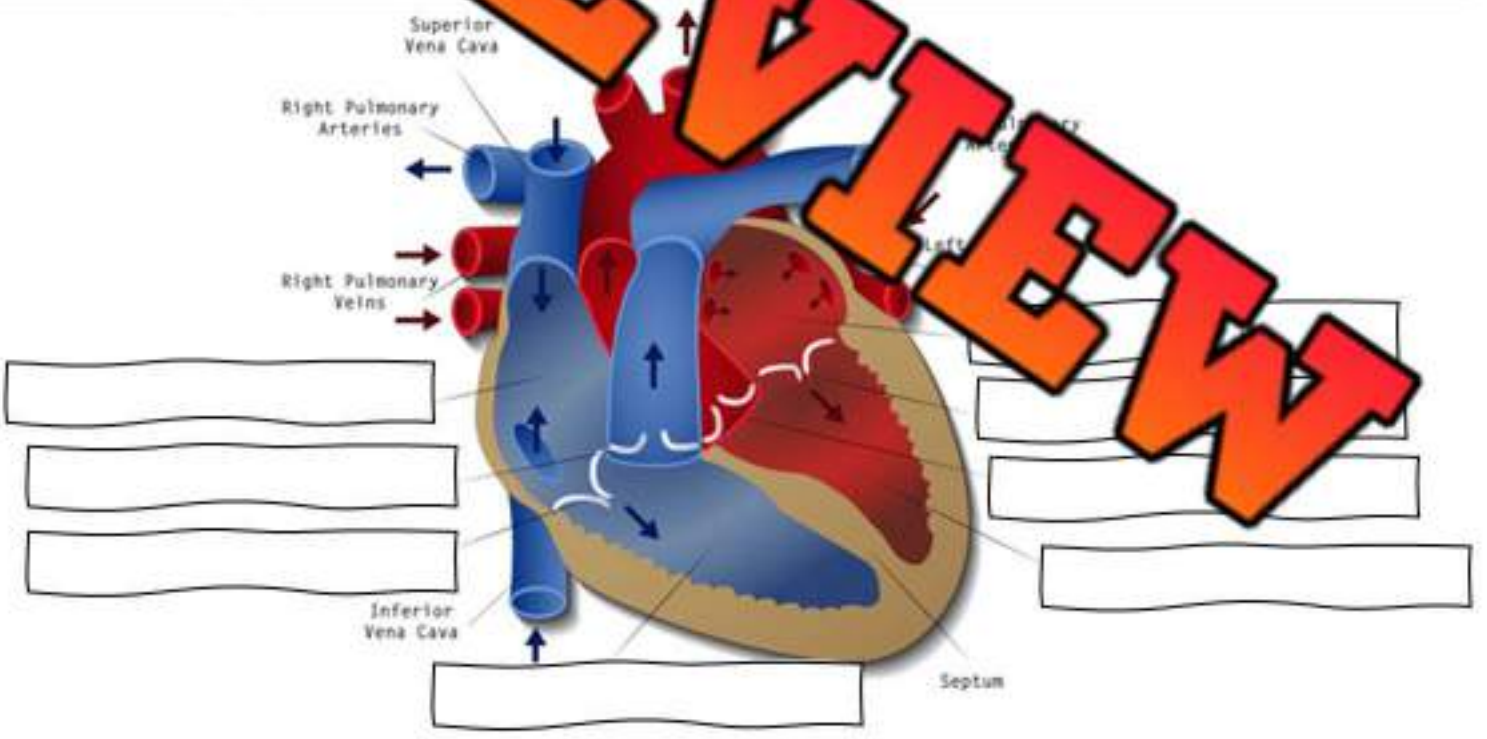
Use information from the text to support your answer

1) What is the function of our heart valves? Why do we need them?

2) What could happen if our valves stopped functioning properly?

Diagram

Label the diagram below by filling in the missing labels



Questioning

Write 2 questions you have about the reading

1)	
2)	

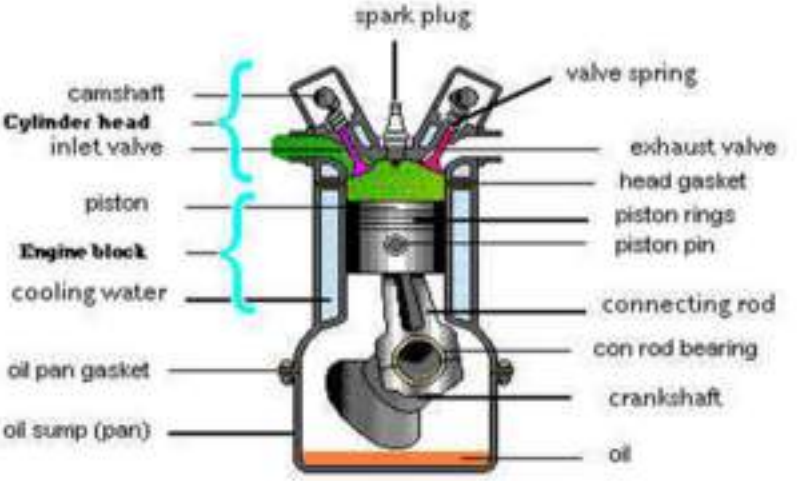
Name: _____ 80

Curriculum Connection
12

Valves in Mechanical Devices

Valves in Vehicles

The valves in an engine are responsible for letting air and fuel into the cylinders to be combusted. These valves are called **intake valves**, as they allow fluids to move into the engine. Valves are also used to let out exh[illegible] from that combustion. [illegible]alves are called **exhaust val[illegible]**



J[illegible] engine has valv[illegible] regula[illegible] of fluids through its c[illegible] eve[illegible] an engine works [illegible], as it [illegible] quality air and fuel through its intake valves, and it releases exha[illegible] ough[illegible] valves.

Valves in Water Systems

The tap in your bathroom uses [illegible] valv[illegible] te the flow and temperature of the water that comes out of the tap. The [illegible]e p[illegible] your house is held at a pressure higher than the pressure of the [illegible]ound [illegible]ssure difference causes the water to come up from the ground-leve[illegible]s an[illegible] our house, through the faucet.

A faucet or tap is a valve that controls the flo[illegible] y[illegible]rn the tap on, you are opening the valve. When the valve is closed, [illegible] bloc[illegible] flow of water. As soon as you open the valve, the high-pressured w[illegible]ant[illegible] to the area outside of the tap, which has lower air pressure. If you oper[illegible] the tap fully, you will get a large flow of water as there is more room for the water to flow. If you open it slightly, you will allow a small flow of water out through the stopper.

Depending on which handle you turn, you can access cold or hot water. The hot water comes from a hot water tank in your house. Depending on the type of faucet you have, different valves regulate the release of hot and/or cold water.

Turning on the cold-water tap will give you water directly from the cold-water line, which could come directly from the city's water service or from a well. Turning on the hot-water will send water from the hot-water line that comes from your hot water tank. When you turn both handles, or use one faucet in the middle, water will flow from both lines, resulting in a certain temperature dependent upon the ratio of hot to cold water.

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Curriculum Connection
12

Valves in Mechanical Devices

Summarize How do valves work in combustion engines and water systems?

Combustion Engine	
Water Syste	

Inference ...se y... ...ding to answer the questions below.

1) How is an engine's valve si... ...he ... ...ve in our circulatory system?

2) When you turn on the hot water, why do you think y... ...get c... ...ter first?

True or False Circle whether the statement is true or false

1) When gas is burned, the emissions exit out through the exhaust valve	True	False
2) Gas and air enter through the exhaust valve	True	False
3) Water underground is under less pressure than above ground	True	False
4) Our taps are valves that control the flow of water to where we want it	True	False
5) We need two hot and cold faucets to access hot and cold water separately	True	False

Impacts of Fluid Technologies

Impacts of Fluid Technologies

The understanding of fluids provides us with many technologies that we use to our advantage. Check out some fluid technologies having big impacts on our lives.

Renewable Energy

Some renewable energy sources use the flow of fluids to generate electricity. Without these sources of power, we would be burning more fossil fuels, causing more greenhouse gases to destroy our planet.

Water Power

Hydroelectricity is electricity produced from flowing water. It is by far the number one renewable energy source used around the world. In fact, Canada is the second largest producer of hydroelectricity and it accounts for 59.3% of Canada's electricity supply.

One downside to hydroelectricity is that the reservoirs that are built are changing the ecosystems they flood. They create massive structures that change the flow of water. Not only is the structure itself a hazard for the plants and animals living near it, but the change in the flow of water creates habitat. The change in flow can be felt not just at the site of the dam, but downstream as well.

Wind Power

Wind turbines are the second biggest source of renewable energy in Canada. Wind turbines harness the movement of air to generate electricity. Air is a fluid that moves from areas of high pressure to low.

Wind turbines can, however, be detrimental to the environment. They pose a threat to flying wildlife like birds and bats. They also change the landscape. Large structures and noise pollution.

Hydraulic Devices

The impacts of hydraulic systems has allowed manufacturing companies to produce things we use in our everyday lives. Without these products, our quality of life would suffer.

Hydraulic systems are used in robotics that manufacturing things like automobiles and computers. Without hydraulic systems, less work would get completed, as people would have to manufacture the products manually. In 1913, Ford Motors started the first assembly line to build cars. They had people build cars manually. The average car took one hour and 33 minutes to build. Today, cars are not built from start to finish very quickly because the factories have efficient ways of building many cars all at once. But, we know that Ford's factory in Kansas City produces around 1,300 cars a day! That is 54 every hour and almost one every minute.

Negative impacts of the use of hydraulic systems include more unemployment and environmental concerns. First, with machines taking the place of people, manual labourers are not in as high of demand. In addition, hydraulic systems can cause fluid pollution when these systems leak. Hydraulic fluids are often dangerous to our environment.

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Curriculum Connection
13

Impacts of Fluid Technologies

Impacts Fill in the table to describe the impacts of these technologies

Renewable Energy	
1) How are fluids used to create renewable energy?	
2) What [illegible] gative impacts of these technologies?	
Positi[illegible]	Negative Impacts

Hydraulic Syst[illegible]	
1) How are hydraulic systems increasing productivity in [illegible] ing?	
2) What are the positive and negative impacts of these hydraulic systems?	
Positive Impacts	Negative Impacts

Name: _____ Date: _____

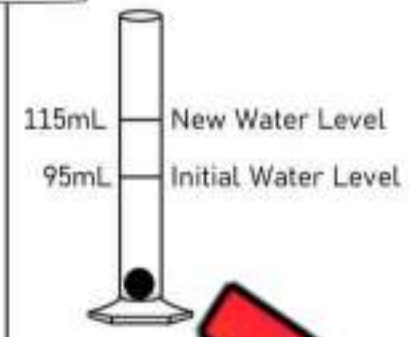
Unit Test - Fluids

Multiple Choice /10

1) Which is a fluid? a) A liquid b) A solid c) A gas d) A liquid and a gas	2) Which has the highest viscosity? a) Water b) Oil c) Ketchup d) Milk
3) Particles in a) Close b) Far apart c) Not moving d) None of the above	4) The density will be higher if the mass is high, and the volume is... a) Small b) Medium c) Large d) All of the above
5) Which state of matter has the nsity a) A liquid b) A solid c) A gas d) Both a and C	h state of matter is easiest to compress? A soli c) A d) No
7) If the mass of an object is 200 g and the volume is 25 cm^3, what is the density? a) 0.125 g/cm^3 b) 0.5 g/cm^3 c) 25/200 g/cm^3 d) 8 g/cm^3	8) If a liquid ... y o ... ^{3}, it will be... a) Positively buoyant b) Negatively buoyant c) Neutrally buoyant d) None of the above
9) If 10 kg of water is displaced when you put an object in water, what is the buoyant force? a) 10 kg b) 20 kg c) 5 kg d) 100 kg	10) When air is compressed, it gets... a) Warmer b) Colder c) Stays the same temperature d) None of the above

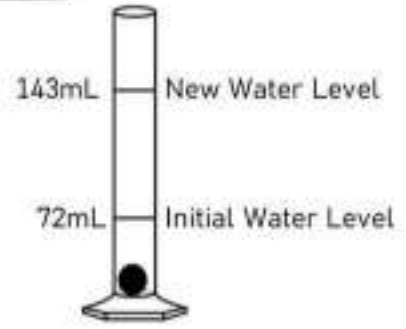
Calculate Fill in the tables below by reading the diagrams

1)



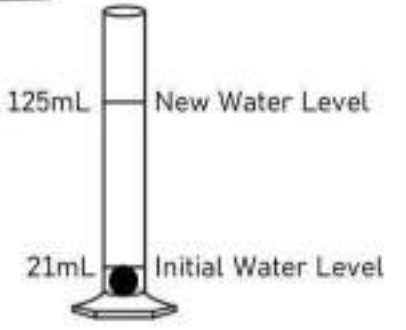
Volume	
Mass	30
Density	

2)



Volume	
Mass	120 g
Density	

3)



Volume	
Mass	
Density	2 g/cm^3

Short Answer Questions (2 mark

1) Why do we need motor oils with di t vis

2) How does heat affect the density of a solid, liquid, and a gas?

3) How does a valve work? How does it regulate flow of fluids? Give an example.

Long Answer

Answer the long answer questions. Each question is 5 marks

1) What is the difference between a hydraulic system and a pneumatic system? What are examples of both? How do they use fluids to perform work?

2) What is buoyancy? Does an egg have more buoyancy in a [illegible] salt water? Explain why that is the case.

Grade 8 Science Unit
Water Systems

	Curriculum Expectations	Pages
1	Use appropriate vocabulary related to their investigations of water systems.	8 - 116
2	Demonstrate that water, as compared to other substances, has a high heat capacity and is able to dissolve a wide variety of solutes.	10 - 13
3	Compare and contrast characteristics and properties of fresh water and salt water	8 - 9, 14 - 19
4		
5		
6		
7	Describe features of the North American drainage system.	28 - 33
8	Describe how erosion and deposition are influenced by the flow rate of a stream or river, and contrast the related characteristics of young and mature streams.	36 - 45
9	Describe how wave action and ice movement in large bodies of water cause erosion and deposition.	46 - 49
10	Explain how tides are caused and describe their effects on shorelines.	50 - 51

Grade 8 Science Unit
Water Systems

	Curriculum Expectations	Pages
11	Describe examples of human interventions to prevent riverbank or coastal erosion.	52 – 53
12	Identi[illegible]ors that can cause flooding either individually or in comb[illegible]	54 – 59, 63 – 64
13	[illegible] exam[illegible] way in which technology is used to contain or [illegible]ge[illegible] to flooding, and discuss related positive a[illegible] impa[illegible]	60 – 62
14	Identify sources of d[illegible]ter an[illegible]he methods for obtaining water in area[illegible]upp[illegible]	65 – 71, 101 – 106, 110 – 116
15	Explain how and why water may ne[illegible]o be tr[illegible] for humans.	76 – 81, 94 – 98
16	Compare the waste-water disposal system within th[illegible] communities to one used elsewhere.	[illegible]
17	Identify substances that may pollute water, related environmental and societal impacts of pollution, and ways to reduce or eliminate effects of pollution	82 – 86
18	Identify environmental, social, and economic factors that should be considered in the management of water resources	34 – 35, 72 – 75, 99 – 106, 110 – 116
19	Use the design process to develop a system to solve a water-related problem.	80 – 81, 94 – 98, 107 – 108

NAME: _____

Water Systems

Name: _____ 10

Curriculum Connection
2

High Heat Capacity

Does Water Have A High Heat Capacity?

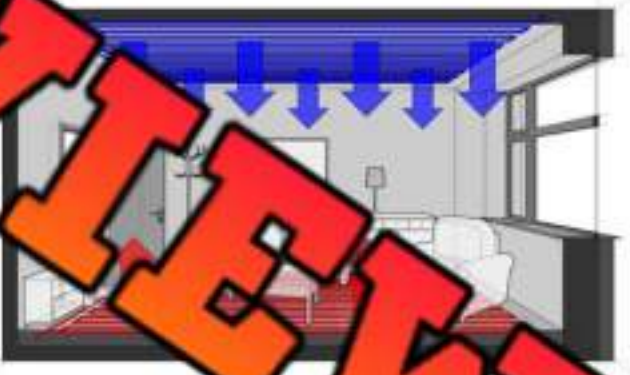
Water does have a relatively high heat capacity compared to other substances. Heat capacity is a measure of the amount of heat energy that is required to raise the temperature of a substance by a certain amount. Water has a high heat capacity because it requires a relatively large amount of heat energy to raise its temperature.

The heat capacity of water is often used as a reference value when comparing the heat capacities of other substances. For example, the heat capacity of water is about 4.18 joules p[illegible]am degree Celsius (J/g°C). This means that it takes about 4.18 joules of heat ener[illegible]se the temperature of 1 gram of water by 1 degree Celsius.

The h[illegible]ity of water is due to the strong bonds between the molecules of wate[illegible]s[illegible]e a large amount of energy to be broken in order to increase[illegible]emper[illegible]e water. This is why it takes a relatively large amount of heat energy to ra[illegible]ra[illegible]of water compared to other substances.

In general, [illegible] lowe[illegible]apacity than water, which means that they require a smaller am[illegible]of he[illegible]aise their temperature. The heat capacity of some common oils is [illegible]ab[illegible]

Oil	Heat capa[illegible]g°C
Olive oil	2.09
Sunflower oil	2.03
Coconut oil	1.96



Using Water's High Heat Capacity

Water's high heat capacity is used in a variety of ways to take advantage of its ability to absorb and store large am[illegible] energy without undergoing a significant temperature change.

1) Cooling Systems: Water is often used as a coolant in electronic and mechanical systems because it can absorb and remove excess heat from these systems. Water is used as a coolant in a variety of applications, including in car engines, power plants, and computer systems.

2) Thermal Energy Storage: Water's high heat capacity makes it an effective medium for storing thermal energy, which can be used to generate electricity or heat buildings. For example, excess electricity from renewable energy sources such as solar panels or wind turbines can be used to heat water, which can then be stored in a tank. The stored thermal energy can then be used to generate electricity when it is needed, using a process known as thermoelectric power generation.

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Curriculum Connection
2

High Heat Capacity

Questions

Answer the questions below using evidence from the text

1) What does it mean for water to have a high heat capacity?

2) How c[illegible] take advantage of its high heat capacity?

Questioning

Write 3 questions [illegible] reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1) Oil has a higher heat capacity	True	False
2) Having a higher heat capacity means the liquid retains its heat longer	True	False
3) 1 g of water needs 4.18 J of energy to increase heat by 1° C	True	False
4) Sunflower oil requires over twice as much energy than water to increase heat	True	False
5) Pools heat up fast because they have a high heat capacity	True	False

Name: _____ 12

Curriculum Connection
2

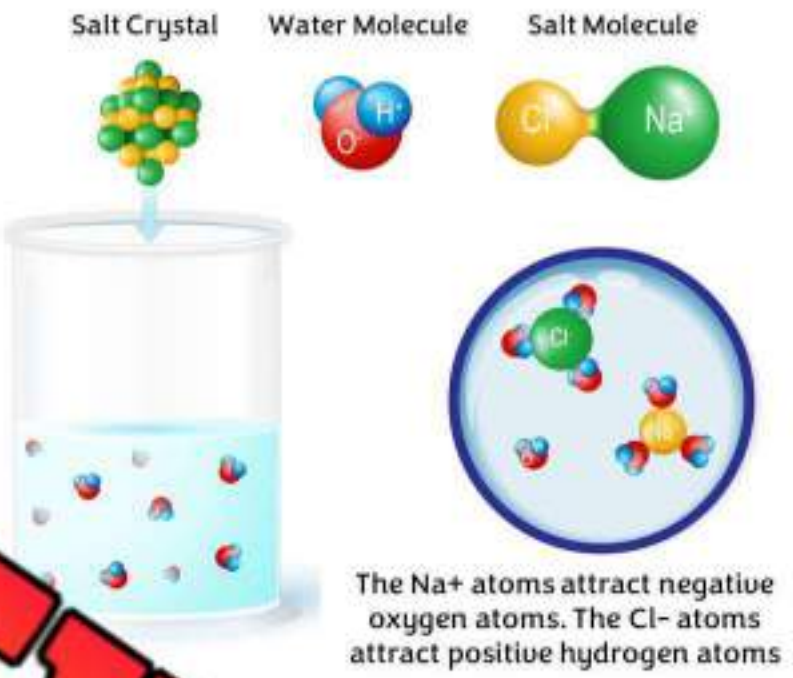
Universal Solvent - Water

Universal Solvent – Water

Water is called the **universal solvent** because more substances dissolve in water than in any other substance. This is important because as water moves, it is breaking down and carrying valu[illegible]emicals, minerals, an[illegible]

W[illegible]est because of its chemi[illegible]tion. Water molecules a[illegible]ade of two hydrogen atoms and [illegible] atom. This gives them a positiv[illegible]l ch[illegible]ir hydrogen side and a negative electrical charge on their oxygen sid[illegible] Sinc[illegible]e attract, water molecules can attract many other different types of mole[illegible]as it ha[illegible]es.

How Does Salt Dissolve in Water



The Na+ atoms attract negative oxygen atoms. The Cl- atoms attract positive hydrogen atoms

Saltwater – Dissolving Salt in Water

Water is so heavily attracted to other substances, like s[illegible]ll brea[illegible]wn and dissolve the other substance, changing its chemical composi[illegible]n s[illegible]de. In water, the salt molecule made of one sodium and one chlorine atom ar[illegible] means the single atoms are floating by themselves in the water.

The positive sodium atoms from the salt attracts the negative oxygen atoms from the water and the negative chlorine atoms from the salt attract the positive hydrogen atoms in the water. The attraction is strong, creating new saltwater molecules that are bonded together, forming a homogenous solution.

Insoluble Substances

Some substances, like oil, will not dissolve in water. These insoluble substances have atoms that are very strongly attracted or bonded to each other. Therefore, the water molecules cannot separate them, so we will see both the water and oil molecules.

Name: _____ 13

Curriculum Connection
2

Universal Solvent - Water

Questions

Answer the questions below using evidence from the text

1) Why is water considered the universal solvent?

2) Why does [illegible]lve into water?

Diagram

Draw diag[illegible]ach [illegible]riptions below

Water Molecule	**Salt Molecule**	**Salt-Wat[illegible]ecule**

True or False

Circle whether the statement is true or false

1) Positively charged atoms attract other positively charged atoms	True	False
2) Hydrogen is a positively charged atom	True	False
3) Chlorine is attracted to hydrogen which bonds them together	True	False
4) Oil molecules and water molecules bond together to form a solution	True	False
5) Salt molecules separate into individual atoms when put in water	True	False

Name: _____ 14

Curriculum Connection
3

Water Characteristics

Types of Water

There are many different types of water, but the three main types are potable water, freshwater, and saltwater.

Potable water – Drinking water that comes from surface and ground sources that is treated to meet the standards for consumption. Potable water can be used to cook with as well. Potable water is what comes from our taps.

Freshwater – …e water found in glaciers, lakes, ponds, rivers, streams, and groundwater. Freshwater …s than 1,000 parts per million (ppm) of salt dissolved into the water.

Saltwater … found in the oceans and seas. It makes … …w… the Earth. Saltwater is water that con… …oughl… …or 35,000 ppm. If you take a litre of water fro… …u c… …d extract 35 grams of salt.

What is in our Water…

Potable Water

Our potable water may appe… …ut th… …ways many microscopic particles, some of … …n a… …e or healthiness of the water. When solid… end… …er, t… …n often be filtered, making the water clean… …ever, s… …ti… dissolve into the water, leaving a clear solution that … …s it impossible to detect the solids without using tech…

Total dissolved solids (TDS) is a term that rep… …ts t… combined total of all solids found in drinking water. Com… TDS found in potable water are:

- Algae, fungi, and bacteria
- Pesticides, herbicides, fertilizers
- Pharmaceuticals – medicines
- Minerals – Arsenic, lead, mercury, chlorine, sodium, potassium, magnesi…, fluoride

In Canada, the guidelines for TDS is less than 500 milligrams per litre (500 ppm). Average Alberta well water has a TDS level of closer to 1,000 mg/L. Alberta is known to have hard water due to the high levels of calcium and magnesium that it contains.

Freshwater

The amount of TDS ranges in different freshwater sources. It could range from 100-20,000 mg/L.

Saltwater

There are over 35,000 mg/L of TDS in saltwater. This should not be surprising as there is a lot of sodium in saltwater.

Name: _____ 15

Curriculum Connection
3

Water Characteristics

Questions

Use information from the text to support your answer

1) What is the difference between potable, freshwater, and saltwater?

2) What [illegible] TDS? What is an acceptable amount of TDS in Canada?

Making Connections

Have you [illegible]oticed [illegible]s floating in water? Explain.

True or False

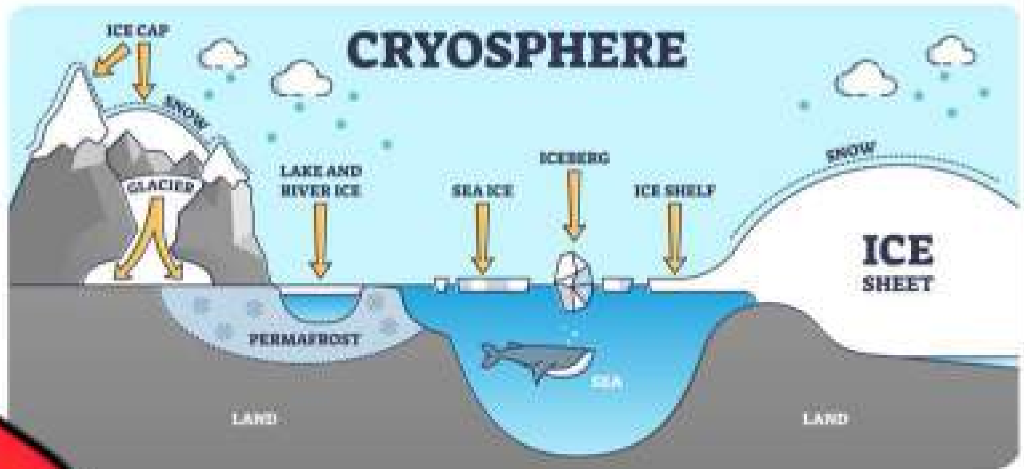
Circle whether the statement is true or false

1) If you can't see TDS in water, then the water is clean and free of TDS	True	False
2) Alberta has hard water because of the magnesium/calcium in contains	True	False
3) Canada suggests that less than 300 mg/L of TDS is preferable	True	False
4) Examples of TDS are medicine, pesticides, and minerals	True	False
5) Freshwater has the most TDS	True	False

Name: ______________________ 16

Cryosphere - Glaciers

What is the Cryosphere?



The **cryosphere** is the part of the earth's surface that has solid water – ice. The cryosphere is made up of regions ... d the world that h... temper... 0° This is the ...ezing ... id ...ter. The cryosphere is made up of different forms of glaciers, includin... ...ce she... ... and river ice, sea ice, icebergs, and ice shelves.

What are Glaciers?

A **glacier** is a slow moving, la... ...f ic... ...frozen over a long period of time.

- Ice Sheet – Ice sheets are the la...est ... ...sheets are the size of continents as they must be bigger tha... ...00 squ... ...s. The only ice sheets on Earth are in Antarctica and Greenland. How... ...uring ... age 20,000 years ago, two ice sheets covered most of the norther... ...(Canada).
- Ice Cap – Ice caps are smaller than ice sheets, as they ... ...an ... squ...e kilometres. Most ice caps are found near the north and south...oles... ...da has the Devon Ice Cap on Devon Island in Nunavut. It covers 12,000...
- Icebergs – Icebergs are floating pieces of ice that are more than 15 met... ...long that are found in oceans or lakes. Icebergs are created when they break off a larger glacier. Icebergs are made of freshwater, as they begin their live on land.
- Sea Ice – Sea ice is frozen ocean water, therefore, it is made of saltwater. Sea ice floats on the ocean's surface. It covers about 7% of the earth's surface and 12% of the world's oceans.
- Ice Shelf – Ice shelves are permanent floating sheets of ice that are connected to a landmass. When ice breaks off an ice shelf, it can become an iceberg.

Name: _____ 17

Curriculum Connection 3

Cryosphere - Glaciers

Questions

Use information from the text to support your answer

1) What is the cryosphere? What is part of the cryosphere?

2) What[illegible]e some glaciers formed?

Order

Put the glaciers below in [illegible]rom [illegible]st (1) to largest (6)

Iceberg	Ice Cap	Ice Sheet	Ic[illegible]	[illegible]a	Lake/River Ice

Multiple Choice

Circle the best answer

1) The largest glacier is an	Ice cap	[illegible]ce sheet
2) An ice sheet must be larger than	100,000 km^2	50,000 km^2
3) A glacier that is smaller and is made of freshwater	Sea Ice	Iceberg
4) The regions in our cryosphere must be below	0°C	-5°C
5) Sea Ice is made of	Freshwater	Saltwater
6) Which glacier is attached to a landmass?	Ice Shelf	River Ice
7) Glaciers are...	Moving	Still

Name: _____ 18

Curriculum Connection 3

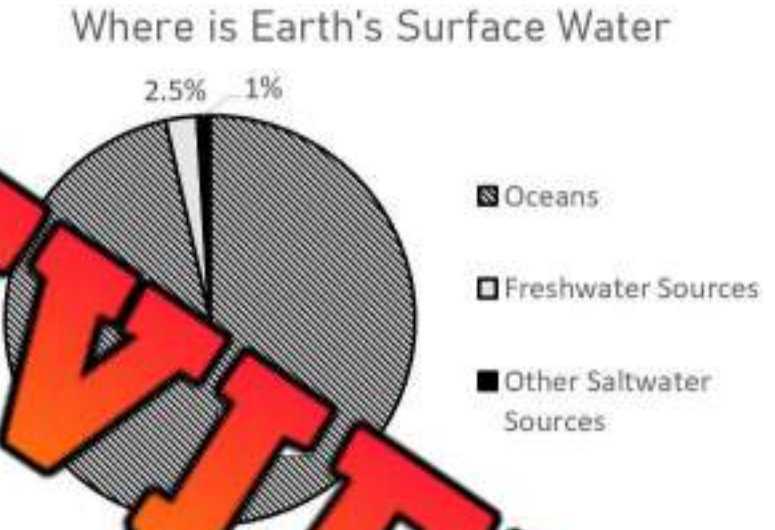
Water Distribution on Earth

Water Distribution

The amount of water on the Earth never changes. The water that you drink today is the same water dinosaurs drank millions of years ago. Scientists believe the overall amount of water on our planet has remained the same for two billion years.

Water is everywhere! Outside of the obvious places we can find water, there is also water in the air, in the soil, in you, and in aquifers. An **aquifer** is a natural underground area where water [illegible] spaces between rocks and sediment.

Oceans



Yes, you [illegible] 5% of all the water on [illegible] surface is in our oceans. [illegible] that over 96% of all water [illegible] saltwater. Saltwater contains [illegible] sodium chloride. Ocean water has an average salinity of 3.5%. To make saline mixture the same as what is found in an ocean, mix 35 grams of salt into 1 litre of [illegible] water is or how much salt has dissolved into water.

Other Saltwater Sources

Almost all of the Earth's saltwater is found in oceans, but some can be found [illegible] and in brackish water. **Brackish water** is less salty than saltwater but has more salinity than freshwater. We can find brackish water where freshwater and saltwater mix, like in estuaries. An **estuary** is an area where rivers connect with the sea.

Freshwater Sources

The remaining 2.5% of earth's surface water is found in freshwater sources. But, its not that simple, as 68% of freshwater is found in icecaps and glaciers. To make matters worse, over 30% of the remaining 32% is found underground. As a result, only 0.3% of earth's freshwater is found in rivers, lakes, and swamps.

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Curriculum Connection
3

Water Distribution on Earth

Questions

Use information from the text to support your answer

1) Where is most of the earth's surface water located? Why is that a problem?

2) Wher th's freshwater located? Why could that be a problem?

Making Connections

Have you ev in sal Share your experience

True or False

Circle whether the statement is true or false

1) The Earth has a lot of freshwater for us to use	True	False
2) The Earth's supply of water is almost all salty	True	False
3) Salinity refers to how much salt has dissolved in water	True	False
4) Brackish water has a stronger salinity than saltwater	True	False
5) Saltwater has a salinity of over 3.5%	True	False

Name: _____ 20

Curriculum Connection
4

Ocean Currents and Climate

Climate

Climate is the average temperature, precipitation, wind and humidity in a geographic location over a number of years. Weather is what is happening in the short term, climate is what happens over the long term.

Ocean Currents Affect Climate

The Sun affects the weather on Earth. The Sun's radiation does not affect all of the Earth in the same way. The equator region gets more solar radiation than the polar regions.

Seventy percent of the Earth's surface is covered with water. Oceans absorb and store a lot of the Sun's energy. Through ocean currents, the oceans distribute the heat that they store. Ocean currents bring warm water and precipitation from the equator to the north and south poles and ocean currents bring cold water from the poles back to the tropical regions.

The Gulf Stream is an ocean current that is 100 kilometers wide. It starts in the Gulf of Mexico and travels across the Atlantic Ocean going up the European coastline. The warming affect of the Gulf Stream makes European countries 5 degrees warmer than Canada even though they are on the same latitude.

In this way, ocean currents moderate the global climate, helping even out the distribution of solar radiation which reaches the Earth's surface. Without the moderating effect of ocean currents, temperatures on Earth would be more extreme. The equator region would be too hot for anything to live there, and the polar regions would be too cold.

Thermohaline Circulation

This map shows the ocean current called the global conveyor belt. This current is caused by changes in temperature and changes in the amount of salt in the water in the current. The term thermohaline come from thermo meaning temperature and haline meaning salty.

The blue lines are deep salty water cold currents, and the red lines are less salty, surface warm water currents. From the map you can see that the same water can travel all around the Earth moving in these currents. The water in the global conveyor belts travels a few centimeters per second. Based on the speed at which the water flows, it would take a drop of water a thousand years to make the journey around the world.

Name: _____ 21

Curriculum Connection
4

Ocean Currents and Climate - Questions

Questions Answer the questions below using evidence from the text

1) What is the difference between climate and weather?

2) What is t[illegible] conveyor belt?

Questioning What q[illegible] do[illegible] ter reading the information?

1)	
2)	
3)	

True or False Circle whether the statement is true or false

1. Ocean currents change where they flow from year to year.	True	False
2. Ocean currents affect weather – temperatures and rainfall/precipitation	True	False
3. Oceans cover 70% of the earth's surface.	True	False
4. The Gulf Stream is a current in the Pacific Ocean that is 100 kilometres wide	True	False
5. The amount of salt in ocean water affects ocean currents.	True	False

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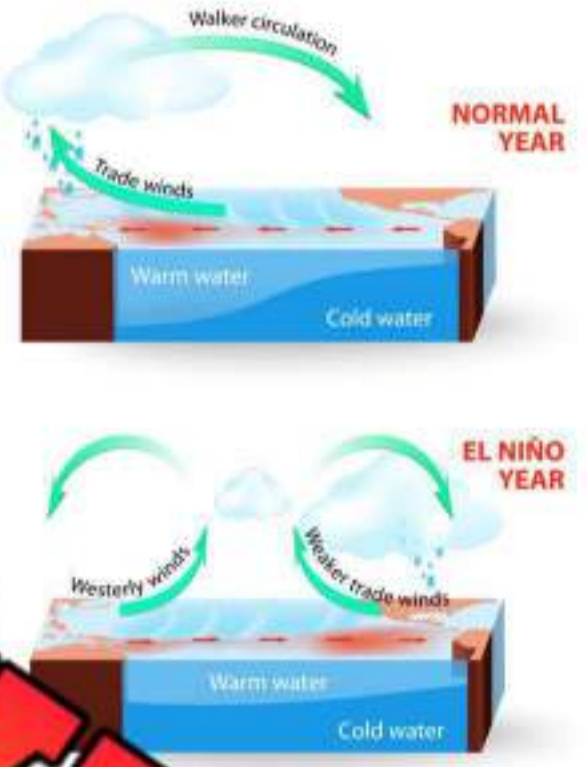
Curriculum Connection
5

El Niño

El Niño and La Nina

Warmer or colder than average ocean temperatures in one part of the world can influence weather around the world. The El Niño Southern Oscillation (ENSO) Cycle is a pattern of weather caused by the Trade Winds that blow in a band near the equator from the west Coast of South America to Asia. The ENSO Cycle is the oscillating back and forth pattern of warm water and cold trading places as winds blow across the Pacific Ocean. El Niño means, the boy and the warm phase. La Nina means the girl and the cold phase.



During an El Niño the Trade Winds which blow from east to west weaken and warm water towards Asia and Australia. This creates an enormous pool of warm surface water in the western Pacific Ocean and leaves cooler water along the coast of South America. This creates the normal pattern of weather in the countries affected by Pacific currents. Rain tends to form over warm water.

In some years the Trade Winds are not as strong causing surface water to drift eastward toward South America. This is called El Niño and creates a winter climate in North America. The warm ocean water attracts storms and causes the Jet Stream winds to blow further south than they normally do. This causes heavy rain and flooding in the southern United States and warmer drier weather in Pacific Northwestern United States and Canada. El Niño causes droughts is Australia because when the warm water is on the South America side the cool water is on the Australia side and there is less moisture over cool water.

When the Trade Winds get stronger again, sometimes, they blow harder than usual, causing cool surface water to accumulate along the coast of South America. This cool surface water causes unusually cold conditions in the Pacific Ocean pushing the Jet Stream winds north. This is called La Nina. La Nina causes drought in the southern United States and heavy rain and flooding in the Pacific Northwest. In Australia La Nina causes more rain in their summer.

An El Niño or La Nina happens every 2 to 7 years. El Niño happens a bit more often than La Nina. El Niño and La Nina cause water shortages, and because of flooding and drought they reduce our ability to grow food.

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Curriculum Connection
5

El Niño

Draw Draw a diagram of the weather conditions during an El Niño year

Questions Answer the questions below using evidence from the text

1) What is the main weather pattern that causes El Niño and La Nina?

2) Does El Niño affect different continents in different ways? Why? Why not?

True or False Circle whether the statement is true or false

1. El Niño is a cold weather phase.	True	False
2. ENSO is a weather pattern caused by changes to how hard the Trade Winds blow.	True	False
3. El Niño and El Nina affects several continents.	True	False
4. El Niño and El Nina don't cause any harm.	True	False
5. El Niño means the boy in Spanish.	True	False

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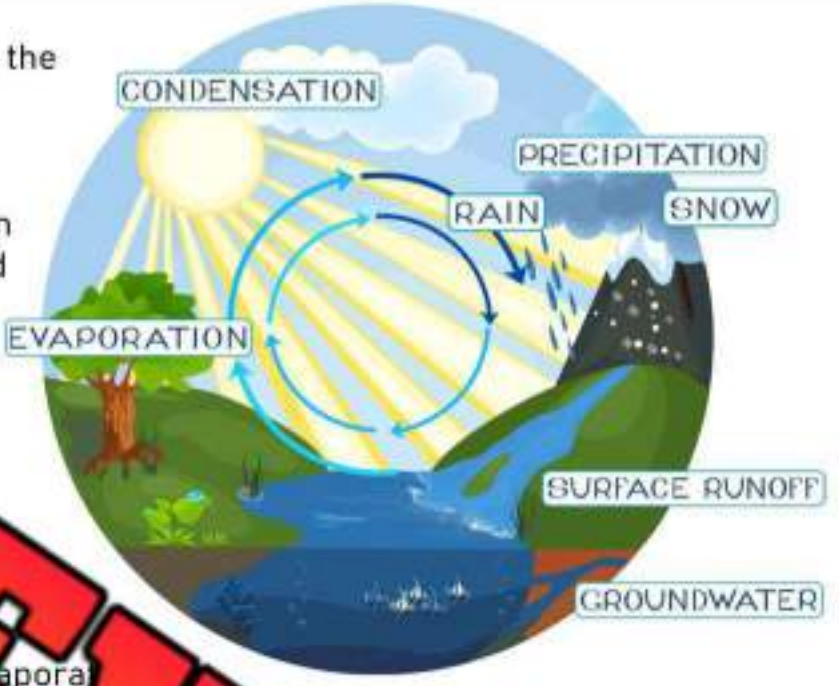
Curriculum Connection
6

Global Water Cycle

What is the Global Water Cycle?
The global water cycle, also known as the hydrologic cycle, is the continuous movement of water on, above, and below the surface of the Earth. It involves the transfer of water between the atmosphere, land, and oceans, and it is driven by the sun's energy, which drives the evaporation of water from the surface of the Earth and the precipitation back onto the surface.



The global water cycle has several components:

Evaporation: Water is continuously evaporating from the surface of the Earth, including from oceans, lakes, rivers, and soil. The heat of the sun causes the water molecules to gain energy and move faster, which allows them to escape into the atmosphere as water vapour.

Condensation: As the water vapour rises into the atmosphere, it cools and the molecules slow down. When the molecules slow down enough, they form clouds that condense around particles in the atmosphere, forming clouds.

Precipitation: As the clouds move and cool, the water droplets in the clouds can become too heavy to stay suspended and they fall back to the surface as precipitation, including rain, snow, sleet, and hail.

Runoff: When the precipitation reaches the surface of the Earth, it can either be absorbed into the ground or run off into streams, rivers, and lakes. Some of the water that is absorbed into the ground becomes part of the groundwater system, while the rest flows back into the oceans.

Transpiration: Water is also transferred between the land and the atmosphere through the process of transpiration, in which water is evaporated from the leaves of plants. This process helps to regulate the temperature and humidity of the atmosphere.

Overall, the global water cycle is a complex and dynamic system that plays a vital role in the Earth's climate and ecosystem. It is responsible for the distribution of water throughout the Earth's surface and atmosphere, and it is driven by the sun's energy.

Name: _____ 25

Curriculum Connection
6

The Sun and The Water Cycle - Questions

True or False

Circle whether the statement is true or false

1) Evaporation is the process of water turning into vapour	True	False
2) When vapour rises, it cools and forms clouds	True	False
3) Condensation is when water drops to the surface	True	False
4) The sun's e rgy is what drives the water cycle	True	False
5) When pla rate water, it is called precipitation	True	False

Summ e

Explain how the global water cycle works

Questions

Use information from the text to s ur an

1) Why is the sun considered the driver of the water cycle?

2) What is the difference between evaporation and condensation in the water cycle?

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Curriculum Connection
6

Water Cycle Diagram

Water Cycle Explain how each process below circ ter wat r cycle

Process	How It Circulates Water
Precipitation	
Condensation	
Evaporation	
Transpiration	
Infiltration	

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Curriculum Connection
6

Water Cycle Diagram

Diagram

Label the parts of the water cycle

Evaporation	Condensation	Transpiration	Infiltration
Groundwater	Ocean	Stream	Precipitation

Questions

Answer the questions below

1) Where are the main areas that water is stored? (note: they are not a[illegible]am)

2) Where does most of the water get evaporated from?

3) Where are two places that water goes when it pools on top of the soil?

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Curriculum Connection
7

Watersheds

What is a Watershed?

A **watershed** is an area of land where surface water drains down into a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, lake, or ocean.

Everyone lives in a watershed! The water that la on your property will either be eva d or drained down to a common st ver. When the water reaches takes it downw ere it reaches a larger body of wat hed sometimes referred to as a drainage basin.

Watershed Importa s

To understand how the houses to a large body of water, it is helpful to understand the t w.

Spring – where groundwater retur to through a natural opening in the Earth's crust

Draining Divide – the line that separates watersh at is und hills or mountains. A neighbouring watershed will have its s that could lead to the same large body of water

Confluence – where two flowing bodies of water, like two riv mee larger channel.

Tributary – is a stream or a river that flows into a larger river. A tributary not flow directly into a sea or ocean

Flood Plain – a strip of flat, dry land that is beside a stream, river, or lake that gets covered by water during a flood

Subwatershed – a smaller watershed within the larger system. In the diagram above, if you lived in the mountains, your subwatershed is the small system that drains your water into tributaries.

Estuary – an area that is open to an ocean or sea where one or more rivers or streams meet. We will find brackish water in an estuary.

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Curriculum Connection
7

Watersheds

Questions

Use information from the text to support your answer

1) What is a watershed? Why are they important?

2) What ? How do you think gravity affects a drainage divide?

Making Connections

Do you have an aries ? Explain your subwatershed

True or False

Circle whether the statement is true or false

1) A drainage divide is usually along hills or mountains	True	False
2) A confluence is a smaller flowing body of water, like a stream or river	True	False
3) A tributary is where two confluences meet to form one river	True	False
4) An estuary is an area open to an ocean where rivers or streams meet	True	False
5) A flood plain is the flat land beside a stream or river	True	False

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Curriculum Connection
7

Lake Winnipeg Watershed

Lake Winnipeg Watershed

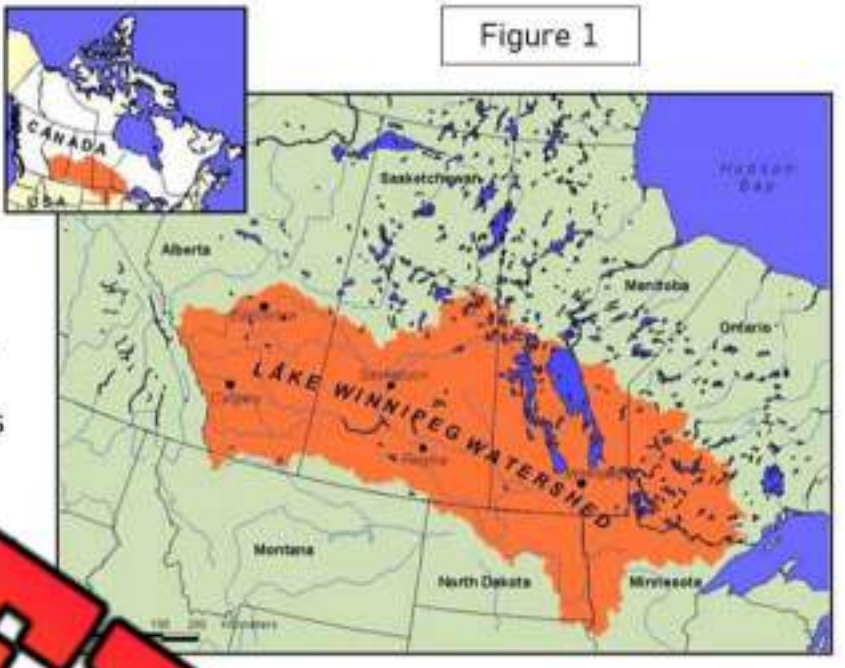
The Lake Winnipeg watershed is the drainage basin of Lake Winnipeg, which is the fifth-largest freshwater lake in Canada. The Lake Winnipeg watershed covers an area of approximately 361,000 square kilometers and is located in central Canada, in th inces of Manitoba, Ontario, and ewan.

The atershed is a part o , also known as ydrolo n the hydrologic cycle, nu moving on, above, w the surface of the Earth. yes transfer of water betwee atmosphere, land, and ocean driv n's energy, which drives the evaporation of water from the su f th precipitation of water back onto the surface.

The Lake Winnipeg watershed is pa large watershed, which is bordered by the Saskatchewan watershed to the wes Hud watershed to the north, and the Great Lakes watershed to the south s and erta, Saskatchewan, and Ontario drain into the Lake Winn

The Lake Winnipeg watershed is a major source of freshwater for the region, and it is home to a number of rivers and lakes, including the Red River, the Winnipeg River, and Lake Manitoba.

Figure 1



Drainage Divide

The major watershed drainage divides are shown in figure 2. The Lake Winnipeg watershed drains into the Hudson Bay. The arrow shows the drainage route.

Other watersheds are displayed, including the Great Continental Divide that runs all the way from Alaska to New Mexico. This divide is made by mountain ranges, like the Rocky Mountains.

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Curriculum Connection
7

Lake Winnipeg Watershed

Questions

Use information from the text to support your answer

1) What is the Lake Winnipeg Watershed? Which provinces does it serve and where does it drain into?

2) Why [illegible]tant? What are they part of?

Questioning

Write 3 questions [illegible] reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1) The Lake Winnipeg watershed collects water from 3 provinces	True	False
2) Lake Winnipeg is the 5th largest lake in Canada	True	False
3) The Lake Winnipeg watershed drains into the Hudson Bay	True	False
4) Lake Winnipeg drains into the Great Lakes	True	False
5) The Lake Winnipeg watershed is part of the St. Lawrence drainage divide	True	False

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Curriculum Connection
7

Research - My Watershed

Learn more about the subwatersheds in your area and which watershed services your location.

Research Answer the questions below

1) Which watershed do you live in?

2) Where d[illegible]d eventually drain its water into?

3) What tributaries do y[illegible]f they don't have a name, describe them. Where do they end up drai[illegible]

4) Where does the water come from that ends up in these tributaries?

Research | Answer the questions below

5) What is the closest reservoir to you? What is the purpose of this reservoir? (try searching reservoirs near me and click on the one nearest your city/town).

6) Draw your local watershed. Draw the tributaries in your area and where they drain. (hint: search your city, town, or neighbourhood online using a mapping website to help sketch the tributaries in your area)

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Curriculum Connection
8

Weathering, Erosion, Deposition

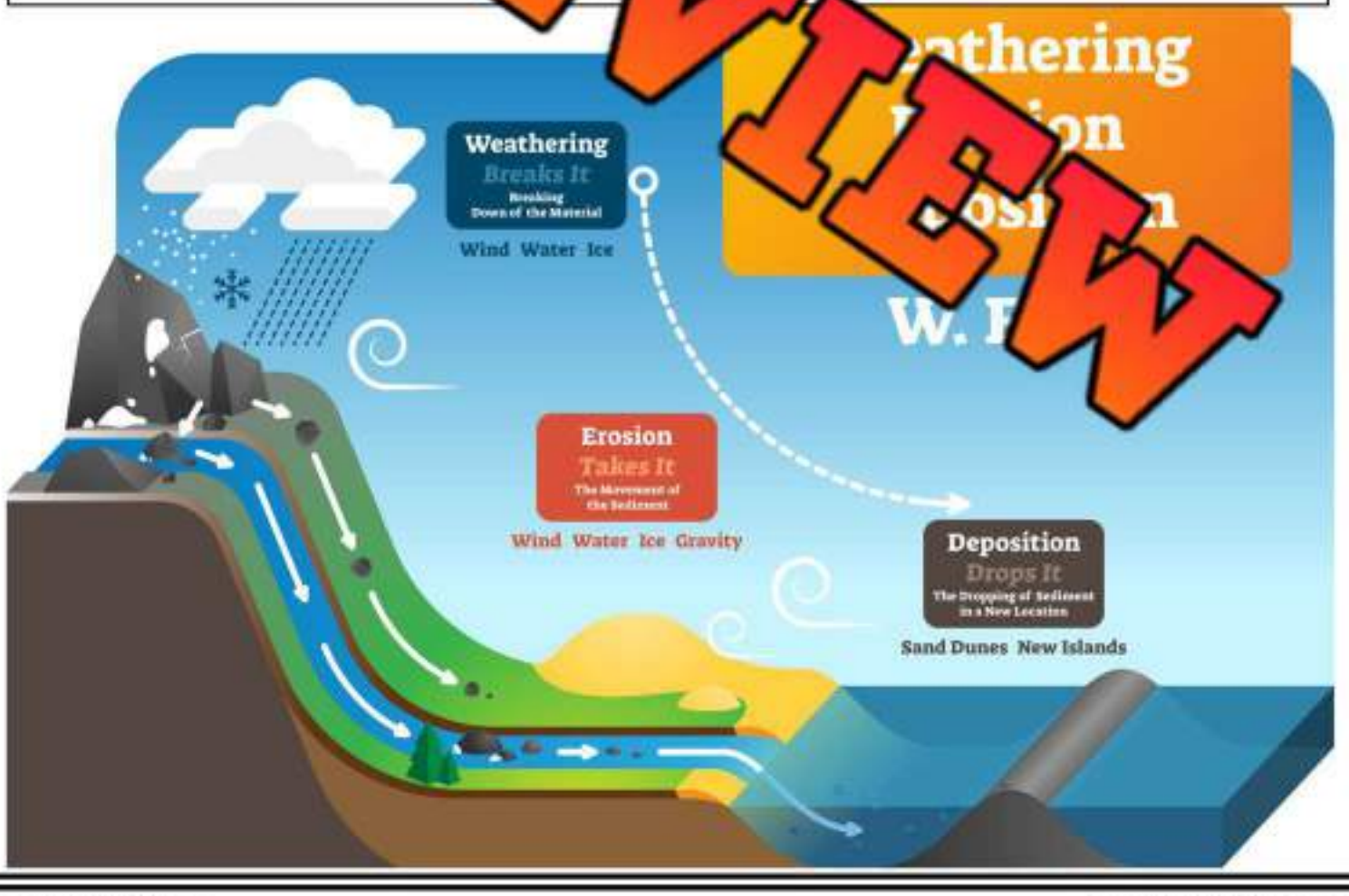
Weathering, Erosion, and Deposition

There is a process that is slowly changing our land. It is known as weathering, erosion, and deposition.

1) Weathering – Breaks it! Weathering breaks down Earth's materials. The smaller the broken pieces, the easier for these pieces to be eroded. Pieces of broken rock are called sediments.

2) Erosion – Takes it! Erosion takes the sediment to somewhere new. Gravity, wind, water, and ice all have enough force to move sediments. If a sediment is too large, it will req stronger force to be eroded. Sand, clay, and silt are easier eroded. Pebble and larger rock pieces will require more force.

3) De eposition is the dropping of sediment in a new location. De happ the eroding agent, whether its gravity, ice, or water, runs out of ergy s no nger move the sediment. This often happens when the sedime to a rm or landmass and can no longer move. Deposition is t ing o nts so that sedimentary can begin. Sedimentation ca ha sure of the water and sediments on top compact the sediment menta This creates new landforms, like sand dunes or new islands.



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Curriculum Connection
8

Weathering, Erosion, Deposition

True or False

Circle whether the statement is true or false

1) Weathered rock becomes sediment	True	False
2) Sediments never stop moving and are constantly being eroded	True	False
3) Deposition is when erosion stops, and sediments are deposited	True	False
4) Erosion, w hering, and deposition can make sand dunes and islands	True	False
5) Weatheri n, and deposition changes our land	True	False

Quest.

A questions below using evidence from the text

1) What is depos y doe en?

2) How are islands formed by weathering, erosio

Wordsearch

Find the words from the word bank

Word Bank	
Soil	Erosion
Rocks	Sediment
Land	Deposition
Dunes	Weathering

R Q W E A T H E R I N G P D V Y R
S J C D U N E S L Y M I A L A N D
I L D H S N D E P O S I T I O N Q
S O I L X F W U G S E D I M E N T
W H R O C K S E R O S I O N Y Z H
K J I U C K J J Q O G E P O Q F X

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Curriculum Connection
8

Meandering Streams

What is a Meandering Stream?

A **meandering stream** has a single channel that winds snakelike through its valley. As the water flows through an area that is relatively straight, it often develops bends as it erodes its way through the path of least resistance. Once a meander starts, it often gets [illegible] exaggerated, creating mo[illegible] in the stream.

What C[illegible]ers[illegible]eams?

As wate[illegible]s throu[illegible]am, it pushes with a str[illegible]on outside of the be[illegible]a[illegible]the inside of the bend. [illegible]des th outside of the curves fu[illegible]r creating bigger bends.

To make the bends even [illegible]he [illegible]tream has a slower flow rate. This makes the eroded sediment more likely to [illegible]ide, creating even larger bends! Notice this is represented on the d[illegible]- dep[illegible]on the inside and erosion on the outside.

Alluvial Deposits

The material deposited by streams and rivers are call[illegible]po[illegible]me cases, the alluvial deposits form floodplains or deltas that creat[illegible]il us[illegible]row plants. Alluvial deposits consists of silt, sand, clay, gravel, as well as [illegible]org[illegible]

Floodplains are the lands beside a stream or river while deltas [illegible] rivers empty their water and sediment into another body of water, lik[illegible]e or other river.

Components of Meandering Streams

- Meander Scar – Crescent shaped portion of a stream that was abandoned when a meander was cut off. This happens when sediment fills in a wall that separates the meander scar from the rest of the stream.
- Oxbow Lake – A U-shapes lake or pool that forms when a wide meander of stream is cut off, creating a free-standing body of water. They form when a stream finds a different, shorter, course.
- Backswamp – Found in a floodplain and forms when deposits of fine silts and clays settle on the land after a flood. The deposits create a marsh-like landscape with poor drainage.

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Curriculum Connection
8

Meandering Streams

True or False

Circle whether the statement is true or false

1) Erosion happens on the inside of a curve more than the outside	True	False
2) Deposition happens on the inside of a curve more than the outside	True	False
3) Meander scars form when sediment deposits, cutting off a part of the stream	True	False
4) Alluvial deposits consist of silt, sand, clay, gravel and organic material	True	False
5) Alluvial d are not fertile, meaning not good for planting	True	False

Questi

the questions below using evidence from the text

1) How do meand s fo Why are they so bendy?

2) How does an oxbow lake form?

Diagram

Draw a diagram of a meandering stream. Label
- erosion, deposition, alluvial deposits, oxbow lake, me scar

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Curriculum Connection
8

Experiment - Flow Rate of a Stream (V2)

Research Question — What are we learning more about?

The **flow rate** of a stream is how fast the water in a stream is moving. The slope of the stream affects the flow rate. The steeper the slope of the stream, the faster the flow rate will be. The flow rate is measured in cubic metres per second (m^3/s).

Materials — What do we need?

- ✓ A meas[illegible]e (metre stick)
- ✓ Plast[illegible]at will float – fill half full of water
- ✓ St[illegible]
- ✓ A st[illegible] with f[illegible]er that you can walk in – not too deep

Method — How [illegible]comp[illegible]periment?

1) With a partner, measure [illegible]f th[illegible] stream that you will measu[illegible]ime[illegible] takes for the float to get from one po[illegible] the other. You should try to use a len[illegible] at least 3 metres, but up to 10 metres will work.

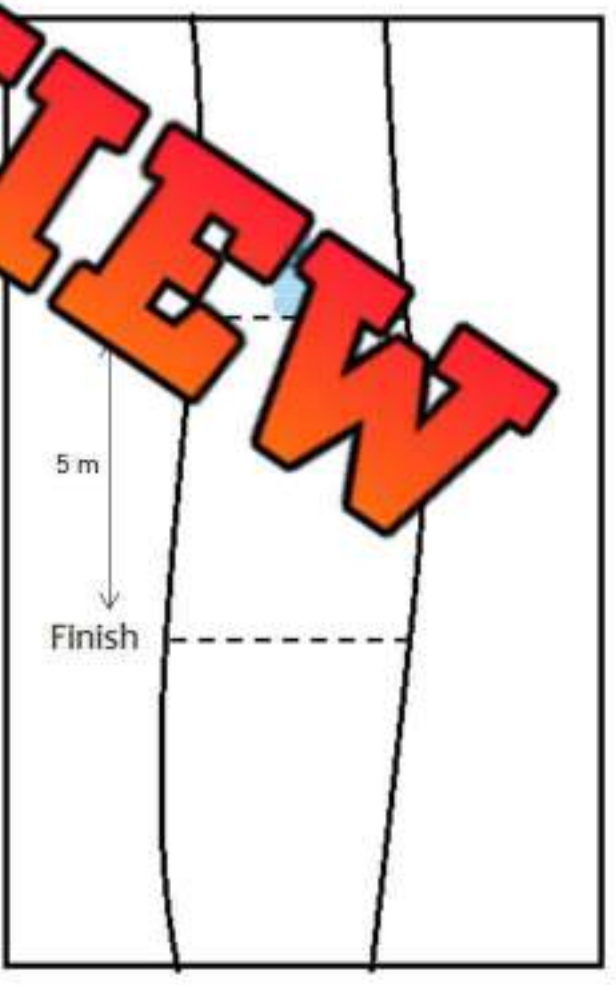
2) Measure the depth of the stream in two places

3) Measure the width of the stream

4) Have one partner stand at the start and the other partner at the finish. When the person at the start says go, they will drop the float. The other partner will start the stopwatch.

5) Record how many seconds the floating bottle takes to cross the finish. You can repeat this 3 times and average the times to get a more accurate reading.

6) Use the formula on the back of the page to determine the float rate of the stream



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Curriculum Connection
8

Experiment - Flow Rate of a Stream (V2)

Measurements	Write your measurements below

Depth of the Stream			
Average Depth (Add them both up and divide by 2)			
Width o[illegible]tream			
Le[illegible]			
Seconds			
Average Ti[illegible] (add up all three ti[illegible] and divide by 3)			

Results	Answer the qu[illegible]stio[illegible]

1) Use the formula below to find the flow rate in cub[illegible]tres [illegible]nd (m^3/s).

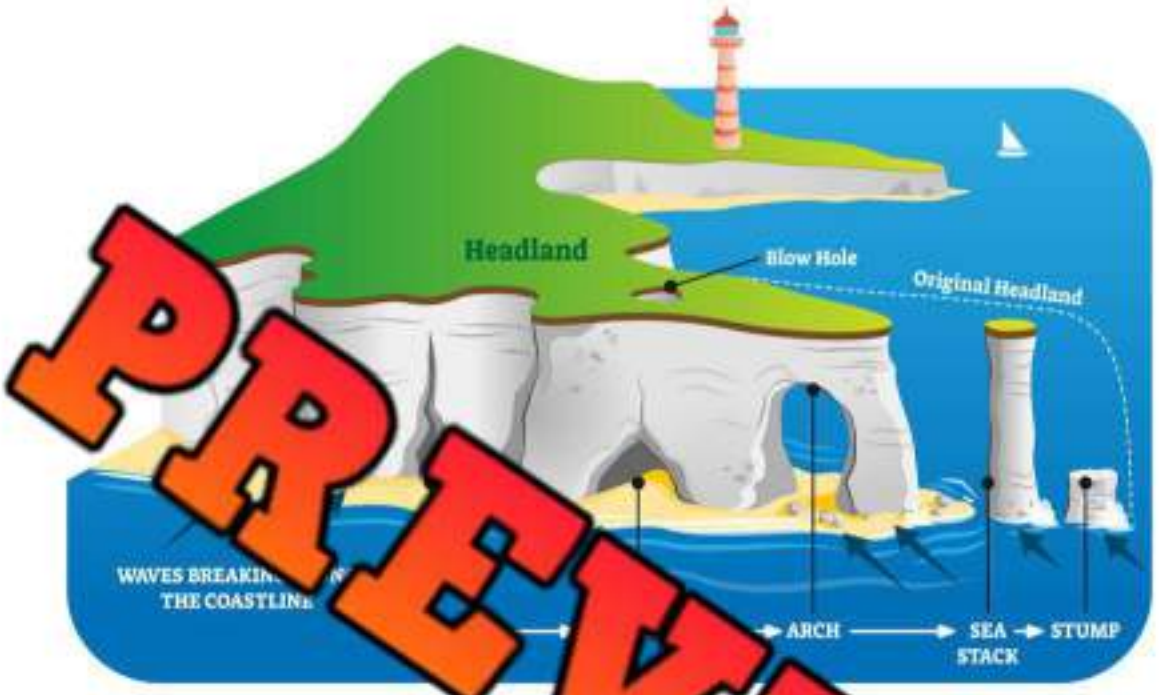
m^3/s = width x depth x (leng[illegible]

2) Describe the flow rate as fast, slow, or medium speed. Explain how [illegible]

3) Do you think there is a steep, moderate, or gentle slope? Explain how you know.

Example of Erosion - Coastal Erosion

COASTAL EROSION



Coastal Erosion

Where there is moving water, there will be signs of e h. Or astline of bodies of water, there will be examples of coastal erosion g the eas where there is a headland, you may find cracks in the coast, cav the stumps. A **headland** is a coastal landform that comes to a point, th th a s op.

Ocean waves are one of the most powerful natural phenomena. They have a significant impact on the shape of the Earth's coastlines. When the waves crash into the coastline, they weather the rock coastline. As sediments of rock become eroded, cracks can form. Over time, these cracks can become larger, forming caves. If the force of the moving water is strong enough, arches may form. When weathering breaks down an arch, a sea stack will form. Sea stacks are vulnerable to wind and water forces. Over time, they will lose stability and break apart, leaving behind a stump.

Most coastlines are straight. Headlands, like the one shown above will eventually be straightened out by erosion. The wave action will cut away at the headlands, weathering rocks that will be eroded along the shoreline of the bay, filling in the bay.

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Curriculum Connection
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Example of Erosion - Coastal Erosion

True or False

Circle whether the statement is true or false

1) A headland is a coastal landform that has a sheer drop	True	False
2) Costal erosion creates caves, arches, cracks, sea stacks and stumps	True	False
3) Irregular coastlines, like headlands will eventually be straightened	True	False
4) Caves and [illegible] stacks form quickly, after a couple months	True	False
5) It is comm[illegible]e sea stumps in rivers and lakes	True	False

Quest[illegible]

[illegible]the questions below using evidence from the text

1) Why do you t[illegible]on't se[illegible]umps in rivers and lakes?

2) How are sea stacks formed?

Questioning

Write 3 questions you have about coastal erosion

1)	
2)	
3)	

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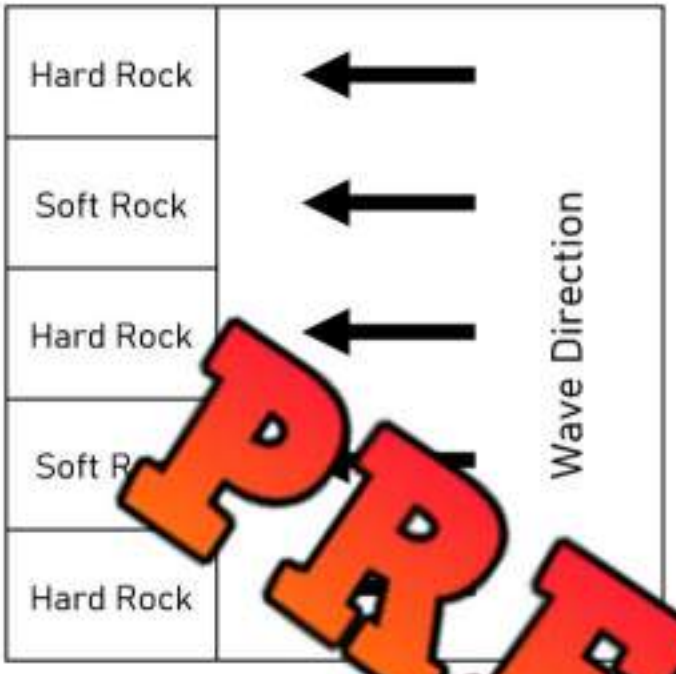
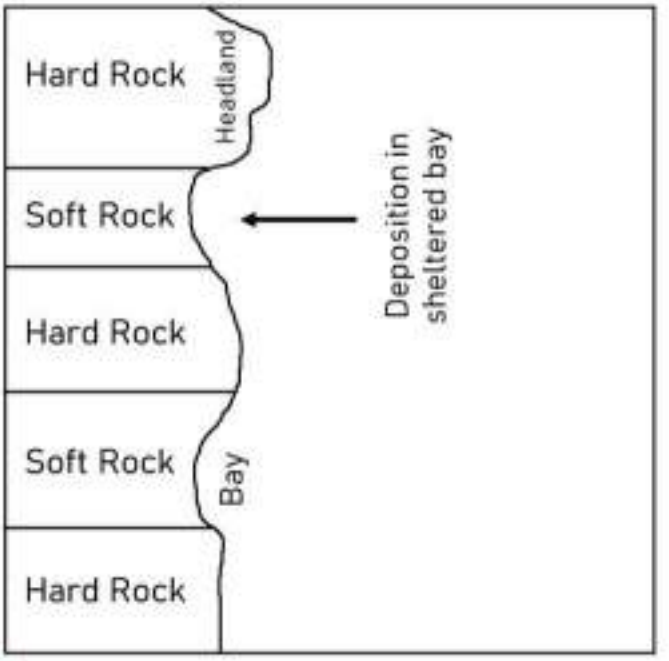
Curriculum Connection
9

Formation of Headlands and Bays



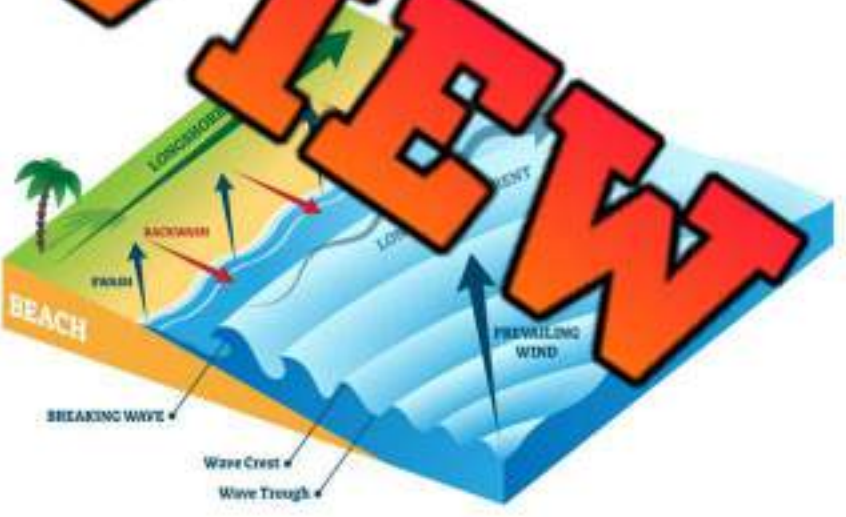


Formation of Bays and Head

When waves attack a discordant coastline, headlands and bays will form. A **discordant coastline** occurs where bands of different types of rock run perpendicular to the coastline. The different rock types weather and erode at different rates, leading to the formation of bays and headlands.

In the example above, the coastline is made of bands of hard and soft rock. When the waves attack the coastline, the soft rock is eroded more quickly than the hard rock. The eroded material piles up in the bay, forming a beach.

ORE TRANSPORT



Longshore drift is the movement of sediment along a coastline by waves which approach the shore at an angle. Longshore drift eventually deposits the sediment along the coast.

Over time, the hard rock will get weathered and eroded as well. This will lead to cracks in the headlands, sea caves, arches, sea stacks, and stumps. The eroding hard rock can cause islands to form as the sediments are deposited off the shore.

Eventually, coastlines tend to straighten as headlands are eroded by the attacking waves. When headlands are eroded, bays disappear as well.

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Curriculum Connection
9

Formation of Headlands and Bays

True or False

Circle whether the statement is true or false

1) Discordant coastlines has different strengths of rock	True	False
2) Hard rock erodes much faster than soft rock	True	False
3) Hard rock will not erode ever	True	False
4) Longshore drift moves sediment and deposits it along the coastline	True	False
5) Over time[illegible]nds are eroded and coastlines are straightened	True	False

Questi[illegible]

[illegible]r the questions below using evidence from the text

1) Why do headl[illegible] fo[illegible]

2) What eventually happens to all coastli[illegible]oth ha[illegible]oft rock?

Diagram

Draw a diagram of the formation of headlan[illegible]

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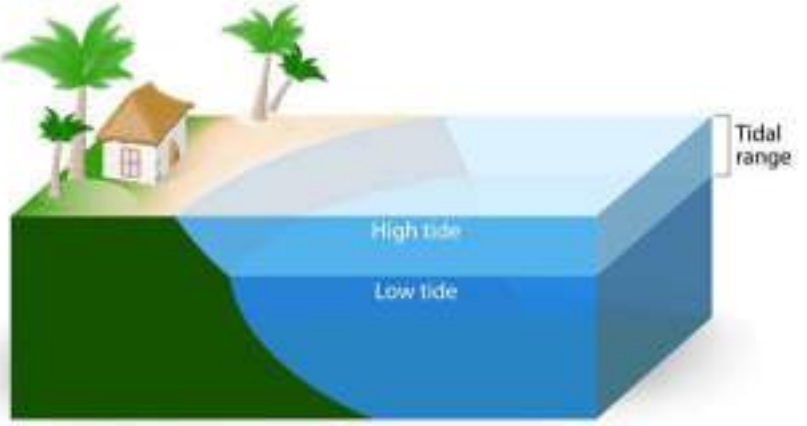
Curriculum Connection
10

Effects of Tides on Shorelines

What are Tides?

Tides are the rise and fall of sea levels that occur on a regular basis due to the gravitational forces of the moon and the sun. Tides have a significant effect on sh[illegible]s, as they can cause the w[illegible] to rise and fall by seve[illegible] th[illegible]e of a day.



There are t[illegible]r tides[illegible]des and low tides. High tides occur when the water level is at its hig[illegible]poi[illegible] occur when the water level is at its lowest point. The tidal range is the [illegible]in se[illegible]tween the low tide and high tide.

The height of the tides depe[illegible]on a[illegible]rs, including the position of the moon and the sun relative to the Earth, th[illegible]pe of th[illegible]li[illegible] and the depth of the water.

Effects of Tides on Shorelines

Tides can have both positive and negative effects on shorelines. [illegible]e p[illegible]t they can help to nourish and replenish shoreline ecosystems by bring[illegible]lents and sediment.

However, tides can also have negative effects on shorelines. High tides can cause flooding in low-lying areas, which can damage buildings and infrastructure and disrupt transportation and other activities.

Tides can also cause erosion by carrying away sediment and exposing the shoreline to the forces of waves and currents. When the tide comes in, the higher water level will create waves that are strong when they reach land. As waves crash into the top portion of the tidal range, they can erode beaches and other shorelines.

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Curriculum Connection
10

Effects of Tides on Shorelines

True or False

Circle whether the statement is true or false

1) Tides are caused by gravity from other planets	True	False
2) High and low tides are caused by the moon	True	False
3) The difference between high and low tide height is the tidal range	True	False
4) The changing tide can cause flooding on shorelines	True	False
5) Tides do [illegible]e erosion on shorelines	True	False

Questi[illegible] questions below using evidence from the text

1) What are tides[illegible]ney [illegible]pen?

2) If you were building an oceanfront hom[illegible] would [illegible]nt to understand the tidal range?

Diagram

Draw a diagram a high tide and low tide. Label both and t[illegible]l range

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Curriculum Connection 11

Controlling Coastal Erosion

Coastal erosion is the process by which the shoreline is worn away by the action of waves, currents, and wind. Coastal erosion is a natural process that has been occurring for millions of years, but it can be exacerbated by human activities such as the construction of sea walls and the removal of natural barriers such as sand dunes.

There are several ways to prevent or mitigate coastal erosion:

Natural barri: Natural barriers such as sand dunes, vegetation, and coral reefs can help to prote shoreline by dissipating the energy of waves and currents.

Structur al barriers such as sea walls, breakwaters, and revetments can be p prote eline from the action of waves and currents. These barriers ca e co ng variety of materials, including concrete, stone, and steel.

Beach nourishment: Be s the addition of sand or other sediment to the beach to increase its eight help to protect the shoreline from erosion by dissipating the ener ve s.

Piers: Piers are structures that extend fr shore the water and are used for a variety of purposes, including as a landing for boats, as a fishing platform, or as a promenade for pedestrians. Piers can help to dissipate the energy of waves by acting as a barrier that absorbs some of the energy of the waves before they reach the shoreline.

Breakwaters: Breakwaters are structures that are built offshore to protect the shoreline from the action of waves and currents. Breakwaters are usually made of rock, concrete, or other durable materials, and they are designed to absorb the energy of the waves and protect the shoreline from erosion.

Land use planning: Land use planning can help to prevent coastal erosion by ensuring that new developments are located in areas that are less vulnerable to erosion. This can include building structures on higher ground or further inland.

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Curriculum Connection
11

Controlling Coastal Erosion

True or False

Circle whether the statement is true or false

1) Planting vegetation on coastlines can dissipate wave energy	True	False
2) Breakwaters are human-made structures that slow down wave energy	True	False
3) Land-use planning means we build our homes anywhere we'd like	True	False
4) Sand dunes, vegetation, and coral reefs are natural barriers to waves	True	False
5) Getting ri[illegible]y sand dunes has no consequences	True	False

Questi[illegible]

[illegible]r the questions below using evidence from the text

1) What structur[illegible]uil[illegible]your property if you were worried about coastal erosion.

2) What is a pier? Have you used one befor[illegible] How do[illegible]slow[illegible]waves?

Diagram

Draw a diagram of a method of controlling coastal ero[illegible]

Factors Causing Flooding

Factors Causing Flooding

Flooding is the occurrence of water covering land that is normally dry. There are several factors that can cause flooding, including:

1) **Rainfall**: Heavy rainfall can cause flooding by overwhelming the ability of the ground to absorb the water, causing it to run off into rivers, streams, and other bodies of water. This can cause the water levels in these bodies of water to rise, leading to flooding. During the spring season, rainfall is the most common cause of flooding.

2) **Snowmelt**: In colder regions, the melting of snow can cause flooding when the water is unable to drain properly due to frozen ground or other factors.

3) **Quick Thaw**: Quick thaw is a term used to describe the rapid melting of snow and ice. Often when quick thaw happens, the ground is still frozen, meaning it cannot absorb the snow and ice that is melting. This leads to flooding of water left on top of the ground. Quick thaw can also cause frozen pipes to burst as the pipes expand and contract. This can lead to water damage and flooding in buildings and homes.

4) **Storm Surges**: Storm surges are large waves that are caused by high winds during storms. Storm surges can cause flooding in coastal areas and further inland.

5) **Dam Failure**: A dam is a structure built to contain water, and a dam failure is the failure of a dam to hold back the water it is designed to contain. Dam failures can cause flooding downstream from the dam.

6) **Lack of Vegetation**: Having more plants to absorb and transpire water lessens the risks of flooding.

7) **Land Development**: Land development can contribute to flooding by changing the way that water flows over the land. For example, the construction of buildings and roads can change where water flows, causing water to flow in areas unable to handle the excess water.

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Factors Causing Flooding

True or False

Circle whether the statement is true or false

1) Flooding only happens in our basements	True	False
2) Flooding is when water covers land that is normally dry	True	False
3) Cutting down trees and vegetation reduces risks of flooding	True	False
4) Constructing roads and buildings changes the flow of water	True	False
5) Coastal fl happens when storms surge	True	False

Questi

r the questions below using evidence from the text

1) When have yo ood efore? Why did the flooding happen? Explain the effects of the floo

2) How does quick thaw cause flooding?

Wordsearch

Find the words from the word bank

Word Bank	
Storm	Rainfall
Surge	Snowmelt
Flood	Vegetation
Thaw	Development

D T X R E C F H N D S V W O T L E M W O N S
K O G Z O B Y T G T R A I N F A L L L F P E
H H O O Z K L J O T W G B B T G C J M I E B
S A O L W Z M R H A A V E G E T A T I O N M
O S O M F P M C P L H T N E M P O L E V E D
F M F E H Y B D Y N T C C P Q T L B R T F A
E G R U S J C T H V I R O D W V G V M L V A

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Curriculum Connection
12

Coastal Storms

What is a Coastal Storm?

A **coastal storm** is a change in atmospheric conditions that create strong winds, heavy rain or snow and sometimes thunder and lightning. Coastal storms are also called tropical storms. These storms form in the vast oceans and then move towards landmasses, often causing massive destruction.

Types of Coastal Storms

There are three main types of coastal or tropical storms – hurricanes, cyclones, and typhoons. These storms are all the same, as they all form over warm ocean waters, rotate around an area of low pressure, and have wind speeds of over 119 km per hour. We have different names based on where the storm happens.

Hurricane

A hurricane will form over the North Atlantic Ocean and Northeast Pacific.

Cyclone

A cyclone will form over the South Indian Ocean.

Typhoon

A typhoon is formed over the Northwest Pacific Ocean.

How Coastal Storms Form

A coastal or tropical storm will form in the following steps:

1) The water needs to be warm, at least 26.5 degrees Celsius. This is why tropical storms begin in warmer areas near the equator.
2) When wind blows across the warm ocean water, the warm, moist air rises rapidly
3) As it rises, the moist air cools and the water in it condenses, forming large storm clouds
4) The cooling water also releases a lot of heat. This heat transfer creates enough energy to cause strong winds
5) The strong winds push even more air up from the ocean's surface causing more clouds and even more wind
6) The rapidly moving air creates an area of low air pressure in the centre. This middle part of the storm is called the eye of the storm. It is calm, but around the eye has the strongest, most devastating winds.

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Curriculum Connection
12

Coastal Storms

Questions

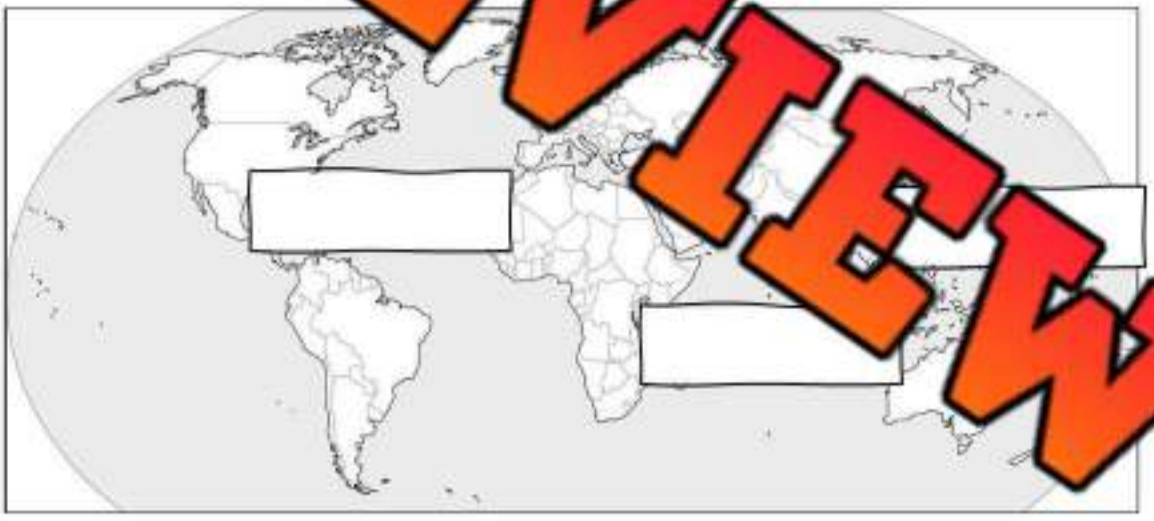
Use information from the text to support your answer

1) What is a coastal storm? What wind speeds need to be exceeded to be considered a coastal or tropical storm?

2) What is th[illegible]ce between a hurricane, cyclone, and typhoon?

Label

Fill in the b[illegible]re eac[illegible]ypes of coastal storms form



Ordering

Order the steps from first to last in the development of a coastal storm

	The eye of the storm is formed
	The moist air cools, creating large storm clouds
	Water is warmed to a minimum of 26.5 degrees Celsius
	Strong winds are created by warm and cool air moving causing changes in air pressure
	Wind blows across the warm ocean water causing the moist air to rise

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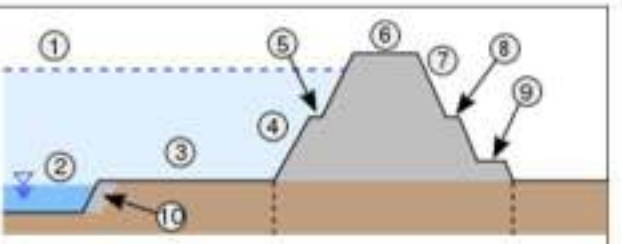
Curriculum Connection 13

Using Dikes and Levees to Prevent Flooding

Preventing Flooding – Dikes and Levees



Dikes and levees are structures that are built to contain and control the flow of water to prevent flooding. Both dikes and levees are built to hold back water and protect against the risk of flooding, but they differ in the way that they are constructed and the materials that are used.

What are Dikes?

Dikes are ear[illegible]mbankments that are built to hold back water and protect against the risk of floodi[illegible]are typically made of earth and rock, and they are designed to be wide and tall enough to the water and prevent it from flowing over the top. To build a dike, the [illegible]one:

1) **Site pr[illegible]aration**[illegible]ep in building a dike is to prepare the site by clearing the area of vege[illegible]er
2) **Excavation**: The [illegible]ep is [illegible]he area where the dike will be built. This involves removing s[illegible]pression that will be filled with the materials used to build
3) **Construction**: The dike is then [illegible] by [illegible]material on top of the compacted foundation. The material u[illegible]ild th[illegible]is usually earth and rock.
4) **Finishing**: The final step in building a di[illegible]is to fin[illegible]e su[illegible]of the dike to protect it from erosion and other weathering effects. Th[illegible]involv[illegible]layer of vegetation or other protective material to the s[illegible]e of

What are Levees?

Levees are similar to dikes but have the following differences:

- ☒ **Materials**: Dikes are typically made of earth and rock, while levees [illegible]of compacted earth or other materials.
- ☒ **Construction**: Dikes are built by excavating a depression and filling it with [illegible]mpacted earth and rock. Levees are usually built by compacting layers of earth or other materials on top of a compacted foundation, without the need to dig down.
- ☒ **Shape and size**: Dikes are usually wider and taller than levees and are designed to hold back larger amounts of water. Levees are usually narrower and shorter than dikes and are designed to protect against smaller bodies of water or to regulate water levels in a specific area.
- ☒ **Location**: Dikes are usually built to protect low-lying areas from the risk of flooding from rivers or other bodies of water. Levees are usually built along the banks of rivers or other bodies of water to hold back the water. Levees are built in areas where large storm surges are not expected.

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Curriculum Connection
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Using Dikes and Levees to Prevent Flooding

True or False

Circle whether the statement is true or false

1) A levee is usually taller and bigger than a dike	True	False
2) Both levees and dikes are usually made from earth and rocks	True	False
3) Levees and dikes are used to prevent water from spilling inland	True	False
4) The first step is to pile earth on top of where the dike will be built	True	False
5) The last st[illegible]lves planting vegetation to slow down water's movement	True	False

Questi[illegible]

[illegible]r the questions below using evidence from the text

1) What are the [illegible]twe[illegible]kes and levees?

2) How are dikes built? Explain the steps

Diagram

Draw a diagram of a levee or a dike in a city/[illegible]

Disadvantages of Using Dikes/Levees

Dikes and levees are effective tools for managing flooding and protecting against the damage caused by excess water. However, there are also some downsides to using dikes and levees, including:

1) **Cost**: Dikes and levees can be expensive to build and maintain. The cost of constructing and maintaining these structures can be a significant burden for governments and communities, especially in areas that are prone to frequent flooding.

2) **Environmental impacts**: Dikes and levees can have negative impacts on the environment. For example, they can disrupt the natural flow of water and sediment, which can affect the ecology of the area. In addition, dikes and levees can block the migration of fish and other aquatic species, which can have negative impacts on the local ecosystem.

3) **Dependency**: Dikes and levees can create a sense of dependency on the part of the community on the structures for flood protection. This can lead to complacency and a lack of preparedness for other types of disasters, such as earthquakes or hurricanes.

4) **Limited effectiveness**: Dikes and levees are not always effective at preventing flooding, especially in areas that are prone to extreme weather events or that have steep topography. In some cases, dikes and levees can be overtopped or breached, leading to flooding despite their presence.

Opinion

Your city is planning to build a levee along the river and then build a shopping centre there. Write a letter to the city explaining your support or criticism of their plan. Explain why it is a good idea.

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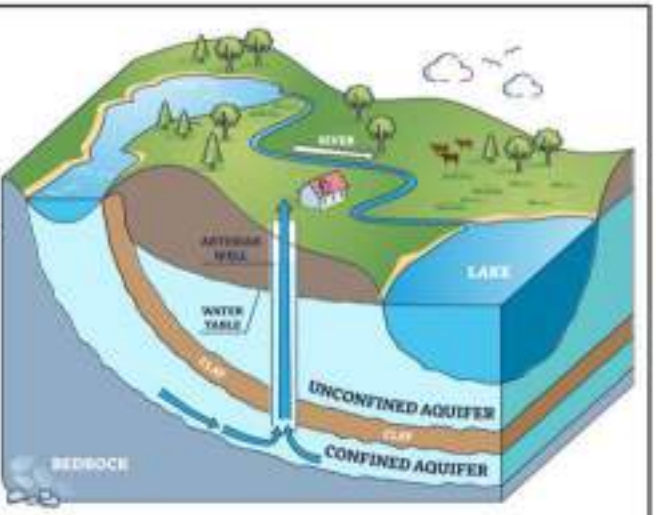
Curriculum Connection
14

Water Table and Aquifers

What is the Water Table?



The **water table** is the upper-level underneath the ground that is permanently saturated, or filled, with water. I'm sure you have wondered where the water from puddles on land go. Some of the water is evaporated, b most of it seeps into the soil, joining the w e.

The e ground's surface is called t turate above the water table. This zone has both water and oxygen between t n t il. When you dig down into the ground, you will be digging in this zone y wo water table. The water table is typically 4 to 10 metres below the grou

The amount of water in th abl m season to season. During the summer, the water table typically has less t, as water will evaporate and not seep into the ground. During late winter an ring, th r ta the fullest, as snow is melting and seeping into the ground.

Aquifers

An **aquifer** is an underground layer of material that contains e u material could be sand, clay, or gravel. These materials allow water to which allows them to hold water. The material could also be rock, if the rock d space that water can enter.

Aquifers are like rivers or streams underground that allow the movement of water. Aquifers contain groundwater sources of water that are often accessed by wells for people to get clean water from.

An **unconfined aquifer** has direct contact with the atmosphere. Therefore, unconfined aquifers are found just below the ground level. The water table is considered an unconfined aquifer. A **confined aquifer** is surrounded by many rock and clay materials. It has no exposure to the ground level, as it is found deep underground.

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Curriculum Connection
14

Water Table and Aquifers

Questions

Use information from the text to support your answer

1) What is a water table? Where is it found?

2) What is the [illegible]nce between an unconfined aquifer and a confined aquifer?

Diagram

Draw a diagram [illegible]ate [illegible]quifers underground

True or False

Circle whether the statement is true or false

1) A confined aquifer is right below the Earth's surface	True	False
2) The water table is easy to access by digging with a shovel	True	False
3) A well accesses groundwater in the water table	True	False
4) A confined aquifer is surrounded by rock and clay	True	False
5) Groundwater is clean and safe to drink from wells	True	False

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Curriculum Connection
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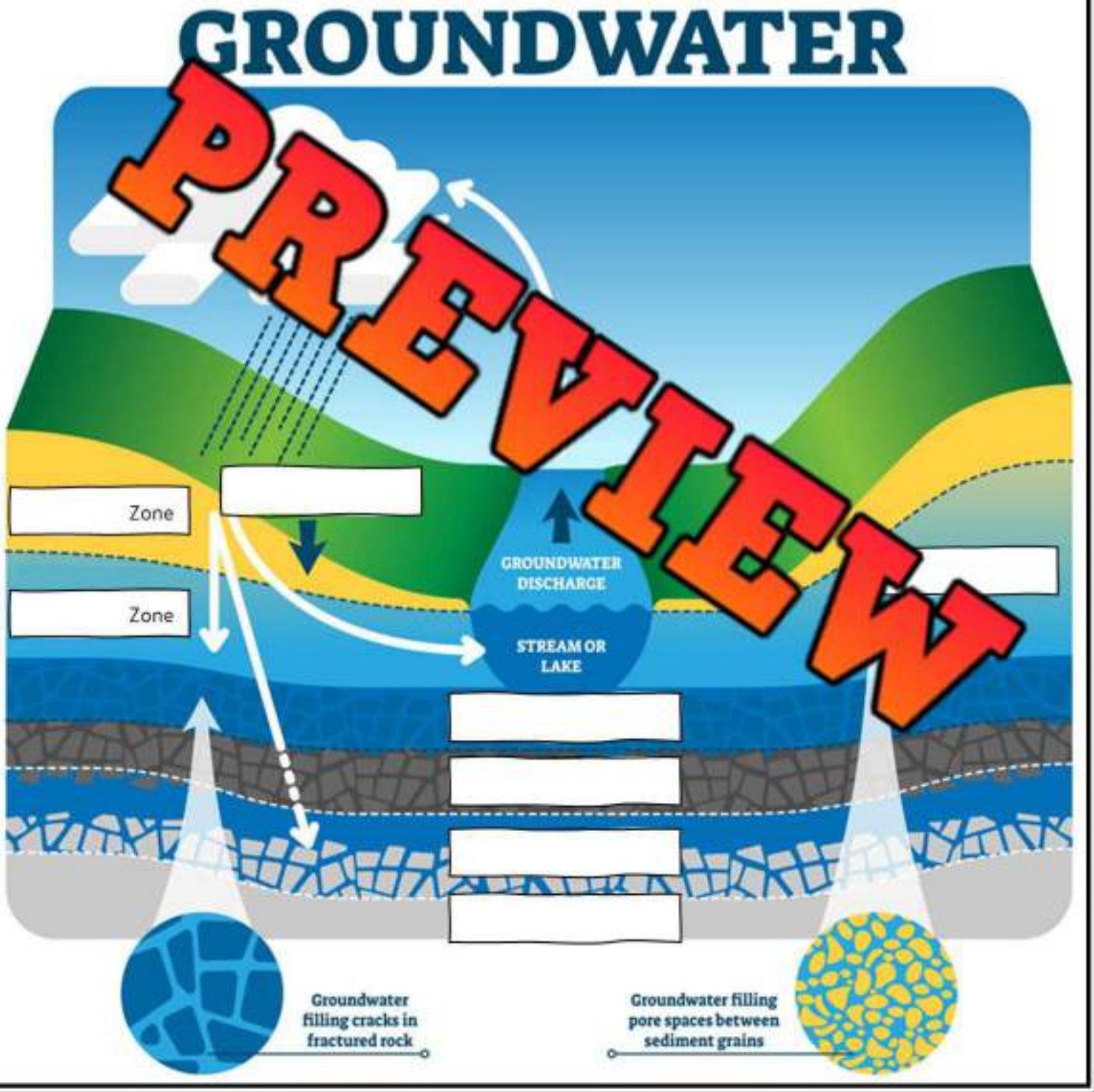
Groundwater Diagram

Diagram Label the parts of the groundwater system

Bedrock	Confining Bed	Confined Aquifer	Unconfined Aquifer
Saturated Zone	Unsaturated Zone	Water Table	Infiltration



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Curriculum Connection
14

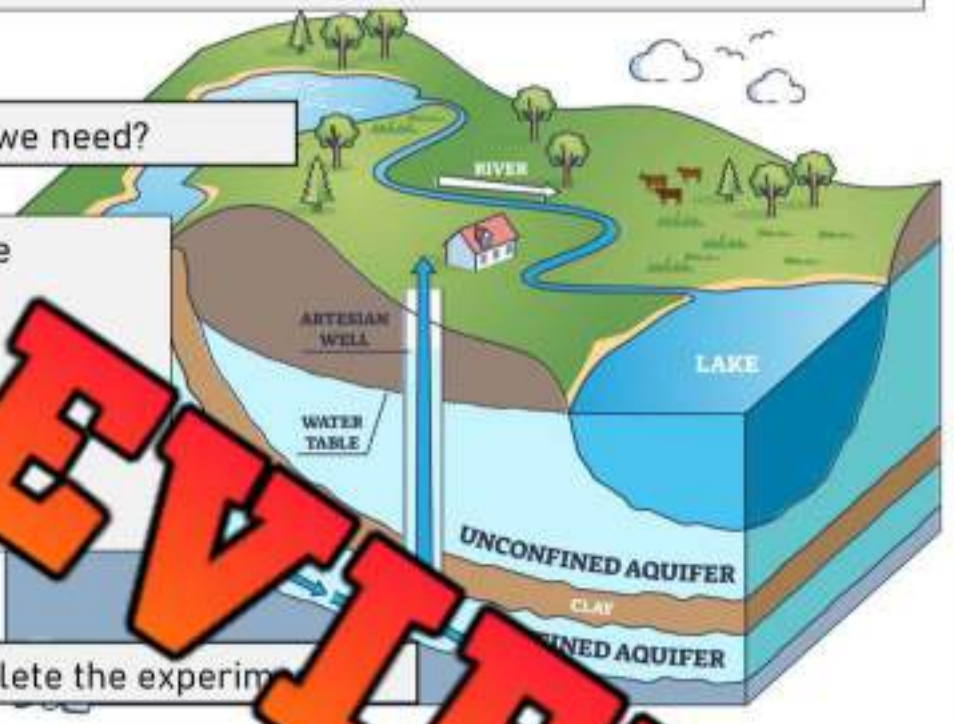
Experiment - Groundwater Model

Research Question What are we learning more about?

Today, we will be making a model of groundwater that shows water in an aquifer as well as in our water table.

Materials What do we need?

- ✓ 1 [illegible] glass [illegible]ase
- ✓ Sand
- ✓ Gravel
- ✓ Water



Method How do we complete the experim[illegible]

1) In the glass, layer sand and gravel alternating b[illegible]n the two[illegible] the glass is about 3/4 full. This will create an aquifer.

2) Slowly pour water into the glass. Observe how the water m[illegible]

3) Continue slowly pouring water into the container. Stop about 3 cm below the top of the aquifer. The level of water in the container is the water table. A **water table** describes the boundary between water-saturated ground and unsaturated ground

4) Slowly add a small amount of water to the container to represent rainfall. This demonstrates the recharging of the groundwater.

5) If possible, you could keep this model for days and weeks and observe how the water evaporates (is used) and how it recharges with rain.

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Curriculum Connection
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Experiment - Groundwater Model

Diagram

Draw a diagram below

Draw the model you have made and label the following – aquifer, groundwater, water table, bedrock

Results

Ans[illegible] below

1) Describe what happened when you first [illegible] water i[illegible] gl[illegible]

2) When the aquifer filled with water, did it become saturated [illegible] satu[illegible]

3) What does the glass represent? Is the glass permeable or impermeable?

4) What happens to the water table when it rains?

Water Quality

What is Water Quality?

Water quality is how suitable water is for an intended purpose. This purpose could be for survival of different aquatic species, or it could be for human consumption. As we make sure aquatic ecosystems have quality water, we also help ensure water is safe for human use too. Below are 5 indicators that are measured to understand water quality.

Temperature and Dissolved Oxygen

The water temperature in an ecosystem is one of the most important factors. For optimal health, aquat anisms need the water temperature to be within their optimal range. Therefore, w eratures change due to human activities, the organisms that have lived in tha stressed to the point of death.

Th er affects the amount of dissolved oxygen (DO) the water can hold. As temp e, the amount of DO decreases. Aquatic organisms need the oxygen that is dis wat allow them to breathe.

pH Levels

The pH is a measureme hou A pH of 7 is neutral, a pH of 14 is basic, and a pH of 1 is acidic. Qua rang etween 6.0 and 8.5. If the pH values go outside of the range of 4.5 and ate lethal for aquatic organisms. The pH can be ged are added to water through farming practices ng pe

Nutrients and Minerals

Water should have nutrients available for living o s to consume. Nitrogen and phosphorous are the two mi po nutrients, as they are often in short supply and are need plants, algae, and microbes. Other nutrients like iron, manga d c re ded as well. When humans perform some activities, we change the a unt water. For example, when we use fertilizers high in nitrogen and phos nutrients can get into the water, causing too much growth of algae. This cha e balance in the aquatic ecosystem, and can lead to unsafe, low quality water.

Bacteria

Water quality is complex because not all bacteria is bad. However, a common form of bacteria that exists in water is fecal matter. When fecal matter is in our drinking water, it can lead to cholera, and other diarrheal diseases. We can test how much fecal matter is in water by checking its E.coli levels.

Turbidity

The measurement of turbidity level tells us how clean water is and its clarity. Turbidity measures how many suspended solids there are in the water. Some water might be cloudy, indicating that there could be particles like sand, gravel, silt, clay, algae or organic matter from animals, plants, and algae.

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Curriculum Connection
15

Water Quality

Summarize What do the indicators of water quality mean?

Temperature and DO	
pH Levels	
Nutrients and Minerals	
Bacteria	
Turbidity	

Questions Use information from the text to support yo

1) Why do you think not all water tastes the same? Why might that be a prob

2) Why might the pH levels in a stream be too acidic or basic? Why is that a problem?

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Curriculum Connection
15

Experiment - Testing pH Levels

Research Question What will the pH levels be in puddles, or local streams and rivers?

Materials What will you need for the experiment

- ❑ A bottle or cup to collect water with
- ❑ pH strips – can be found at hardware stores or pool stores
- ❑ This paper to track results
- ❑ Pencil to record results

Procedure How will you complete the experiment

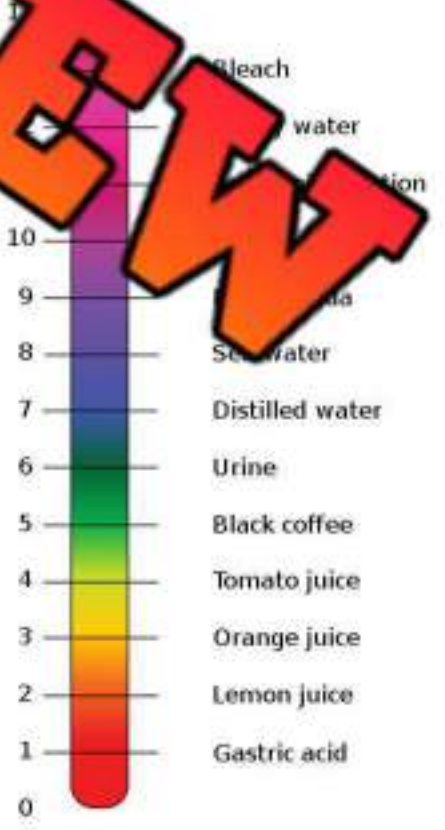
1) Find local water sources nearby your school. For each source, collect water into your bottle or cup

2) Follow the instructions for the pH strips. Usually, you will saturate the strip with water and compare the colour to the colour guide they provide

3) Write the pH level result you found for the ecosystem you were measuring

4) Describe the ecosystem. Write down any factors that might influence the pH level in that area. Examples – farm or auto shop nearby, loose soil, other pollutants

5) Answer the remainder of the questions on the back of this page



Observations

What did you notice as you completed the experiment

1) What is the first source of water you tested? Describe the source (puddle, stream, etc.)

2) What was the pH of this water source?

3) What around the water source could impact the pH level?

1) What is the sec of wa tested? Describe the source.

2) What was the pH of this wa ?

3) What around the water source could imp the pH ?

1) What is the third source of water you tested? Describe the source.

2) What was the pH of this water source?

3) What around the water source could impact the pH level?

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Curriculum Connection
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Experiment - Making A Water Filter

Research Question Can we filter dirty water and make it clean again using the materials below?

_____

_____

_____

Materials What will you need for the experiment

- ❑ 2-litre plastic bottle, rinsed and clean
- ❑ Dirty water (with grass clippings, old crunched up leaves, cooking oil, or tiny pieces of foam)
- ❑ Measuring cup
- ❑ Spoon
- ❑ Stopwatch or any clock with a second hand
- ❑ Filtering materials – use as many as you can find: activated charcoal, gravel, sand (coarse and/or fine), cotton balls
- ❑ Coffee filter (old sock, napkin, paper towel will work too)

Procedure How will you complete the experiment

1) Cut the top off the 2-litre bottle and flip it over to fit it back inside the cut part of the bottle
2) Place the coffee filter or paper towel into the bottom of the filter
3) Add all your materials as layers into your filter. Do this strategically in terms of size of materials.
4) Record the order of your materials on the back of this page. Draw a diagram of the filter
5) Stir the dirty water and measure a cup of it
6) Pour the dirty water into the filter. Time how long it takes for the water to pass through the filter
7) Carefully scoop out the filter materials. Make a note of which materials took what out of the water.

Observations

What did you notice as you completed the experiment

1) Which materials did you use for the layers in your filter?

2) Draw a diagram of the layers of your filter. Label each layer.

3) How long did it take for the wa pas filter?

4) When you took the materials out, did you notice hater out which parts of the dirty water?

5) Compare your observations with your classmates. Did you notice a relatio ip between the cleanliness of the water and the time it took for it to pass through the filter? If so, why would that be?

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Curriculum Connection
16

Primary and Secondary Water Treatment

What is the Difference Between Wastewater and Sewage?

Wastewater is any water that has been negatively affected in quality. Wastewater can come from human activities in their homes, or commercial buildings. It can also come from factories, where a higher percentage of chemicals are disposed of in the water. Wastewater could be created through agricultural practices, or it could be rainwater from gutters on a house.

Sewage is a type of wastewater that is produced by people in a community and is carried to a sewage treatment plant through a sewer system. There are two main types of sewage: blackwater and greywater. **Blackwater** is wastewater that has been used in toilets, while greywater is wastewater from showers, sinks, washing machines, bathtubs, and washing machines. Blackwater needs more treatment before it can become **whitewater**, which is clean, drinking water.

From Wastewater to Drinkable: Primary and Secondary Water Treatment

Below are the steps of a typical wastewater treatment system.

1) When water leaves our homes or schools, it is taken to a pumping station close by
2) The wastewater is pumped to the main water treatment plant
3) There is a screen that removes large materials such as paper, plastics
4) Grit and heavy inorganic solids are removed at the bottom
5) The primary clarifiers allow any organic material to settle out. It can be separated from the water. Grease is also removed during this step
6) The organic material and grease are pumped to a digester, which allows it to further and become methane-rich gas. This gas can be used as an energy source to generate electricity
7) The water that moves on is called **effluent water**, which is water that flows out as treated wastewater. This water isn't ready to drink, but it is free of sediments and will look clean
8) The effluent water moves to an aeration tank, where any contaminants like phosphorus are removed
9) The water then goes to the secondary clarifier, where chemicals are added to removed more contaminates
10) The last step is the ultraviolet disinfection of the water. This step disinfects the water ensuring it is clean. The water is then usually released into a body of water
11) Another treatment plant will take the water from the body of water and treat it further to ensure its quality

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Curriculum Connection
16

Wastewater and Sewage

Questions

Use information from the text to support your answer

1) What is the difference between wastewater and sewage?

2) How is w[illegible]ed? Give examples.

Summarize

How is wastewater from yo[illegible] it becomes drinkable water?

True or False

Circle whether the statement is true or false

1) Blackwater is water from the bathroom sink	True	False
2) Water from toilets is treated and becomes whitewater we drink	True	False
3) The disinfecting process uses ultraviolet technology	True	False
4) A digester allows organic matter to break down to create methane gas	True	False
5) Water from these treatment plants usually returns directly to our homes	True	False

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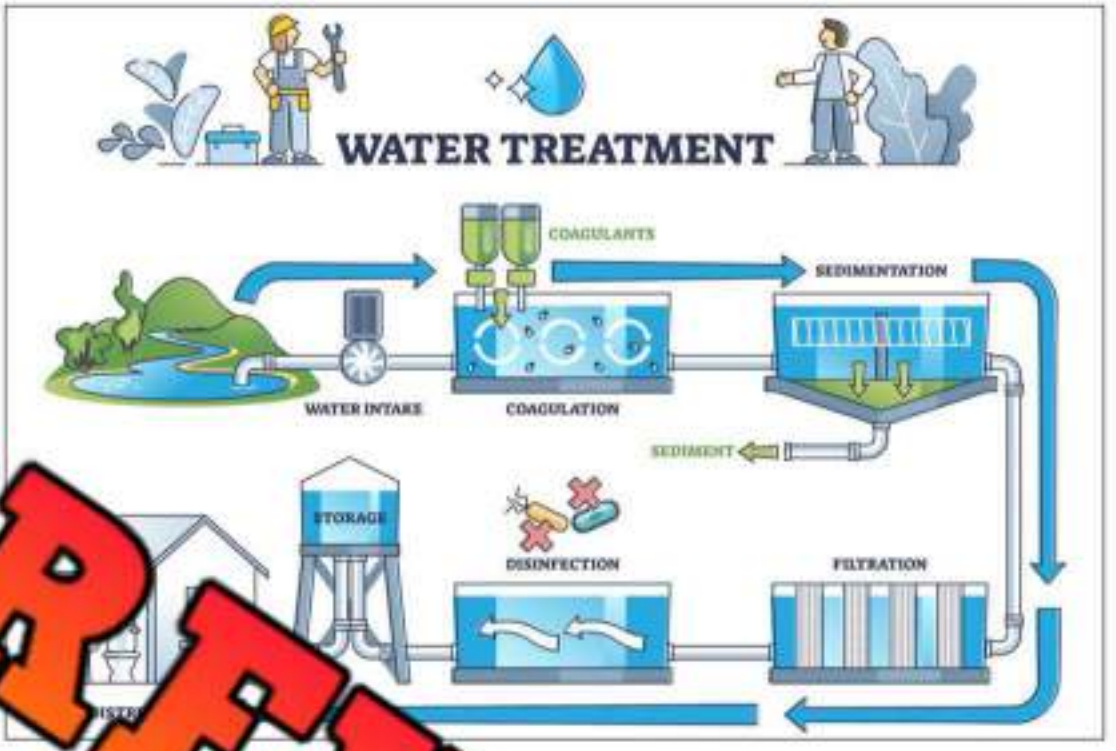
Curriculum Connection
16

Research - Tertiary Water Treatment

When treated water is returned to a body of water, it is then taken through another process of treatment before we drink it. Research the terms from the diagram to learn more about this process.



Research

Answer the questions below

1) What does water intake in the [illegible] mean?

2) What is coagulation in water treatment?

3) What is sedimentation in water treatment

4) What is filtration in water treatment?

5) What is disinfection in water treatment?

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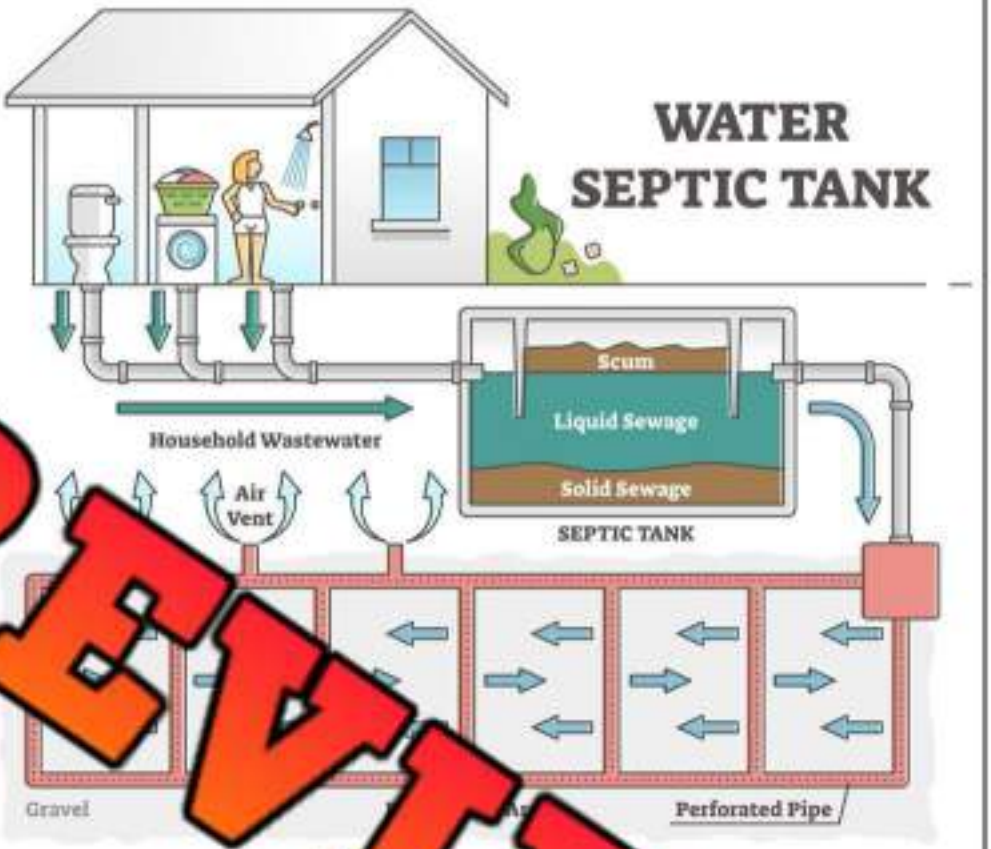
Curriculum Connection
16

Rural Wastewater Treatment - Septic Tanks

What is a Septic System?

A **septic system** is an underground wastewater treatment structure that is commonly used in rural areas that do not have sewer systems. Below are the steps wastewater takes before being [illegible]roduced back into the [illegible]ment.



1) When [illegible] a h[illegible] into a [illegible]tic tan[illegible]
2) The watery [illegible] called effluent, [illegible] most of the tank
3) The scum floats to the top. It is composed of fats, like greases in oils that often come from our kitchen sink
4) The solid sewage comes from toilets. It sinks [illegible]botto[illegible]
5) There is an outflow pipe that has a screen on it to [illegible]lids fl[illegible]ving the septic tank
6) The effluent flows through the outflow pipe and into the dr[illegible]age [illegible] perforated pipes, which are pipes with holes in them.
7) The water will drain through the holes in the pipes so that it is retur[illegible]ed [illegible]o the environment. These pipes rest on a gravel bed, which further filters the [illegible]ter
8) The water will seep down into the groundwater and aquifers

Pros of a Septic Tank

- ✓ Most cost efficient – no monthly fees with a septic tank
- ✓ Durability - lasts a long time if properly maintained

Cons of a Septic Tank

- ✓ Requires pumping – every three to five years, the solid sewage needs to be pumped
- ✓ Backed up drains – the pipes in the septic tank can get clogged if toilets are misused
- ✓ Broken pipes – tree roots, digging, or earthquakes can break pipes underground

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Curriculum Connection
16

Rural Wastewater Treatment - Septic Tanks

Questions

Use information from the text to support your answer

1) Where are septic tanks commonly used? Why is that the case?

2) How do s[illegible]rk?

Pros/Cons

What are the pr[illegible]nd c[illegible]tic tank?

Pros	[illegible]

True or False

Circle whether the statement is true or false

1) Most houses in big cities have a septic tank	True	False
2) A cottage is more likely to have a septic tank	True	False
3) Septic tanks take wastewater and release it back into the groundwater	True	False
4) You could drink the water that comes out of a septic tank	True	False
5) Scum floats, like oils and greases from our kitchen	True	False

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Curriculum Connection
16

Personal Water Consumption - Survey

It may seem that we have a lot of water available to us, but we've learned that only 1.2% of all water can be used as drinking water. We've also seen how much treatment is needed to turn wastewater from our homes into drinking water. For these reasons, we need to assess our personal water consumption.

Research Answer the questions below

Questions	Answer
1) Do you ta… r showers or both?	
2) While … do you let the water run?	
3) Do you t… he wa… e yo… wash your hands?	
4) Do you take lon… , or sh… ers?	
5) Does your toilet have …	
6) Do you have a pool that you … ll w…	
7) Is your shower a high flow or low flow? … g?	
8) Do you wash dishes with running water?	
9) Do you run a dishwater without it being comple… ?	
10) Do you use your washing machine without a full load?	
11) If you have a pool, do you use a solar cover to stop water from evaporating?	
12) Do you water your gardens or lawn a lot?	

Question How would you describe your water usage? Do you waste a lot of water?

Conserving

Write about your plan to conserve water below

1) Use some of the ideas from the previous page to come up with ways you could conserve water in your daily life.

2) Why should you conserve water? Explai[illegible] more about how water is treated and the lack of freshwater availab[illegible] help[illegible] understand the importance of conserving water.

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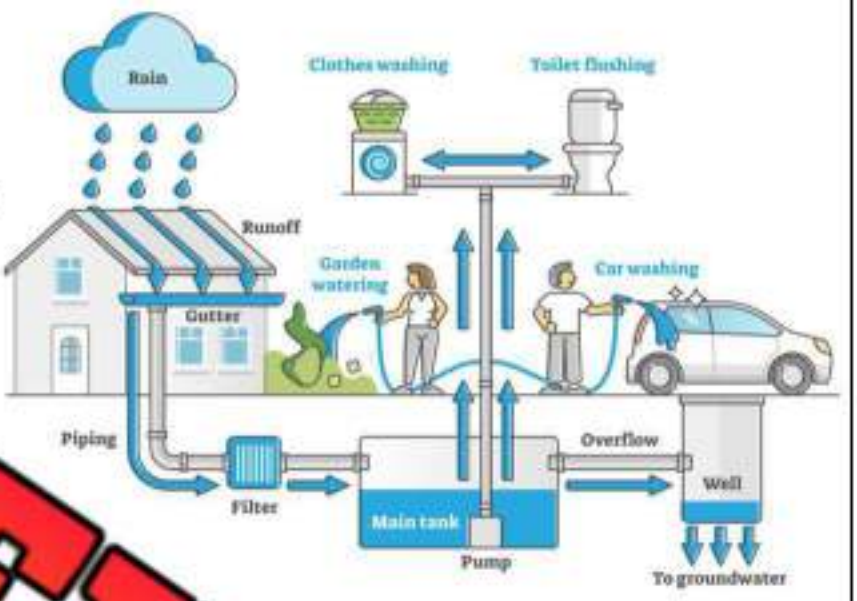
Curriculum Connection
14, 18

New Technologies - Rainwater Harvesting

What is Rainwater Harvesting?

Rainwater harvesting is collecting rainwater run-off from a structure in order to store it for later use. We can harvest rainwater by channelling the rainwate the roof of our house dow to a storage tank. Ra be as simple as ecting rrel It can also be co with systems that harvest r ter larger tanks that supply an e ehol



Rainwater is safe to use for ost wash your clothes and car, water your garden, and flush your toilet treated You may even be able to drink your rainwater, if you filter and treat the rain appro

Rainwater Harvesting Around the World

The idea of rainwater harvesting may seem foreign to you, eing all around the world. In rural areas in countries like Brazil, China, New Zeal d ar s scarce. These places have began using rainwater harvesting to meet th w ds.

Even though Brazil has 18% of the world's total freshwater, only 28% o razil's cities have enough water. Drought is a big problem in Brazil's rural areas and when it does rain, it only does so intermittently.

In 2003, a program called "Programa Um Milhão de Cisternas" ("One Million Cisterns") was created to provide one million homes with rooftop rainwater harvesting systems. These systems collect and store rainwater until the dry season. All that is needed is a gutter, a pipe, and a 16,000L tank. To get water out of the tank, a manual pump can be used. Having these systems is providing millions of people water in Brazil.

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Curriculum Connection
14, 18

New Technologies - Rainwater Harvesting

Questions

Use information from the text to support your answer

1) What is rainwater harvesting? What can you do with rainwater?

2) How is rai arvesting helping rural areas in Brazil?

Diagram

Draw d how ater harvesting system works

True or False

Circle whether the statement is true or false

1) Rainwater can be used to drink without treating or filtering it	True	False
2) Rainwater harvesting is done by collecting water runoff from a roof	True	False
3) Rainwater harvesting allows rural areas in some countries to get water	True	False
4) All of Brazil has access to freshwater	True	False
5) Rainwater is the same as ocean water	True	False

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Curriculum Connection
14, 18

New Technologies - Greywater Systems

What is Greywater?

Greywater is gently used water from your sinks, showers, tubs, and washing machine. It is not water that comes From the toilet or kitchen. The greywater may look dirty, as it could have dirt, grease, soap, or hair in it.

Greyw[illegible]an be collected by homeowners using systems so [illegible]reywater can be reused to water gardens [illegible]tems can actually treat and filter the g[illegible]water [illegible]n be reused in toilets and washing machin[illegible]

Why Use Greywater

Water can be described as w[illegible] or b[illegible] is toxic water and white is clean water. In Canada, the average pers[illegible]uses [illegible]ter a day. That is the equivalent of 670 standard water bottles.

Water conservation is important. We have a l[illegible]water [illegible]but only 2.5% of all water is freshwater that we can use. The remaining [illegible] is [illegible]ns. Changing saltwater to water we can drink and wash with takes a lot [illegible]d en[illegible]

Wasting white water for things that do not require white w[illegible]er is [illegible] environment. White water needs to be treated, filtered, and tested to [illegible]n enough to drink. The process of turning black and grey water into white wat[illegible]es a lot of energy. Using a greywater system that treats greywater and plumbs it back for reuse can cut a household's white water consumption in half.

How Does A Greywater System Work?

A greywater recycling system runs the greywater through a filtration process. The process takes the scum and any solid particles out of the water. Afterwards, the water is pumped back so it can be reused in the laundry room, bathroom, and kitchen. When the water is flushed down the toilet, it is blackwater that is sent away from the house.

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Curriculum Connection
14, 18

New Technologies - Greywater Systems

Definitions

What do the terms below mean?

Whitewater	
Greywater	
Blacky	

Questions

...ormal... ...the text to support your answer

1) How does a greywater sy... ...ork?

2) Why should people use greywater systems? Why is wate... ...etio... ...rtant?

True or False

Circle whether the statement is true or false

1) Greywater is water from the toilet	True	False
2) Most of the water on Earth is freshwater we can use to drink	True	False
3) Blackwater can be treated and reused at home	True	False
4) Greywater can be reused for drinking at home	True	False
5) Greywater is reused for flushing toilets and watering plants	True	False

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Curriculum Connection
14, 18

Desalination Techniques

What is Desalination?

Desalination is the process by which saline water is converted into freshwater we can drink. With 97.5% of all surface water on the earth being salt water, it could become important to develop desalination methods to provide us with more freshwater. In the past, it has required too much energy to convert salt water into freshwater. The more energy-efficient method is treating the freshwater we already have.

However, scientist know that our misusing of freshwater could lead to more and more comm[illegible]es running out of freshwater. That is why energy-efficient methods of desalination [illegible]portant. Today, only 1% of the freshwater we use comes from the desalinatio[illegible]ater.

Proces[illegible]ati

One of th[illegible]st use[illegible] of desalination is c[illegible]on.

Distillation is whe[illegible]g so[illegible] elevates the tempera[illegible]of t[illegible] water so that it begins to e[illegible] The evaporated water condenses [illegible]er surface creating water droplets. [illegible]e droplets are freshwater as the salt and other minerals do not evaporate.

Solar distillation is when the sun is the primary heat source that causes the evaporation. In this process, water is pumped up fro[illegible] thro[illegible]lter and into a desalination tank. The filter ensures no large sedi[illegible]ject[illegible]nto the tank. The evaporation inside the tank leads to freshwater co[illegible]ing through the out pipe. The salt and minerals return to the ocean thro[illegible]e bottom.

Advantages and Disadvantages of Solar Distillation

Advantages of Solar Distillation	Disadvantages of Solar Distillation
✓ Simple to design and build	✓ Rate of distillation is very slow (6 litres a day)
✓ Low installation cost	✓ Only works on sunny days
✓ Simple maintenance	✓ Will not provide enough water for a lot of people
✓ Can be used at the household level	✓ Can become corroded by the salt and minerals

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Curriculum Connection
14, 18

Desalination Techniques

Questions

Use information from the text to support your answer

1) Why might improving desalination techniques be important?

2) What is a [illegible]llation system? What are their pros and cons?

Diagram

Draw your ow[illegible]am [illegible]illation system

True or False

Circle whether the statement is true or false

1) A solar distillation system turns saltwater into freshwater	True	False
2) Most of the Earth's water is freshwater	True	False
3) Desalination techniques could be useful in giving us more freshwater	True	False
4) Desalinating is done a lot now and provides us with a lot of freshwater	True	False
5) Desalination techniques use too much energy right now to be effective	True	False

Name: _____ 107

Curriculum Connection 19

Desalinization Science Experiment

Research Question — What are we learning more about?

Desalinization is the removal of salt from water. Since freshwater (non-salt water) is scarce compared to the amount of saltwater available, using desalinization techniques could end water shortages.
Today, we will test one desalinization technique.

Materials — What do we need?

- ✓ La
- ✓ Sa
- ✓ Water
- ✓ Spoon
- ✓ Boil safe mug
- ✓ Tinfoil
- ✓ Ice
- ✓ Stovetop
- ✓ Plastic spoons to taste - optional

Method — How do we complete the experim

1) Mix salt into a large pot of water. If you use warm [illegible] dissolv[illegible]cess will be faster. You can let students taste the saltwater at t[illegible] with [illegible]spoon
2) Place a mug inside the pot. Be careful not to get any saltwa[illegible]r in
3) Cover the pot with tinfoil. Seal the edges but allow enough slack for th[illegible]e to dip slightly.
4) Put the ice cubes in the middle
5) Put the pot on the stovetop and turn it on, bringing the water to a boil
6) Let the saltwater simmer for about 10 minutes or until the ice cubes melt. Don't let it boil dry.
7) Turn off the heat and let the pot cool for 20 – 30 minutes. Once cool, carefully remove the tinfoil.
8) Have students taste the water in the mug using their spoon. You can also have them taste the water left in the pot.

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Desalinization Science Experiment

Observations

What happened? How did each of the liquids taste?

Liquid	How Did It Taste? Describe the saltiness. Rate it from 0 – 10 (10 being most salty thing you've ever had)
Saltwater Mixture Before B	
Wate	
Saltwater Left i the Pot	

Results

Answer the q tion

1) What is desalinization? Why is it importa

2) Why was the water in the mug freshwater? What happened to e sa

3) Why was the water left in the pot more salty than it was originally? Explain using the term concentration.

Name: _____ 110

Curriculum Connection
14, 18

Climate Change - Melting Glaciers

Climate Change - Background

Scientific evidence has shown that our climate has warmed over the last 100 years due to human activity. The everyday actions of our society are creating greenhouse gases that are wrapping a thick blanket around our planet.

The burning of fossil fuels to generate energy is the primary reason for climate change. Since the Industrial Revolution, our society has relied on fuel burning machines to power our technologies. When fossil fuels are burned, the result is carbon dioxide emissions that are called greenhouse gases. These emissions rise into our atmosphere and disrupt the carbon cycle.

Global War

The term ... the long-term heating of the Earth's climate system. Scientists estim... human activities since the pre-industrial period (1850-1900) have increas... age temperature by about 1 degree Celsius. This number is increasing by ... Celsius per decade. At this rate, you can see that we are warming the planet ... unsustainable.

2020	2100	2200	...	...	2600	2700	2800	2900	3000
±0	+1.6	3.6	5.6	...	...	13.6	15.6	17.6	19.6

Melting Glaciers

As a result of human activities causing global warming, glaciers are melting. The **Muir Glacier** in Alaska has retreated and thinned since the 19th century. The images show the state of the glaciers in 1941, and 2004. The glacier has m...ed back about 11 kilometres and has decreased in thickness by more than 800 metres.

The ice sheets on Greenland and Antarctica are melting at a rapid rate. In Greenland, the ice sheet's mass has shed an average of 279 billion metric tons of ice per year. All of this ice is entering the Arctic ocean causing sea level rises. In Antarctica, every 40 hours, one billion metric tons of ice is melted. In total, the Earth is now losing 1.2 trillion tons of ice each year.

The effects of melting glaciers on our land is causing concern over rising see levels. If all glaciers were to melt, the water levels would rise a whopping 70 metres! This would put every coastal city underwater. Fortunately, it is not likely that all glaciers would ever melt, but we are heading in the wrong direction.

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Curriculum Connection
14, 18

Climate Change - Melting Glaciers

Questions

Use information from the text to support your answer

1) Define the terms below.

Industrial Revolution	
Global W	

2) How ing each year? Why is this unsustainable?

Reaction

What is your reaction to th ing gla lain what you're thinking

True or False

Circle whether the statement is true or false

1) The Earth is warming 1 degree Celsius every 100 years	True	False
2) The Muir Glacier has melted to the point it has retreated 11 kilometres	True	False
3) Each year, 1.2 trillion tons of glacier ice is melting	True	False
4) The ice caps in Antarctica and Greenland are melting rapidly	True	False
5) If all glaciers melt, the sea levels will rise 100 metres causing flooding	True	False

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Curriculum Connection
14, 18

Effects of Melting Glaciers

Background – Why Are Glaciers Melting?

Glaciers are melting for two main reasons. First, the increase in temperatures due to global warming are melting glaciers at a rate much faster than they were melting before the industrial revolution. This fact tells us that our human actions are causing glaciers to melt.

The second reason is due to warming ocean temperatures. With the temperatures rising, the ocean's temperatures are rising also. This is [illegible] melting of glaciers under the surface of the ocean. In addition, scientists are concerned that the global ocean currents are causing warmer ocean waters to be pushed toward the poles. This is melting the very important ice sheets in Antarctica and Greenland.

Effects of Melting

Rising Sea Levels

Since 1961, glacial melting has caused the sea levels to rise 2.7 centimetres.

Impact on the Climate

As glaciers are melting at the north and south poles, the oceanic currents are slowing, causing a changing global climate and creating more extreme weather events, like hurricanes and typhoons.

Disappearance of Species

Glacier melting is causing the extinction of many species. Glaciers provide a natural habitat to many animals, including penguins, seals, and polar bears. Almost all penguins are found in Antarctica, where they live on glaciers. Icebergs provide habitats for these animals to take a rest as they travel around their ecosystem. Without these glaciers, many of these animals will become extinct.

Less Freshwater

Melting glaciers help supply the river systems on our Earth. Scientist believe that by the year 2100, 85% to 100% of all arctic ice in Canada will be lost. This means the supply of freshwater into the rivers in Canada will be affected greatly. These regions that are currently being supplied with freshwater from melting glaciers will need to adapt to life with less freshwater available.

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Curriculum Connection
14, 18

Effects of Melting Glaciers

Questions

Use information from the text to support your answer

1) Why are glaciers melting?

2) Why will so[illegible]mals become extinct if glaciers continue to melt?

Summarize

Paraph[illegible]h h[illegible]w in one sentence

Rising Sea Levels	
Impact on Climate	
Disappearance of Species	
Less Freshwater	

Questioning

Write 2 questions you have about the reading

1)	
2)	

Name: _____ Date: _____

Unit Test - Water Systems

Multiple Choice /10

1) An ice sheet is the _____ type of glacier. a) Largest b) Smallest c) Tallest d) Shortest	2) Which type of ice floats in the ocean? a) Ice cap b) Ice Shelf c) Ice Sheet d) Iceberg
3) Freshwater [illegible] than how many ppm of salt? a) 5 000 b) 1 000 c) 100 000 d) 10	4) Beside headlands are usually... a) Caves b) Sea stumps c) Bays d) Rivers
5) A man-made lake is called a [illegible] a) Drainage Divide b) Basin c) Watershed d) Reservoir	[illegible]ich type of well provides the safest water? [illegible] [illegible] Driven c) Dril[illegible]lls d) N[illegible]the
7) Which aquifer is surrounded by rock and clay with no exposure to the ground level a) Unconfined aquifer b) Reservoir aquifer c) Ground aquifer d) Confined aquifer	8) Which t[illegible]rovide[illegible]rgest blockage for wa[illegible] a) Seawall b) Dike c) Levee d) Vegetation
9) Saltwater makes up approximately... a) 50% of all water on Earth b) 85% of all water on Earth c) 97% of all water on Earth d) 99% of all water on Earth	10) Which term explains how cloudy water is? a) pH level b) Bacteria c) Turbidity d) Dissolved Oxygen

Definitions – What does the term mean (1 mark each) /4

Term	Definition (what does it mean)
Watershed	
Freshwater	
Levee	
El Nino	

Short Answer Questions (2 marks ea

1) How do waves create headlands and bays?

2) Where does rainwater that lands on your roof end up? Explain its journey.

3) What is a meandering stream? How do they form?