Preview - Information

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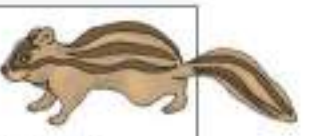
Workbook Preview

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Grade 7 Science Unit

Interactions in the Environment

B1 - Relating Science and Technology to Our Changing World
B2 - Exploring and Understanding Concepts



	Curriculum Expectations	Pages
B1.1	assess the impact of various technologies on the environment	64-66, 97-109, 117-118, 122-123
B1.2	assess the effectiveness of various ways of mitigating the negative and enhancing the positive impact of human activities on the environment	110-116, 119-121
B1.3	analyse how diverse First Nations, Métis, and Inuit practices and	124-132
B3.1		-26, 60-
B3.2		24-36
B3.3	and decomposers within an ecosystem	60-61
B3.4	describe the transfer of energy in a food chain, and explain the effects of altering any part of the chain	46-66
B3.5	describe how matter is cycled within the environment, and explain how the cycling of matter promotes sustainability	67-78
B3.6	explain the differences between primary succession and secondary succession in ecosystems	79-86, 95-96
B3.7	explain how biotic and abiotic factors limit the number of organisms an ecosystem can sustain	87-89, 93-96
B3.8	describe how different approaches to agriculture and to harvesting food from the natural environment can impact an ecosystem, and identify strategies that can be used to maintain and/or restore balance to ecosystems	64-66, 97-121

Preview of 100 pages from this product that contains 214 pages total.

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Grade 7 Science Unit

Strand A - STEM Investigation and Communication Skills

	Curriculum Expectations	Pages
A1.1	use a scientific research process and associated skills to conduct investigations	18, 37-40, 90, 137, 140
A1.2	use a scientific experimentation process and associated skills to conduct investigations	90-92
A1.3	use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	18-23, 37-40, 90-92
A1.4	follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	18-23, 37-40, 90-92
A1.5	communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	18-23, 91-92
A2.1	write and execute code in investigations and when modelling concepts, with a focus on planning and designing programs	133-138
A2.2	identify and describe impacts of coding and of emerging technologies, such as artificial intelligence systems, on everyday life, including skilled trades	133-137
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	133-135, 137, 139, 141
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	41-42, 133-137, 139-141
A3.3	analyse contributions to science and technology from various communities	42, 133-136

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INTERACTIONS IN THE ENVIRONMENT



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Name: _____ 11

Curriculum Connection
B3.1, B3.2

Ecosystems

What is an Ecosystem?

An ecosystem is a network of interactions among living organisms and their environment. A **living organism** is anything alive, which includes plants, animals, and microbes. Living organisms are the **biotic** parts of an ecosystem, while non-living things are the **abiotic** parts.

The living organisms in an ecosystem need each other, as no one plant, or animal could survive by itself. Plants need animals in many ways, while animals need plants to survive.

Organisms interact with the abiotic parts in their ecosystem, like the sun, soil, water, rocks and air. Biotic components of an ecosystem meet their needs by interacting with the abiotic components. Biotic components in an ecosystem use abiotic components for shelter. Animals will live under rocks, in dens, or in trees. These abiotic elements often contain a thriving ecosystem as well. Be careful when you have flipped a rock!

PREVIEW

Interesting Facts about Ecosystems

- Coral reefs are busy underwater ecosystems. They look like plants but are actually animals. They have skeletons and form reefs where a lot of other organisms live, like crabs, starfish, clams, eels and fish.
- Half of the world's species live in tropical rainforests. These ecosystems are home to plants, animals, fungi, and many microscopic organisms.
- The desert is a dry ecosystem where there is very little rain. To live in the desert, you must be able to save water. Cactuses store water and can live without rain for months. The Kangaroo Mouse rarely drinks water and gets its water from food.
- Freshwater ecosystems are home to rare species. Ponds, lakes, streams, and rivers are freshwater ecosystems home to species that can't live in the salty ocean water. These ecosystems are all over the world.
- Most tundra ecosystems are located in the Arctic in the Northern Hemisphere. The tundra is massive and has no trees because the ground is permanently frozen.





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Curriculum Connection
B3.1, B3.2

Questions
Use information from the text to support your answer.

1) How do biotic and abiotic elements interact with each other?

2. Define the terms below.

Biotic	
Abiotic	
Ecosystem	

Visualizing
Draw what you were reading. Explain the picture.

True or False
Circle whether the statement is true or false.

1. An ecosystem is a community of living things interacting with dead things.	True	False
2. Half of the world's species live in tropical rainforests.	True	False
3. Only plants and animals that can hold water can survive in the desert.	True	False
4. The ocean is a freshwater ecosystem.	True	False
5. Not much grows in the tundra because the ground is frozen.	True	False

PREVIEW

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Curriculum Connection
B3.1, B3.2

Terrestrial Ecosystem

What is a Terrestrial Ecosystem?
A **terrestrial ecosystem** is a land-based community of organisms. The picture below shows a terrestrial ecosystem that is home to biotic and abiotic components. The biotic things interact with each other and the abiotic components to survive.



PREVIEW

Interpret Analyze the picture and answer the questions below.

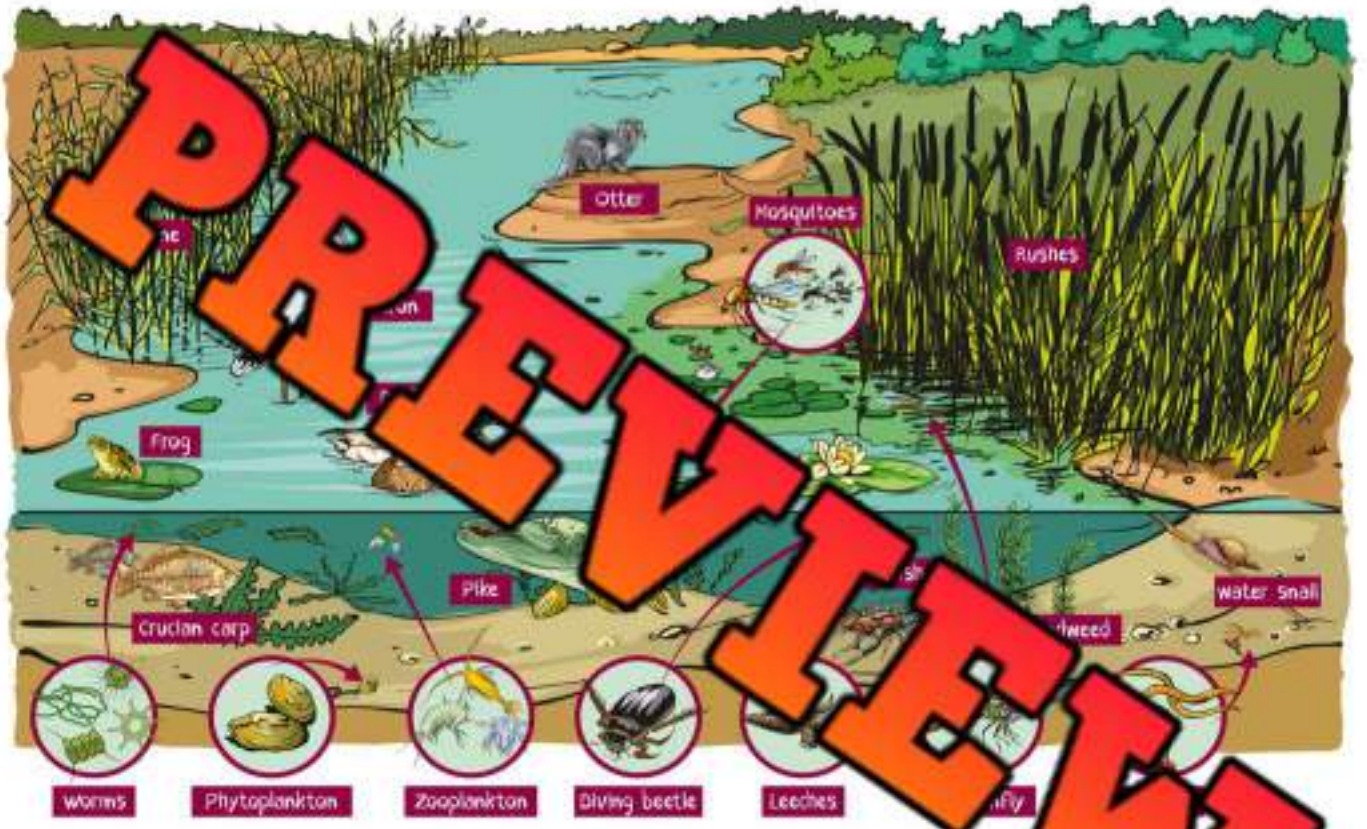
How are the organisms interacting with the abiotic and other biotic components in their ecosystem? List 5 ways.
1)
2)
3)
4)
5)

Name: _____ 15

Curriculum Connection
B3.1, B3.2

Aquatic Ecosystem

What is an Aquatic Ecosystem?
An **aquatic ecosystem** is community of organisms that live in and around a body of water. The picture below shows an aquatic ecosystem that is home to biotic and abiotic elements. The biotic things interact with each other and the abiotic components to survive.



PREVIEW

Interpret Analyze the picture and answer the questions below.

How are the organisms interacting with the abiotic and other biotic components in their ecosystem? List 5 ways.
1)
2)
3)
4)
5)

Name: _____ 24

Curriculum Connection
B3.1, B3.2

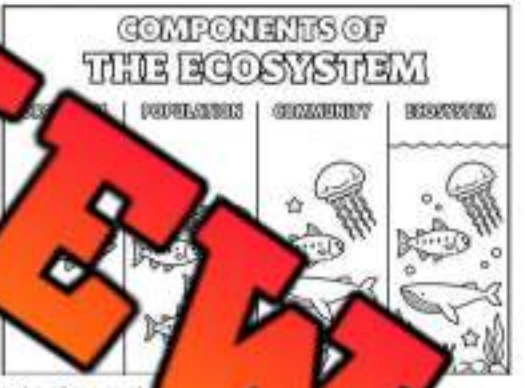
Living Things – Basic Needs

Basic Needs of Living Things

Biotic components of an ecosystem have basic needs they must meet. If they don't, they will become an abiotic component.

Plant Basic Needs

1) **Light** – eived from the sun and used to make food as part of photosynthesis
2) **Wate** – ll provides water to plants so that the plant can spread nutrients
3) **Air** – lants dioxide that they find in the air in our atmosphere.
4) **Warmth** – s can in colder temperatures (cedar trees, boxwood hedges) while ne Either way, all plants need some warmth.
5) **Space** – All plants ne o gro ystem has a carrying capacity that will allow it to provide life for ain components



Animal Basic Needs

1) **Food** – Animals need to find food in their eco m. Animals eat other living things, like plants or othe animals.
2) **Water** – Animals need freshwater to drink. Freshwater is found puddles, rivers, etc. Freshwater is not found in oceans.
3) **Shelter** – Animals find shelter using abiotic components, like rocks, logs and dead trees. Some animals live in caves, or in other biotic components like trees and plants. Animals use these shelters for protection so they can hide from predators.
4) **Air** – Animals need oxygen from the air in our atmosphere. Our air is made of 78% nitrogen and 21% oxygen. Many other gases make up the remaining 1%.
5) **Space** – Animals also need space to survive. They need room to gather resources like food and water. An ecosystem has a carrying capacity for animals. If too many animals live in an ecosystem, overpopulation problems like not enough food will occur.

PREVIEW

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Name: _____ 25

Curriculum Connection
B3.1, B3.2

Questions Use information from the text to support your answer.

1) What do all biotic components in ecosystems need to survive?
2) How do biotic things use abiotic things to survive in their ecosystem?

PREVIEW

Questioning Write three questions about the reading.

1)	
2)	
3)	

True or False Circle whether the statement is true or false.

1) All biotic things need air and water.	True	False
2) All biotic things need shelter.	True	False
3) Some animals need freshwater while other animals need saltwater.	True	False
4) All marine animals can survive in freshwater, like lakes, rivers and ponds.	True	False
5) Ecosystems can be overpopulated with too many biotic components.	True	False

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Curriculum Connection
B3.1, B3.2

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____

Is the statement true or false?

Plants use photosynthesis for food.	T	F
Freshwater is found in oceans.	T	F
Animals need carbon dioxide.	T	F
Plants need nitrogen from air.	T	F
Air is 78% oxygen.	T	F

Name: _____

Is the statement true or false?

Plants use photosynthesis for food.	T	F
Freshwater is found in oceans.	T	F
Animals need carbon dioxide.	T	F
Plants need nitrogen from air.	T	F
Air is 78% oxygen.	T	F

Name: _____

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Animals need carbon dioxide.	T	F
Plants need nitrogen from air.	T	F
Air is 78% oxygen.	T	F

PREVIEW

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Curriculum Connection
B3.2

Biotic Factors in Forests

Forest Ecosystems

Forests are ecosystems that are communities for living and non-living things. Scientists use the term **biotic** to refer to anything living and **abiotic** as anything non-living. Examples of biotic and abiotic things we find in forests include:

Biotic	Trees, shrubs, birds, mammals, fish, insects, grasses, fungi, ferns, bacteria
Abiotic	wind, sunlight, water, rocks, air, temperature, human-made things

Biologis who study living things. They look at how living things are affe ar things. When a biotic or abiotic thing affects a biotic thing, we cal biotic ctor



Biotic Factors g thin t trees

- Leaf Miner – A le er i an insect that lives inside a leaf and eats the le like i who get inside the plant and eat it. Most lea inse hs, flies, and beetles. The larva need to ea pla urvive.
- Tent Caterpillars – Caterpillars are s utterfl oths in the larva stage. They need to eat plants to survive. Tent cate illars ar lar moths. The adult moth lays eggs in the branches of a tree. When the atch uild silk "tents" in the branches. The larvae are hungry! They can l th e in just days! This is called **defoliation**. When there is a infestation terpill a forest, it can lead to the defoliation of tens of thousands of hec res
- Blight – Blight is a plant disease that happens when a fungi ba gh a plant. Blight causes the browning of leaves and small branches bacteria destroy the chlorophyll inside the plant that is needed to keep ant green and healthy. A tree with blight cannot survive as it also needs chlorophy o make food.



- Yellow-bellied Sapsucker – Just like the name implies, the yellow-bellied sapsucker sucks the sap out of trees. They use their sharp beak to drill holes in the tree so the sap can seep out of the holes. The sapsucker eats the sap and can cause the tree to die if too much sap is lost.
- Deer – A deer is a herbivore consumer, meaning they eat only plants. They enjoy the leaves of trees. Sometimes, deer can cause damage to trees by eating the tender bark of younger trees. This causes the tree to die. Trees will also die if the deer eats all of the leaves.

PREVIEW

Name: _____ 28

Curriculum Connection
B3.2

Questions Use information from the text to support your answer.

1) How do biotic things affect forests?

2) What bi[illegible] factor did you find most interesting? Explain how it damages living things.

PREVIEW

Making Connections [illegible] the [illegible] emind you of?

True or False Circle whether the statement is true or false.

1. Rocks, soil, and wind are all biotic factors.	True	False
2. An abiotic factor is something non-living affecting living things.	True	False
3. Leaf-mining happens when larva eat plant leaves from the inside out.	True	False
4. Deer are abiotic factors affecting living things.	True	False
5. Biologists study both biotic and abiotic factors.	True	False

Name: _____ 29

Curriculum Connection
B3.2

Abiotic Factors in Forests

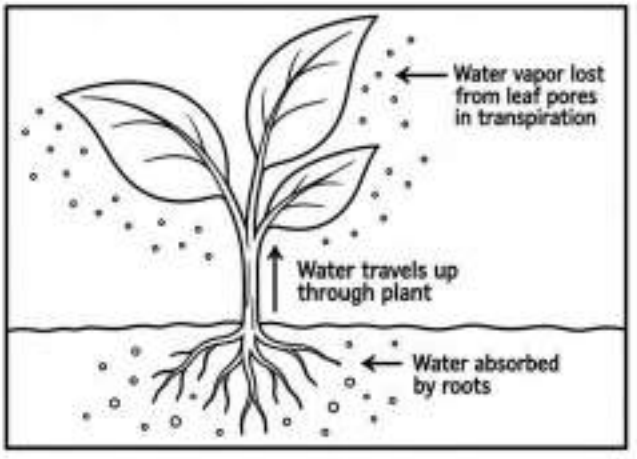
Abiotic Factors - How Non-Living Things Affect Trees
Trees and forests need non-living things to survive. Soil, temperature, wind, sunlight, and water are all examples of abiotic factors. Read about them below.

Soil – Trees need quality soil to grow. Good soil is able to hold water and also drain the right amount of water as well. This allows the plants to receive the perfect amount of water. Good soil should also have nutrients in it. The nutrients make the soil slightly acidic, which is needed for plants to grow. Soil can be too dry, wet, loose, or compressed. The soil in forests is quality soil because of all the plants already growing there. When plants decay, they add nutrients to the soil, making it even better.

Temperature – Trees need an ideal temperature to survive. Depending on the tree, some will die in cold temperatures. For example, a warm March and April can bring early blooming maple trees are then killed by a May frost. In Canada, two main types of trees exist – deciduous and coniferous. Deciduous trees lose their leaves when the temperature drop while coniferous trees do not. These trees can survive the cold temperatures to start growing when it warms up.

Wind – Trees are great at blocking the wind for us, but did you know that trees actually need wind? They need the wind to blow against the trees that causes their roots to grow deeper into the soil, which in turn supports the tree as it grows taller.

Sunlight – Almost every living thing needs sunlight to survive and trees are no exception. Some trees need less sunlight than others. All trees need some. This is because they use sunlight as part of photosynthesis to make the food they need to survive.



Water – Trees need water to survive. Water is a key part of photosynthesis, which is the process of plants creating food for themselves. The process of photosynthesis requires sunlight + water + carbon dioxide to make glucose (sugar) that it uses for food. But
plants need water for more then just photosynthesis. They also use water for transpiration. Transpiration is the process of water travelling from the soil and roots up through the trunk and branches where it exits through tiny holes in the leaves. Transpiration is important because as the water travels, it carries nutrients from the soil into the plant.

PREVIEW

Name: _____ 30

Curriculum Connection
B3.2

Questions

Use information from the text to support your answer.

1) How do abiotic factors affect trees?

2) Why is w[illegible]r so important for trees? How do trees get water?

PREVIEW

Summarizing

Explain[illegible] idea[illegible] supporting details from the reading.

True or False

Circle whether the statement is true or false.

1. Abiotic means non-living.	True	False
2. Transpiration is the process of water moving through a plant.	True	False
3. Sunlight + water + oxygen produces carbon dioxide and fructose for plants.	True	False
4. When plants transpire, water is lost through the roots of a plant.	True	False
5. Plants need wind so they can grow stronger roots.	True	False

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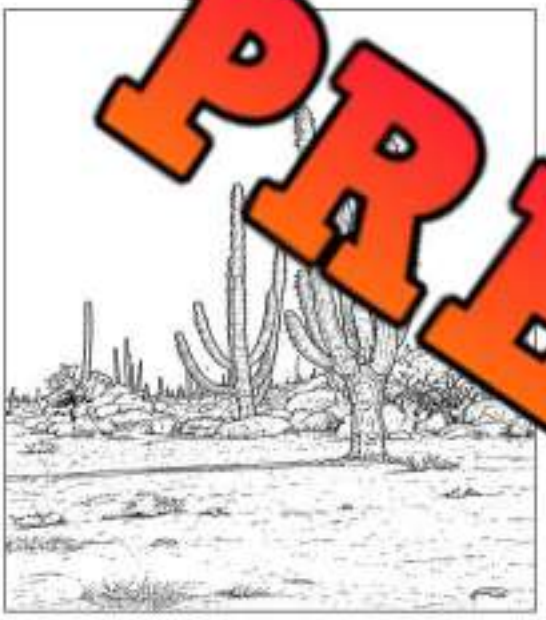
Curriculum Connection
B3.2

Abiotic Factors - Biodiversity

An ecosystem will thrive if the abiotic factors are favourable for a large variety of organisms. Conversely, if an ecosystem provides unfavourable abiotic factors, it will be difficult for a lot of biodiversity to exist in the ecosystem.

Interpret How do the abiotic factors affect the ecosystems in the pictures?

PREVIEW



Water	
Wind	
Ter	
Soil	



Water	
Temperature	
Soil	
Rocks	

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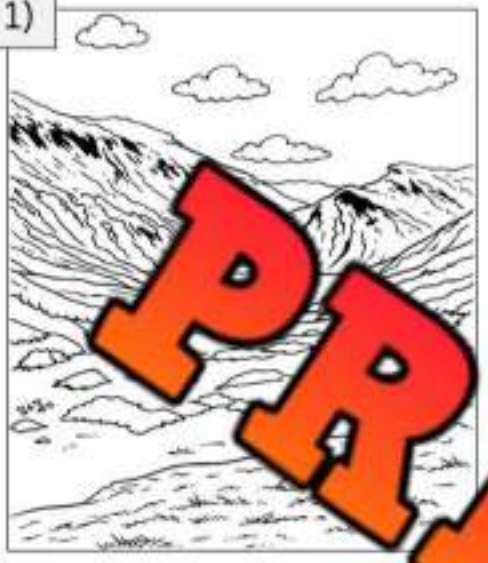
Name: _____ 36

Curriculum Connection
B3.2

Abiotic Factor - Biodiversity

Interpret How do the abiotic factors affect the ecosystems in the pictures?

1)



Water	
Temperature	

2)



Wa	
Temperature	
Soil	

Which ecosystem would you find more biodiversity? Explain.

PREVIEW

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Name: _____ 37

Curriculum Connection
A1.1, A1.3, A1.4

Experiment – Designing a Zoo Enclosure

Research Question What do animals need to survive?

You work at a zoo and need to build another enclosure for at least 3 different animals to live in. Which three animals will you bring to your zoo? Make sure these animals can survive together in the same enclosure.

Materials What do we need for our activity?

1) Clay
2) A box – shoebox, pizza box, etc.
3) Pipe cleaners
4) Toothpicks or wooden dowels
5) Straws
6) Construction paper



PREVIEW

Method How do we complete the experiment?

1) Decide which animals you want to buy for your zoo.
2) Research what the animals need to survive.
3) Write down things on the backside of the page that you want to include in your enclosure.
4) Draw a plan of your zoo enclosure.
5) Complete the checklist to make sure the animals have everything they need.
6) Begin making the model of your zoo enclosure.
7) Complete the extension activity – math connection.

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Curriculum Connection
A1.1, A1.3, A1.4

Planning Answer the questions below.

1) Which animals will you choose for your enclosure?



2) What will you [illegible] enclosure so that your animals can survive? Look online at enc[illegible]he[illegible]imals and include some of the same abiotic and biotic features.

3) What could you put in the enclosure so that the animal has fun?

PREVIEW

Name: _____ 39

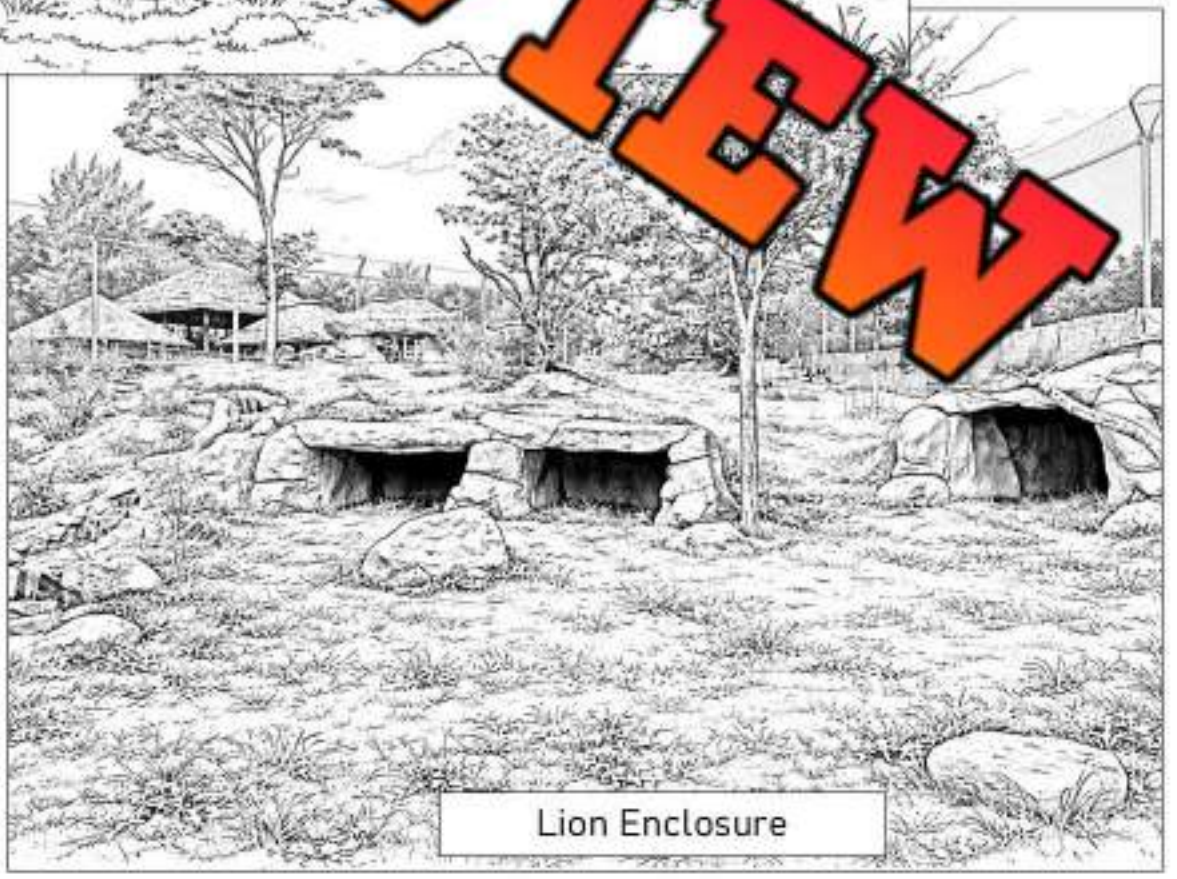
Curriculum Connection
A1.1, A1.3, A1.4

Zoo Enclosure Examples

Planning Look at the examples below.



Gorilla Enclo



Lion Enclosure

PREVIEW

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Name: _____ 40

Curriculum Connection
A1.1, A1.3, A1.4

STEAM – Designing a Zoo Enclosure

Draw Draw a plan of your enclosure from a bird's eye view.



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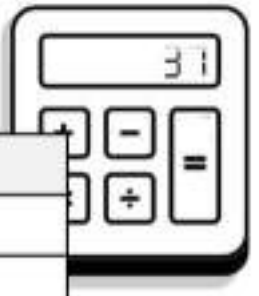
Name: _____ 41

Curriculum Connection
A3.2

STEAM – Designing a Zoo Enclosure

Materials are not free! How many materials did you use? Find out how much your enclosure cost to make.

Math Answer the questions below.



Material	Cost
Pipe Cleaners	$1.25 each
Cardboard Boxes	$5 each
	$6 for one piece
Toothpicks	$0.30 each
Wooden Dowels	$2.50 each
Straws	$0.75 each
Pieces of Paper	$1.50 each

How many of each material did you use? Write the number and calculate the cost.

Material	Number	Cost
Pipe Cleaners		
Cardboard Boxes		
Clay		
Toothpicks		
Wooden Dowels		
Straws		
Pieces of Paper		
Total Cost		

If you charged $1.25 for a visitor to see the animals in your enclosure, how many visitors would you need to pay back the enclosure?

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Name: _____ 42

Curriculum Connection
A3.2, A3.3

Zoo Enclosure – Real World Problem

Lions are carnivores. They only eat meat. Also, lions are predators. They hunt and stalk their prey.

Think Look at the picture and answer the questions.



PREVIEW

1) Is it fair to lions to have humans behind glass in their enclosure? Explain.

_____

_____

_____

_____

_____

_____

2) [illegible] ...res used?

_____

_____

_____

_____

3) How do you think the lions feel in this picture?

_____

_____

_____

_____

Name: _____ 43

Curriculum Connection
B3.3

Food Chain – Producers and Consumers

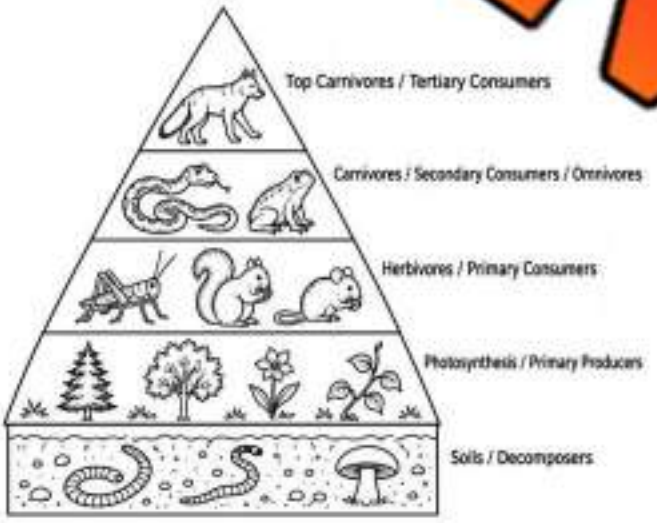
Food Chain

Every living thing needs energy in order to survive. When we run, jump, swim, and do anything, we are using energy. We obtain the energy we need from the food we eat. All living things need energy, which means all plants and animals need energy. Plants get energy from sunlight, water, and nutrients in a process called photosynthesis. Animals obtain energy by eating plants and/or animals. All living things need energy to grow. In the food we, we can see how each living thing gets food and how the nutrients are passed fr ature to creature.

Rea bout how the food chain in a pond ecosystem works and how the energy i ing organisms.

Prod

Producer are th ur vironment. They are called **producers** because they can produce their ey d using light energy from the sun, carbon dioxide from the air, and om t rocess is called photosynthesis and it leads to glucose/sugar as the me. In a pond, green plants produce their own food so they can gro es of s in a pond are algae, water lily, duckweed, and cattails.



Cons

Animals are **consumers** because they cannot their own food on their own. They nee nsum ts and/or animals in orde ot eed to survive. Humans ar rs be we cannot produce our o and ed to rely on plants and/ ani **Carnivores** are animals animals. **Herbivores** are anima eat only plants and **omnivores** are anim who eat both plants and animals.

In a pond, the consumers are animals that eat living plants and/or animals. Examples of consumers in a pond are beavers, tadpoles, ducks, dragonflies, turtles, frogs, birds, snakes, and fish.

Decomposers

Decomposers are bacteria and fungi that eat decaying matter in the form of dead plants and animals. They break down the decaying matter so that it turns into soil to be used by plants. When they break down the dead plants and animals, they release nutrients and mineral salts that go into the soil. This makes the soil rich in nutrients for plants to grow. Examples of decomposers in a pond are molds, fungi, insects and worms that reuse and recycle materials that were formerly living.

PREVIEW

Name: _____ 44

Curriculum Connection
B3.3

Questions

Use information from the text to support your answer.

1) What is the difference between a producer and consumer?

2) What is a decomposer? Why do you think they are important?

3) What is the difference between a carnivore, herbivore, and an omnivore?

4) How does the food chain in a pond work?

PREVIEW

True or False

Circle whether the statement is true or false.

1. Most humans are carnivores.	True	False
2. Examples of producers in a pond are mold and fungi.	True	False
3. Producers are plants who can produce their own food.	True	False
4. Consumers are animals who cannot produce their own food.	True	False
5. An omnivore is at the top of the food chain.	True	False
6. Decomposers provide nutrients for soil.	True	False
7. Plants produce their own food via a process called photosynthesis.	True	False

Curriculum Connection
B3.3

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____

Is the statement true or false?

1) Carnivores are animals that eat both plants and animals.	T	F
2) The process of photosynthesis results in the production of glucose or sugar in plants.	T	F
3) Humans are considered producers because they consume both plants and animals for energy.	T	F
4) Tadpoles and dragonflies in a pond ecosystem are examples of producers.	T	F

Name: _____

Is the statement true or false?

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4) Tadpoles and dragonflies in a pond ecosystem are examples of producers.	T	F

PREVIEW

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Name: _____ 46

Curriculum Connection
B3.3, B3.4

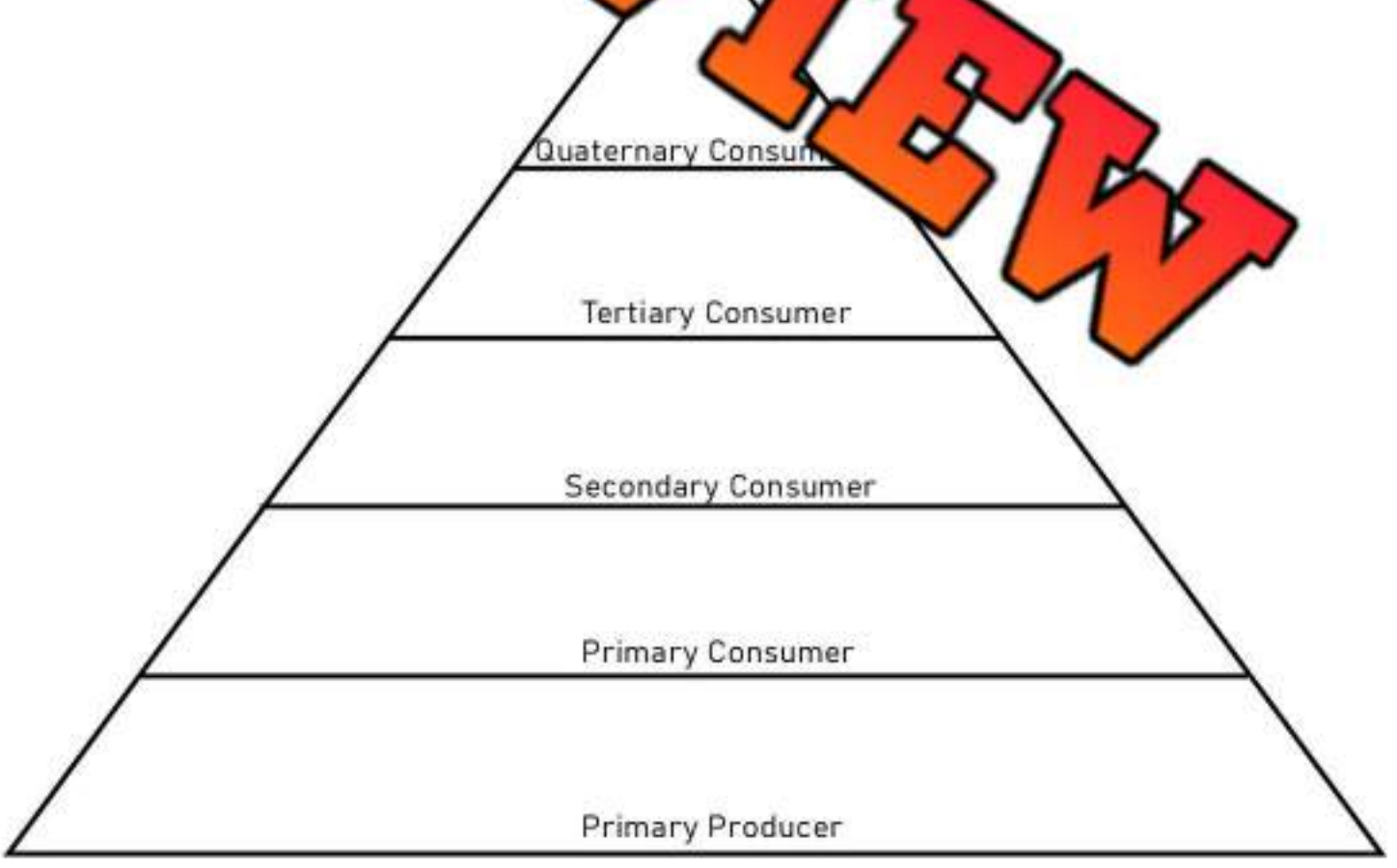
Nutrient Cycle – Food Chain

Nutrient Cycle
A nutrient cycle refers to the movement and exchange of nutrients from plants to animals and then back to plants. When plants grow, they produce food for animals. When animals die, their decaying matter becomes nutrients for the soil so that plants can grow again. This completes the cycle.

The Food Chain
The bottom of the food chain is made of primary producers, which are plants. The primary consumers are herbivores that eat only producers – plants. They tend to be smaller in size and there are many of them. The secondary consumers are next on the food chain, and they eat both plants and animals. The tertiary consumers eat the other animals below them in the food chain. They are the herbivores. A quaternary consumer is an animal who is at the top of the food chain. This means it's the top predator who has no natural enemies. When it dies, the nutrients passed from plants to animals is restored back into the soil. As the pyramid rises, plants and animals contain the sun's energy from the previous step. The problem is that the energy flow energy is lost each time it is passed on.

PREVIEW

Research Create your own by filling in plants and animals.



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Curriculum Connection
B3.3, B3.4

Decomposers and Detritivores

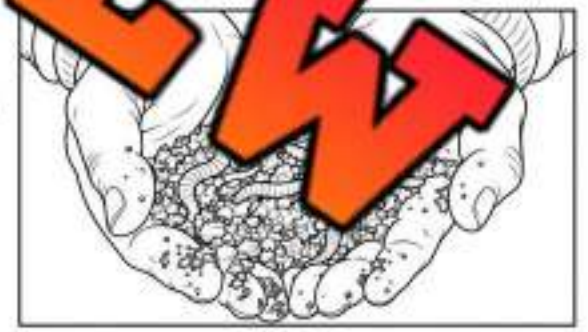
What are Decomposers?

A **decomposer** is an organism that breaks down organic material. **Organic material** is any material that was alive but is now dead. For example, the remains of a deceased animal will be broken down by decomposers. Also, the fruits and vegetables that were alive before the[illegible]re picked are now organic material that will be broken down by decompo[illegible]mples of decomposers are bacteria and fungi.

Fund[illegible] Decom[illegible]

Decomposers a[illegible] tan[illegible]cause they allow organic material to be recycled in an ecosystem. Can y[illegible]ine wh[illegible]ystem would look like it there were skeletons, leaf piles, and other o[illegible]h[illegible]al [illegible]ound?

Decomposers are **het[illegible]c**, w[illegible] they get their energy from the nutrients in dead organic matter. Bacte[illegible]ngi [illegible]y releasing enzymes that begin to decay the dead organism. When the [illegible]nic mate[illegible]s br[illegible] down by decomposers, the nutrients from the organic matter is releas[illegible] the s[illegible]y this because when an animal dies and is decomposed, often pla[illegible]ea[illegible]ains as the soil is richer in nutrients.



Most decomposers are microscopic organisms, meaning you can't see them without a microscope.

What are Detritivores?

A detritivore is similar to a decomposer.

Detritivores are organisms that eat dead plant and animal remains. Worms are one of the most important detritivores. Worms take in food through their mouths and pass a 'cast' through their rear end. The cast is very valuable fertilizer for the soil. When it is mixed with the soil, plants will grow efficiently in it.

Both detritivores and decomposers work together to clean up our ecosystems. Without them, we would have organic material everywhere.

PREVIEW

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Curriculum Connection
B3.3, B3.4

Questions

Answer the questions below using evidence from the text.

1) What is the difference between decomposers and detritivores?

2) Why ar[illegible]osers and detritivores important for the nutrient cycle?

PREVIEW

Visualizing

What we[illegible]d pi[illegible]head while you were reading?

True or False

Circle whether the statement is true or false.

1) A worm is a decomposer.	True	False
2) Bacteria is a detritivore.	True	False
3) Detritivores and decomposers work together to break down organic matter.	True	False
4) Without decomposers and detritovores, we'd have leaf piles everywhere.	True	False
5) Decomposers and detritovores are the clean-up crews in our ecosystems.	True	False

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Curriculum Connection
B3.3, B3.4

Memory Game: Who Eats Whom?

Objective

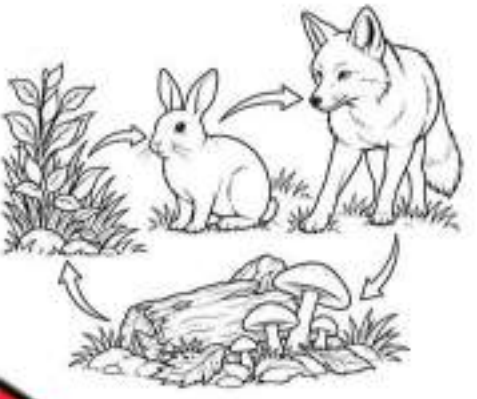
What are we learning about?

Students will identify producers, consumers, predators, and prey and recognize feeding relationships within an ecosystem by matching related cards.

Materials

What will you need for the activity?

- Me y gam rovided) with the terms on one set a nitio nother set.
- A flat surface like the fl lay out the cards.



Instructions

How will you complet the acti

1) Divide the class into groups of 3 or 4. Give d a set mory Game cards. (Provided)
2) Have each group lay all the cards face down in a grid on a
3) The students take turns flipping over two cards at a time, trying a matching term and its definition.
4) If a student finds a match, they remove those cards from the grid and keep them.
5) If the cards do not match, they are turned back over, and the next student takes a turn.
6) The game continues until all the cards have been matched.
7) After the game, review the terms and definitions with the class.
8) Discuss how the organisms depend on one another and what might happen if one organism disappeared from the food chain.

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Curriculum Connection
B3.3, B3.4

Cards | List Ecosystem Connections

Term	Definition
Ecosystem	Living and non-living things interacting in an area.
…sm	An individual living thing.
Biotic	A l… art of an …m.
Abiotic	A non-living p…t of an ecosystem.
Producer	An organism that makes its own food.

PREVIEW

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Curriculum Connection
B3.3, B3.4

Cards | List Ecosystem Connections

Term	Definition
Consumer	An organism that gets energy by eating others.
D[illegible]poser	An organism that breaks down dead matter.
Predator	[illegible]at hunts and [illegible]imals.
Prey	An animal that [illegible]unted by another animal.
Food Chain	A sequence showing how energy moves between organisms.

PREVIEW

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Curriculum Connection
B3.3, B3.4

Cards | List Ecosystem Connections

Term	Definition
Food Web	A network of connected food chains.
Habitat	The natural place where an organism lives.
Population	[illegible] one species [illegible] area.
Community	Different populations living and interacting in an area.
Limiting Factor	A factor that restricts the size of a population.

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Curriculum Connection
B3.3, B3.4

Cards | List Ecosystem Connections

Term	Definition
Competition	A struggle between organisms for limited resources.
Succession	The gradual change of an ecosystem over time.
Biodiversity	The variety of living things in an ecosystem.
Sustainability	Using resources without harming their future availability.
Invasive Species	A non-native species that can harm an ecosystem.

PREVIEW

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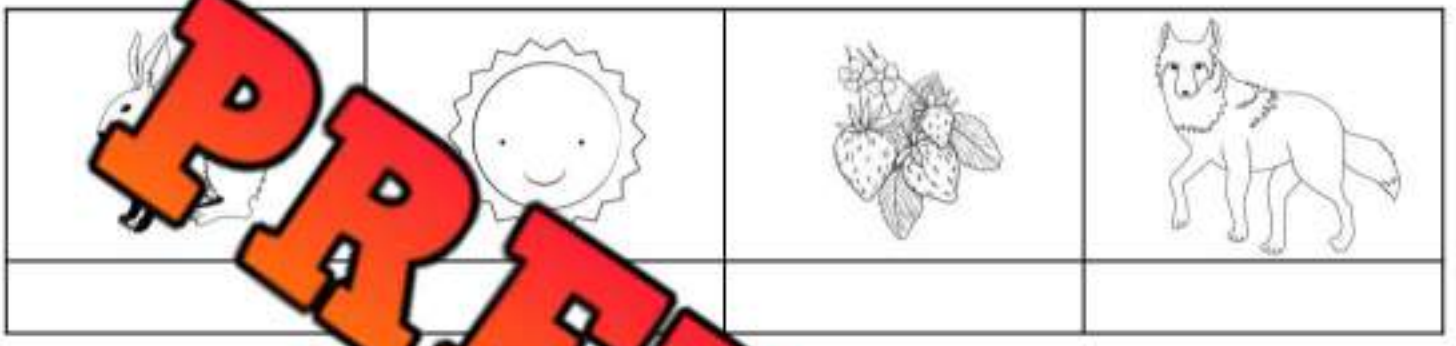
Curriculum Connection
B3.4

Ordering Energy Chains

Energy Chain Order the plants and animals by numbering them.

4-Link Energy Chain

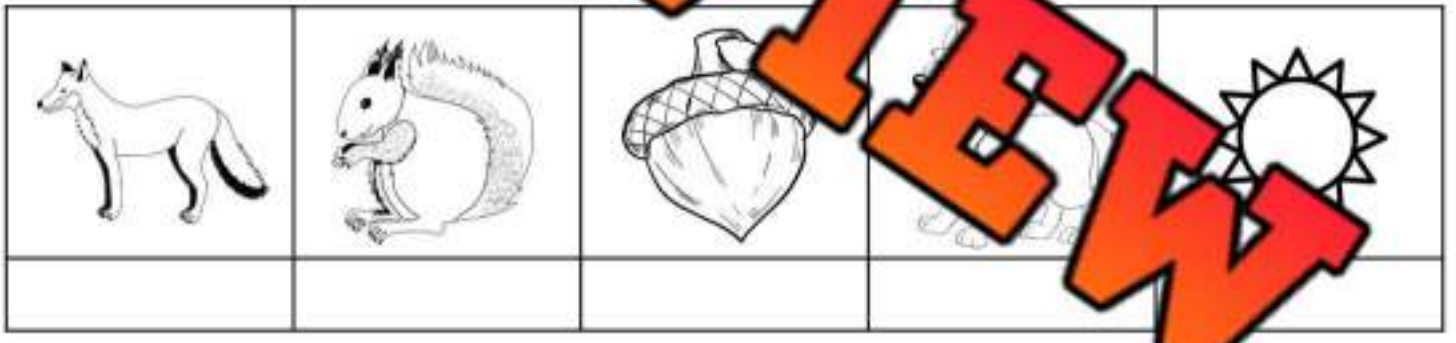
Number the plants/animals 1-4



PREVIEW

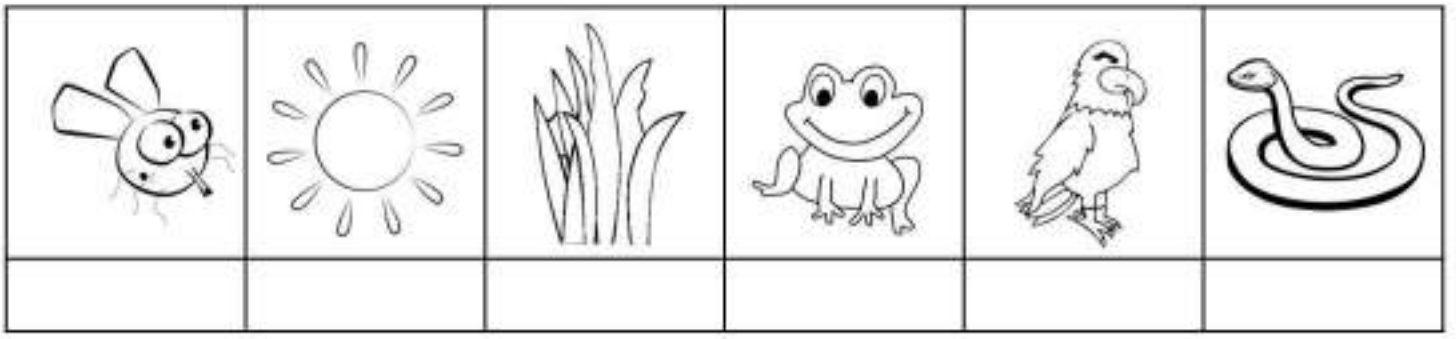
5-Link Energy Chain

Number the plants/animals 1-5



6-Link Energy Chain

Number the plants/animals 1-6



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Curriculum Connection
B3.4

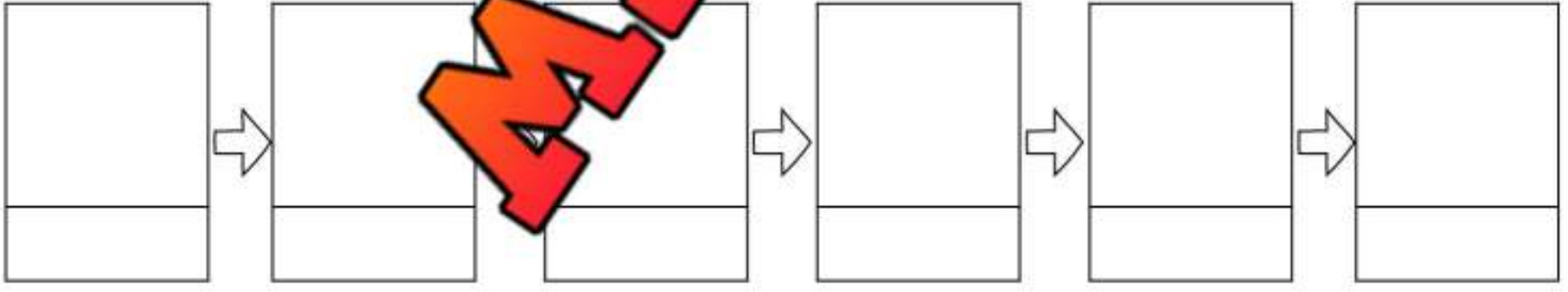
My Energy Chains

Energy Chains Draw your own energy chains bel

5-Link Energ Chai



Energy Chain



PREVIEW

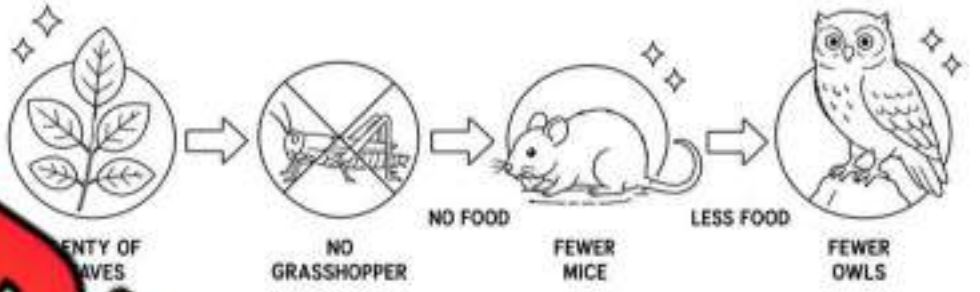
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Curriculum Connection
B3.4

Altering the Food Chain

IMPORTANCE OF THE FOOD CHAIN



PREVIEW

Chan

When we hange ems we can sometimes cause unintended changes to food chains that can th n man t ways. In the basic example above, you can see that if we get rid of g pop ulation will grow drastically while the mice population will shrink. Wit to h l population will also shrink.

Altering the Food Chain – Real Li Exa

In Borneo, DDT was used as a pesticide mosqu ried malaria. Malaria is a disease caused by a parasite that mosquitoes sp peo can be deadly but usually causes flu-like symptoms.

The problem with using DDT was that it didn't just squ also killed all the other insects in the region it was used. This meant the cock ach h were the main food for lizards. The number of lizards dropped dram t as the number of cats that ate the lizards. The cats kept the rat population under trol. With less cats, the rat population grew tremendously.

The overpopulation of rats became a serious problem in Borneo. The rats ended up causing multiple epidemics that caused more deaths than malaria caused in the first place. To solve the problem of too many rats, the government of Borneo brought in thousands of cats from other countries. "Operation Cat Drop" was a success! With cats back in Borneo, they began to control the rat population.

Many lessons were learned from Borneo. Mainly that if you don't understand the inter-relationships between things, solutions often cause more problems.

Name: _____ 63

Curriculum Connection
B3.4

Questions

Use information from the text to support your answer.

1) What can happen if we alter a food chain?

2) Give yo[illegible]xample of a food chain. Discuss what would happen if humans affected one par[illegible]

PREVIEW

Summarize

What happened in Bo[illegible]

True or False

Circle whether the statement is true or false.

1) When humans get rid of pests, it can affect other animals.	True	False
2) In Borneo, the use of DDT was successful in eliminating mosquitos.	True	False
3) Getting rid of mosquitos would have no other consequences.	True	False
4) Eliminating one species will only affect the organisms that feed on them.	True	False
5) One small change in an ecosystem can cause big changes to all organisms.	True	False

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Curriculum Connection
B1.1, B3.4, B3.8

Overfishing – Effects on Food Chain

What is Overfishing?

Overfishing is when humans fish for one type of species too much, which causes the population of the species to become underpopulated. The result can sometimes lead to the endangerment or extinction of that species.

Overfishing Effects on the Food Chain

When one species becomes underpopulated, it affects other species a great deal. The ocean ecosystem is complex. The apex predators, like sharks, dolphins, and seals, eat large fish. The large fish eat smaller fish and shellfish. The smaller fish eat smaller organisms like krill and phytoplankton.

The problem is that all animals will eat essentially anything they can find. Whales eat anything from fish to plankton, krill, or algae. Sharks are the same way. A shark is an apex predator that will eat almost anything, including other sharks and krill.



Therefore, when we overfish one species, like cod, we affect the food source of sharks and whales, as well as the organisms in the food chain above and below the fish.

Example – Overfishing in the European North Sea

- Norwegian cod were overfished after humans overfished the area.
- Local fishermen began to fish for pout because the cod were no longer available. Pout fish are small fish in the same family as cod.
- The overfishing of pout became a problem as the pout populations decreased. The pout fish eat a lot of krill, which caused a massive increase in the krill population.
- Krill eat copepods, which meant that with more krill, the populations of copepods decreased significantly.
- With less copepods, the juvenile cod who eat copepods had less to eat. This meant that the efforts to increase the Norwegian cod populations again by not fishing them were slowed as the juvenile cod had less food to eat.

PREVIEW

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Curriculum Connection
B1.1, B3.4, B3.8

Questions
Use information from the text to support your answer.

1) What is overfishing? Why does overfishing happen?

2) How do [illegible]shing cause problems for the food chain?

PREVIEW

Visualizing
Draw what you w[illegible]ere reading. Explain the picture.

True or False
Circle whether the statement is true or false.

1) Sharks eat anything from krill to other sharks.	True	False
2) The food chain in an ocean is simple.	True	False
3) Organisms in the ocean only eat organisms from the level just below them.	True	False
4) Overfishing one species can cause problems for many other species.	True	False
5) In the European North Sea, Norwegian cod were saved by not fishing them.	True	False

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B1.1, B3.4, B3.8

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____

Fill in the Blanks Questions.

1) When one species becomes underpopulated, it affects other species a great deal because the ocean food chains are _____.

2) Overfishing one species, like tuna, affects the food source of sharks and _____.

3) The overfishing of pout caused a massive increase in the _____ population.

Name: _____

Fill in the Blanks Questions.

1) When one species becomes underpopulated, it affects other species a great deal because the ocean food chains are _____.

2) Overfishing one species, like tuna, affects the food source of sharks and _____.

3) The overfishing of pout caused a massive increase in the _____ population.

PREVIEW

Name: _____

Fill in the Blanks Questions.

1) When one species becomes underpopulated, it affects other species a great deal because the ocean food chains are _____.

2) Overfishing one species, like tuna, affects the food source of sharks and _____.

3) The overfishing of pout caused a massive increase in the _____ population.

Name: _____

Fill in the Blanks Questions.

1) When one species becomes underpopulated, it affects other species a great deal because the ocean food chains are _____.

2) Overfishing one species, like tuna, affects the food source of sharks and _____.

3) The overfishing of pout caused a massive increase in the _____ population.

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Curriculum Connection
B3.5

Sustainability – Cycle of Matter

What is Sustainability?

Sustainability for our ecosystems is their ability to continue in a healthy manner. This means they continue to provide resources for the biotic components of the ecosystem to survive and flourish. An unsustainable ecosystem is one that has declining plant or animal populations that could cause the decline of other populations. This is unsustainable as the ecosystem is changing, meaning it did not continue in a healthy manner.



Cycle of M – Nutrient Cycle

Nutrients iving substances that living things need to nts are examples of matter that f ystems, giving living things uilding y need to grow and carry out ife pr of nutrients are vitamins and vita zinc. These nutrients help animals grow bones, fight infections, a wou

Flow of Nutrients (Matt

- Decomposers release n her down dead organisms
- The nutrients are added to oil
- Plants suck up the nutrients from th ing t nts
- The nutrients pass on to the primar sumers at plants
- The nutrients pass on to the higher-level con s wh at the lower-level consumers
- When living things die, the cycle repeats as de dead organisms

PREVIEW

Matter Moves Throughout The Environment

The flow of matter doesn't happen all in one place. Matter can be taken from one place in an ecosystem and brought to a new place. Check out the example below:



1) A bear catches salmon from a stream.
2) It brings the salmon into the forest and eats it.
3) The remains of the salmon as well as the waste from the bear is broken down by decomposers.
4) The nutrients from the broken down remains and waste is added to the soil.
5) New plants will grow in the soil that was enriched from the salmon.

This is why we sometimes have unwanted plant growth in areas where we don't want it. Animals will spread nutrients through their waste, creating nutrient rich soil that plants will grow in. Combine that with the spread of seeds from the wind, and you could find new ecosystems anywhere that is left untouched. This cycle of nutrients promotes sustainability, as the earth's natural processes encourage the survival of ecosystems.

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Curriculum Connection
B3.5

Questions Answer the questions below using evidence from the text.

1) What does sustainability mean? Why is it important for ecosystems to have sustainability?

2) How do[illegible]r (nutrients) flow through our ecosystems? Why does that help sustain[illegible]

PREVIEW

Example Write your own example of h[illegible]er is [illegible]throughout our environment.

True or False Circle whether the statement is true or false.

1) If the environment is left alone, it will stop growing new plants.	True	False
2) The environment needs humans to spread fertilizer and seeds.	True	False
3) Matter is moved around our environment naturally by organisms.	True	False
4) The flow of matter through the environment helps sustainability.	True	False
5) Living organisms need nutrients to survive.	True	False

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Curriculum Connection
B3.5

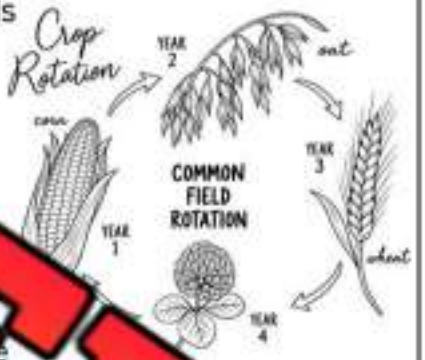
Sustainability – Crop Rotation

What is Crop Rotation?

Crop rotation is the planned sequence of growing different crops year after year to get better results. If you grow the same crop every year, you will have problems with:

- Weed buildup – weeds that enjoy the stable environment you have created by growing the same crop each year will grow out of control
- Pests – pests like locusts or Japanese beetles enjoy certain types of crops. If you continue to grow the same crops, these pests will stick around and destroy your crops
- Disease – diseases like black spot or blight will survive in the soil year after year if crops are not rotated as the same crops are usually not good hosts for the disease

When farmers rotate their crops, they usually receive yields of 10 to 15% higher than growing the same crop each year.



Benefits of Crop Rotation

The problems mentioned above will be lessened, as many environments cause the problems of weeds, pests and diseases to be minimized. Furthermore, when one type of crop is grown each year, as the crop decays at the end of the growing season, the nutrient profile will provide valuable nutrients for a new crop next season.

PREVIEW

Common Crop Rotation – Soybeans and Corn

Corn and soybeans are commonly rotated year after year. Corn needs lots of nutrients, especially nitrogen. Adding nitrogen to the soil is expensive for farmers, so instead, they grow soybeans the year before growing corn. When soybeans decompose, they provide the soil with nitrogen, which then naturally fertilizes the soil for the corn the next year.





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Questions

Use information from the text to support your answer.

1) What is crop rotation? Why is it used?

2) How do corn and soybean crop rotation work? How does it help corn?

PREVIEW

Questioning

Write 3 questions you have about the reading.

1)	
2)	
3)	

True or False

Circle whether the statement is true or false.

1) Crop rotation can help reduce pests, disease, and weeds.	True	False
2) Crop rotation using any crops is the best method.	True	False
3) The crops used last year will provide nutrients for the new crops.	True	False
4) Crop rotation creates sustainability because crops can grow year-after-year.	True	False
5) When corn decomposes, it provides nitrogen for soybeans to grow in.	True	False

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B3.5

Invasive Species in Ontario

What are Invasive Species?
Invasive species are plants, animals, insects, or other organisms that come from other places and can cause harm in their new environments. In Ontario, invasive species can damage forests, lakes, rivers, and wetlands. Here are some important examples found in Ontario.

1) Garlic Mustard
Garlic mustard is an invasive plant originally from Europe. It was brought to North America in the early 1 as an edible herb. Today, it is one of Ontario's most aggressive forest invaders. I w in forests, along roadsides, and near rivers. Garlic mustard spreads quickly a t native plants such as trilliums.

How Garlic
People c help b identify garlic mustard and removing it carefully from their property. Invas ould ed in the garbage rather than composted or left in natural areas. Hi also s and keep pets on a leash to reduce the spread of seeds.

2) Zebra Mussels
Zebra mussels are small freshw muss ly came from Europe. They were first found in Lake St. Clair in 1988 and la d th t the Great Lakes and into many inland lakes and rivers.

Zebra mussels attach themselves to hard surf and c water pipes. They also filter large amounts of plankton from the water, g aq bs and affecting native species.



Preventing Zebra Mussels
Boaters can help prevent the spread of zebra mussels by cleaning, draining, and drying boats and equipment before travelling between bodies of water. Preventing their movement is important because invasive species can be extremely difficult to remove once established.

3) Emerald Ash Borer
The emerald ash borer is an invasive beetle native to Asia. It was first discovered in Ontario in 2002 near Windsor. The insect attacks ash trees. Its larvae feed beneath the bark, interfering with the tree's ability to move water and nutrients. Large numbers of ash trees have been killed in Ontario because of this invasive insect.

Managing Emerald Ash Borer
Managing emerald ash borer includes watching ash trees for signs of infestation and following rules designed to slow the movement of invasive pests. People can also help prevent the spread of forest pests by avoiding the movement of firewood over long distances.

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Curriculum Connection
B3.5

Questions

Answer the questions below using evidence from the text.

1) What makes a species invasive?

2) What methods are being used to control or prevent these invasive species?

PREVIEW

Making Connections

Have you heard of invasive species? Did you know about [illegible] Ash Borer can have in Ontario?

True or False

Circle whether the statement is true or false.

1) Garlic Mustard was brought to North America from Europe.	True	False
2) Zebra Mussels are freshwater mollusks.	True	False
3) Emerald Ash Borers are native to Ontario.	True	False
4) Garlic Mustard can push out native forest plants.	True	False
5) Emerald Ash Borer larvae can damage ash trees.	True	False

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Curriculum Connection
B3.5

Activity – The Sports Field Debate



Debate | Ecological Balancing Act: The Sports Field Debate

1) **Introduction** (15 mins): Begin the class by discussing the basics of debate: the importance of clear arguments, evidence, listening, and respectful rebuttal. Next, present the issue to be debated: A proposal has been made to build a sports field on a piece of land that is currently a forest/wetland. Discuss what a forest/wetland is, its ecolo[illegible]mportance, and what a sports field would bring to the community.

2) **Tea[illegible]** (5 mins): Depending on the size of the class, divide them into two [illegible]ns[illegible]n team and the development team. If the class is large, you [illegible]nt to h[illegible] debates with smaller teams.

- The Conse[illegible]will[illegible]e against building the sports field in order to protect the forest/[illegible]
- The Developmen[illegible]m w[illegible]sports field, focusing on the benefits to the community.

3) **Research and Preparation** [illegible]ins[illegible]n time to research and prepare their arguments. They should focus[illegible]ecolo[illegible]cial, and economic implications of their stance. You ca[illegible]vide so[illegible]s to help them get started, like articles about similar cases, infor[illegible]n on[illegible]portance of wetlands/forests, or benefits of sports fiel[illegible]

4) **Argument Development** (15 mins): Each team wi[illegible]ent th[illegible]uments to the class. Remind students that respectful listening [illegible]du[illegible]ti[illegible] Each student should have a chance to speak.

5) **Rebuttals** (15 mins): After both sides have presented, each tea[illegible] opportunity to rebut the other's arguments. Encourage them to use [illegible]nd evidence to refute points, not personal attacks.

6) **Closing Statements** (10 mins): Each team will make a final argument summarizing their stance and the most compelling reasons to support it.

7) **Class Vote** (5 mins): Following the debates, hold a class vote to decide which team made the stronger argument. Remind students that they are voting based on the quality of the argument, not their personal beliefs on the issue.

8) **Reflection** (10 mins): End the activity with a discussion on what students learned from the activity, how their perspectives may have changed, and the importance of considering multiple viewpoints when making decisions that impact both the community and the environment.

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B3.5

Research | Answer the questions below.

1) Which team are you on? What are you arguing?	

2) How w[illegible]elopment affect each of the following? Remember to look for inform[illegible]r argument.	
Ecological Plants and Animals	
Economy Money (Jobs, Taxpayer Money, Profits)	
Social Affecting People (Hurting/ Helping People and their Community)	

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Curriculum Connection
B3.5

Research Answer the questions below.

3) List your top 5 arguments from the research you found.	
1	
2	
3	

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B3.5

Research Answer the questions below.

4

5

PREVIEW

4) Write your closing statement below.

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Curriculum Connection
B3.5

Research Answer the questions below.

5) While your opponent is sharing their arguments, write down rebuttals you think of. You can use jot notes (not full sentences). You will share these rebuttals after both sides get a chance to share their arguments.

PREVIEW

6) What did you learn from the debate? Which side did yo[illegible]? W[illegible]y a[illegible]uments that stood out to you.

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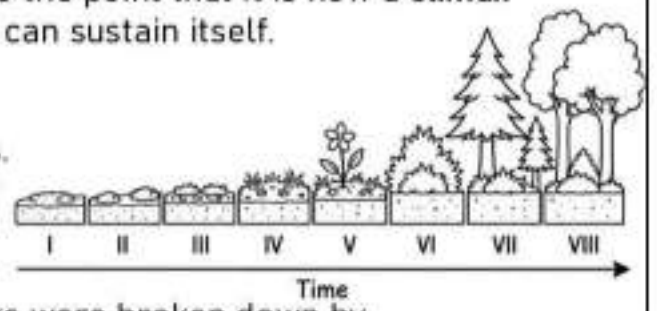
Name: _____ 79

Curriculum Connection
B3.6

Ecological Succession

What is Ecological Succession?

Ecological succession is the gradual and progressive growth of species in any given area. Ecosystems are developing slowly all around us. An ecosystem has reached a steady state, when the interactions between biotic and abiotic factors are sustainable. The ecosystem has undergone ecological succession to the point that it is now a **climax community**, as it has developed to the point that it can sustain itself.



Primary S an

When an o living organisms, it is lifeless. **Prima** growth or succession of living isms be colonize the lifeless land. Wh Earth med, there was no soil. The Earth de These rocks were broken down by microorganisms int th formed soil. The soil allowed plants to grow.

The first living nis called the pioneer species. Fungi and lichen are the most common pi ies in succession because they can break down minerals to form soil. is pecies like grasses, mosses, and small plants will grow.

Primary succession will happen w ew pa and is created. Often, this happens when a volcano spews lava and e lava c he rocks can form islands that become home to pioneer species. For exam waii i of islands that were formed when lava cooled. Hawaii is home to act can ue to spew lava that increases the size of the islands. As new land is o nary s ion continues to occur as plants and animals begin to live o land

Secondary Succession

When an ecosystem gets destroyed or disturbed, secondary succession begins. **Secondary succession** is the development of a new ecosystem in the area that was damaged or destroyed.



Secondary succession is different than primary succession as primary succession is the development of an ecosystem from new land or completely destroyed land that has no soil. **Secondary succession** is the development of an ecosystem that hasn't been completely destroyed. The land will have soil, which allows development to happen faster.

For example, when a forest fire burns forests to the ground and kills everything except the soil, secondary succession begins. The decaying of the organic matter will create nutrient rich soil that will allow a new ecosystem to develop quickly, The pioneer species in secondary successions are usually grasses, shrubs, and small plants.

PREVIEW

Name: _____ 80

Curriculum Connection
B3.6

Questions

Use information from the text to support your answer.

1) What is the difference between primary and secondary succession?

2) Which succession will take longer? Explain why.

PREVIEW

Definitions

What do the terms below

Ecological Succession	
Primary Succession	
Secondary Succession	

True or False

Circle whether the statement is true or false.

1) Primary succession is the development of an ecosystem from nothing.	True	False
2) Secondary succession is the development of an ecosystem from only soil.	True	False
3) When a volcano creates new land, secondary succession begins.	True	False
4) When a flood wipes out most of an ecosystem, secondary succession begins.	True	False
5) The pioneer species in a primary succession would likely be a tree.	True	False

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Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____

Circle the correct answer.

1) Which type of succession occurs on newly formed land with no soil?	Primary / Secondary
2) What do fungi and lichen help to create during primary succession?	Soil / Water
3) What is the steady state of an ecosystem called when it can sustain itself?	Climax / Pioneer
4) What type of succession follows a forest fire that leaves soil intact?	Secondary / Primary
5) Which of the following is typically a pioneer species in secondary succession?	Grasses / Lichen

Name: _____

Circle the correct answer.

1) Which type of succession occurs on newly formed land with no soil?	Primary / Secondary
2) What do fungi and lichen help to create during primary succession?	Soil / Water
3) What is the steady state of an ecosystem called when it can sustain itself?	Climax / Pioneer
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Name: _____

Circle the correct answer.

1) Which type of succession occurs on newly formed land with no soil?	Primary / Secondary
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5) Which of the following is typically a pioneer species in secondary succession?	Grasses / Lichen

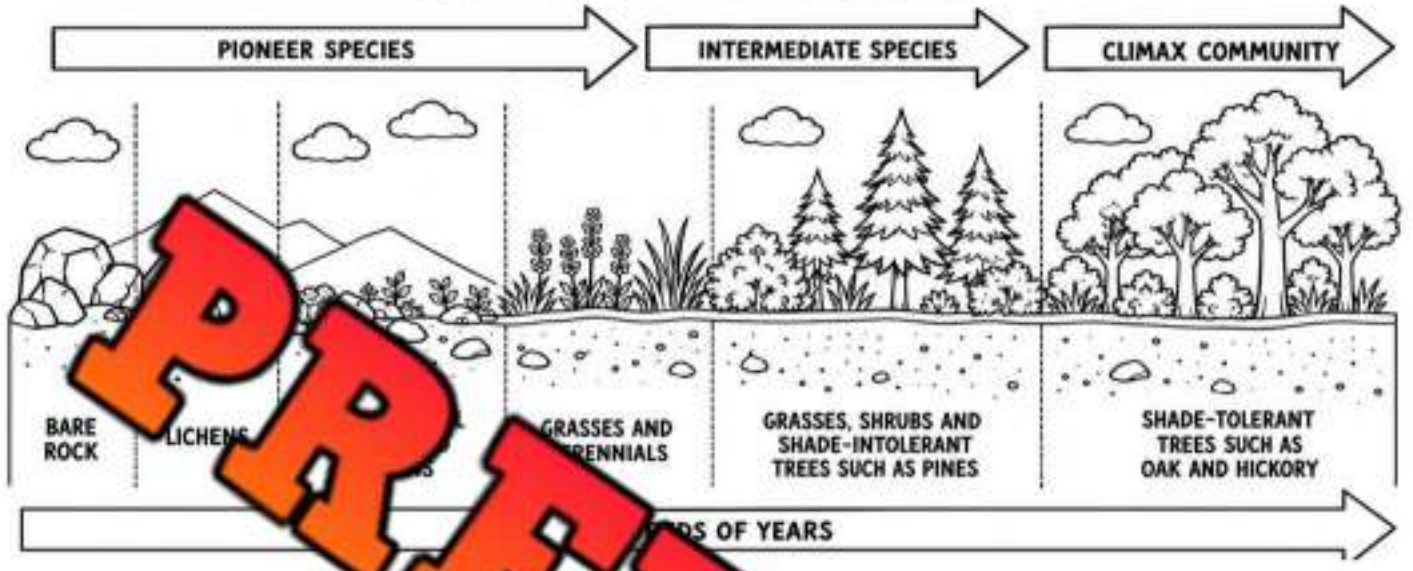
PREVIEW

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Primary Succession Diagram



PREVIEW

Questions Answer the

1) What is the pioneer species in this p succes

2) What are some other pioneer species in this s ion?

3) Describe the stages in this example of primary ess

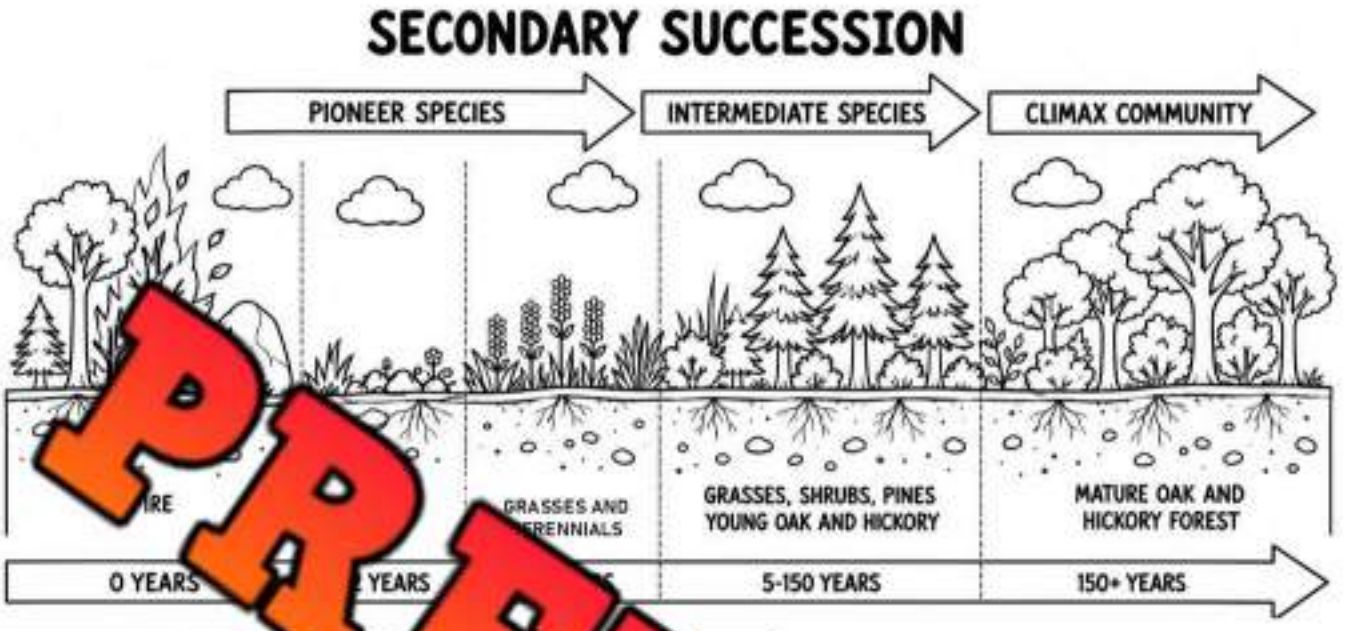
4) What is a climax community? What is the difference between the climax community and intermediate species community?

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Secondary Succession Diagram



PREVIEW

Questions	Answer[illegible]tions
1) What are the pioneer species in this s[illegible] succ[illegible]?	
2) What caused the secondary succession? What oth[illegible]atur[illegible]asters could cause a secondary succession?	
3) Describe the stages in this example of secondary succession.	
4) How long does it take for secondary succession to develop through all the stages?	
5) Could this ecosystem go through another secondary succession? Is this a cycle?	

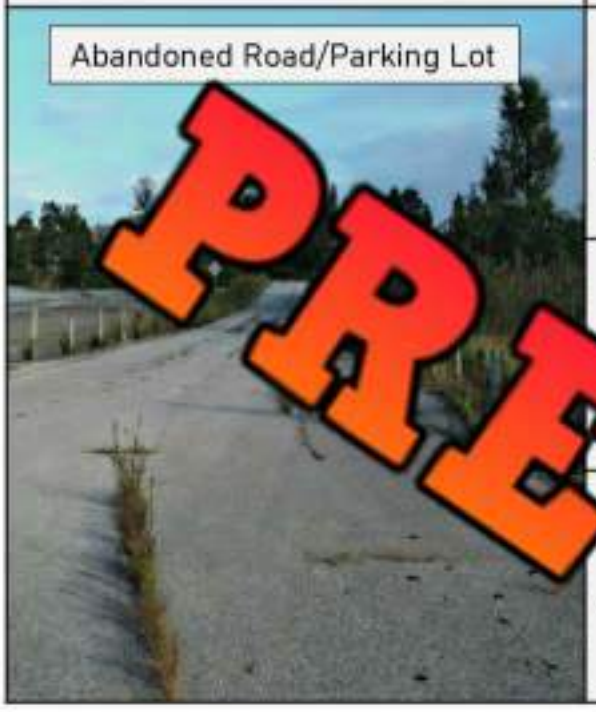
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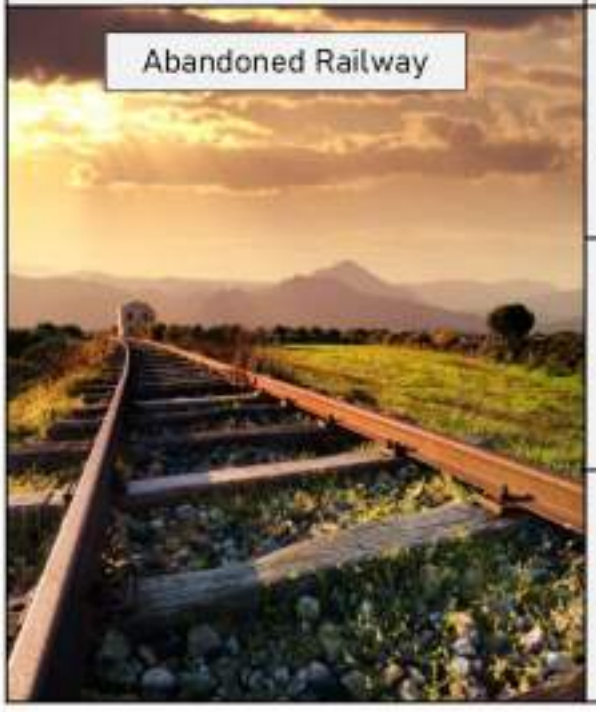
Name: _____ 85

Curriculum Connection
B3.6

Predicting The Future of Ecosystems

Predict What will the ecosystem look like if left by humans after 10, 20, and 100 years?

Ecosystem	Time	What Will the Ecosystem Look Like?
 Abandoned Road/Parking Lot	10 Years	
	20 Years	
	100 Years	

Ecosystem	Time	What Will the Ecosystem Look Like?
 Abandoned Railway	10 Years	
	20 Years	
	100 Years	

PREVIEW

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Curriculum Connection
B3.6

Predict What will the ecosystem look like if left by humans after 10, 20, and 100 years?

Ecosystem	Time	What Will the Ecosystem Look Like?
	10 Years	
	20 Years	
	10 Ye	

Ecosystem	Time	Look Like?
	10 Years	
	20 Years	
	100 Years	

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Curriculum Connection
B3.7

Ecosystems – Biotic and Abiotic Limiting Factors

Limits of Habitats

Every ecosystem has its limits. The classroom you are in now is a learning environment that has its limits. Imagine adding 30 more students into your learning environment. The outcome would be a challenging situation for all the students and your teacher.

Your learning environment has a certain number of resources that are shared amongst y ssmates. Students would be fighting over desks, chairs, school supplies and mor h would not be able to support each of you the way they were before the e ent

PREVIEW

Biotic Limiting

The availability of hings many other living things can survive in an ecosystem. Some examp limiti rs are food, mates, and competition with other organisms for abiotic re

If the population of one animal sp omes pulated in an ecosystem, it could strain the entire ecosystem. These a mals ha sa , which means there will be a lack of food supply for the overpopulat ulatio their prey will be overhunted, which will lead to their population to bec This w e the population of their prey to become overpopulated.



Abiotic Limiting Factors

Non-living limiting factors can also affect how much population an ecosystem can support. Some abiotic limiting factors include temperature, space, soil, altitude, water, and amount of sunlight available in an ecosystem.

In Africa, the availability of water is a common limiting factor for an ecosystem. Watering holes are scarce in some parts of Africa, and all animals need water to survive. Even humans avoid living in secluded deserts because the lack of water makes it impossible for humans to survive. Some species, like cacti, have adapted to survive using limited water.

Name: _____ 88

Curriculum Connection
B3.7

Limiting Factors

List the biotic and abiotic limiting factors for growing ecosystems.

Biotic Limiting Factors	
Abiotic Limiting Factor	

Questi

ion from the text to support your answer.

1) What abioti ors an ecosystem near you? Why isn't there more biodiversity in th tem?

2) What abiotic limiting factors affect human pop ns i tems?

PREVIEW

Biotic Limiting Factors

Explain what would happen to the ecosystem if...

What would happen in an ecosystem if the biotic factors below were removed?	
Trees	
Plants	
Predators	
Prey	

Curriculum Connection
B3.7

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____ Mark ____

Sort each limiting factor into the correct group. Write each word in the correct box.

Limiting Factors to Sort		
Food	Water	Competition
ight	Mates	Temperature
	Predators	Soil
Factors		Abiotic Limiting Factors

Name: _____ Mark ____

Sort each limiting factor into the correct group. Write each word in the correct box.

Food		Competition
Sunlight	Mates	
Space	Predators	
Biotic Limiting Factors		

Name: _____ Mark ____

Sort each limiting factor into the correct group. Write each word in the correct box.

Limiting Factors to Sort		
Food	Water	Competition
Sunlight	Mates	Temperature
Space	Predators	Soil
Biotic Limiting Factors		Abiotic Limiting Factors

PREVIEW

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Name: _____ 90

Curriculum Connection
A1.1, A1.2, A1.3, A1.4

Experiment – Ecosystem in a Bottle

Research Question

What are we learning more about?

Can you build an ecosystem that has a water and land connection? What does the ecosystem need to survive?

Materials

What do we need for our activity?

- ✓ One [illegible] bottle
- ✓ [illegible]
- ✓ [illegible] sorbs water (cotton)
- ✓ Wat[illegible] – pon[illegible] p water that has sat outside for 24 hours [illegible] kill [illegible] arine)
- ✓ Soil
- ✓ Plants – you co[illegible] all sprouting plant
- ✓ Small rocks for water e[illegible]
- ✓ A dead leaf for water ecosy[illegible]m
- ✓ Living things for water and land ec[illegible]s (sn[illegible] worms)



Method

How do we complete the exp[illegible]

1) Remove the label from the bottle.
2) Cut the bottle about 1 cm below the shoulder.
3) Poke a hole in the bottle cap for the string (wick) to go through.
4) Wet the string and put it through the hole.
5) Fill the bottom of the bottle with water and small rocks.
6) Add a dead leaf (it is full of microorganisms) for the snails to eat.
7) Add soil to the top part (land ecosystem). If possible, layer the soil with larger rocks (gravel) on the bottom and then finer soil on top. Add the top to the bottom (see above).
8) Add a worm to the soil.
9) Add plants.
10) Ensure the wick is in the soil and is soaking up water from the bottom.

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Curriculum Connection
A1.2, A1.3, A1.4, A1.5

Journal Observations

Fill in the date and write what you observed that day.

Date -

Date -

Date -

Date -

Date -

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Curriculum Connection
A1.2, A1.3, A1.4, A1.5

Results Answer the questions below.

1) What are the abiotic elements in your land-water ecosystem?

2) What a[illegible] biotic elements in your land-water ecosystem?

3) How are the biotic e[illegible]s interac[illegible]th the abiotic elements? Explain at least 2 interactions.

4) How is your ecosystem doing? Is it thriving? Is it crashing – on its way to extinction? Explain.

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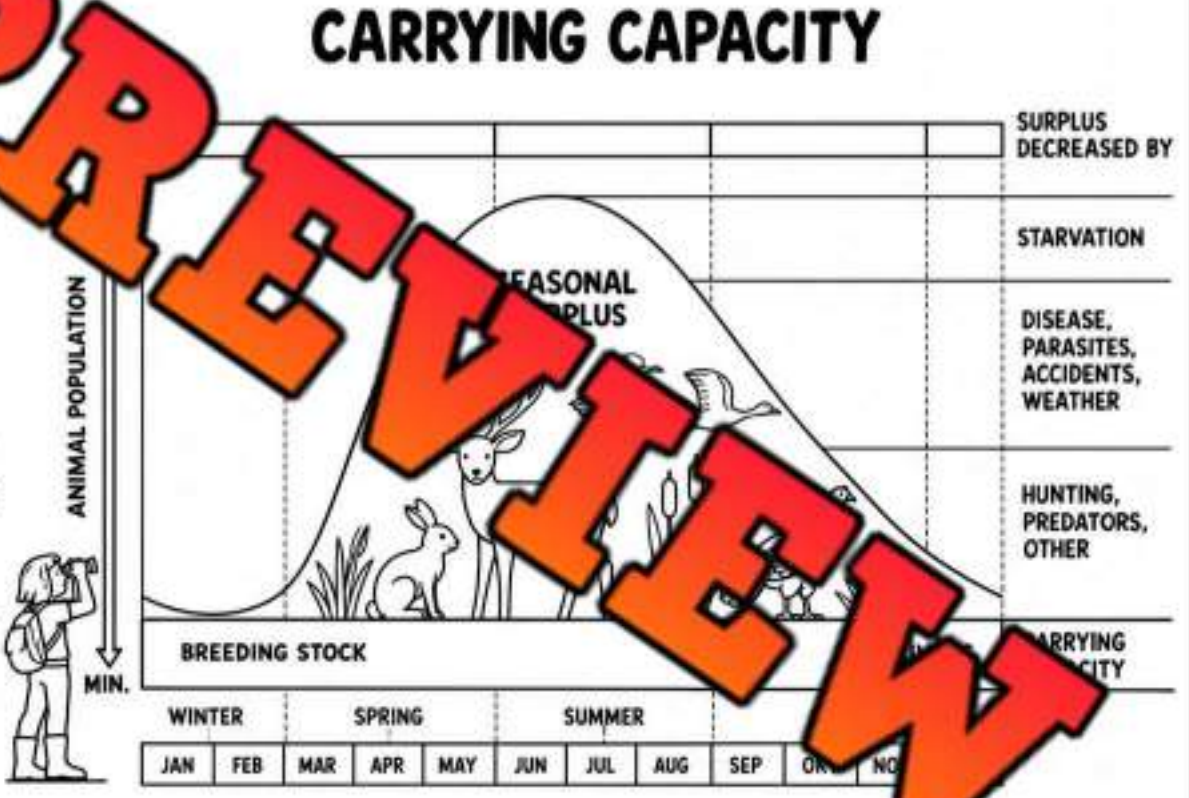
Curriculum Connection
B3.7

Ecosystems – Carrying Capacity

Carrying Capacity

In an ideal ecosystem, populations could grow without constraints on resources. The problem we know is that resources are limited. The amount of resources in an ecosystem determines the carrying capacity of that ecosystem.

Carrying capacity refers to the number of plants and animals an ecosystem can support. When too many plants and animals enter an ecosystem, it can lead to competition for food, mates, water, space, and sunlight. If there is not enough prey animals in a forest to feed a large population of predators, then food becomes the limiting factor. Likewise, if there is not enough space in a pond for a large number of fish, then space is the limiting factor. Every ecosystem has a carrying capacity, however, some ecosystems can support a higher population than other ecosystems.



PREVIEW

Reaching the Carrying Capacity

Overpopulation in an ecosystem will naturally resolve itself. If the animal population becomes too large, many animals will starve as they won't be able to find food. Also, the reproduction of new animals will decrease if animals cannot find a mate. These factors will reverse the overpopulation of an ecosystem.

In temperate climate zones, there are usually four seasons. The changing of seasons affects the populations in ecosystems. As you can see in the graphic, animal populations are highest in the spring and summer months. The carrying capacity is controlled by not only starvation, but also the weather, diseases, parasites, accidents, hunting by humans, as well as predators.

During the winter months, the animal populations in most ecosystems is very low as many animals hibernate or migrate because of the lack of food available.

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Curriculum Connection
B3.7

Questions

Use information from the text to support your answer.

1) What does carrying capacity mean? What happens when a carrying capacity is reached in an ecosystem?

2) How [illegible] the populations and carrying capacities for ecosystems?

3) How is overpopulation [illegible] ecosystem?

PREVIEW

Seasons

Describe the animal populations during each of the

Fall	
Winter	
Spring	
Summer	

Name: _____ 95

Curriculum Connection
B3.6, B3.7

Fact or Fiction – Ecosystem Limits and Change

Objective

What are we learning about?

Students will strengthen their understanding of limiting factors, population size, ecological succession, and ecosystem change by deciding whether different statements are fact or fiction.

Materials

What will you need for the activity?

- A set of statements about ecosystem limits and change
- A 'Fact' sign and a 'Fiction' sign to distinguish the two sides of the room
- Designated areas in the classroom for the 'Fact' and 'Fiction' signs, allowing enough space for students to move to either side



PREVIEW

Instructions

How will you complete the activity?

1) Your teacher will read statements. Pay close attention as each statement is shared.
2) Consider carefully whether you think the statement is true or false.
3) If you decide the statement is true, walk to the 'Fact' side of the room.
4) If your guess is that it's not true, move to the 'Fiction' side of the room.
5) Stay on your chosen side and listen attentively for the correct answer to be revealed.
6) When the right answer is announced, return to your seat, ready for the next round.
7) Have fun getting up and moving!

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Curriculum Connection
B3.6, B3.7

Fact or Fiction | Read the statements to the class.

#	Statement	Fact or Fiction
1	A drought can limit the size of an animal population.	Fact
2	Populations can grow forever if predators are absent.	Fiction
3	A forest can slowly recover after a wildfire.	Fact
4	Ecol al succession always happens within a few days.	Fiction
5	Food ome a limiting factor when populations grow.	Fact
6	cosystem are caused by humans.	Fiction
7	ors c ntrol the population of their prey.	Fact
8	Adding n isms makes an ecosystem healthier.	Fiction
9	Sunlight can be a l ctor f	Fact
10	Primary succession beg her well developed.	Fiction
11	Competition may increase when food bec scar	Fact
12	A flood can change the populations livin	Fact
13	Secondary succession can occur after a fores	Fact
14	Limiting factors only affect animal populations.	
15	Removing a predator can affect several other populations	ct
16	Every ecosystem can support an unlimited number of organisms.	Fiction
17	New species can appear as an ecosystem goes through succession.	Fact
18	Temperature never affects how many organisms an ecosystem supports.	Fiction
19	A population will always decrease when more food becomes available.	Fiction
20	Disease can act as a limiting factor in a population.	Fact

PREVIEW

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Name: _____ 97

Curriculum Connection
B1.1, B3.8

International Trade – Introducing Invasive Species

What is an Invasive Species?

An **invasive species** is an organism that causes problems in a new environment where it is not native. Quite often, an invasive species is an organism that grows and spreads quickly in a new area. The reason they spread quickly in a new area is because they often do not have the u predators that control their population. This means the invasive species populatio ome out of control.



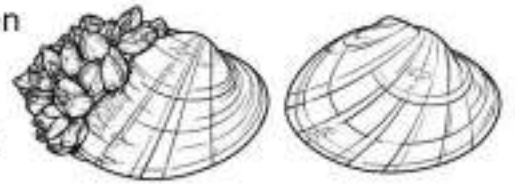
How Species

When we rade i y, w receive shipments from ntrie rm of shipping containe d g most common form of tra tha delivers these items are ocean t s. S countries can unintentionally get into these ships, containers or ever ages.

Problems with Invasive Species – Zebra Mussel

Zebra mussels are an invasive species in Ontario that the B d Caspian Seas. The Zebra mussels came in the ballast water of ships tin an port. When the ballast water was released into the great lakes, the re accidently brought into a new environment where they have wreaked hav

First, Zebra mussels eat phytoplankton which causes clearer water, allowing more sunlight to penetrate deeper. This forces light-sensitive fish, such as walleye, into deeper and darker waters. Secondly, the fish and birds who eat Zebra mussels are struggling to digest the invasive species. With the Zebra mussels putting other species at risk, they are reducing the biodiversity in Ontario. The Walleye have been directly affected as they have had to move environments and the birds and fish who feed on the Zebra mussels are dying as a result.



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Curriculum Connection
B1.1, B3.8

Visualizing What were you picturing in your head while you were reading?

True or False Circle whether the statement is true or false.

1) Invasive species [illegible] their natural	True	False
2) Species from other [illegible] and end up in new places.	True	False
3) Invasive species can be [illegible] the environment.	True	False
4) Zebra mussels helped the water system [illegible]	True	False
5) Zebra mussels travelled in ballast water of ships [illegible]	True	False

Questions Answer the questions below using complete sentences.

1) What is an invasive species? How does trade create invasive species?

2) How were the Zebra mussels introduced to the waters in Ontario? Why are they an invasive species and why are they harmful?

PREVIEW

Name: _____ 99

Curriculum Connection
B1.1, B3.8

Human Use of Forests – Past and Present

Human Use of Forests

Since the beginning of time, humans have used forests to their advantage. Our use of forests has changed as humans have developed new technologies. There is concern that our forests are not being managed properly, and that if we continue using them the way we do now, we will damage the wildlife that need forests to survive.

How Humans Used Forests in the Past

For thousands of years, people have found food and medicine in forest ecosystems. Berries, apples, nuts, sugar, and syrup are all examples of foods that are found in forests. Tea brewed from tree leaves and stems helped treat illnesses. Alder leaves and bark was used to stop bleeding and cure a fever. Spruce bark was used to make a tea high in Vitamin C which could cure scurvy.

People also used forests to get wood to build things like shelters, furniture, fences, canoes, snowshoes, and sleighs. These things made life easier by providing people with comfortable homes to live in and ways to travel. Tools were also built out of things found in forests. Wood was used to make hammers, and tree branches were used to make traps for animals.

When humans made things in the past, it required quite a bit of work. This meant that when something was made, it wasn't discarded. It was needed and it took time and effort to make, so it was cherished.

How Humans Use Forests in the Present

In today's world, lumber is a valuable natural resource. Many developed countries sell to other places to make money. A lumber mill or sawmill is a place where logs are cut into lumber. We now have machines that can take a chopped down tree and turn it into different shaped pieces of lumber in minutes. This lumber is sold in stores all over Canada and the world. We use wood to build houses, boats, and as fuel for fires, for paper, sporting equipment, pencils, musical instruments and much more.



We still use forests in the same manner as humans did in the past, but more is wasted in today's world. This is because it is so easy for businesses to manufacture wood products and sell them to us. The problem is that half of the world's forests have already disappeared. As it stands now, the world loses more than 23 million acres of forests each year.

Deforestation is the permanent removal of trees. Deforestation happens for two main reasons – (1) to produce lumber for humans, (2) to clear forests for farming.

PREVIEW

Name: _____ 100

Curriculum Connection
B1.1, B3.8

True or False

Circle whether the statement is true or false.

1) People wasted more in the past than they do now.	True	False
2) Lumber is wood that has been made into certain shapes and sizes	True	False
3) Deforestation is the replanting of trees after you cut them down.	True	False
4) Many forests are cut down to provide space for farming.	True	False
5) Each year, 20 million acres of forests are destroyed.	True	False

Making C[illegible]s

What does the reading remind you of in your life?

PREVIEW

Questions

Use information from the text to supp[illegible]nswer

1) How were forests used in the past compared to how they a[illegible] use[illegible]

2) What is deforestation? Why is it happening and why do you think it is a problem?

Curriculum Connection
B1.1, B3.8

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____ Mark ____

Check only the true statements.

Statement	✓
Humans have used forests for thousands of years.	
People in the past used forests only for food.	
Wood was used to build shelters and furniture.	
Modern machines can process trees into lumber.	
Forest use today produces no wasted wood.	
Lumber is an important natural resource in Canada.	
Deforestation means planting new trees in forests.	
Forests may be cleared to create farmland.	

Name: _____ Mark ____

Check only the true statements.

Statement	✓
Humans have used forests for thousands of years.	
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Name: _____ Mark ____

Check only the true statements.

Statement	✓
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Name: _____ Mark ____

Check only the true statements.

Statement	✓
Humans have used forests for thousands of years.	
People in the past used forests only for food.	
Wood was used to build shelters and furniture.	
Modern machines can process trees into lumber.	
Forest use today produces no wasted wood.	
Lumber is an important natural resource in Canada.	
Deforestation means planting new trees in forests.	
Forests may be cleared to create farmland.	

PREVIEW

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Curriculum Connection
B1.1, B3.8

Agriculture – Clearcutting Forests

What is Clearcutting?

Clearcutting is a strategy used in the logging industry where all trees in an area are cut down at once. The loggers do not consider the tree type, age, or the effects on the ecosystem. Clearcutting is used to harvest wood and create land for agriculture. The new farmland is used to grow crops and/or raise livestock that need areas to graze.

Using the clearcutting method allows wood prices to be steady, and relatively inexpensive. If clearcutting is not used, the wood prices would increase. Clearcutting also provides the necessary farmland to keep up with our growing human population.



Problems with Clearcutting

When a forest is clearcut, all the animals and plant life in the forest lose their habitat. The animals must leave, while the plant life is destroyed. The process of clearcutting often kills animals as well. When part of an ecosystem is clearcut, the loss of animals from the clearcut area can affect the food chain in the entire ecosystem.

Clearcutting affects the soil in many ways. First, when an area is clearcut, the carbon in the soil is released into the air, which contributes to climate change.

Second, when we clearcut a forest, the soil becomes loosened, which results in soil erosion into rivers and streams. Losing soil into our water systems means we have less soil to grow plants that allow for terrestrial ecosystems.

Lastly, the loose soil can also cause landslides. Landslides can have devastating effects on other nearby ecosystems and habitats, including neighbourhoods.

PREVIEW

Name: _____ 103

Curriculum Connection
B1.1, B3.8

Questions Use information from the text to support your answer.

1) What is clearcutting? Why is it done?

2) How d[illegible]utting affect the environment and ecosystems?

PREVIEW

Questioning Write 3 questions you h[illegible]ding.

1)	
2)	
3)	

True or False Circle whether the statement is true or false.

1) Clearcutting helps keep wood prices low.	True	False
2) Clearcutting is used to create more farmland for plants and livestock.	True	False
3) Clearcutting only affects the plants and animals living in the forest.	True	False
4) Soil erosion can happen due to clearcutting.	True	False
5) Clearcutting has no impact on food chains.	True	False

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Curriculum Connection
B1.1, B3.8

Infographic Example - Deforestation

DEFORESTATION

environmental infographic

PREVIEW

CAUSES

URBANIZAT



intentional

use under agriculture

54%



oil palm plantations expansion 22%



logging 19%



grazing 5%



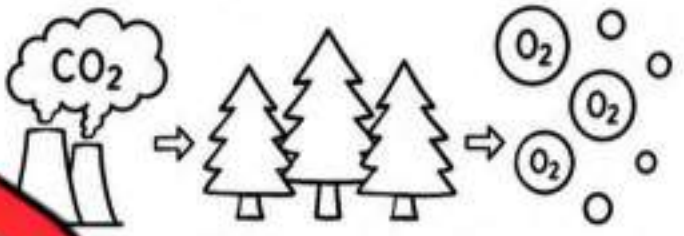
70% of forests in the Amazon have been converted to fields for grazing

unintentional

FOREST FIRES

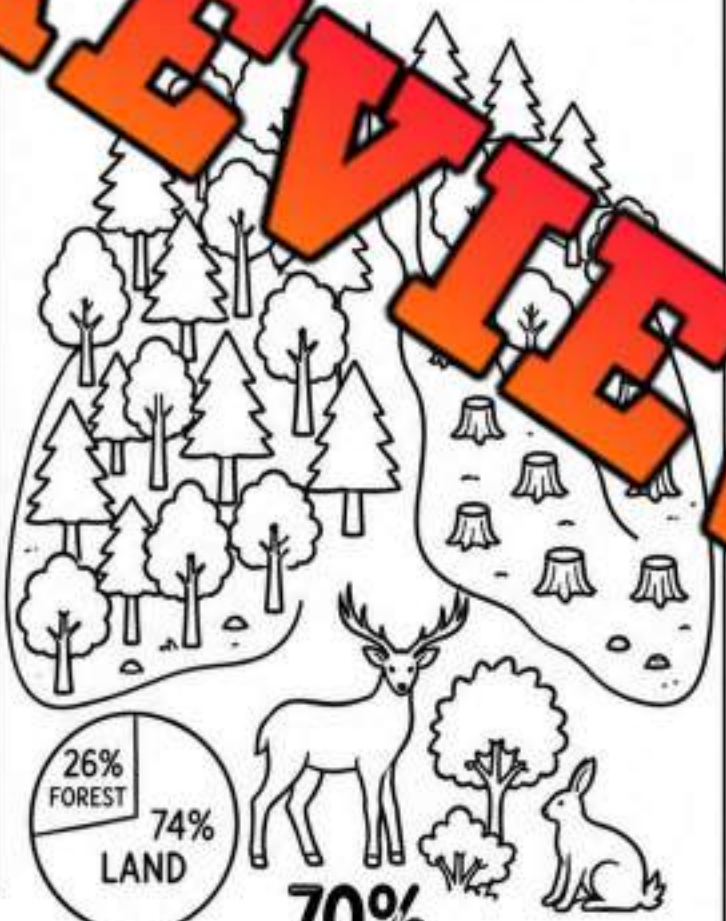


Four major natural causes of wildfire ignitions exist: lightning, sparks from rockfalls, spontaneous combustion, volcanic eruption



MILLION HECTARES OF FOREST LOST

NUAL 6 HECTARES ARE RESTORED



70%

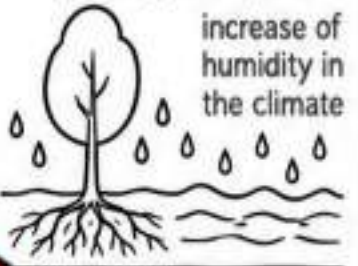
OF PLANTS AND ANIMALS LIVE IN FORESTS

AFTER-EFFECT

greenhouse effect intensification



hydrological impact



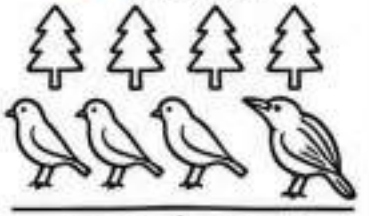
increase of humidity in the climate

desertification



soil erosion

ical diversity reduction



swamp formation



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Name: _____ 105

Curriculum Connection
B1.1, B3.8

Analyze Write five things you learned from the infographic.

1)	
2)	
3)	
4)	
5)	

PREVIEW

Questions Use information from the text to support y... wer

1) Why are forests shrinking?

2) What does the large picture in the middle of the infographic symbolize? Explain.

Name: _____ 106

Curriculum Connection
B1.1, B3.8

Deforestation Statistics – Infographic Activity

The rate we are developing our land is affecting the environment. When we cut down forests to build farmlands, we are destroying ecosystems that many different species of animals depend on. The destroying of these ecosystems causes less biodiversity, which has led to many species going extinct. Check out the statistics below:



- The wo[illegible]has lost one third of its forest due to deforestation
- 10 mi[illegible]ares of forests are lost each year to make more fa[illegible]d livestock grazing
- 2,4[illegible]ees ar[illegible]each minute
- Every sec[illegible]the s[illegible]football field is cut down
- In the last 50 ye[illegible]nim[illegible]worldwide have declined 68%
- In the last 10 years, 4[illegible]have[illegible]clared extinct
- 53% of all land in Canada is [illegible]lan[illegible]
- By 2030, projections are that we wi[illegible]only 1[illegible]e world's rainforests left
- Over half of the world's wildlife species live in [illegible]ainfo[illegible]
- 25% of all cancer fighting medicines come fr[illegible]e ra[illegible]
- 75% of deforestation in South America is due to ill[illegible]g

PREVIEW

Statistics Which statistics will you use for your infographic?

1)	
2)	
3)	
4)	
5)	

Name: _____ 107

Curriculum Connection
B1.1, B3.8

My Infographic - Deforestation



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Name: _____ 108

Curriculum Connection
B1.1, B3.8

Livestock Farming – Effects on Ecosystems

What is Livestock Farming?

Livestock farming is the strategic management and breeding of animals for the purpose of using their meat and products (milk, eggs, leather, etc.). It occurs when companies raise animals for human consumption or to obtain meat, milk, wool, honey and many other things.

Why Livestock Farming Is Important

By the year 2050, the human population will grow to nearly 10 billion people. Producing enough fo meet the demands of the growing population means we need predictable sources of estock farming allows farmers to control the breeding and management of their a

2, it was concluded that approximately 86% of the world eats meat. erage ats 97kg (213lbs) of meat and poultry each year. Livestock farming provides fo products such as meat, eggs, milk, and cheese. Without livestock farm would eat much less meat and find their calories from other food source

Problems with Livestoc lems

Livestock farming has bee the oblems:

- Deforestation – 39% of the ha sed for livestock farming. Forests and trees are cleared to provide lan als e and to grow crops for livestock to eat.
- Pollution – Livestock farming produces mass unts n. Animal waste emits around 400 different harmful gases int tmo air pollution. Water pollution is also problematic. For example, un issippi River loses roughly 15,000 square kilometres a year of ara e to ltural runoff.
- Greenhouse gases – Livestock farming releases almost on th greenhouse gas emissions. Some organizations believe this num rds of 51%. Either way, livestock farming produces more greenhouse gase the cars, trucks, planes, and ships in the world!
- Desertification - Livestock overgrazing turns arable soil that has a variety of plant life into desert or arid soil that has no vegetation. Overgrazing happens when the livestock are confined to smaller areas where they eat the plants down to the roots. With no plants or leaves to protect the soil, the soil is exposed to hot temperatures, which causes it to dry out.



- Loss of Biodiversity – It has been estimated that livestock farming has contributed to approximately 30% loss in global biodiversity. The most biodiversity is in our forests, and many forests have been clearcut to make more farmland.

PREVIEW

Name: _____ 109

Curriculum Connection
B1.1, B3.8

Questions Use information from the text to support your answer.

1) What is livestock farming? Why is it important?

2) How m... livestock farming require? Why is it so much?

PREVIEW

Problems What are 5 problems t... stock ... causes to our ecosystems?

Problem	...natio...

Name: _____ 115

Curriculum Connection
B1.2, B3.8

Locally Grown Food

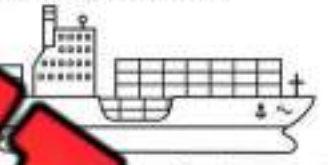
Locally Grown Food



Food that is grown locally means the food has been grown nearby. Local food could have been grown down the street from where you live. The best way to buy local f[illegible]is to go to a farmers' market. At a farmers' m[illegible]cal farmers bring their crops and sell th[illegible]

[illegible]we sh[illegible]ery store, almost all of the food is not grown locally. [illegible] and [illegible]ables come from Mexico, where the growing season is longer. Canada h[illegible]ee tr[illegible]t with Mexico, which keeps the cost for these plants low.

Some foods we cannot b[illegible]lly, [illegible]bananas, pineapples, and mangoes do not grow in Canada. Also, during the [illegible]month[illegible]g grows in Canada. This means we can't buy fresh fruits and vegetables fro[illegible]l far[illegible]



Benefits of Buying Local Food For Ecosystems

1) Local food doesn't have to travel as far to arrive o[illegible]e. Wh[illegible]buy fruits and vegetables from Mexico, the food had to travel on transp[illegible]ca[illegible] airplanes. The use of these transportation methods creates CO^2 [illegible]damage ecosystems
2) Canada has strict regulations on how food is grown and harvested. When we buy Canadian food, we know the food was not grown using unsafe additives, pesticides, or herbicides. The use of these substances destroys ecosystems by killing pests or affecting the quality of soil over time.
3) When we buy from local farms that we trust, we keep them in business. When we see local farms that use sustainable agricultural practices, we can support them by buying their products. This will ensure that more farms use environmentally friendly practices, like allowing their livestock to graze naturally in a pasture or silvopasture.

PREVIEW

Name: _____ 116

Curriculum Connection
B1.2, B3.8

Questions Use information from the text to support your answer.

1) Why is it hard to always buy fruits and vegetables locally?

2) Wher[illegible] buy fruits and vegetables locally?

3) What are t[illegible]ns wh[illegible]hould buy fruits and vegetables locally?

4) How does buying locally help the environment (ecosystems and biodiversity)?

PREVIEW

Name: _____ 119

Curriculum Connection
B1.2, B3.8

Technological Advancements Helping Ecosystems

Technologies Helping Ecosystems

With species being endangered and close to extinction, scientists have been developing technologies that can help monitor endangered species. Radio tracking collars, drones, and time-lapse photography are technologies that help scientists by providing them with detailed information about ecosystems.



Radio Tra[illegible] Collars

A radio tr[illegible]ollar is used by wildlife researchers to provide informa[illegible]about an endangered species. The rese[illegible]llar on the animal's neck or ankle in order [illegible]ck the [illegible]ement of the animal, temperature of the animal, an[illegible]s s[illegible]live or not.

They are [illegible] to be [illegible]table for animals so that they do not even know they are wearing [illegible] co[illegible]rs in it to detect temperature and movement. This infor[illegible]t by [illegible]rnal antenna that is inside the collar back to the researcher.



Drones

Drones are now being used to count [illegible]onitor wild animals in ecosystems all over the world. Most animals shy away from humans, which [illegible] it hard for scientists to perform accurate counts of animal populations. Drones allow scientists to have airborne eyes in the sky that can gather a lot of information. Data from Robot Process Automation (RPA) has been found on average to be between 43%[illegible]76 accurate than traditional ground-based data collecting.

Drones have also been used to rescue animals. When a stranded dog was lost in a mudflat area, a drone with sausages dangling from it led the dog back to safety.

Time-Lapse Photography

Researchers also use time-lapse photography to observe wildlife in different ecosystems. These cameras are called field cameras and are placed in strategic locations in an ecosystem. The cameras stay there for a long period of time, and they snap pictures when they detect motion. As time goes on, thousands of pictures are put together in a shorter, condensed video. Researchers can interpret these videos much more efficiently than if they had to watch the ecosystem for the entire length of time. The time-lapse photography shows the growth of the ecosystem over time.

PREVIEW

Name: _____ 120

Curriculum Connection
B1.2, B3.8

Questions

Answer the questions below using evidence from the text.

1) Why is it important that humans use technology to track endangered species?

2) Do you think scientists should use collars on wild animals to track them? Explain your opinion.

PREVIEW

Making Connections

What does the [illegible] you of in your life?

True or False

Circle whether the statement is true or false.

1) Drones can be used to track endangered species.	True	False
2) Animals are more afraid of drones than humans.	True	False
3) Drones can even be used to rescue animals.	True	False
4) Timelapse photography shows the growth of an ecosystem over time.	True	False
5) Radio tracking collars are painful for animals to wear.	True	False

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Curriculum Connection
B1.2, B3.8

Exit Cards

Cut Out Cut out the exit cards below and have students complete them at the end of class.

Name: _____

Circle the correct answer.

1) What is a unique rescue method used by drones?	Sausages
	Nets
2) How do drones help scientists monitor wild animals more accurately?	Aerial
	Ground
3) What technology is used to create condensed videos from thousands of pictures?	Drones
	Time-lapse
4) What information does a radio tracking collar provide about an endangered species?	Movement
	Diet
5) What do the sensors in radio tracking collars detect in animals?	Temperature
	Weight

Name: _____

Circle the correct answer.

1) What is a unique rescue method used by drones?	Sausages
	Nets
2) How do drones help scientists monitor wild animals more accurately?	Aerial
	Ground
3) What technology is used to create condensed videos from thousands of pictures?	Drones
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Name: _____

Circle the correct answer.

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	Nets
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4) What information does a radio tracking collar provide about an endangered species?	Movement
	Diet
5) What do the sensors in radio tracking collars detect in animals?	Temperature
	Weight

PREVIEW

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Name: _____ 124

Curriculum Connection
B1.3

Indigenous Groups and The Environment

Land Ownership



For non-Indigenous people, land is something they can own and develop as they see fit. They change the land from raw or unfinished to places they can call home or work. They make money from the land by selling natural resources [illegible]wood, minerals, fish, and other animals.

[illegible]eople do not feel the sam[illegible]d. They view the land as [illegible]nethi[illegible] connected to.

Spiritual Conn[illegible] Interc[illegible]dness

Each First Nation [illegible] ha[illegible] connection to the land that differs from nation to nation. The [illegible]overn[illegible]nd provincial governments across Canada understand that a[illegible]writ[illegible]is connection be protected in the constitution and in the court [illegible].

Spiritual connections means th[illegible]ndige[illegible]elieve that everything in the universe is connected. The spirit wor[illegible] conne[illegible]to t[illegible]ortal world, the land is connected to the sea, and the sky is connect[illegible]he gr[illegible]

Indigenous Views of Sustainability

Since the environment has been around for so long, [illegible]eno[illegible]ople of Canada have an intricate, respectful, grateful, and prote[illegible]tie[illegible]ing connected to the environment means they feel a responsibility[illegible]nd and all the creatures that live on it. This is not just an emotiona[illegible]eel everything on the land has a spirit! If the connection between the sp[illegible]on the land is broken, the well-being of the Indigenous group is affected.

The Indigenous believe in environmental stewardship and taking care of the land. Before they make decisions, they think about the impacts the decisions will have on their ecosystems. They believe in biodiversity and protecting all species so that the environment as a whole, can stay healthy. This holistic approach is important to the Indigenous, as they believe everything is connected. If one part of the environment is unhealthy, the entire environment will suffer.

The rest of the world is learning a lot from the Indigenous views on sustainability. The greed and mismanagement of the land by corporations would not happen if everyone adopted the holistic approach of the Indigenous. Many are still learning how one part of an ecosystem affects all parts of the ecosystem.

PREVIEW

Name: _____ 125

Curriculum Connection
B1.3

Questions Answer the questions below using evidence from the text.

1) How do Indigenous groups in Canada view the land? Why is it a sustainable approach?

2) How do Indigenous people view the land? What could we learn from the Indigenous?

Inference What would have happened to the environment if European settlers/explorers adopted Indigenous way of life?

PREVIEW

True or False Circle whether the statement is true or false.

1) The Indigenous feel connected to the environment.	True	False
2) The Indigenous view land as something that can be owned.	True	False
3) For the Indigenous, if one part of the environment is unhealthy, it all is.	True	False
4) The Indigenous way of life is more sustainable than the non-Indigenous.	True	False
5) The Indigenous sell the resources on the land to make a lot of money.	True	False

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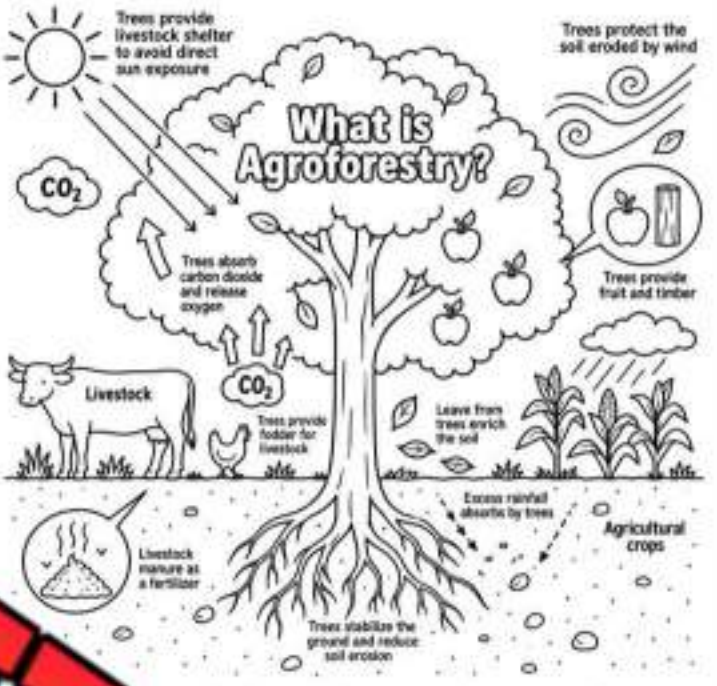
Name: _____ 126

Curriculum Connection
B1.3

Indigenous Practices Promoting Sustainability

Indigenous Farming Practices

The Indigenous people of Canada have mastered the sustainable development of their farming systems. They have been using the following methods successfully for many years.



1) Agrof[illegible]try – the planting of trees with [illegible]s allowed the Indigenous to [illegible]t[illegible]perature, sunlight, [illegible]il and rain) [illegible]re tha[illegible]ts receive. Using agr[illegible]vid[illegible]hem with a wid[illegible] prod[illegible]h as food, fodde[illegible]woo[illegible] medicine while a[illegible]
2) Crop Rotations – the [illegible]s ha[illegible] been using crop rotations [illegible]nou[illegible] and they still use them today. Many First Nations plant the three [illegible]– co[illegible]ns, and squash in a crop rotation.
3) Intercropping – instead of only planting a [illegible] crop [illegible]d, intercropping means you plant 2 or more crops togethe[illegible]g so[illegible]. The risk of single crop failure. It will also increase biodiversity [illegible]a [illegible]f predatory insects that can feed on pests.

PREVIEW

Sustainable Indigenous Ways of Life

It is obvious that the Indigenous ways of life are more sustainabl[illegible] Canadian ways of life. This is clear because we will find more biodivers[illegible]ndigenous communities than we find in Ontario's cities.

So, what do they do differently? Check out the list below.

1) Only take resources from the land that are needed
2) No wasting of resources, including animals they hunt (every part of the buffalo is used)
3) Respect the environment. For example – show patience in allowing old crops to decompose so they can provide nutrient rich soil (as opposed to burning the old crops)
4) The priority is not about making money or more development, it is about maintaining a healthy environment by honouring the Earth.
5) No pollution – traditional Indigenous methods of transportation (canoes) emitted zero pollution.

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Curriculum Connection
B1.3

Questions Answer the questions below using evidence from the text.

1) What agricultural practices do the Indigenous use that promotes sustainability?

2) How is [illegible]enous way of life more sustainable?

PREVIEW

Visualizing What were you pic[illegible]g in [illegible]e you were reading?

True or False Circle whether the statement is true or false.

1) Agroforestry is the planting of trees with crops.	True	False
2) Intercropping is when you grow different crops each year on rotation.	True	False
3) The Indigenous are more concerned with development than the environment.	True	False
4) The Indigenous have always created a lot of pollution.	True	False
5) The Indigenous do not waste natural resources.	True	False

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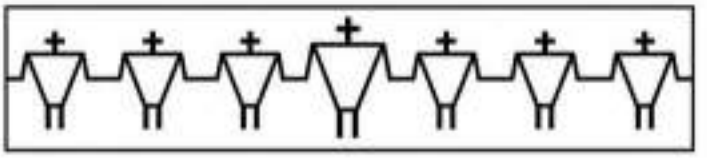
Name: _____ 128

Curriculum Connection
B1.3

Seventh Generation – Indigenous Teaching Sustainability

Seventh Generation Principle – Ancient Haudenosaunee Philosophy

The **Seventh Generation Principle** is based on an ancient Haudenosaunee philosophy that the decisions we make today should result in a sustainable world seven generations into the future.



The Seventh Generation pictograph shows that all 7 generations are connected. Decisions our great grandparents, grandparents, and parents made have affected our current environment. The decisions we make will affect our children, grandchildren, and great-grandchildren. Likewise, the decisions we make will impact the next 7 generations.

Typically, the Seventh Generation Principal applies to decisions being made about our energy, water, and natural resources. But the Indigenous also apply it to decision making related to sustainable relationships with other First Nations or government organizations.

Learning From the Seventh Generation Principle

In 1988, an American company started named Seventh Generation. Their name is inspired by the Indigenous Seventh Generation Principle. The company sells cleaning supplies like laundry detergent, spray cleaner, and dish soap.

Their mission is to transform the world into a healthy and sustainable place for the next seven generations. They are doing the following to ensure their products positively affect the next seven generations:

- use of renewable plant-based products
- use of recyclable materials in their packaging
- use of **biobased** products, meaning less chemicals that are harmful for the environment. When a biobased cleaning supply is washed down the drain, it isn't as harmful to the environment because the ingredients come from natural sources that will be broken down



We can all learn from the Haudenosaunee's ancient philosophy. If we think about the next seven generations before we buy a car for example, we might choose the electric vehicle that produces less emissions. If everyone considers the impact of their decisions, there is no doubt that we will achieve a more sustainable future.

PREVIEW

Name: _____ 129

Curriculum Connection
B1.3

Questions

Answer the questions below using evidence from the text.

1) What is the Seventh Generation Principle? Why is it helpful for sustainability?

2) What is [illegible]any Seventh Generation? Why do you think they chose their name? What do [illegible]y do to ensure sustainability for 7 years?

PREVIEW

Making Connections

What decisions [illegible] made [illegible]or this week that could impact 7 genera[illegible]. What [illegible]y[illegible]e done differently?

Sustainable?

Circle yes if the action is good for the next 7 generations and no if it isn't.

1) Throwing plastic into the garbage.	Yes	No
2) Walking or biking to school.	Yes	No
3) Convincing your parents to buy a big truck instead of a car.	Yes	No
4) Burning a bunch of cardboard instead of recycling it.	Yes	No
5) Leaving a TV on all night without watching it.	Yes	No

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Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Technology in Zoos

Zooscaping

Zoos have changed a lot over the last 5-10 years. In the past, animals lived in small cages for visitors to observe. TVs outside of the cages would show the public video about the animal's natural habitat and how the animal behaved in the wild.

Today, many zoos are "zooscaping," which is the building of interconnected systems of rooms or large spaces where animals can roam freely within their natural h[illegible]. The change has allows visitors to witness n[illegible]ural behaviours of animals.



Tech[illegible]

Many [illegible] are ex[illegible]ng with new technologies t[illegible]e e[illegible]rience for visitors and t[illegible] the li[illegible]e animals.

The San Dieg[illegible]o us[illegible]which is an app visitors can do[illegible] tell[illegible] when they are near anim[illegible]ons[illegible] alerts to visitors using the app telling them when animals ne[illegible] wi[illegible] they can help.

Motion sensors are also being [illegible] help[illegible]s. At the Melbourne Zoo in Australia, motion sensors turn on a s[illegible]wer whe[illegible] toi[illegible] tand below the shower head. This allows the tortoises to cool off an[illegible] clea[illegible]

The Internet of Things – Helping Animals

In England, tiny computers are worn by antelopes [illegible]a. Si[illegible]ese animals are from Africa, they are use to warm temperatures. Th[illegible]re, [illegible]uters have been combined with temperature sensors and a heater in their pen. When the temperature reads too low and the animal is in their pen lying down, the heater would turn on. If the temperature ran too high but the animal is not in their pen, the heater stays off.



The system uses the 'Internet of Things' (IoT), as different components work together to achieve a goal. The **Internet of Things** describes a network of physical objects (things) that have sensors on them so they can interact with each other.

In this example, the animals wear sensors that interact with the sensors on the heater. The sensors on the heater work by sensing if an animal is in front of them (the animals are in their pen).

PREVIEW

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Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

True or False

Circle whether the statement is true or false.

1) Technology is improving the zoo experience for visitors.	True	False
2) Technology in zoos does not help the animals.	True	False
3) Some animals in zoos are not adapted to living in cooler temperatures.	True	False
4) Sensors are being used to help animals in zoos.	True	False
5) Zooscan[illegible]ns zoos are bringing in smaller cages for their animals.	True	False

Questi[illegible] Answe[illegible]stions below using evidence from the text.

1) How is techn[illegible]ping a[illegible]zoos?

2) What is the Internet of Things? How is [illegible]elping [illegible]ope[illegible]land?

PREVIEW

Directions

Finish the If/Else statements below for the heating and showering systems.

if sensor detects motion

then turn ☐ shower

else

then turn ☐ shower

if heat sensor detects overheating

if heater sensor detects movement

then

else

then

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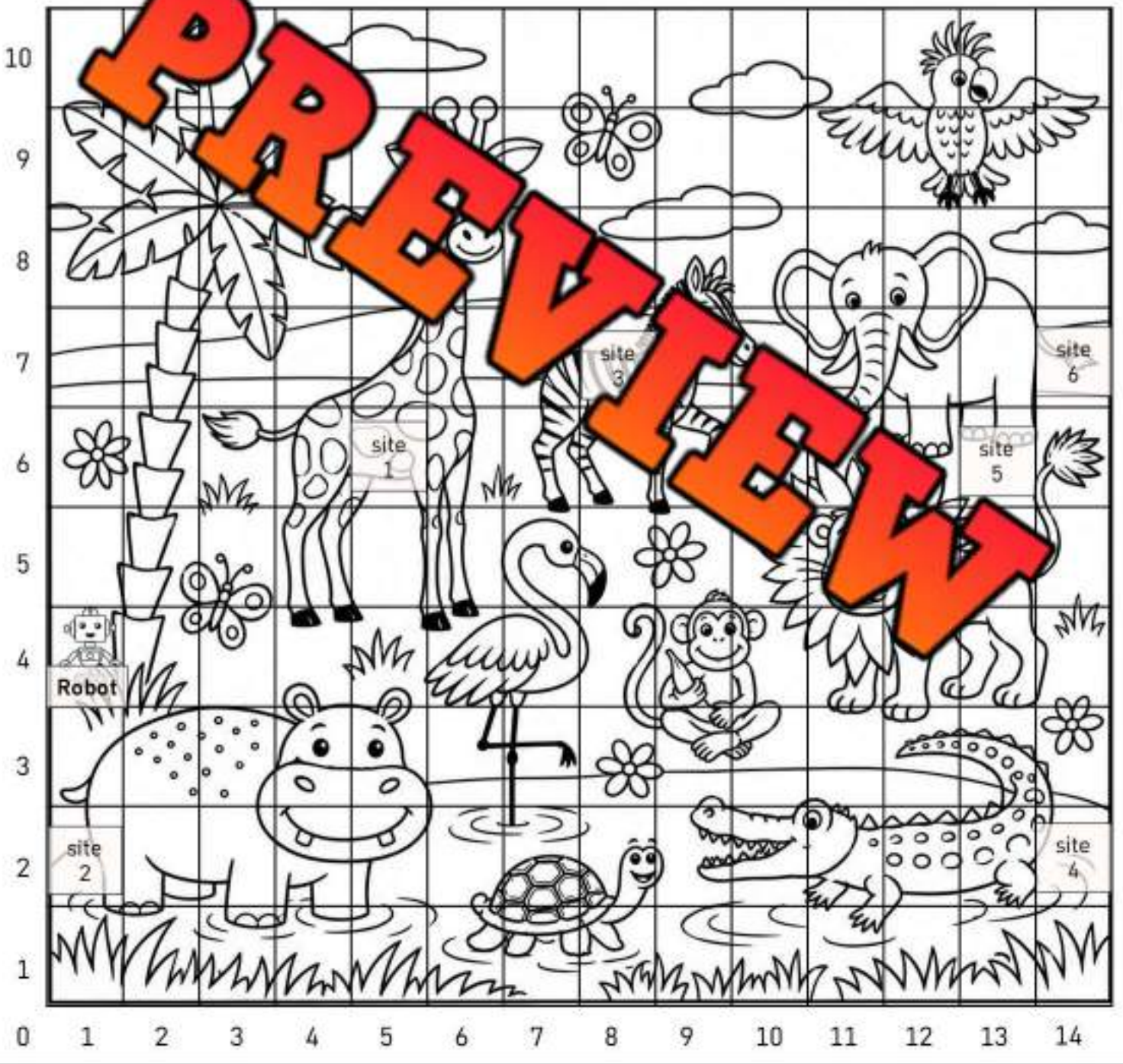
Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Remote Control Photography

Learning about endangered species in their natural habitat is difficult because they will not act naturally if they see humans. Thanks to ideas like the BeetleCam, observing endangered animals is getting easier. The BeetleCam is a small camera that takes pictures and videos. It is a small rover like device that camouflages into nearby habitats. The BeetleCam is operated using a remote control that uses coding to instruct the camera.

Mapping

Use this map to write the code on the next page.



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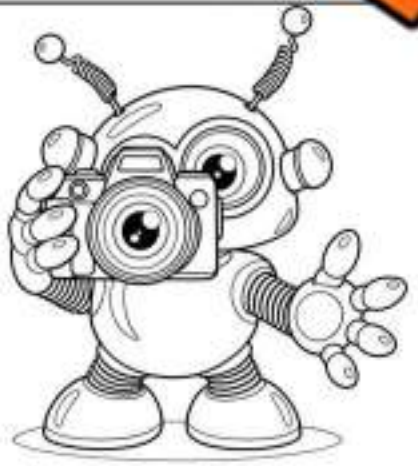
Curriculum Connection
A2.1, A2.2, A3.2, A3.3

Coding The camera has started in position (1, 4). Move it to all the sites in an efficient path by writing code similar to the example code below. Try to write as few lines of code as possible.



Exam

- move to (3,
- take 5 pictures
- move to (5, 5)
- take 3 pictures of site8



Code

PREVIEW

Question Why is it helpful that robots can take photos and collect video? How does it help scientists understand natural habitats?

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Name: _____ Date: _____

Unit Test – Interactions in the Environments

Multiple Choice /10

1) Which of the following is a biotic factor? a) Air b) Animals c) Rocks d) Water	2) Which of the following is an abiotic factor? a) Trees b) Shrubs c) Fish d) Temperature
3) Which e[illegible] has the most biodiversi[illegible] a) Ra[illegible] b) Tundra[illegible] c) Desert d) Grassland	4) Which of the following animals is an apex predator a) Eagle b) Chipmunk c) Snake d) Rabbit
5) Which of the following is a[illegible]ser? a) Snake b) Fish c) Fungi d) Dragonfly	[illegible]n animal that eats both animals and a) Carn[illegible] b) He[illegible]re c) [illegible]mpos[illegible] d) O[illegible]
7) Which part of the food chain gets the most energy from the sun? a) Decomposers b) Producers c) Consumers d) Apex predators	8) Clearcutti[illegible]sts a) Loss of biodiversity b) Soil erosion c) Landslides d) All of the above
9) Which system of agriculture has trees, livestock, and crops together a) Factory farming b) Pasture c) Silvopasture d) All of the above	10) Which technology is causing a lot of problems for ecosystems and the environment? a) Drones b) Vehicles c) Radio tracking collars d) All of the above

PREVIEW

Definitions – What does the term mean (1 mark each) /5

Term	Definition (what does it mean)
Ecosystem	
Primary Succession	
Secondary Succes	
Carr C	
Ecosystem	

PREVIEW

Short Answer Questions (ach) /6

1) What is the difference betw bio lements in an ecosystem?

2) What is the role of decomposers in an ecosystem?

3) What is clearcutting? How does it affect ecosystems?

Long Answer (5 marks each) **/10**

1) Describe one food chain. Use the terms: decomposers, producers, primary/secondary/tertiary and quaternary consumers? What happens when one part of the chain is removed?

2) How do agricultural practices affe[illegible]osyste[illegible]ustainable agricultural practices are better for our environment?

PREVIEW

Workbook Preview

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Name: _____ 6

Curriculum Connection
D2.1

Structures - Form and Function

What is a Structure?

A **structure** is something made of many parts that is put together to serve a purpose. Our bodies are structures, as they have bones that are put together to serve a purpose – giving our muscles support so we can move.



Form and Function of Structures

Structures are all around us. Every structure has a function, meaning it was built to do something. A chair is a structure that is commonly made of materials like wood, metal, and/or plastic. A chair's function is to support a person's load so they can rest. Therefore, the **function** of a structure is the structure's purpose – what it needs to do.

Preview of 55 pages from this product that contains 161 pages total.



make a structure, we need to understand the function of the structure before we build it. In other words, we need to know what forces will act on the structure before we can decide what materials we will use and how we will arrange the materials.

Imagine someone asking you to build a bridge. Without anymore information, you would have no idea what type of bridge to make. You might ask:

1) How long does the bridge need to be?
2) What loads will use the bridge – people, animals (pets), cars, transports?
3) How long will the bridge need to last?
4) How much money will I be paid to build the bridge?

Understanding the answers to these questions will help you understand the function of the structure and will allow you to make a bridge that works for the purpose.

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Curriculum Connection
D2.1

Structures - Form and Function

Questions

Use information from the text to support your answer

1) What does form follows function mean? Why is it important?

2. Define the following:

Structure	
Form	
Function	

PREVIEW

Visualizing

What were you picturing in your mind while you were reading?

Describe the structure

True or False

Circle whether the statement is true or false

1) Structures are materials found in the environment	True	False
2) Structures are the arrangement of materials or parts to form something	True	False
3) It is good to build structures without knowing how they will be used	True	False
4) We need to understand the function of a structure before we build it	True	False
5) Understanding the loads that will act on a structure is important	True	False

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Types of Structures - Shell, Solid, Frame



Types of Structures

When we understand the function of a structure, we can begin to decide which form we will use. There are three main forms: shell, solid, and frame structures.

Shell Structures

A **shell structure** is a strong layer on the outside that holds itself up. Shell structures are usually very thin, allowing for an interior space. Common examples of shell structures are eggshells, mugs, dome arenas, igloos, basketballs, and tin cans. Shell structures are very strong compared to their weight, which makes them useful for large areas. They are also very simple and inexpensive compared to other types of structures.



Solid Structures

A **solid structure** has no space inside and is usually made of one solid material. A hydro dam is a solid structure that is used to block the movement of water. Other examples of solid structures are bricks and cement patio stones. Each of these structures have no space inside and are made of one material. Solid structures are usually heavy and strong. Well made solid structures can last a long time.

Frame Structures

A **frame structure** is a structure that has a combination of horizontal beams and vertical columns that form a skeleton that can be covered or open. A frame structure is like a shell as it has space inside, but the frame structure will have beams and columns that make the shell stronger. While an igloo shelter is a shell, a house is a frame shelter because it usually has walls (columns) and floors (beams). Some examples of frame structures are buildings, spider webs, trees, bicycles, and bridges.

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Curriculum Connection
02.1

Types of Structures - Shell, Solid, Frame

Questions

Use information from the text to support your answer

1) What is the difference between a frame and a shell structure?

2) Write ... examples of each type of structure you can see right now.

Frame	
Solid	

PREVIEW

Type of Structure?

Is the s... a sh...me, or solid structure?

1) House	Sh...	F...	Solid
2) Eggshell	Shell		Solid
3) Car	Shell		Solid
4) Telephone pole	Shell	Frame	
5) Bottle	Shell	Frame	
6) Pyramid	Shell	Frame	Solid
7) Beehive	Shell	Frame	Solid
8) Leaf	Shell	Frame	Solid

Questioning

Write 2 questions you have about the reading

1)	
2)	

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D2.2

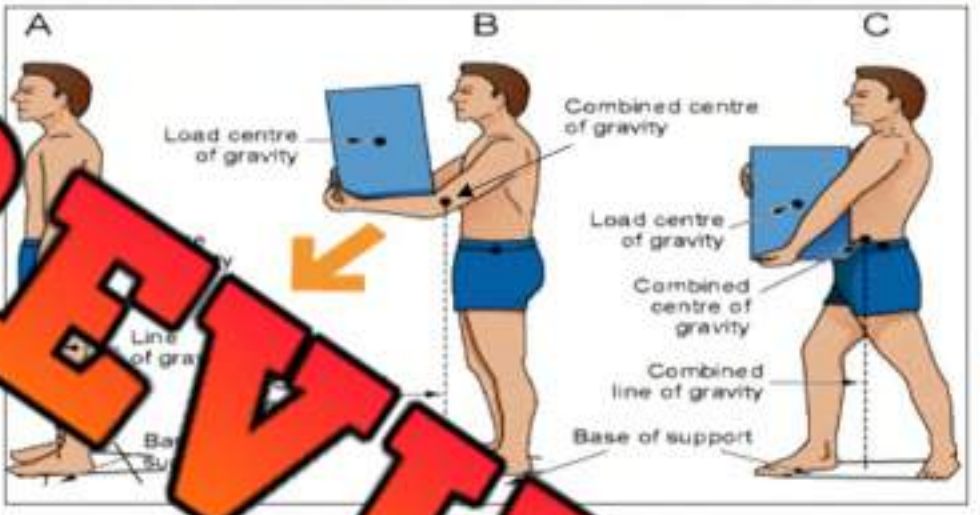
Centre of Gravity

Gravity

What goes up must come down. That is true because of gravity, the force that pulls everything towards the Earth's centre. Sometimes gravity can make things turn or topple over. Tall buildings will topple over if they are not stable because gravity is pulling the building do towards the Earth's centre.

Centre of

The ta
more d t it is
engineers to m
and not fall over. B
understand an important
scientific principle called
centre of gravity. The



PREVIEW

Centre of gravity (CG) is an imaginary point on a st re wh weight of the structure is evenly dispersed around it. This mea th ght on all sides – above, below, in front, behind, and on both sides.

A ball has a clear centre of gravity with it being right i cen es, the centre of gravity is a bit more complicated. It is slightly above o we have more weight on the top half of our body than the bottom half.

Tall structures will topple over easier because their centre of gravity is higher. If you build a tower of blocks with a stack of single blocks on top of each other, it will eventually fall. The centre of gravity is in the centre of the tower. As you build the tower higher, the CG becomes higher as well, making it more unstable. But if you make the base wider, the centre of gravity will be lower because there is more weight on the bottom. The tower will be more stable if the bottom half of the tower has more blocks.

When engineers and architects design structures, they must understand the CG of the structure. Keeping the centre of gravity as low as possible will increase its stability.

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Centre of Gravity

Questions

Use information from the text to support your answer

1) What does centre of gravity mean? Why is it important?

2) If you [illegible] a structure, how could you use your understanding of CG to ensure [illegible] stable?

PREVIEW

Diagram

Draw a diagram of a t[illegible] and la[illegible] centre of gravity is

D[illegible] and how you kept it [illegible]

True or False

Circle whether the statement is true or false

1) A structure's CG is always in the middle of the structure	True	False
2) A structure's CG is where there is equal weight surrounding it	True	False
3) The lower the CG, the more stable a structure is	True	False
4) In football, you have more stability/balance when your standing straight up	True	False
5) A tower with a wider base has a lower CG	True	False

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D2.2

Centre of Gravity - Which is More Stable?

Evaluate Circle the structure that is more stable. Explain why below

1)





2)





3)





4)





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02.3

Internal Forces

Internal Forces Resisting Motion in Structures

Structures must be built to withstand the external forces that act on them. Internal forces are forces felt from the inside of structure. The structures are constantly resisting the external forces acting on them. Structures have the following internal forces: compression, tension, shear, and torsion.



Compression

Compression is a pushing internal force. A structure will feel ompression inside of it if it is being squeezed or pushed down. When on our chair, we are applying an external force that is our body w the chair. If the chair has strong compressive internal ill resist the compression. If not, the chair will collapse.

Tension

Tension is a pulli . Whe oth ends of a material or structure, we are applying tension to it not break when tension is applied to it because they have tensil . A ro ing might break as the internal tensile force would be too strong. It e to break a popsicle stick by pulling both ends of it. On the other han we an elastic by applying tension to it and pulling it apart. This means a has strength than a popsicle stick.



Shear Force

Shear force happens when there are two opposing g on me structure. When you want to open a bag of chips, you e ba applying two opposing forces to the top of the bag. The ba nt meaning the shear internal force acting on the bag was too stron sist.

A good example of shear force in action is using scissors. T s put force in different directions on the pin that holds the two parts togethe force applied to the pin is called a shear force.

Torsion Force

Torsion is a twisting force that is applied to a structure. The internal force occurs when the structure begins to twist or bend. A common example of torsion is when we twist a wet towel to wring it out.



When engineers design a bridge, they need to understand how much wind the bridge will need to endure. The Tacoma Narrows Bridge sustained damage from strong winds that caused the bridge to twist, meaning its weakness was torsional strength. The internal torsional force was too strong as the bridge couldn't resist the wind's external force, which caused it to twist and collapsed.

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02.3

Internal Forces

Questions

Use information from the text to support your answer

1) What is an internal force?

2) When [illegible] structure fail due to too strong of an internal force?

PREVIEW

True or False

Circle whether [illegible] true or false

1. Torsion is a twisting force	True	False
2. Shear force requires two forces in opposite di[illegible]ns	True	False
3. Sitting on a chair puts compressive internal forces o[illegible]	True	False
4. Turning a screw into wood is a shear force	[illegible]	False
5. Turning the tap on is a torsion force	[illegible]	False
6. The strings on a guitar are under tension internal forces	[illegible]rue	False
7. Tearing a piece of paper is a torsion force	True	False

Matching

Match the definition to the term

Answer	Term	Description
	Shear	a) When a structure is exposed to twisting
	Tension	b) When a structure is exposed to pushing or squeezing
	Compression	c) When a structure is exposed to two forces in opposing directions
	Torsion	d) When a structure is being pulled apart

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Tacoma Narrows Bridge

Learn more about the engineering failures that led to the Tacoma Narrows Bridge collapsing.



Research | Answer the questions below

1) Where was the bridge located?

2) When [illegible]uilt? When did it collapse?

	Collapsed

3) What internal forc[illegible] the bridge to resist? Circle the answer

Compression	Torsion	Shear

4) Why did the bridge collapse?

5) What materials was the bridge made of?

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02.3

External Forces – Dead and Live Loads

External Forces – Dead Loads and Live Loads

All structures need to support a load. The seat you are sitting in needs to support the load of a person sitting in it. There are two types of loads, dead loads, and live loads. A **Dead load** is the effect of gravity acting on the structure. It is the weight of the structure itself that the structure must be able to support.

A **Live load** is a force that moves or changes while acting on a structure. Wind is a live load as the force of the wind is constantly changing.

The l oad is the combination of the dead load and live load that the structure must be a thstand.

PREVIEW

Live at the example of loads below. Label them live or dead loads



















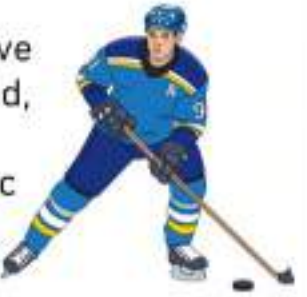
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02.3

Describing External Forces

Describing Forces



We see forces happening in our day-to-day life all the time. You have described these forces to your friends and family. You may have said, "wow, I hit the puck so hard with my slap shot" or, "did you see that huge gust of wind that just knocked that tree down?" In the scientific world, we use key terminology to describe forces.

Terminology - Magnitude

Magnitudm used to describe how much force is acting on a structure. All forces h engths. These forces can be measured in terms of the stren magnitude of the force. A weightlifter might say they bench p sed 2 hin they pushed a magnitude of 200lbs of force into the bar.

An earthq alway d in terms of its magnitude, or strength of its force. The Richter m tu a number to quantify the amount of seismic energy (force) t eased arthquake. In 1960, the strongest earthquake ever recorded h an namis in Chile, Hawaii, and Japan. It was a magnitude of 9.6 on the Rich



Terminology - Direction

Forces act in a particular direction and have depending on how strong the push or pull is. **direction** describes where the force is coming fro nd is g into your face, it is difficult to walk, but if it is blowing at your b lo lk faster.

It is important to understand the direction of a force, so v e net force. The **net force** tells us how much force is acting on a structure ame of tug of war, if two groups apply the same pulling force on the rope, th ope will not move. This means the net force acting on the rope is a net zero force.

Terminology – Point/Plane of Application

Point of application describes where the force strikes on the structure. **Point of application** is the side of the structure affected by the force. Where a force is applied to a structure is important in understanding how the structure will handle the force.



For example, If a strong force hits the top of a skyscraper, it might have a stronger impact than if it hit the bottom or base of the structure. Some structures are designed to have the user apply a force in a certain area, like the handle on a shopping cart.

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Curriculum Connection
02.3

Describing Forces

Describe Describe the forces below

1)



Magnitude	
Direction	
Point of Application	
Plane of Application	

2)



Magnitude	
Direction	
Point of Application	
Plane of Application	

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Describing Magnitude - Newtons

Measuring Magnitude - Newtons

We describe the magnitude of a force using newtons (N). A **newton (N)** is the standard unit for force. One newton (N) is a small magnitude of force, just enough to stretch an elastic band. 10 N is a force that could lift a 1 L bottle of pop. 500 N could lift something that was 50 kg or 110 lbs!

Newtons and Kilograms

There is a [illegible]nship between the amount of force (N) needed to lift something in kilogram[illegible]ry 1kg of mass we want to lift, we would need to apply 9.8 N of force. T[illegible]p[illegible]mate amount of force needed, we can round that to 1 kg = 10 N of f[illegible]eeded.

This only a[illegible]tion an object becaus[illegible]e an [illegible] friction will creat[illegible]her f[illegible] acts on the object.

We can use a spring [illegible] measure how many Newtons [illegible]ee[illegible] to lift something. As shown in the pic[illegible] a spring scale has a hook on the bot[illegible] that we can attach a load to. It also has a display or scale that shows us the magnitude of force in Newtons that is pulling do[illegible]. [illegible]o scales on the left show objects applying a force of 5 N. The sp[illegible] on [illegible]ght shows a smaller object producing 3 N of force.



PREVIEW

Common Magnitudes of Force

Force in Newton (N)	Description of the Force
1 N	1) The force needed to lift a smartphone
50 N	2) Average force needed to break the shell of an egg
720 N	3) Average force of a human bite
9000 N or 9 kN	4) The bite force of one adult alligator
16 500 N or 16.5 kN	5) The bite force of an average sized crocodile
100,000 N or 100 kN	6) The average force applied by a seatbelt to a restrained passenger in a car that hits a barrier at 100 km/h
890,000 N or 890 kN	7) The maximum pulling force of a large truck

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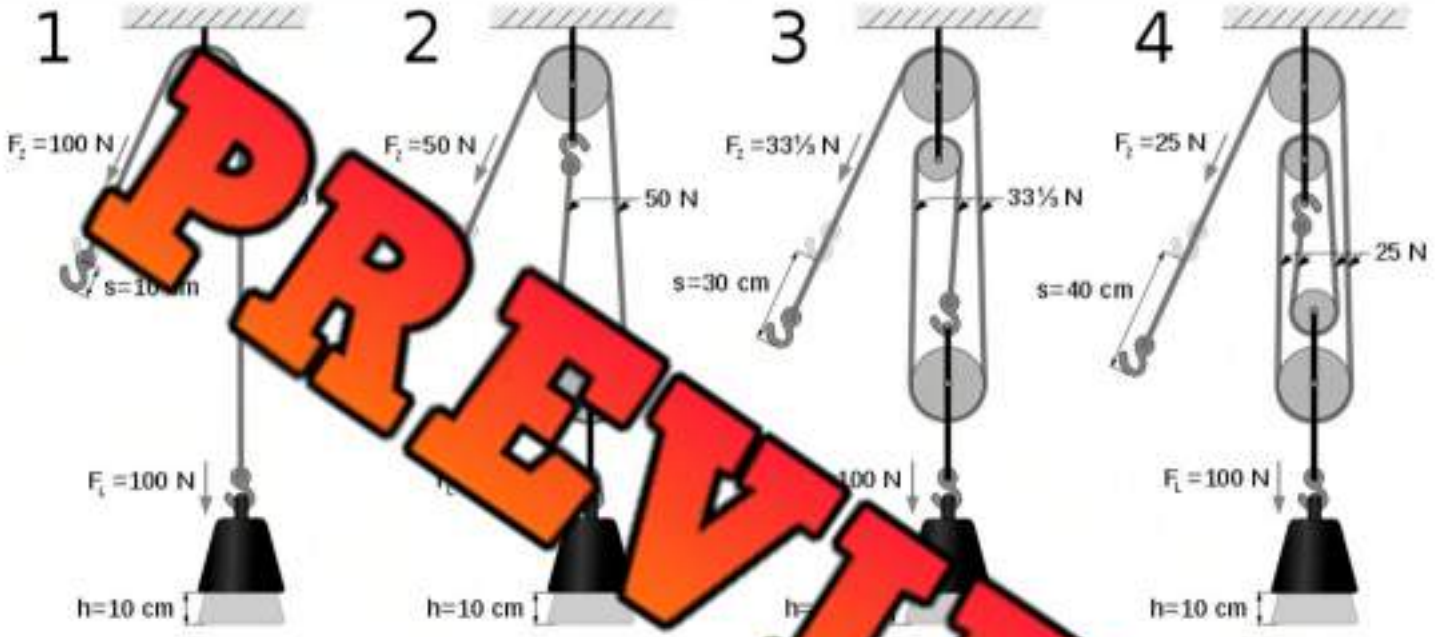
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Curriculum Connection
02.3

Pulley System - Force/Distance Ratios

Force and Distance Ratio

Using a pulley system allows for a mechanical advantage to make a load easier to move. When we add a pulley, it changes the amount of force you need to apply into the pulley, however, it also changes the distance you need to pull. In the diagram below, the differences between using 1 pulley compared to 2, 3, and 4 are outlined.



PREVIEW

Questions Fill in the table below a wer

Number of Pulleys	Load	Force Required	Di to Pull (cm)
1	100 N		
2	100 N		
3	100 N		
4	100 N		

1) What do you notice happens to the relationship between force required and distance to pull when you add a pulley?

2) When would you use extra pulleys? When would just one pulley be enough?

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Force Diagrams

What is a Force Diagram?
A **force diagram** is a simple picture that shows the magnitude and direction of a force using arrows. Force diagrams help engineers to understand what forces will act on a structure. If they can predict the net forces acting on all sides of the structure, they will know how strong to make the structure.

To read a force diagram, you need to understand the following:

- A circle or rectangle represents the object on which the force acts on.
- The length of the arrow shows the strength of the force. The longer the arrow, the stron[illegible]
- Th[illegible]ow shows the direction of the force

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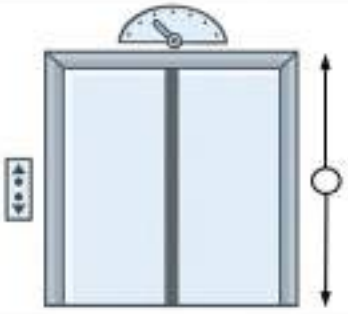
Questions [illegible] in the force diagrams and answer the questions

1)



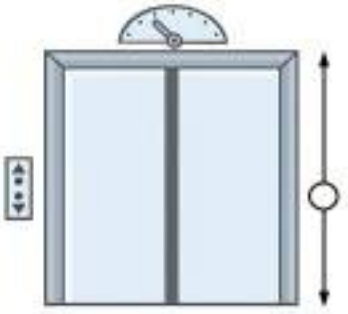
Will the elevator go up or down? Will it be [illegible] or slow? Explain.

2)



Will the ele[illegible] it be fast or slow? Explain

3)



Will the elevator go up or down? Will it be fast or slow? Explain.

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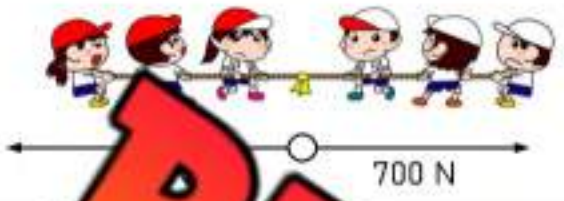
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D2.3

Force Diagrams

Questions Examine the force diagrams and answer the questions

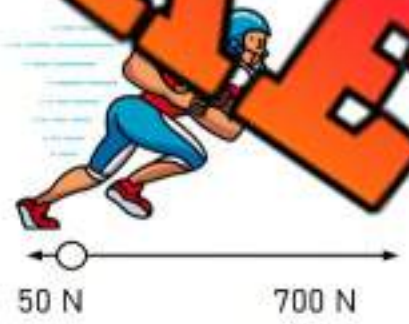
1)



Who will win? Explain how you know.

What is the net force of the team on the left?

2)



Which direction is the player moving and how fast will he go? Explain.

What is the net force for the player?

3)



When the skydiver is ... is happening with the ... them?

When they release the parachute, what forces are acting on them now? Are they moving?

What is the net force during the free fall?

What is the net force after the chute is released?

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D2.3

Mass vs Weight

Mass vs Weight

Our weight is based on gravity. **Gravity** is the force of attraction that pulls together all matter. The Earth has a gravitational pull that pulls all matter towards the centre of the earth.



Weight is the measurement of the force of gravity pulling on an object. This means our **weight** is how hard gravity is pulling us towards the Earth's core. Mass is different. **Mass** is the amount of matter in an object.

On other planets or on the moon, we weigh a different amount because their gravitation[al pull] is stronger or weaker. For example, our weight on the moon would be about 6 [times less] than earth because the moon is much smaller and has 6 times less of a gra[vitational pull]. However, our mass is the same everywhere, including on the moon becaus[e] bodie[s] have the same amount of matter.

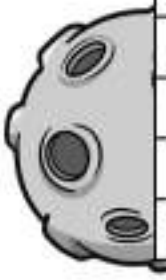
PREVIEW

Math Time

[To find the weight on earth] divide the [weight on the moon] by 6 to find the weight on the moon. [To find the weight on the moon] multiple [the weight on earth] by the moon by 6 to find the weight on earth.



Weight on th[e moon]	Weight on Earth
15 kg	
50 kg	
	kg
110 kg	
	[4]50 kg



Questions

Use information from the text to support your answ[ers]

1) What is the difference between mass and weight?

2) Why would you weigh less on the moon than on Earth?

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Curriculum Connection
D2.3

Assignment - External Natural Forces

A **natural force** is an event that happens in our environment that is due to nature and not human beings. Examples of natural forces include earthquakes, landslides, tsunamis, hurricanes, tornados, and avalanches.



1) Choose a natural force from the list above, or your own that your teacher has approved
2) Answer the questions about the natural force you chose
3) Decide how you will present the information you learned to your class. You have the following options, plus any options approved by your teacher. Your presentation should teach others about the things you learned about the natural force you chose.

Poster PowerPoint Prezi Song Skit

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Research the questions below

1) Which natural force did you choose?

2) What is the natural force? Why does it occur?

3) What kinds of structures are vulnerable when this natural force strikes? Explain why.

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Curriculum Connection
D1.1, D2.4

Symmetry in Structures

What is Symmetry in Structures?

Symmetry is when a structure is made up of the same parts so that one side is the same as the other side. Structures built with symmetry could be split using a line of symmetry. On both sides of the line of symmetry, the structure would be the same. Remember, a structure is multiple parts or elements puts together to make something complex. When we put the parts together in a repeated pattern, the structure becomes more unified, as opposed to parts put together.



Why Use Symmetry in Structures?

Engineers will use structures symmetrically so that they are stronger, and to make them more aesthetically appealing.

Strength of Symmetry

Symmetrical structures are more stable because forces that act on a symmetrical structure are balanced. For example, when we sit on a chair, the force of our weight acting on the chair is balanced through all 4 legs because the chair is symmetrical. Imagine the chair was asymmetrical, with different leg lengths. When we sit on the chair, it will wobble, and our weight could be concentrated on one leg instead of being balanced on all four. The chair could collapse as our force might be too strong for one leg.

When a structure is symmetrical, it is easy to determine its centre of gravity (CG). For a symmetrical structure, we can easily determine where the CG is. When engineers understand where the CG is, they can create stability for the structure.

Symmetry = Aesthetically Pleasing



Aesthetics is the study of beauty, attractiveness, and taste. Scientists have discovered that the human brain prefers symmetrical structures over asymmetry. Symmetry gives us a sense of balance, which is calming and more appealing.

The idea of symmetry in structures has been used for many years. The Taj Mahal was built in 1631, and it emphasizes the use of symmetry in structures.

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Curriculum Connection
D1.1, D2.4

Symmetry in Structures

Questions

Use information from the text to support your answer

1) Why are symmetrical structures often more stable than asymmetrical structures?

2) Wh[illegible]tures more aesthetic? Why is that important?

PREVIEW

Making Connections

Dr[illegible]well. It is symmetrical? Explain.

True or False

Circle whether the statement is true or false

1) Asymmetrical structures allow forces acting on it to be balanced	True	False
2) Symmetrical structures are more aesthetically pleasing	True	False
3) It is easier to find the centre of gravity in asymmetrical structures	True	False
4) The Taj Mahal is a symmetrical structure	True	False
5) My school is symmetrical	True	False

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D2.4

Asymmetrical Structures

Examine What worries you about the structures below? Are the structures as stable as they could be? Do you think the engineers added extra support?

1)

Denver Art Museum



2)

Auditorio de Tenerife



3)

Walt Disney Concert Hall



4)

Capit in Abu Dhabi



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Curriculum Connection
D1.1, D2.5

Structural Failures - Bad Foundation

What is a Foundation?

The **foundation** of a structure is its base that supports the building and anchors it to the earth. The foundation of a building is critical to its stability. If the foundation fails, the building will lose its stability, and will likely cause a structural failure, or collapse.



Building D[illegible]ndations

The fou[illegible]ling is like the roots for a pla[illegible]nger the roots are for a pl[illegible]the ta[illegible]ger the plant will be. The same thin[illegible]uct

In Canada, [illegible] seas[illegible]er that causes freezing and thawing of our structures. Engineer[illegible]st [illegible] climate will affect the structures they are building.

The building code in C[illegible]qui[illegible] foundation of a structure needs to be 150mm (6 inches) below the [illegible]al fr[illegible]**line** is the maximum depth underground that the soil will not free[illegible]ng the [illegible]t temperatures of the year.

The local frost line will vary, depe[illegible]ing on t[illegible]ea i[illegible]ada you live. For example, to build a deck in Ottawa, you need d[illegible]tings[illegible]0 inches because the frost line is 54 inches. In the warmer climat[illegible]bbo[illegible] only need to dig 18 inches as the local frost line is 12 inches.

PREVIEW

Basements – Great Foundations

With the frost line in Canada being between 2 and 8 feet, most pe[illegible]use decide to build a basement as well. If they are already building a fou[illegible]elow the frost line, they usually build the basement full depth around 8 feet.



Having a basement means the foundation of the home is definitely built deep enough. Freezing and thawing will not be a problem and the house's foundation will not fail due to temperature changes.

Did you know that in warmer climates, houses do not have basements? In places like Florida, the frost line is very close to the surface, so home builders often don't bother with the extra expense of building a basement. They still dig a foundation below the frost line, but it might only be 1 or 2 feet underground.

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Curriculum Connection
D1.1, D2.5

Structural Failures - Bad Foundation

Questions

Use information from the text to support your answer

1) Why is a foundation important in structures?

2) Why do[illegible]ses in Canada have a basement? Why don't houses in Florida?

PREVIEW

Diagram

Draw a house wit[illegible] a garage, draw foundation walls underneath (check d[illegible] Explain your diagram.

True or False

Circle whether the statement is true or false

1) A basement should be built right at the frost line	True	False
2) Houses in warmer climates need basements for strong foundations	True	False
3) Most houses in Canada have a basement	True	False
4) It is building code to dig your foundation 6 inches below the frost line	True	False
5) The frost line is different depending on where you live	True	False

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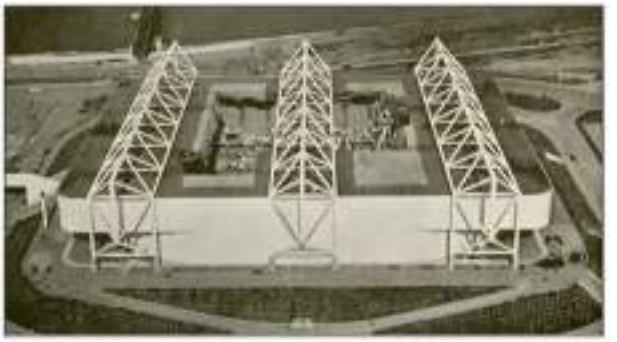
Curriculum Connection
D1.1, D2.5

Structural Failures - Bad Designs

Bad Designs

Sometimes, architects get caught up in having innovative designs that draw attention instead of sturdy structures that will last forever. There is a balance, as many structures with innovative designs get more visitors, which ends up paying off for the owner of the building. Bad designs cause 40-60% of all structural failures.

Kemper Arena – Kansas City, Missouri



In 1979, the $24 million new home for the Kansas City Kings [team] was complete. Helmut Jahn was the [architect] who was praised for his innov[ative] [struc]ture no seams and no inter[ior] [col]umns to [block] spectator views. Instead, he used [exte]rior [sup]port frames to support the ro[of] [whi]ch was th[e] [we]ight of concrete and stee[l] [hold]ing [the] [sea]ts. Jahn won an Honour Award from the American Institute of [Arch]itects.

The flat roof was b[uilt] [to] release r[ain] gradually through undersized drains. But on June 4, 1979, an inten[se] [thu]nderstorm [dro]pped over 10cm of rain on to the roof. The drainage system was too slow, and wa[ter] [bu]ilt up at [the] top of the drainpipes. The uneven distribution of water led to the [dow]nward f[orce] [on] the water becoming too strong over top of the drainpipes.

Along with the heavy winds, the pooling [wa]ter br[ought] added a force too strong for the roof. The forces caused the fractu[re] [o]f b[olt]s that held up the roof. When ev[ery] bolt out[side] [of] [one] snapped on each truss, the ro[of] b[egan] [to] long for the other 2 bolts to supp[ort].



Part of the roof collaps[ed] [in] rubble to the ground. Fortunately, the aren[a] empty, so no one was hurt. To fix the roof, the [cost] was approximately $1 million, which in today's day is approximately $4 million.

Lessons Learned

The main forces acting on an outdoor structure will always be environmental – wind, water, and vibrations from the earth. For a structure to last a long time, they need to be able to withstand the worst wind, rain, and earthquake that has been experienced in that region.

When the roof was rebuilt, the drainage down spouts were built much larger to stop water from pooling. Also, a backup system was created where if one part of the roof failed, the force acting on it would be transferred to another part of the roof. Once the issues were corrected, the arena was re-opened in 1980.

PREVIEW

Name: _____ 49

Curriculum Connection
D1.1, D2.5

Structural Failures - Bad Designs

Questions

Use information from the text to support your answer

1) Why did the Kemper Arena roof collapse?

2) Why is it important to understand the forces of the strongest rain, wind, and earthquake in a region before building an outdoor structure?

PREVIEW

Reflect

Why do architects use innovative designs? Is it worth it to potentially create an unstable structure? Explain your opinion.

True or False

Circle whether the statement is true or false

1) Kemper arena was an innovative arena that had no interior columns	True	False
2) The architect built the arena understanding how rain would runoff	True	False
3) The building's poor drainage system caused pooling on the roof	True	False
4) Jahn used backup systems in case one part of his structure failed	True	False
5) The failure in Jahn's building cost Kansas City $1 million	True	False

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Curriculum Connection
D1.1, D2.5

Structural Failures - Extraordinary Loads

Extraordinary Loads

Our environment sometimes presents extreme conditions that lead to structures being stressed by extraordinary loads. An **extraordinary load** is one that is not within the range of expected loads for a region.

For example, in Canada, we do not experience earthquakes like Japan does. Over a 10-year period, Canada will have approximately 3 earthquakes over a 5.0 magnitude. In Japan, they will experience 89 earthquakes with a magnitude of over 5.0 in that same 10-year period. This is because Japan is positioned along the Ring of Fire, an area where several tectonic plates meet.

In Japan, buildings need to be built to withstand the shifting earth caused by earthquakes. Canada does have other extraordinary loads, like snow piling on roofs. Japan would not require structures to be able to withstand loads from snow. The regions are different and extraordinary loads are different for each region.

PREVIEW

Ice Storm 1998

In 1998, southern Quebec and eastern Ontario were pelted with as much as 100 millimetres of freezing rain and ice pellets. This led to over 4 million residents in Quebec and more than 1 million Ontarians to be left without electricity.



The region received more ice rain in 5 days than they expected for 2 years. This concentrated amount of ice rain and pellets led to extraordinary loads on structures. The failing structures, including downed power lines, broken trees, and collapsed roofs caused massive infrastructure problems.

The ice storm resulted in 35 deaths. The causes of death included carbon monoxide poisoning, trauma from falling structures, fire, and hypothermia.

Over 30,000 utility poles fell, and more than 1,000 giant hydro pylons collapsed. These structural failures led to approximately 4.5 million people to be without electricity. Without electricity, many people had no heat, no water, and no appliances – stove, microwave, or fridge.

Lessons Learned

The ice storm of 1998 was a once in a century storm that produced extraordinary loads. Not all structures can be designed to withstand the forces of such an event. However, Canadians learned to minimize the impact of a storm like this by having backup plans in place.

For example, the effects of the storm were felt strongest in Quebec because their power grid is above ground. After the storm, money was spent to bury lines to prevent another massive power outage.

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Curriculum Connection
D1.1, D2.5

Structural Failures - Extraordinary Loads

Questions

Use information from the text to support your answer

1) What is an extraordinary load? Are extraordinary loads the same in every region?

2) Is it eas[illegible]gineer/architect to plan for an extraordinary load? Explain.

PREVIEW

Summarize

What happ[illegible]d wi[illegible]in 1998?

True or False

Circle whether the statement is true or false

1) An extraordinary load in Canada is different than one in Japan	True	False
2) Extraordinary loads can cause structures to fail	True	False
3) All structures need to be prepared to handle extraordinary loads	True	False
4) It is expensive to create structures that can handle extraordinary loads	True	False
5) Burying power lines will help minimize the damage from another ice storm	True	False

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Curriculum Connection
D1.1, D2.6

Choosing the Right Building Material

Summarize Summarize each heading by paraphrasing the important information

Price	
Availability	
Aesthetics	
Durability	
Sustainability	

PREVIEW

Making Connections Have you ever built something (a skateboard ramp, birdhouse)? What materials did you use? Why did you choose them?

True or False Circle whether the statement is true or false

1) Cement is a very sustainable building material	True	False
2) Bamboo is a sustainable building material	True	False
3) Price is an important factor when deciding a building material	True	False
4) Some HOA's have rules against using certain building materials	True	False
5) Price is more important than durability when choosing a building material	True	False

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Curriculum Connection
02.7

Engineers, Architects, Construction Workers

Engineering

An **engineer** is someone who designs structures. An engineer's job is to make sure a structure fills the need of why the structure is being built. For example, if a city needed a bridge to span across a creek, they would get an engineer to design the bridge. The engineer needs to know what loads will be on the bridge so they can choose proper materials and designs.



Architecture

An **architect** is just like an engineer, however, they are more focussed on the appearance of the structure. For example, you may hire an architect to design your house because they will use ...pealing designs to make your house look awesome. An engineer ...d be more concerned with making your house strong and not ...ce...ed with the appearance.

Construction

A **construction wor...** the ...nt job of carrying out the engineer's or architect's plan. The co... ... the structure using the materials that the architect or engineer want... ...orkers, engineers and architects would never get anything built!

PREVIEW

Definitions

Explain what the ...ing ter...

Engineer	
Architect	
Construction Worker	

Question

Use information from the text to support your answer

Who do you think has the most important job? Explain.

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Curriculum Connection
D1.1, D2.7

Evaluating Structures - Structural Analysis

Who are Structural Engineers?



Structural engineers work to design, plan, and oversee the construction of new buildings and bridges. They also alter or fix existing structures. A very important part of their job is to ensure their structures are safe and stable for the public to use. I'm su[re] you can imagine the pressure associated [with] creating a structure that needs to work, as a structure failure could lead to f[atalities].

Stru[ctural] Analysi[s]

Part of a [structural] engineer's j[ob] is to perform a structural analysis. A **structural analysis** is th[e] [determination] of [the] effects that loads will have on the structure they will build. When [engineers] perform their structural analysis, they focus on investigating the foll[owing] [three] [types] of forces acting on their structure.

1) Magnitude – the size [of the] force [applied] to the structure
2) Direction – the direction [of the] fo[rce] [that will] act on the structure. A strong wind would act on the side plane [of the] struc[ture], whereas the weight of a heavy snowfall would act downw[ards], in the [direction] of gravity.
3) Position – the position on the structure [that the] for[ce] [acts]. Structural engineers need to understand how every [force] wi[ll] [affect] part of the structure because the structure might have we[ak] [points]. A st[ructure] is only as strong as its weakest point.

When the structural analysis is complete, the engineer wi[ll] [know] the forces that will act on every part of the structure. Therefore, th[ey] [can] decide what building materials they will use. They can determine the founda[tion] they will use and how they will reinforce parts of the structure they feel is vulnerable to different loads.



Importance of Structural Engineers

Structural engineers have a strong understanding of physics and material science. They have studied how forces act on different materials. They understand the mathematical equations associated with how much force a building material can handle.

Without structural engineers, our buildings, towers, tunnels, and bridges would not be as safe as they are today!

PREVIEW

Name: _____ 70

Curriculum Connection
D1.1, D2.7

Structural Assessment Report

What is a Structural Assessment Report?
A **structural assessment report** is an unbiased evaluation of the conditions of a structure. When a structural assessment report is completed, an engineer looks closely at all structural systems in order to determine the condition of the entire building.

When is a ctural Assessment Report Needed?
When ther uestions about the stability of a structure, a structural assessment report n nducted. Common reasons for an assessment include:

- Bo or cra dation
- Settlemen of a ng
- Wall cracks
- Sloping floors
- Adding another story to a ding
- When something is added to a st e, like a ls



PREVIEW

Importance of a Structural Assessment Repo
When buying a building, you may find there was ent co ted of the building. The report will tell you if there are any con ut t egrity of the building. You can trust a structural assessment report b se t out by unbiased structural engineers who have the important job o evaluating every structural component of the building.

An engineer who performs a structural assessment report cou e liable for their findings. For example, if an engineer states that a building is safe, if it falls down, that engineer could be charged with negligence because they didn't do their job properly. With that said, if a business owner noticed a structural failure, like a crack in a wall, they need to get it assessed by a structural engineer as they are liable if someone gets hurt in their building.



With so many structures in our communities, it is important that we have structural engineers performing these reports. If we didn't, the structures we use everyday could be faulty, and potentially cause life threatening injuries. Getting our buildings checked regularly means we can feel safe inside structures.

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Curriculum Connection
D1.2

Assignment - Creating an Ergonomic Workstation

Ergonomic furniture is useful in lessoning the pain of repetitive stress injuries. Ergonomic furniture could be any furniture item – table, desk, or chair – that allows someone to use the furniture without suffering repetitive stress injuries.

Create your own workstation using ergonomic furniture. Your workstation will need the following:



- Desk
- Office
- Comp or desktop)
- M
- Ke d

Be creative! W et, y design an ergonomic workstation that allows you to work effi nd sa

PREVIEW

Directions

Follo re

1) Research online "ergonomic wor ion" to dea your workstation
2) Shop online for the items listed above
3) Copy and paste the items you will buy for your w n. F m in a PowerPoint, all on one slide. You can rearrange the picture to create your workstation
4) On the next slide, type out the prices for each office supply that you purchased
5) On the 3rd slide, answer the questions below



- Why did you choose each piece of furniture?
- Will you be safe in this workstation, or will you have repetitive stress injuries?
- Will you be able to be productive in this workstation?
- Is this a realistic workstation? Why or why not?

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Curriculum Connection
D1.2

Evaluating Ergonomic Workspaces

Evaluate Explain the ergonomics in the pictures. What injuries might they sustain? How could they improve?

1)



2)



3)



4)



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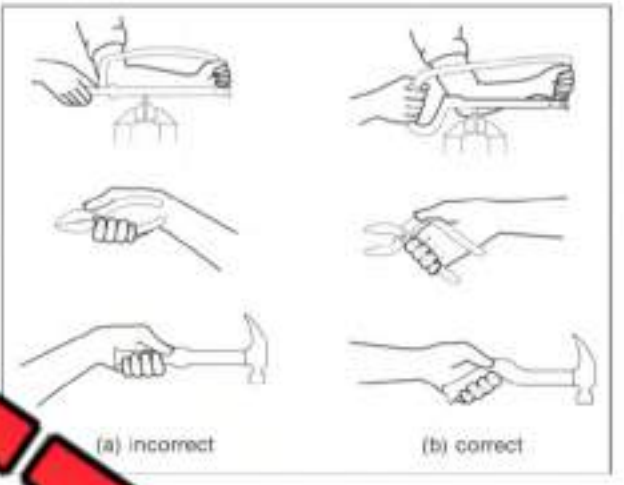
Curriculum Connection
D1.2

Ergonomic Tools

What are Ergonomic Tools

Ergonomic tools are tools designed to let the user perform repetitive motions comfortably without the risk of getting repetitive stress injuries (RSI). Some jobs require the heavy use of the same tools all day long.

When a person uses a tool that is not ergonomically designed, the same motion over and over again will eventually stress their body. This will likely happen the first time they use a tool, and several times the poor movement will lead to injuries. For example, if you use a box cutter all day, the wrong motion may affect you during the first hour, but after many hours of using that same cutter, you will start to get fatigued and if it isn't ergonomically designed.

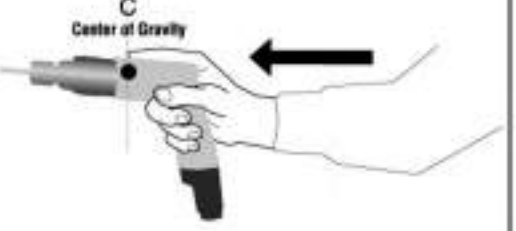


PREVIEW

Ergonomic Hand Tools

The ergonomic design of hand tools can help prevent RSI. Below are some ergonomic principles applied to hand tools.

- Handle should allow the correct straight wrist alignment – not flexed
- Allowing a healthy thumb position that feels natural
- Provide optimal grasping force so you don't need to overwork
- Use of proper weight for tools so they can be operated with one hand
- Reduce muscular effort to reduce strains
- Centre of gravity should be aligned with the gripping hand so that it is easy to hold in an upright position or in the position it will be used



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Curriculum Connection
D1.2

Ergonomic Tools

Questions

Use information from the text to support your answer

1) Why is it important to use ergonomic tools?

2) How should your body be positioned when operating a tool?

PREVIEW

Ergonomic?

Is the use of the tool ergonomic? Explain.













STEM INVESTIGATION AND COMMUNITICATION SKILLS

Form, Function and Design of Structures

PREVIEW





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Grade 7 Science Unit

Strand A - STEM Investigation and Communication Skills

	Curriculum Expectations	Pages That Cover the Expectations
A1.1	use a scientific research process and associated skills to conduct investigations	95 – 100
A1.2	use a scientific experimentation process and associated sk conduct investigations	86 – 90
A1.3	neering design process and associated skills to test devices, models, structures, and/or	84 – 85, 91 - 100
A1.4	follow safety procedures during science ions, including wearing appropriate clothing and safely using tools, inst d mat	84 – 100
A1.5	communicate their find chnology vocabulary and formats that ar cific audiences and purposes	84 – 100
A2.1	write and execute code in investigation hen modelling concepts, with a focus on plann programs	– 104, 107
A2.2	identify and describe impacts of coding and of emerging technologies, such as artificial intelligence systems, on everyday life, including skilled trades	109
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	101 – 106, 108 – 109
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	101 – 106, 108 - 109
A3.3	analyse contributions to science and technology from various communities	101 – 106

PREVIEW

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Curriculum Connection
A1.3, A1.4, A1.5

Experiment - Frame, Shell, and Solid Structures

Background

What is the activity?

Can you design three types of chairs – one shell, one frame, and one solid? Usi[illegible]y and toothpicks, your cha[illegible]ake three diffe[illegible]



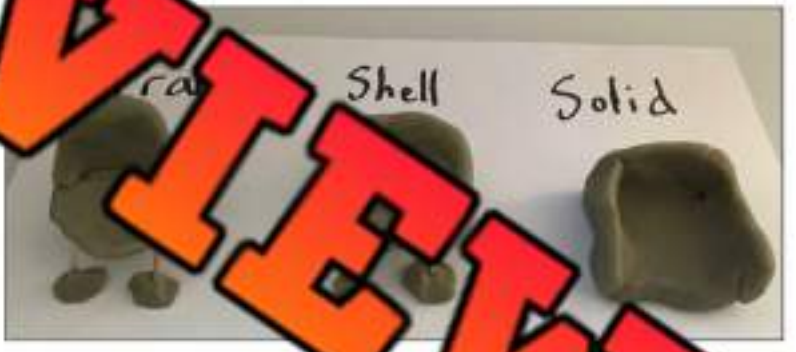




Materials

[illegible]ou need?

- ✓ Clay or playdough
- ✓ Toothpicks
- ✓ Scissors



Method

How will you complete the experiment

1) Hand out materials – 16 toothpicks and a handful of clay or playdough
2) On the back of this page, build your chair structures
3) Cut the pointed ends on the toothpicks to make them sturdier
4) Draw the chairs you made when you are finished



PREVIEW

Name: _____ 86

Curriculum Connection
A1.2, A1.4, A1.5

Mass vs Weight - Experiment

A **spring scale** measures the downward pulling force that happens because of Earth's gravity. When we use a spring scale, we are finding the weight of the object, as weight is a measure of gravitational pull.

A **balance beam scale** measures the amount of mass in an object. When we use a triple beam balance, each beam has a weight on it with a known mass. When we balance the weights with the object we are studying, we can calculate its mass.



This cup has a mass of: 30 + 300 + 5 = 335 grams.

PREVIEW

Mater… …at you need for the experiment

- Spring…cale - …e th… weight of objects in Newtons or grams
- Balance sc… …mini… …ass of objects in grams
- 6 objects that …too h… …r scales (check both)
- Optional - Bucket …pp… …le that you will put your objects in

Procedure

How yo… …orm… …ment

1) Weigh each object using the spring … and th… …le
2) When weighing using the spring scale, if you … …ucke… …ill need to subtract the weight of the bucket
3) Convert the units from the spring scale into gr… …ar…

Observations

Fill in the table below with your … …rva…

Object Name	Force of Gravity (N) Spring Scale	Weight of Objects Spring Scale (g or kg)	Mass in Gra… Balance Sca…	Mass in Kilogram

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Curriculum Connection
A1.2, A1.4, A1.5

Centre of Gravity - Experiments

We can demonstrate the importance of the concept of centre of gravity by performing the activities below. Follow the instructions and answer the questions.



Activities Follow the instructions and answer the questions

1) Stand wi[illegible] back and feet against a wall. Have someone place a pencil at your feet. Try to pick [illegible] ending forward without moving your feet.

What [illegible] nt forward? Why did that happen?

2) Stand against a wall sideways with yo[illegible] and le[illegible] ing the wall, with nothing to hold on to. Try to lift your other leg straig[illegible] out fro[illegible] wal[illegible]

Were you able to do it? Why not? Why is this imp[illegible]?

3) Get on all fours (knees and hands on the ground). Now try to put your hands behind your back (do not shoot hips back, try to keep them above your knees).

Did you fall down? Explain why or why not. Also, ask around the class as some people (females) might be able to do this easier as males tend to have a higher CG than females.

PREVIEW

Name: _____ 89

Curriculum Connection
A1.2, A1.4, A1.5

Investigate - Compression/Tension

Research Question

What are we trying to learn more about?

What is the difference between compression and tension? What does compression and tension do to a bridge when acting on it at the same time?

Material

What you will need for this experiment

- [illegible]
- A black or [illegible]



Method

How you [illegible] riment

1. With a dark marker, draw a series [illegible] across the short side of the sponge. Do this on the top and bottom of the sponge.
2. Pass the sponge around and bend it into a U-shape.
3. Observe what happens to the lines on the top and bottom of the sponge. Ask yourself the following questions while investigating.
    - Do some lines get closer together?
    - Do some lines get further apart?
    - Which side of the sponge is under tension?
    - Which side of the sponge is under compression?





PREVIEW

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Curriculum Connection
A1.3, A1.4, A1.5

Experiment - Satellite Tower

Background — What is the experiment?

You are stranded on a deserted island after your ship wrecked. All you have with you is one piece of paper, a metre of masking tape, and a square of tin foil. Build a satellite to[illegible]er so you can radio for help. It is windy on the island, so make sure the tower is s[illegible]

PREVIEW

Ma[illegible]ls — What will you need?

1. 1 metre of [illegible]ape
2. 1 piece of paper
3. 1 square of tin foil





Method — How will you co[illegible]te the [illegible]nt

1. Work in small groups to build the tower as [illegible]as
2. Once the time is up, your teacher will blow or us[illegible] all [illegible]of the tower
3. Follow the point system below to get as many points a[illegible]oss

Points System — How will your tower be judged?

Criteria	Points
• Your tower is over 1 metre tall – 10 points	
• Your tower doesn't fall over with the force of the wind – 10 points	
• Your tower is aesthetically pleasing – Nice to look at – 10 points	
• For ever 1cm over a metre, you get 1 point.	
Total	

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Name: _____ 95

Curriculum Connection
A1.1, A1.3, A1.4, A1.5

Activity - Building a Bridge #2

Background — What is the activity?

Can you build a bridge using spaghetti noodles? If you layer the spaghetti noodles, can your bridge support a live load as well as its dead load?

We will test how strong your bridge is by increasing the load on the middle of the bridge until it breaks. The bridge needs span a gap of 30cm. Remember, your bridge is only as strong as its weakest part!

PREVIEW

Materials — What will you need?

- ✓ Spaghetti noodles
- ✓ White glue or hot glue
- ✓ Tape
- ✓ Bucket
- ✓ Belt
- ✓ Weights – we used wooden blocks
- ✓ Marshmallows



Method — How will you complete the experiment

1) Provide students with time to plan their bridge
2) Have them begin constructing their bridges. Give each group the same number of materials
3) To test their bridges, wrap the belt around the middle of their bridge and around the bucket. Add weights to the bucket until the bridge fails.



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Curriculum Connection
A1.1, A1.3, A1.4, A1.5

Activity - Building a Bridge #2



Plan How will you make your bridge?

1) Research some spaghetti bridges online. Choose some ideas you want to replicate and write them below.

_____

_____

_____

2) Describe how your bridge will have a...

Strong Foundation	
Low Centre of Gravity	
Symmetry	

3) Draw a plan for your bridge. Label the tape, glue, marshmallows and spaghetti.

PREVIEW

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Curriculum Connection
A1.1, A1.3, A1.4, A1.5

Ergonomics - Designing a Gaming Controller

Background — What is the activity?

Can you make an ergonomic gaming controller that won't give you repetitive stress injuries after long periods of use? Make sure the controller is aesthetically appealing as gamers like their controller to look cool!

Make sure that when someone uses the controller, they can reach all buttons comfortably and they won't get a repetitive stress injury after hours, days, months, or years.

PREVIEW

Materials — What will you need?

You are not limited to any particular material. Below are some options for materials you could use:

- Clay or playdough
- Cardboard
- Buttons
- Newspaper
- Styrofoam
- Wood
- Plastic bottles



Method — How will you complete the experiment

1) Think of the materials you will use to build your controller
2) Now consider how you can shape these materials. Draw a design for your controller on the back of the page
3) Draw the buttons on your controller. You should have directional arrows and/or a joystick, start, select, and at least four action buttons.
4) Begin building your model. Make sure it is ergonomic, meaning it is comfortable to use for long periods of time

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Curriculum Connection
A1.1, A1.3, A1.4, A1.5

Ergonomics - Designing a Gaming Controller

Plan How will you make your ergonomic controller?



1) Research some gaming controllers online to decide on the buttons you will have. Write the buttons you will have below.

2) Which materials will you use to build your controller?

3) Draw a plan for your gaming controller. Include the buttons.

4) How will you ensure that the controller is ergonomic?

PREVIEW

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Curriculum Connection
A1.1, A1.3, A1.4, A1.5

Ergonomics - Designing a Gaming Controller



Results | How did it go?

1) Is your controller ergonomic? Are there some buttons that are uncomfortable to reach? Explain.

2) How could y... yo... ntroller more ergonomic? Explain

3) Is your controller aesthetically pleas... es it h... look that gamers will like?

4) If you were learning from your mistakes, what would your new co...

PREVIEW

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Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Coding - Leaning Tower of Pisa

Horizontal Displacement Sensors

Displacement is how far something has moved from its original position. Horizontal means side-to-side. So, **horizontal displacement sensors** measure how far something has moved side-to-side.

The Leaning Tower of Pisa has a horizontal displacement of 4.5 metres. The sensors in the Tower are always monitored because it is a historic building that no one wants to see fall. The Tower actually falls over 1 mm each year.



The [illegible]news is that computer code has been written to tell engin[illegible]e lean becomes too much for the Tower to stay stable. [illegible] if it leans over 5 metres, it could fall. Chec[illegible]ple[illegible]elow.

[illegible]id [illegible] building move over 5 m?

IF the building [illegible]

ELSE

THEN print, "Dange[illegible]

print, "Safe"

PREVIEW

Questions

Answer the questio[illegible]below u[illegible]inf[illegible]tion from the text

1) What do horizontal displacement sensors do?

2) How are sensors being used to make sure the Leaning Tower of Pisa d[illegible]all down?

3) Why is coding important in keeping structures strong and stable?

Name: _____ 102

Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Coding - Leaning Tower of Pisa

Colour | Colour the Leaning Tower of Pisa Below



PREVIEW

Part 2 | Follow the instructions below

1) Where would you put horizontal displacement sensors? Draw 4 of them on the Leaning Tower of Pisa.

2) Write your IF/ELSE statements below.

Did the building move over 5 m?

IF the building moved over 5 m

ELSE

THEN print,

“ _____

_____

_____ ”

THEN print,

“ _____

_____

_____ ”

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Name: _____ 103

Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Coding - Intelligent Modeling in Construction

Intelligent Modeling



Project managers today use technology to plan building projects and quote prices for these projects. Furthermore, new intelligent modeling is used by computer applications to show how changes to a design will affect the cost it will cost.

For example, if a homeowner is building a new house, they could use intelligent modeling software to make changes to their kitchen. If they upgrade countertops instead of laminate, the intelligent modeling software will instantly calculate the new price based on the measurements of the countertop and the updated prices of the materials.

Intelligent modeling software allows for real-time adjustments to building plans. Defined counts are used to run calculations that tell us how our changes to plans affect our budget.

In the scenario above, the user changes the square footage of the countertops. The program could be coded for the user to enter the price of the building materials, or it could be set to fetch data from a database in an online store.

The code for this program could look something like this:

Defined Counts

set [sq footage] of countertops to [200]

set price of [granite] to [$4 per sq foot]

set price of [laminate] to [$2 per sq foot]

print $400

run granite [sq footage]

print $800

As you can see, when the user selects laminate, the cost of $400 is printed on the screen. When the user changes the building material to granite, the price changes to $800. This all happens in real-time, instantly to allow project managers to work more efficiently.

This data will be stored as a variable. Perhaps we could name the variable countertops. The value for countertops is now $800, which is a data point that is stored. If the appliances have also been chosen, the variable could be appliances. An intelligent model could add appliances + countertops to instantly give you the total cost for both.

PREVIEW

Name: _____ 104

Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Coding - Intelligent Modeling in Construction

Questions Answer the questions below using evidence from the text

1) What is intelligent modeling? How is it used in construction?

2) How is computer technology making building homes more efficient?

PREVIEW

Directions Write defined counts and run... to ... prices below

Defined Counts
set [sq footage] of flooring to [ ]
set price of [hardwood] to [$ per sq foot]
set price of [laminate] to [$ per sq foot]

Calculate cost of laminate

Calculate cost of hardwood

Calculate cost of flooring and countertops together (use code from back page)

Name: _____ 105

Curriculum Connection
A2.2, A3.1, A3.2, A3.3

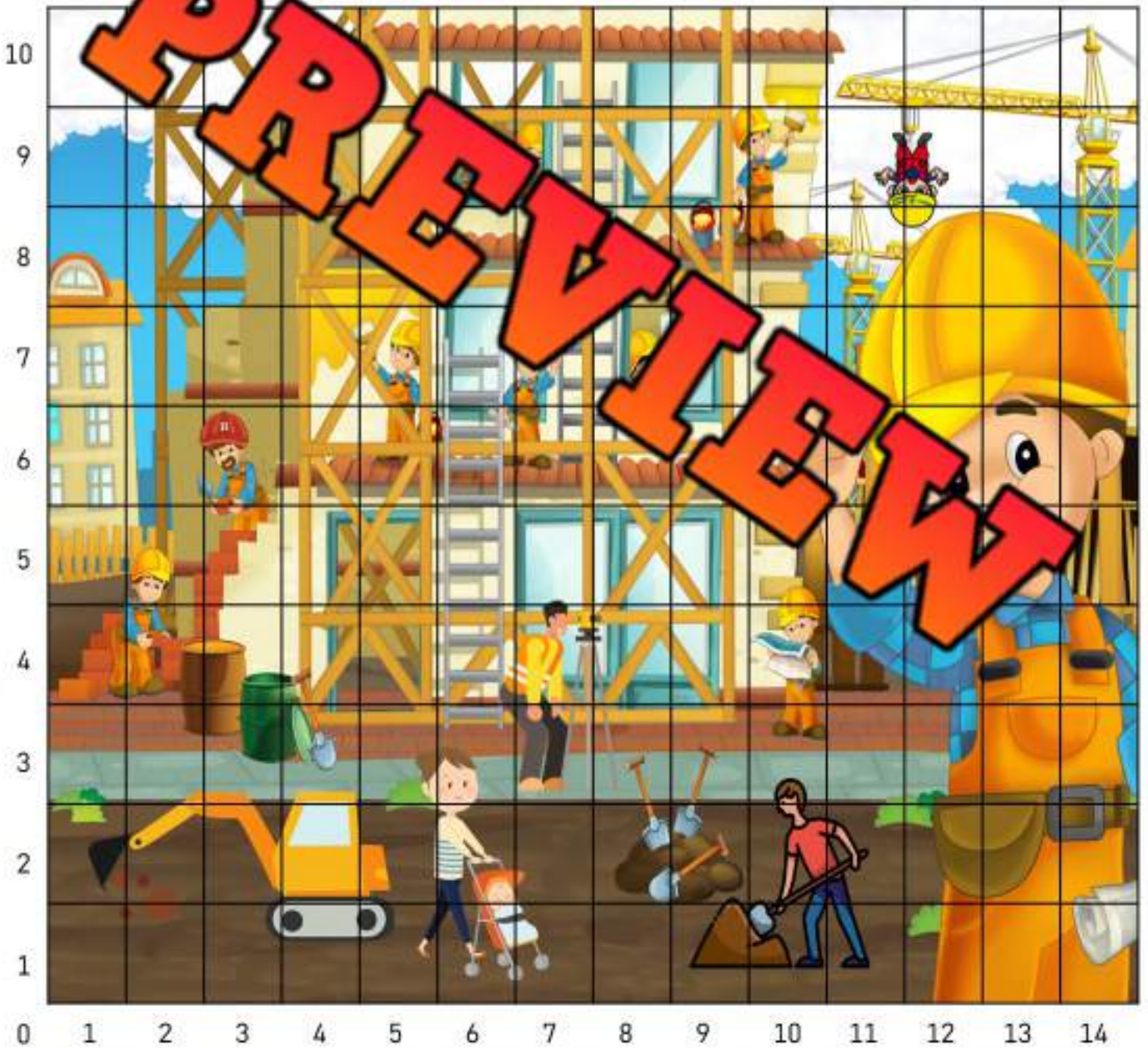
Artificial Intelligence Improving Safety

On large construction sites, hundreds of construction workers can be working at the same time. With so many moving parts, it becomes almost impossible to ensure the safety of everyone on site.

Artificial intelligence (AI) is now being used on construction sites to spot dangerous situations. AI can recognize objects based on their shape. With object recognition, cameras around the worksite can spot missing guard rails, places where people might fall, and people not wearing enough personal protective equipment (PPE).

Mapping

If you were the AI, what safety hazards would you spot below?



PREVIEW

Name: _____ 106

Curriculum Connection
A2.2, A3.1, A3.2, A3.3

Artificial Intelligence Improving Safety

Coordinates Write the coordinates and explain the hazard the AI would find

Coordinates (Choose one coordinate around the middle of the hazard)	**What is the Hazard** 

PREVIEW

Question How is artificial intelligence improving safety on construction sites?

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Name: _____ 107

Curriculum Connection
A2.1

AI Improving Safety At Recess

AI can recognize familiar objects, like people, buildings, and vehicles. Imagine you were tasked to put 4 cameras in your recess area to stop students from getting hurt. The cameras have AI that can detect unsafe behaviours, like jumping from high heights or leaving a fenced area. The codes could look like this:

If student exits [school yard]
THEN sound [alarm]

If student is [2m or more] off the ground
THEN send alert to [teacher device]

IF/THEN Write codes for the AI cameras on your school property

If _____
THEN _____

If _____
THEN _____

If _____
THEN _____

If _____
THEN _____

If _____
THEN _____

If _____
THEN _____

If _____
THEN _____

PREVIEW

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Workbook Preview

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Name: _____ 5

Curriculum Connection
C2.1

The Particle Theory Of Matter

Matter

Matter is anything that has mass and takes up space. All matter can be classified as either a pure substance or a mixture. All matter is made up of tiny particles. The study of matter and its changes is called chemistry.

The Particle Theory

Matter can be classified according to its physical characteristics. The particle theory of matter helps to explain the physical characteristics of matter.

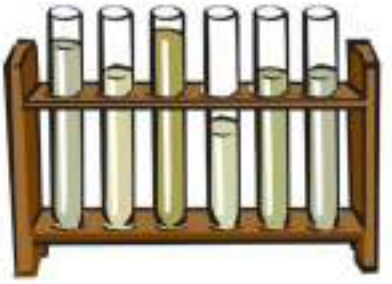
1. Everything is made of particles
2. There are spaces between the particles
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]



Preview of 55 pages from this product that contains 128 pages total.

Solids

In solid form particles are close together. The particles are very strongly attracted to each other. They are locked in a pattern and vibrate in place. Solids have a fixed shape and volume. The spaces between the particles are small.



Liquids

In liquid form, particles are slightly farther apart. Particles are less attracted to each other and are able to slide past each other. The spaces between the particles are larger than in a solid.

Gas

In gas form, particles are far apart and can move in any direction because the attraction forces between them are weak. Gases have no fixed shape and no fixed volume. They expand to fill their container.

Name: _____ 6

Curriculum Connection
C2.1

Particle Theory Questions

True or False

Circle whether the statement is true or false

1) All matter is made of particles	True	False
2) Temperature affects how fast particles move	True	False
3) In solid matter, particles are further apart	True	False
4) When m heats up, the atoms move slower	True	False
5) In gase es expand and fill their container	True	False

Questi g

stions do you have after reading the information?

1)	
2)	
3)	

Explain

List the properties of each state of mat

State of Matter	Properties of the State of Matter
Solid	
Liquid	
Gas	

PREVIEW

Name: _____ 7

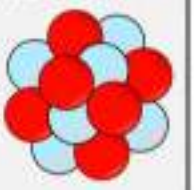
Curriculum Connection
C2.1

Particle Theory

Particle Theory
The **particle theory** states that all matter is made up of tiny particles that are constantly moving. The speed the particles move depends on which state of matter they are in.

Solids
Particles in solids are held tightly together. They are strongly attracted to each other, meaning they move slowly. These particles vibrate instead of move, but they are not still.

Liquids
Particles in liquids are fairly close together with some attraction between them. They move in all directions, but they can't move too far because they are attracted to the particles near them.



Gases
Particles in gases have very little attraction between them. They move rapidly in all directions. They collide with each other and the walls of the container they are in.

PREVIEW

Fill in the Blanks

Fill in the blanks using words from the word bank

Small	Particles	State	Moving	Matter
Gas	Solid	Liquid	Space	Weakest

All things we can touch are made up of _____ particles called _____ compounds that make up _____. The particle theory states that all particles are _____ constantly. They move faster based on which _____ of matter they are in. Particles in _____ have the strongest attraction between particles in _____ have the _____. Particles in _____ are fairly close together. The _____ the attraction, the less the particles will move, like in solids.

Part 2

Add particles (dots) to the beakers to represent which state of matter it is



Gas **Liquid** **Solid**

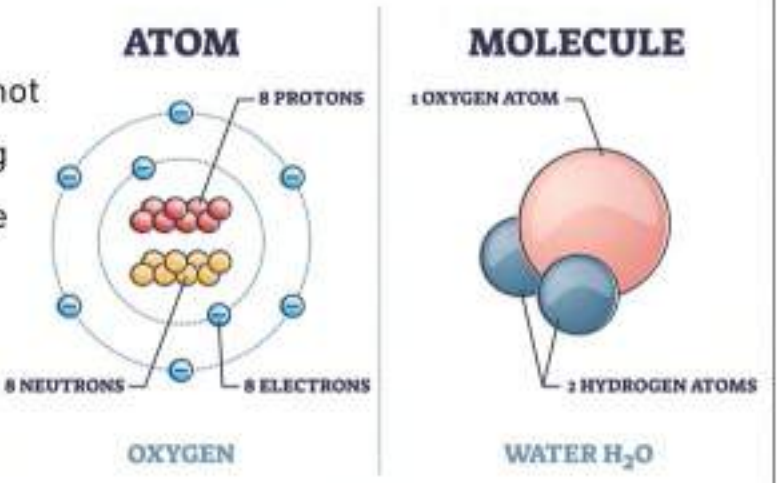
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Name: _____ 8

Curriculum Connection
C2.2, C2.8

Atoms, Molecules and Pure Substances

Atoms vs Molecules



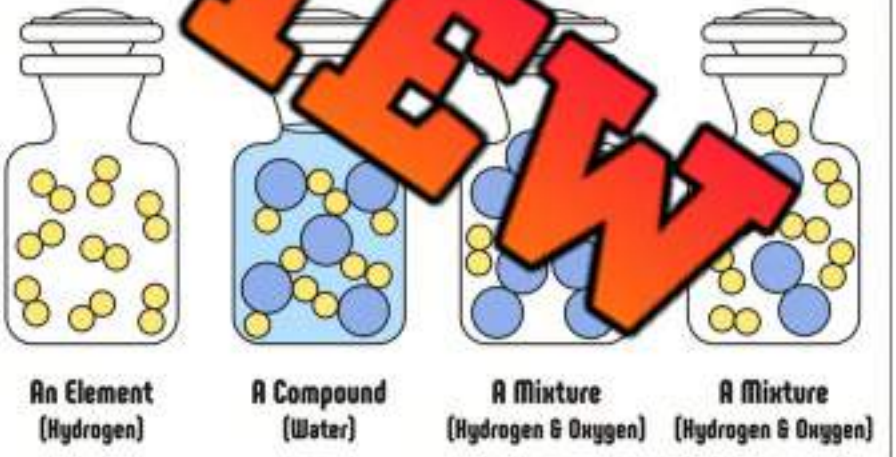
Atoms are the smallest particles. They cannot be divided further, and they are the building blocks of matter. **Elements** are either single atoms or two or more of the same type of atoms bon[illegible]ether. For example, hydroge[illegible] that is made of two h[illegible]

A **molecul**[illegible] a[illegible]s bonded together. Therefore, hydrogen is a molecule because it is ma[illegible] hydro[illegible]. In fact, hydrogen is the smallest molecule!

A compound is a[illegible] w[illegible] se compounds have more than two atoms bonded together. However, t[illegible] ffer[illegible]n an element and a compound is that **compounds** are made of two or more different elements that are combined. Water is a compound because it is made of two different elements (hydrogen and oxygen) that are bonded together. Water has two hydrogen atoms combined with one oxygen atom.

PREVIEW

[illegible]ents [illegible]ounds and Mixtures



Pure Substances

All matter is either a pure substance or a mixture. A **pure substance** is made of just one element or one compound, while a **mixture** has more than one element or compound. Hydrogen is a molecule that is a pure substance because it is made of just one element. Water is a pure substance because it is made of just one compound. Other examples of pure substances are sugar, table salt, baking soda, aluminum and gold.

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Name: _____ 9

Curriculum Connection
C2.2, C2.8

Atoms, Molecules and Pure Substances

Define

What do the terms below mean? Give an example of each

	Definitions	Example
Atom		
Molecu		
Element		
Compound		
Pure Substance		
Mixture		

PREVIEW

Draw

Draw a diagram of each of the terms below

Atom	Molecule	Element	Compound	Pure Substance	Mixture

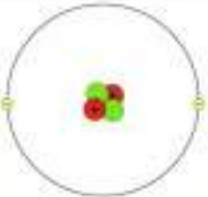
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Name: _____ 10

Curriculum Connection
C2.2, C2.8

Atom or Molecule

Classify Is the description an atom or molecule? Also, is it an element or compound?

1)	One chlorine atom	Atom	Molecule	Element	Compound
2)	Two atoms bonded together	Atom	Molecule	Element	Compound
3)	Five [illegible] bonded together	Atom	Molecule	Element	Compound
4)	Wa[illegible]ydrogen, 1 oxygen	Atom	Molecule	Element	Compound
5)	[illegible]ment w[illegible]e atom	Atom	Molecule	Element	Compound
6)	One sulfu[illegible]	Atom	Molecule	Element	Compound
7)	 Hydrogen	Atom	[illegible]olecule	Element	Compound
8)	Hydrogen  Hydrogen Oxygen	Atom	Mo[illegible]	Ele[illegible]	Compound
9)	Oxygen  Oxygen	Atom	Molecule	Element	Compound
10)	 Helium	Atom	Molecule	Element	Compound

PREVIEW

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Name: _____ 11

Curriculum Connection
C2.2, C2.3

Mixtures

Mixtures



Matter is most often a mixture. A **mixture** contains two or more types of elements or compounds. In a mixture, no chemical reaction takes place between the particles. The different el[illegible]ts or compounds do not bond toge[illegible]ically.

[illegible]rent proportio[illegible] and th[illegible]ve a fixed ratio. When you [illegible] cereal [illegible] milk, you are making a mixtur[illegible] you are in control of how [illegible] you add compared to the cereal. milk and cereal have separate elements [illegible]ompou[illegible]xtures can be separated by physical means. You can strain the milk from the [illegible]easil[illegible]

Mixtures can be homogenous mixtures or he[illegible]ge[illegible] difference between the two types of mixtures is how well they are [illegible]

PREVIEW

Heterogenous Mixtures

Heterogenous mixtures are made up of two or more types of particle[illegible]fro[illegible]e or feel the different types of particles. For example, cereal in milk as well as oil a[illegible] water.

Heterogenous mixtures are not uniform. If you take a sample from different parts of the mixture, the sample will not have the same composition. You can separate components of a heterogenous mixture. For example, you can pick the cereal out of the milk, or you can allow the oil to float to the top of the water and skim it off.

Homogenous Mixtures

Homogenous mixtures are made of two or more types of particles but look like only one type of particle. For example, apple juice, sugar and water, blood, and sports drinks.

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Name: _____ 12

Curriculum Connection
C2.2, C2.3

Mixtures

Questions

Answer the questions below using evidence from the text

1) What is a mixture? Give two examples of mixtures.

2) What is the difference between heterogenous mixtures and homogenous mixtures?

PREVIEW

Making Connections

Give examples of homogenous and heterogenous mixtures you know

Homogenous Mixtures	
Heterogenous Mixtures	

True or False

Circle whether the statement is true or false

1) A mixture cannot be separated as the particles are chemically bonded	True	False
2) Cereal and milk is a homogenous mixture	True	False
3) A salad with different vegetables is a heterogenous mixture	True	False
4) Lemonade is a homogenous mixture	True	False
5) Water is a mixture of hydrogen and oxygen	True	False

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Name: _____ 13

Curriculum Connection
C2.2

Classification of Matter by Composition

Matter can be classified by its state: solid, liquid or gas. Matter can also be classified into two categories: pure substances or mixtures. When you look at a teaspoon full of sugar you can see that all the parts are the same. Sugar is a pure substance. In pure substances there is only one kind of particle (one kind of element or compound). Every part of the substance has the same composition as every other part.

Mixtures are made of two or more substances. In some mixtures like pizza, we can see the different ingredients and easily separate the pepperoni from the pizza. In other mixtures, such as soft drinks, you cannot see the individual parts. You can taste the sugar, but you cannot separate it separately as it is a homogenous mixture.

Infe t is your prediction?

Can you separa th er ingredients in a soft drink? Explain.

Classify Are the substances b pure substances? Explain

Substance	Classification	Reasons for Classification
Sugar	Pure substance	Sugar has on e compound)
Air		
Baking Soda		
Table Salt		
Soft Drink		
Mud		
Silver		
Carbon Dioxide		
Coffee		

PREVIEW

Name: _____ 14

Curriculum Connection
C2.3

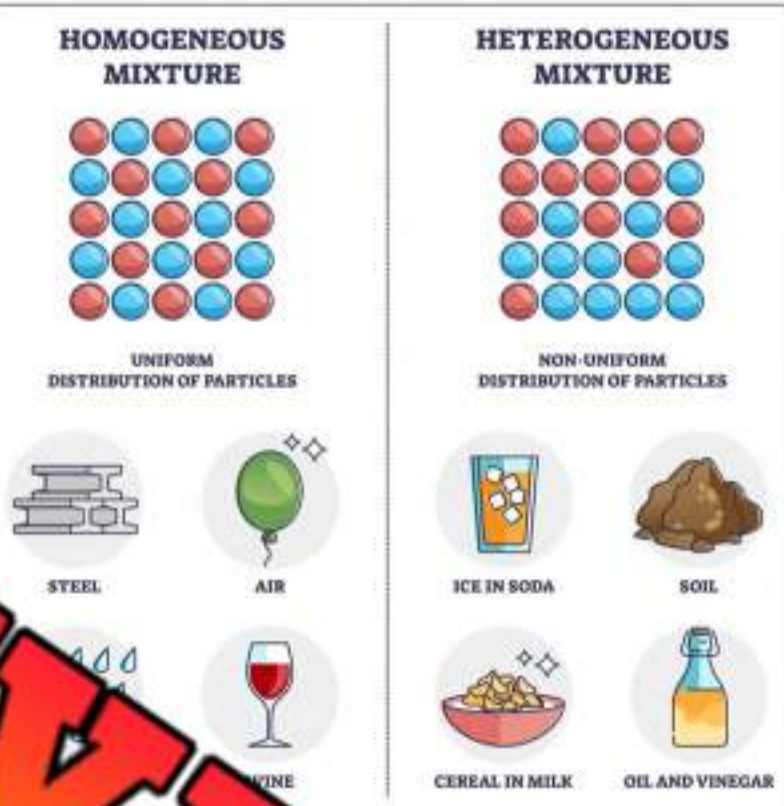
Homogenous vs Heterogenous Mixtures

Heterogenous vs Homogenous Mixtures
A homogenous mixture is uniform, meaning the matter looks the same throughout. Steel, air, rain, and wine are all homogenous mixtures because they look the same throughout and they are made of more than one type of particle.

If you took part of the mixture out, it would be the same as the rest of the mixture. The particles are arranged in a uniform way where they blend together.

A heterogeneous mixture is different. It is not uniform, meaning particles are not blended. Instead, particles can be arranged in a non-uniform way.

If you took a spoonful of a heterogenous mixture, it will likely be different than the rest of the mixture. For next...



PREVIEW

Activities Draw a diagram of the mixtures. The... which... ...ture the example is

Heterogenous Mixture					

Homogenous Mixture					

...	...xture Type
Sandwich	
Black Coffee	
Milk	
Pizza	
Ketchup	

Examples Write your own examples of heterogenous and homogenous mixtures

Homogenous	
Heterogenous	

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Name: _____ 15

Curriculum Connection
C2.3

Homogenous vs Heterogenous Mixtures

Mixtures Is the mixture heterogenous or homogenous?

1)



Heterogenous | Homogenous

2)



Heterogenous | Homogenous

3)



Heterogenous | Homogenous

4)



Heterogenous | Homogenous

5)

Blood



Heterogenous | Homogenous

6)



Heterogenous | Homogenous

7)



Heterogenous | Homogenous

8)



Heterogenous | Homogenous



Heterogenous | Homogenous

10)



Heterogenous | Homogenous

11)



Heterogenous | Homogenous

12)

Drink with ice



Heterogenous | Homogenous

PREVIEW

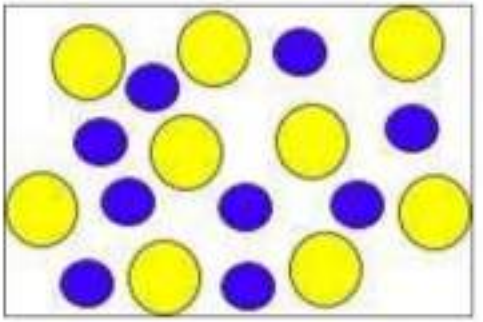
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Name: _____ 16

Curriculum Connection
C2.3

Mechanical Mixtures

Mixtures



Mixtures are made of two or more substances that are not chemically combined. They are combined physically and the substances combined together retain their original chemical identity. Mixtures can be in the form of solids, liquids, and/or gases, in any combination.

An example of a liquid mixture is vinegar and water. These will form a homogenous mixture because you will be able to see the individual components. Two solids, salt and sand will form a heterogenous mixture. You will be able to see each component even after you mix them together. Brass is a homogenous mixture of copper and zinc.



Soft drinks are a mixture of all three states of matter. A liquid, water, is mixed with a solid sugar and flavouring that could be solid or liquid. These ingredients are mixed with carbon dioxide, a gas, to give the drink bubbles. Air is a mixture of gases including nitrogen, carbon dioxide and oxygen.

PREVIEW



Mechanical Mixtures

Mixtures can be classified as mechanical mixtures or solutions. Mechanical mixtures are heterogenous mixtures. You can see the components after you have combined the components. When you make a salad, you combine the ingredients, but you can still see them separately and they maintain their own properties.

The oil and vinegar salad dressing you use on your salad is also a heterogenous or mechanical mixture because the components don't mix, they maintain their own properties.

Another example of a mechanical mixture is asphalt. The components, gravel, sand and bitumen form together and make a strong solid road surface, however, you can still see the individual components of the asphalt.

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Name: _____ 17

Curriculum Connection
C2.3

Mechanical Mixtures

Questions

Answer the questions below using evidence from the text

1) What is the difference between a solution and a mechanical mixture?

2) What [illegible] that you have made? Were they homogenous or heterogenous mixtu[illegible]

PREVIEW

Visualizing

Draw what you were pic[illegible]hile v[illegible]e reading. Explain the picture

True or False

Circle whether the statement is true or false

1. Solutions are mixtures.	True	False
2. Mixtures can be made with different combinations of solids, liquids and gases.	True	False
3. Mechanical mixtures are homogenous mixtures	True	False
4. Mixtures are made of 2 or more substances that are chemically combined.	True	False
5. Oil and vinegar are a homogenous mixture.	True	False

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Name: _____ 20

Curriculum Connection
CZ 4

Solutes and Solvents

Solute
A **solute** is the substance that is being dissolved into the other substance. Salt is a solute because it dissolves into water.

Solvent
A **solvent** is the substance that dissolves the other substance. Water is a solvent because it allows the salt to dissolve into it.

Label the Diagram



Solution Solute olv ous Heterogenous

Dissolving
All solutions are made of a solvent and a lute. Fo xtu e a solution, the solute needs to dissolve into the solvent. When we mal xture stances, we do not always get a solution because sometimes the so ill n the solvent.

Dissolving happens when the larger crystal or pa hin a breaks up into smaller groups or individual particles. This break do ticle esult of coming into contact with the solvent. The particles of the so hen evenly and mix with the particles of the solvent. This leads to a hom nat all looks the same.

PREVIEW

Explain Answer the questions below



What is happening in this picture? Look at the food colouring and explain using the following terms: solute, solvent, dissolving, homogenous.

_____

_____

_____

_____

Name: _____ 22

Curriculum Connection
C2.6

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 k king down and carrying va emicals, minera

W s the b

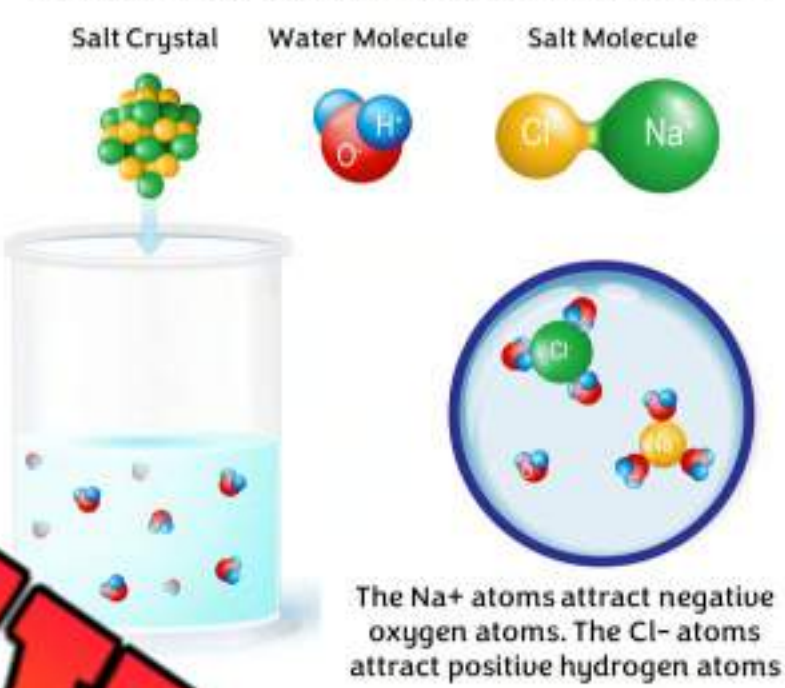
because of its o posi

Water molecules are mad

two hydrogen atoms and o te

atom. This gives them a positive ica hydrogen side and a negative electrical charge on their oxygen side. Si posite s attract, water molecules can attract many other different types of molecules as i both

How Does Salt Dissolve in Water



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

PREVIEW

Saltwater – Dissolving Salt in Water

Water is so heavily attracted to other substances, like sa ill b down and dissolve the other substance, changing its chemical compositi Whe water, the salt molecule made of one sodium and one chlorine atom This 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: _____ 23

Curriculum Connection
C2.6

Universal Solvent - Water

Questions

Answer the questions below using evidence from the text

1) Why is water considered the universal solvent?

2) Why d[illegible]s [illegible]into water?

PREVIEW

Diagram

Draw diagra[illegible]of e[illegible]iptions below

Water Molecule	**Salt Molecule**	**Salt-Wa[illegible] Molecule**

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

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Name: _____ 24

Curriculum Connection
CZ 4

Factors Affecting Solubility

Factors Affecting Solubility

Solubility is a term used to describe how well a solute will dissolve into a solvent. Sand has no solubility in water but salt is soluble in water. There are a few factors that impact the solubility of a solute.



1) Concentration

The **concentration** of a solution is how much solute there is compared to the amount of solvent. When we mix hot chocolate powder with water, the more solute (chocolate powder) we add to the solvent (water or milk), the stronger the concentration. You can **dilute** a solution by adding more solvent.

The higher the concentration, the less soluble the solute becomes. This is because there is a limit to how much solute that can be dissolved into the solvent. Picture trying to dissolve a large amount of hot chocolate powder into a small amount of water. You will likely see clumps of powder that don't dissolve to make the solution.

2) Temperature

The **temperature** of the solvent affects solubility when we heat up a solvent, it can dissolve more solute material and less gas (carbon dioxide). The higher the temperature of the solvent, the faster the particles of the solvent move. More movement of solvent particles causes more collisions between particles causing the solute to break down faster.



When the temperature of the solvent increases, the space between solvent particles get bigger. This leaves more room for solute particles.

3) Pressure

Pressure can also affect solutions. We see this with soda as we can dissolve gas under higher pressure. A can of soda has water (solvent) and carbon dioxide (solute) in a pressurized can to allow more carbon dioxide to dissolve into the solvent. This gives our soda more fizz.

4) Size

The **size** of the solute particles affects the dissolving process. If you take a teaspoon of sugar and stir it into water, it will dissolve quickly. If you take a sugar cube and stir it into water, it will take longer to dissolve.



This is because the solvent can only dissolve the outside surface of the solute. In the sugar cube, the outside surface protects the sugar inside from being dissolved. With a powder, the solvent can dissolve each individual grain of sugar all at once.

PREVIEW

Name: _____ 29

Curriculum Connection
C2.4, C2.5

Kinetic Energy in Solutions - Questions

Questions

Answer the questions below using evidence from the text

1) What does kinetic energy mean? Do solutions have kinetic energy?

2) How d ure and the state of matter of a substance affect its kinetic energ

PREVIEW

Making Connections

What d read ind you of in your life?

True or False

Circle whether the statement is true or false

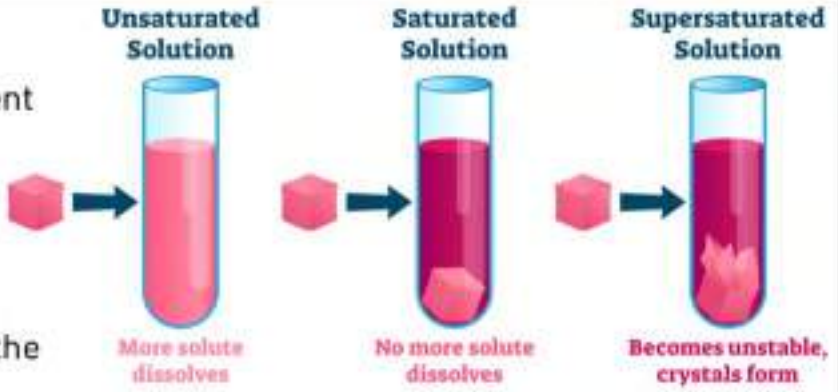
1. Gas has less kinetic energy than liquids	True	False
2. Kinetic energy is the energy of movement	True	False
3. The higher the temperature of a substance, the more kinetic energy it has	True	False
4. Cold oil has more kinetic energy than warm oil	True	False
5. The particles in a solid have no kinetic energy	True	False

Name: _____ 30

Curriculum Connection
C2.5

Saturation

Saturation



The solubility of a substance in a solvent is measured by the concentration of the saturated solution. A solution is considered **saturated** when adding additional solute no longer increases the concentration, at a particular temperature.

For example, if we stir sugar into a glass of iced tea, we will get to a point where additional sugar will not dissolve in the iced tea. Instead, the sugar will drop to the bottom of the glass because the iced tea is saturated with sugar. There is no more room between the iced tea particles to dissolve more sugar.

If more solute can be dissolved in a solution at a given temperature, then the solution is unsaturated. You can dissolve more sugar in an unsaturated solution.

PREVIEW

Saturated and Supersaturated Solutions

In the diagram above, you can see in the unsaturated solution that when adding more solute, it dissolves to make a more concentrated solution. The solution is saturated, no more solute can dissolve, so the solute rests at the bottom of the solute because it is heavier than the liquid.



A **supersaturated solution** happens when we heat up a saturated solution and add more solute to the solvent. While the solution is hot, it will allow more solute to dissolve into the solvent. But as the solution cools, the stable solute becomes unstable and begins to form crystals. You may see this in a jar of honey that has been refrigerated. When they honey is made, it is hot, allowing more sugar to dissolve in the solution, but as it cools, the sugar becomes unstable and forms crystals. If you heat the honey again, it will likely lose its crystals.

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Name: _____ 31

Curriculum Connection
C2.5

Saturation

Define

What do the terms below mean?

Unsaturated Solution	
Saturate Solutio	
Supe Solu	

PREVIEW

Questions

swe below using evidence from the text

1) What is the difference bet nsa saturated solution?

2) How do you make a supersaturated solution?

True or False

Circle whether the statement is true or false

1) We can dissolve more solute in a saturated solution	True	False
2) We can dissolve more solute in an unsaturated solution	True	False
3) We can heat up a saturated solution and dissolve more solute in it	True	False
4) A supersaturated solution will crystalize when cooled	True	False
5) The solute we add to a saturated solution will float if it weighs more than the solvent	True	False

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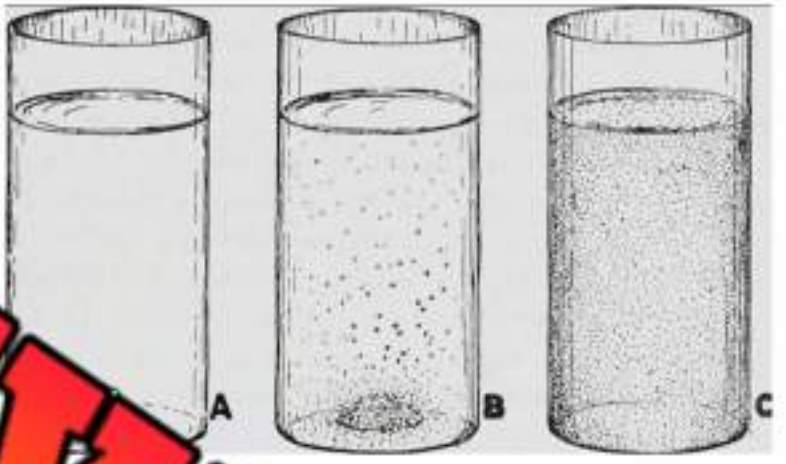
Curriculum Connection
C2.3

Heterogenous Suspensions

What is a Suspension?

A **suspension** is a mixture of a liquid and particles of a solid. A mixture is considered a suspension if the particles in the liquid do not dissolve. Instead, the particles become dispersed throughout the liquid after they have been mixed. They are "suspended" in the liquid.

Over time, the particles will settle at the bottom. An example of a suspension mixture is sand and water. When we stir sand into water, the sand will disperse throughout the water. If you leave the sand and water mixture alone, the sand will eventually settle to the bottom because it is heavier than water (it weighs more).



PREVIEW

Check it out

In figure A above, the liquid and the solid particles are both visible. The mixture has not been stirred yet. In figure B, the stirring has begun, and the particles are beginning to disperse throughout the liquid. In figure C, the mixture has been completely mixed and the particles are now evenly dispersed throughout the liquid. This is a suspension because if we left this mixture long enough, the particles would settle again at the bottom of the liquid, just like in figure A.

Heterogenous Suspensions – Not Solutions

A heterogenous suspension is not a solution because it is a mixture. The one substance has not been dissolved into the other substance. Therefore, we can easily separate the two substances using physical methods, like using a strainer.

Another example would be when we mix flour with water. The flour will be suspended in the water, creating a mixture, not a solution.



Flour and Water Suspension

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Curriculum Connection
C2.3

Heterogenous Suspensions

Questions

Answer the questions below using evidence from the text

1) Why is a heterogenous suspension considered a mixture and not a solution?

2) Why is [illegible] considered a heterogenous suspension?

PREVIEW

Diagram

Draw a diagram of [illegible]sion. Label the substances used

Before Stirring	**After Stirring**	**After a [illegible]od of Time**

True or False

Circle whether the statement is true or false

1. A suspension is a solution	True	False
2. A suspension is a mixture between a liquid and the particles of a solid	True	False
3. In a suspension, the particles of a solid will settle after a period of time	True	False
4. Milk is an example of a suspension	True	False
5. It's called a suspension because the particles float in the liquid	True	False

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Curriculum Connection
C2.3

Heterogenous Colloids

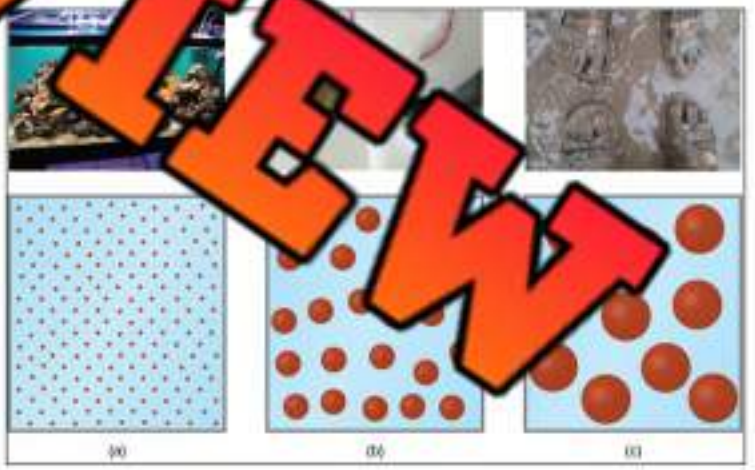
What is a Colloid?

A **colloid** is a mixture where very small particles of one substance are evenly distributed through another substance. A colloid mixture looks like a solution because the small particles appear to dissolve into the other substance. This is not the case however, as the particles are floating or suspended in the other substance, even if you cannot see it with your eyes.

A colloid is similar to a suspension except for the fact that in a colloid, the particles do not eventually settle to the bottom. The particles in a colloid will stay suspended or floating.

Colloids can be mixtures of liquids or gases. An example of a liquid colloid is milk. Milk has butterfat globules dispersed and suspended in water. No matter how long you leave milk, the globules will not settle. Fog is an example of a gaseous colloid mixture as particles are suspended in the air.

PREVIEW



Check it out

In figure A, the water is a colloid of tiny particles (minerals) mixed in the liquid water. In figure B, the water in the milk is mixed with the butterfat globules that are slightly larger particles than the minerals in figure A. In figure C, the mud is a colloid mixture of water and soil. The soil particles are even larger than the butterfat globules, but they will not settle regardless of how long the mixture sits.

Examples of Colloids

- Mayonnaise – when the egg yolks and oil are mixed, they form a stable mixture that won't separate.
- Perfume – the spray contains gases and liquids that mix together and do not separate

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Curriculum Connection
C2.3

Heterogenous Colloids

Questions

Answer the questions below using evidence from the text

1) What is the difference between a suspension and a colloid?

2) Why i[illegible]

PREVIEW

Visualizing

Draw what you w[illegible] pict[illegible] were reading. Explain the picture

True or False

Circle whether the statement is true or false

1. Colloids are the exact same as suspensions	True	False
2. Colloid mixtures do not settle regardless of how long they sit	True	False
3. A colloid can be a mixture of solids, liquids, or gases	True	False
4. Sand mixed with water is a colloid	True	False
5. In a colloid mixture, the particles must be evenly distributed	True	False

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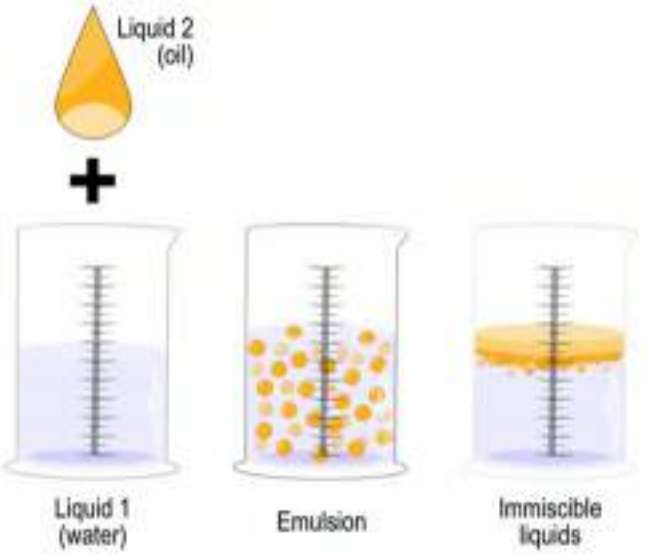
Name: _____ 37

Curriculum Connection
C2.3

Heterogenous Emulsions

What is an Emulsion?

An **emulsion** is a heterogenous mixture of two or more liquids, where one ends up as very tiny droplets inside the other. The liquids are usually not mutually soluble, which means they do not mix completely.



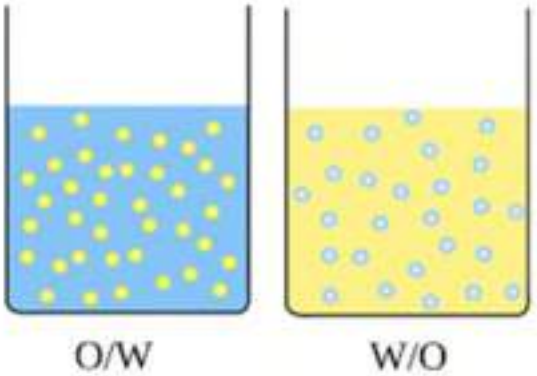
For example, we add water to a bottle containing oil and notice that after some shaking, the water will not dissolve into the oil, instead appear as bits and pools in the oil.

When you leave the mixture alone, the liquid with the higher density will sink to the bottom. In oil and water, the water has a higher density, so it will sink to the bottom. Since the oil is lighter with a lower density, it rises to the top. These two liquids are **immiscible**, meaning they cannot be used to create a homogenous solution.

PREVIEW

Oil and Water Emulsions

Most of the emulsions contain water as one of the two liquids. For this reason, emulsions are classified into two categories: (1) oil-in-water and (2) water-in-oil. **Oil-in-water** emulsions mean water is the main liquid and an oil liquid is being mixed into the water. **Water-in-oil** emulsions mean that oil is the main liquid with water being mixed into the oil.



Check it out

The image on the left shows how oil and water interact with each other. The O/W beaker shows the oil-in-water type of emulsion, and the W/O beaker shows the water-in-oil mixture. Both are emulsions as they do not mix well enough to resemble suspensions or colloids.

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Curriculum Connection
C2.3

Heterogenous Emulsions

Questions

Answer the questions below using evidence from the text

1) What would happen to the O/W beaker if we left it for awhile? Which liquid would rise?

2) Wh[illegible]vide an example of one emulsion.

PREVIEW

Diagram

Draw 2 diagrams of [illegible]hel the liquids in the emulsions



True or False

Circle whether the statement is true or false

1. An emulsion is a homogenous mixture where two liquids dissolve evenly	True	False
2. An emulsion is a mixture where two liquids do not mix completely	True	False
3. The two main liquids in an emulsion are water and oil	True	False
4. The liquid with a higher density in an emulsion will rise to the top	True	False
5. An emulsion is a mixture of a liquid and tiny particles of a solid	True	False

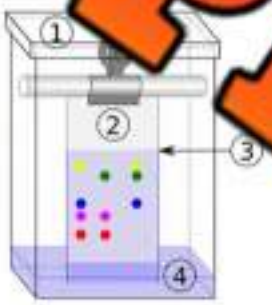
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Curriculum Connection
C2.7

Separating Mixtures

Separating Mixtures
Many of the substances we use everyday were once part of a mixture. Humans have been separating mixtures for many years. In ancient history, industrious humans separated metal from ore to make tools and weapons. Read below to learn more about some of the common separation processes.

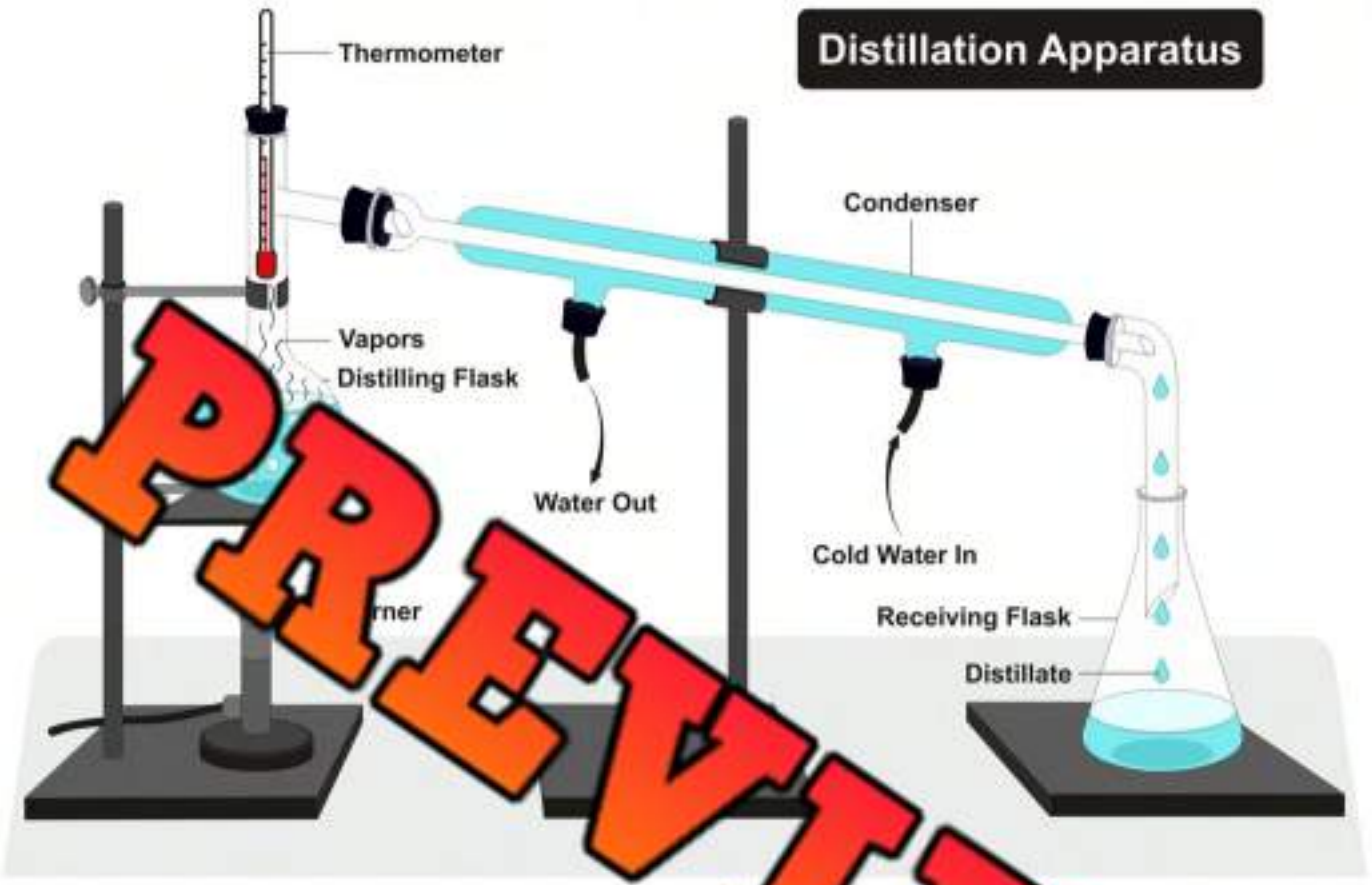
Separation Proce	How It Works
Pap Chrom  	This method is commonly used in the food industry. It is used to ine how many substances are in a mixture and what the es are. The process works like this: ear mixture on filter paper tace r in a solvent. The various substances that make up th ll be attracted to the solvent at different rates, w the different substances in the mixture 3) r d pap w the separated substances attached to th
Filtration 	Filtration is used to arate in te s from a liquid. We use filtration in water treatmen when ter from rivers is filtered to remove solid pa To fi e use filter paper to allow only the water to pou paper olid particles cannot pass through the paper, wh they ttered out and separated from the liquid.
Evaporation 	Evaporation is often used to separate a homogenous on. When salt has dissolved into a liquid, we can evaporate the id to separate the salt again. Evaporation occurs when we heat the liquid to its boiling point. The liquid becomes a gas and when all the liquid has evaporated, the solid particles remain. We can use **simple distillation** to collect the evaporated water (condensation) to enjoy clean water.
Magnetism 	Magnetism is ideal for separating a mixture of two solids with one part having magnetic properties. If we mixed sand and iron together, it would be difficult to pull all the little pieces of iron out manually. Instead, we could use a magnet to attract the iron pieces out of the sand, leaving only the sand remaining.

PREVIEW

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Curriculum Connection
C2.7

Separating Mixtures - Distillation



PREVIEW

Distillation

Distillation allows you to separate the solute from the [illegible] a solu[illegible]uring the distillation process, the solution is boiled. This vaporizes the [illegible]ent [illegible]gas) and separates it from the solute. The solute remains in the original [illegible]

Then the solvent gas rises and condenses on a relatively cool surfa[illegible]led the condenser. The condenser collects the vapour which creates water droplets that travel down the condenser tube before dropping into the receiving flask. The drops are called the distillate, which will now be the solvent. At this point, the solvent has been separated from the solute as the solute will be the only thing remaining in the original flask (distilling flask).

Some types of bottled water are created by distillation. This process is common when creating drinking water from salt water, also called desalination. Distillation removes the salt (solute) from the water (solvent).

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C2.7

Separating Mixtures - Distillation

Questions Answer the questions below using evidence from the text

1) What does distillation mean? How does it work?

2) Explain why separating a solid mixture is often easier than separating components of a solution.

3) A chef is cooking a stew and it is too watery. What filtration technique could they use to separate some of the water from the stew? Do they need to use distillation? Explain.

PREVIEW

Diagram Draw a diagram of the distillation process

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Curriculum Connection
C2.2, C2.8

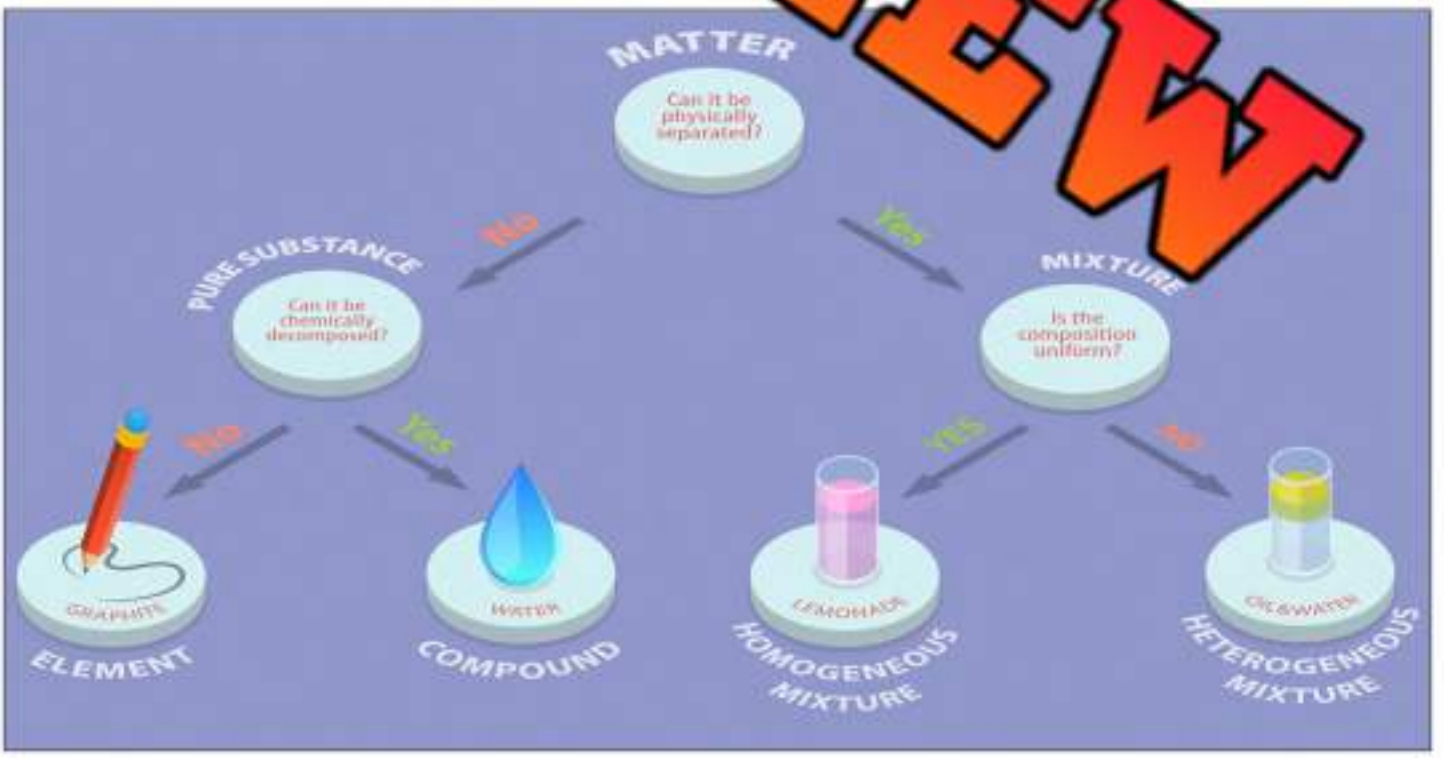
Identifying and Classifying Matter

Classifying Matter

The flow chart below helps us classify matter into pure substances or mixtures. It can also be used to further classify matter into elements, compounds, homogenous mixtures, or heterogenous mixtures. Follow along below.

1) Can the matter be physically separated? Can you use methods like evaporation, filtrat[illegible]illation, or chromatography to separate the substances? A simple exa[illegible]eparating water from salt by evaporating the saltwater solution a[illegible]nsation that is just water. The salt will remain in the container. This means [illegible] physically separated. If the matter can be separated physically, it [illegible]ure. If [illegible] pure substance.
2) Can the pure subst[illegible]mposed? Can you separate the compound into only one element? [illegible] yo[illegible]e an element. If yes, it is a compound that can be separated into elements.
3) Is the mixture uniform? Does it look [illegible]same th[illegible]hou[illegible]es, the mixture is homogenous. If not, the mixture is heterog[illegible]

PREVIEW



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Curriculum Connection
C1.1

Producing Carbon Dioxide

What is Carbon Dioxide?

Carbon dioxide is a colourless gas that has a sharp odor and a slightly sour taste. Carbon dioxide makes up 0.03 percent of the air in our atmosphere. It is a very important gas that plants need in order to produce the food they need to survive.

Producing Carbon Dioxide



Carbon di be produced in a number of dif ed when carbon-containi materi gasoline, are burned with pl gen in ve the fire. This happens w e b vehicles.

You can also produce car diox ids and liquids. For example, mixing baking soda and vinegar togeth produc al reaction that produces carbon dioxide gas into the atmosphere. You ma witne when building a volcano experiment and mixing the two substanc en ing volcano.

Carbon Dioxide Solutions

When we create a solution using carbon dioxide and water, the solu onic acid. Carbonic acid is used in soft drinks to give carbonation and fizz to th . When you open the soft drink, the fizz you hear is the carbon dioxide separating from the liquid into our atmosphere.

Aerosol cans also use carbon dioxide. They are called chlorofluorocarbons (CFCs). The gas is used to create pressure inside the can. The liquid in the can (perfume, whipped cream, bug repellant, cleaning) is mixed with the carbon dioxide gas so that when you press the button, the gas and liquid solution is released into the atmosphere. This is why we shake aerosol cans before we use them. CFCs are adding more carbon dioxide into our environment and are contributing to global warming.

PREVIEW

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Curriculum Connection
C1.1

Producing Carbon Dioxide

Questions

Answer the questions below using evidence from the text

1) How is carbon dioxide made by forming a solution?

2) How [illegible] to make solutions we use in our lives?

PREVIEW

Making Connections

What do [illegible] mind you of in your life?

True or False

Circle whether the statement is true or false

1) Carbon dioxide will not form a solution with water	True	False
2) Carbon dioxide is produced when vinegar and baking soda are mixed	True	False
3) A soft drink has carbonic acid – a solution of carbon dioxide and water	True	False
4) CFCs are good for the environment	True	False
5) Carbon dioxide released into the atmosphere causes global warming	True	False

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Environmental Effects of Pure Substances

Pure Substances – Elements and Compounds

Humans have benefitted from the use of pure substances since the beginning of time. Remember that all elements and compounds are pure substances. Examples of pure substances are iron, diamond, sugar, salt, gold, and aluminum. To get these pure substances, they need to be mined and then refined.



Mining

Most pure s are found in the ground, where they need to be r ra om the Earth. Mining is either done in open p r und hile pure substances are needed to build the thin n ou he process of mining harms our environment.

Mining for gol en mines. When it rains, groundwater runs over the ground that has been d the ctivity. The groundwater picks up elements such as mercury, cadm and it over fields where crops are grown and into lakes and rivers. Plants a ine life hese poisonous elements and when people eat the fish and plants, they also ing se po elements.

Refining Pure Substances



Pure substances don't usually occur in their pure form in in order to obtain pure substances, people must refine the raw materials they are found in. **Refining** is a process used with metals to separate the desired material from the impurities surrounding them.

For example, when gold is mined from the earth, it isn't found in its pure form. Instead, it is mixed with other elements, usually zinc, copper, silver, and iron. To refine the gold, it is often put into a mixture of hydrochloric acid and nitric acid. The result is the other elements separate from the gold so they can be removed, leaving 99.999% pure gold.

The refining process uses acids that are bad for the environment. When an acid has been used, it becomes waste. The acid waste pollutes water, affecting our drinking water and the habitats for marine animals. Producing gold for one wedding ring generates 20 tons of waste.

PREVIEW

Name: _____ 50

Curriculum Connection
C1.1

Environmental Effects of Pure Substances

Questions

Answer the questions below using evidence from the text

1) What two processes need to happen to get pure substances from the Earth and to make them usable for humans?

2) Wh... Why is gold refining bad for the environment?

PREVIEW

Making Connections

What do... ...ind you of in your life?

True or False

Circle whether the statement is true or false

1) Gold refining uses acids that pollute our water	True	False
2) Open pit mining only affects the habitats on land	True	False
3) When it rains over an open pit, the groundwater gets polluted	True	False
4) Getting pure substances from the Earth isn't harmful to the environment	True	False
5) Gold is found in its pure form underground	True	False

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Curriculum Connection
C1.1

Research Assignment - Uranium



Uranium is a pure substance that is radioactive. Learn more about the benefits and drawbacks to using uranium by answering the questions below.

Questions | Answer the questions below

1) What is uranium used for?

2) Where is ura[illegible]low[illegible]extracted from the Earth?

3) Why is uranium harmful to humans?

4) What are the benefits of using uranium?

PREVIEW

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Curriculum Connection
C1.1

Research Assignment - Uranium



Questions Answer the questions below

5) How do people dispose of uranium? Why is this a problem?

6) How t[illegible] does [illegible] radioactive? Why is this a problem?

7) Do nuclear power stations create air pollution[illegible]in.

8) Do you think humans should continue to use uranium? Explain why or why not.

PREVIEW

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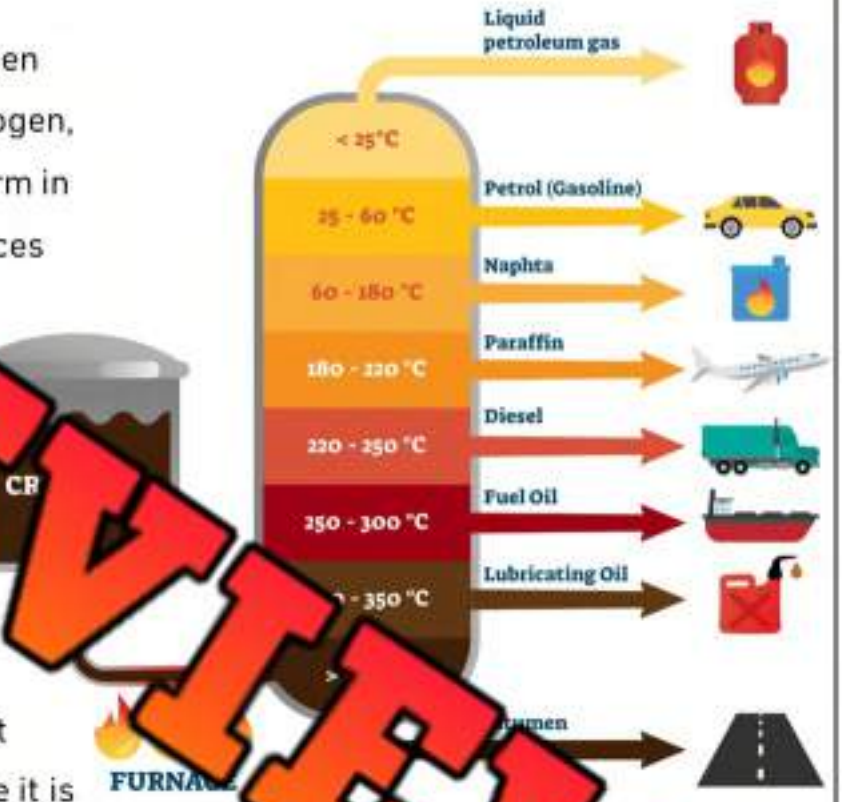
Curriculum Connection
C1.2

Refining Oil

Crude Oil

When oil is found in its natural form underground, it is called **crude oil**.

Crude oil is a mixture of mainly hydrogen and carbo[n] small amounts of nitrogen, sulfur, an[d] [i]t exists in liquid form in under[ground] [v]o[id]s the tiny spaces within s[edimentar]y [r]ock. In Canada, crude [oil] is [found] most[ly] in Alberta, where 42 [thousand] drilli[ng] [rigs] are pumping out crude oil [from] the ground.



PREVIEW

Refining Crude Oil

Crude oil is a dark and sticky liquid that cannot be used without refining it. Once it is refined, it is used to make bitumen for roads, lubricating oil, [engine] diesel, propane, and fuels for different machines (airplanes, ships, etc.).

Fractional Distillation of Crude Oil

To refine crude oil, a process known as fractional distillation is used. First, a furnace is used to boil the liquid crude oil. The vapours from the boiling crude oil rise into the next chamber, where they are heated at a different temperature. The only thing remaining is the parts of the crude oil that do not vapourize at that temperature.

As you can see from the graphic, liquid gas (propane) continues to vapourize as it is heated at lower and lower temperatures. Using the fractional distillation method allows crude oil to be used in many useful ways so nothing is wasted.

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Curriculum Connection
C1.2

Impact of Separating Mixtures - Maple Syrup

Impact of Separating Mixtures - Maple Syrup



To make maple syrup, sap from a maple tree needs to be collected. The sap is a mixture of sugar, water, and minerals. Almost all (98%) of tree sap is water, and the remaining 2 percent is almost all sugar. To make maple syrup, the sugar needs to be separated from the water.

Harvesting Maple Syrup

Maple syrup is made by collecting the sap from maple trees to evaporate the water content and leave the sweet syrup behind. To make one litre of maple syrup, you will need dozens of litres of sap.

The sap is a very dilute mixture of water to sugar, with 98% being water. Therefore, the ratio of sugar to water is only 2 parts to 98 parts, or 2%. To make maple syrup, the sap is heated up and boiled so that the water evaporates. As the water evaporates, the concentration of the mixture becomes less diluted with water and more concentrated with sugar. In fact, when the maple syrup is finished, it should be a mixture that is 66% sugar and 34% water.



The separation process is traditionally done in small sugar shacks that use wood burning stoves to heat the maple sap. The fuel used to create the heat needed to evaporate the mixture is usually wood.

When wood is burned, the fire produces carbon dioxide emissions that are bad for the environment. Carbon dioxide is a greenhouse gas that is thickening the blanket in our atmosphere. The thickening blanket is trapping extra heat that should be reflected back into space. The extra heat is causing global warming and climate change.

PREVIEW

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Curriculum Connection
C1.2

Impact of Separating Mixtures - Maple Syrup

Questions

Answer the questions below using evidence from the text

1) What is maple syrup? What is it made of?

2) What is [illegible] of making maple syrup? Is it good for the environment? Explain.

3) In sap, what is the solvent a[illegible] so[illegible]

Solvent	Solute

4) During the evaporation separation process, is th[illegible]ly the solute needed?

PREVIEW

True or False

Circle whether the statement is true or false

1) Sap is made of mostly sugar	True	False
2) Maple syrup has a higher concentration of sugar than sap	True	False
3) Sap is a mixture of sugar, water, and minerals	True	False
4) Sap is a pure solution	True	False
5) Maple syrup is a solution	True	False

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STEM INVESTIGATION AND COMMUNITICATION SKILLS

Pure Substances and Mixtures

PREVIEW





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Grade 7 Science Unit

Strand A - STEM Investigation and Communication Skills

	Curriculum Expectations	Pages That Cover the Expectations
A1.1	use a scientific research process and associated skills to conduct investigations	77 – 78
A1.2	use a scientific experimentation process and associated sk conduct investigations	65 – 70, 73 - 76
A1.3	u neering design process and associated skills to test devices, models, structures, and/or	71 – 72
A1.4	follow safety procedures during science ions, including wearing appropriate d clothing and safely using tools, inst d mat	65 – 76
A1.5	communicate their find usi chnology vocabulary and formats that ar iate cific audiences and purposes	65 – 76
A2.1	write and execute code in investigation hen modelling concepts, with a focus on plann programs	79, 81 - 82
A2.2	identify and describe impacts of coding and of emergi technologies, such as artificial intelligence systems, on everyday life, including skilled trades	
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	77 – 82
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	77 – 81
A3.3	analyse contributions to science and technology from various communities	77 – 80, 82

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Curriculum Connection
A1.2, A1.4, A1.5

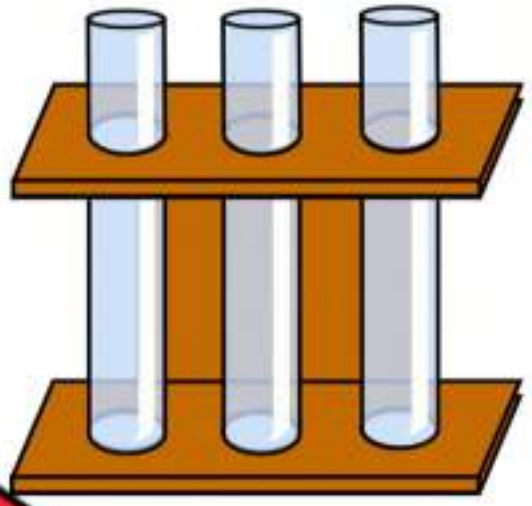
Homogenous and Heterogenous Mixtures

Information — What is this lab about?

Today we will be creating three homogenous and/or heterogenous mixtures using the materials listed below.

Materials — What you need for the experiment

1) Wate
2) 3
3) 1 ta spoon
4) 1 tablespo s
5) Vegetable oil
6) Stir stick
7) Food colouring (optional)



PREVIEW

Procedure — How you perform the expe t

Experiment 1: Water and Salt
1) Fill the test tube halfway with water
2) Add one tablespoon of salt
3) Stir and wait
4) Answer the questions on the backside of the page



Experiment 2: Water and Sugar
1) Fill the test tube about 1/2 full of water
2) Add one tablespoon of sugar
3) Stir and wait
4) Answer the questions on the backside of the page



Experiment 3: Water and Oil
1) Fill the test tube about 1/3 full of water
2) Add an equal amount of vegetable oil
3) Add one drop of food colouring for colour (optional)
4) Stir the oil and water
5) Answer the questions on the backside of the page

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Curriculum Connection
A1.2, A1.4, A1.5

Emulsions Lab

Information — What is this lab about?

We've all heard that water and oil don't mix, but what happens when we add them together slowly and mix?

Research Question

1. If we mix water (95% water), oil, and an egg together and mix it, will it mix together, or will it separate after mixing?

PREVIEW

Materials — What you need for the experiment

1. 1 mixing bowl
2. 1 wire whisk
3. 1 measuring cup
4. Measuring spoons
5. 2 plastic cups (for vinegar and oil)
6. 1 egg
7. 4 tsp of vinegar
8. 1 cup of vegetable oil



Procedure — How you perform the experiment

1. Add the egg and 1 tsp of vinegar to the mixing bowl
2. Beat the two ingredients using the whisk until it is slightly thick
3. Add oil, 1 tablespoon at a time, while continuously beating the mixture until 1/3 cup has been added
4. Add 1 teaspoon of vinegar and continue to beat the mixture
5. Repeat steps 2 and 3 until all of the liquids have been added

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Curriculum Connection
A1.2, A1.4, A1.5

Emulsions Lab

Hypothesis

What do you think will happen?

Do you think the ingredients will become a homogenous mixture (all look the same)? Or will the ingredients stay separate so we can see the ingredients in the mixture?

Results

Answer the questions below

1. Was your hypothesis correct? What happened to your mixture?

2. Why is this mixture an emulsion?

3. An emulsifier is an ingredient used often in cooking to stop liquid ingredients separating from each other. Emulsifiers are added to emulsions to make them more like solutions or colloids. Which ingredient do you think is the emulsifier in this experiment? Explain.

4. Why do you think emulsifiers are used in cooking? Explain with an example.

PREVIEW

Name: _____ 71

Curriculum Connection
A1.3, A1.4, A1.5

Lab - Making a Crystal

Information — What is this lab about?

Sugar crystals form when you mix boiling water and sugar. The sugar particles are in a crystalline structure, but we cannot see them. When we leave a solution of sugar dissolved in water uncovered, the water will evaporate, and the solution will become mostly sugar. As the wat ticles disappear, the sugar particles will find each other and join back into crystals. some solutions can be separated, through evaporation.

Mat s — at you need for the experiment

1) 3 cups sugar
2) 1 cup boiling wate
3) Food coloring (optional)
4) Flavoring (optional — cinnamon an peppermint will work)
5) Clean glass or plastic jar
6) Wooden skewer



Procedure — How you perform the experiment

1. Dissolve the sugar into the boiling water
2. Add a few drops of food colouring/flavouring if desired
3. Allow the solution to cool off a bit before pouring it into the jar
4. Pour the sugar solution into the jar. Place the wooden skewer into the jar with no lid
5. Place the jar somewhere where it won't be disturbed for a few days.
6. After a few days, you will begin to see crystal growth as the water evaporates.
7. Remove the crystal and enjoy!



PREVIEW

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Name: _____ 72

Curriculum Connection
A1.3, A1.4, A1.5

Lab - Making a Crystal

Results

Answer the questions below based on the results of the experiment

1) What were the two substances in this experiment?

2) Is sug[illegible]oluble[illegible]e? Explain.

3) Can you separate sugar and water aft[illegible]sugar [illegible]s into the water? Explain.

PREVIEW

Diagram

Draw a diagram of the processes below. Label the substa[illegible]ces [illegible]at source

Creating the Sugar Solution	Evaporating the Sugar Solution in the Jar

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Name: _____ 73

Curriculum Connection
A1.2, A1.4, A1.5

Experiment - Saturated and Supersaturated Solutions

Information — What is this lab about?

To make a saturated solution, you need a solute and a solvent. Today, we will be experimenting with salt (solute) and water (solvent). If we add just a small amount of salt to water, we will likely have an unsaturated solution as the water can probably dissolve more salt. When the water cannot dissolve anymore salt, we have a saturated solution.

If the water cools, we will have a supersaturated solution because colder water cannot dis as much solute as warmer water. Therefore, when the solvent cools, the saturated becomes supersaturated, and crystals will form. Let's test this out!

Ma — hat you need for the experiment

- ✓ 1 cup of w
- ✓ A kettle – op
- ✓ Fridge – optiona
- ✓ Salt – about 7 tables
- ✓ Spoon
- ✓ A clean glass





Procedure — How you perform the ex nt

1. To make an unsaturated solution, mix 1 tablespoo into a you have a kettle, use hot water. Stir the solution.
2. To make a saturated solution, continue adding salt and continue w many tablespoons you have added. When the salt will no longe can see salt on the bottom of the cup that won't dissolve), you have a saturat dtion
3. If you are using hot water, you have created a saturated solution in hot water. As the water cools, the solution becomes supersaturated because more salt has been dissolved into the solvent than the current temperature could dissolve. If you didn't use a kettle, you could put your solution in the fridge to cool it.
4. Optional – Whole class activity - to make a crystal, pour your solution into a new clean glass. Don't pour the salt on the bottom of the cup, only pour the supersaturated solution.
5. Let this solution cool by putting it in the fridge or letting it sit out for awhile
6. Add a few salt crystals to the cooled solution. Did you see any crystals form?

PREVIEW

Name: _____ 74

Curriculum Connection
A1.2, A1.4, A1.5

Experiment - Saturated and Supersaturated Solutions

Observations

What did you notice?

1) How did you make an unsaturated solution? What did it look like?

2) How did you make a saturated solution? What did it look like?

3) How did you make a supersaturated solution? What did it look like? Do you see crystals on the side of the glass or on the bottom?

PREVIEW

Diagram

Draw a diagram of the solutions below

Unsaturated Solution	**Saturated Solution**	**Supersaturated Solution**

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Curriculum Connection
A1.2, A1.4, A1.5

Separating Mixtures

Information — What is this lab about?

There are many ways to separate substances in a mixture. In many mixtures, you can visibly see the different substances and pick them out to separate them. This is time consuming though, so you'd be better off choosing a more efficient method.

Try to separate the mixtures below using the materials you are provided with. See how fast you can separate these mixtures.

PREVIEW

Materials — What you need for the experiment

- ✓ Rocks – (large, medium sized, and small)
- ✓ Dirt
- ✓ Gravel
- ✓ Sand
- ✓ Water
- ✓ Salt
- ✓ Spoons
- ✓ Sieves or strainer - different sizes work best
- ✓ Coffee filter
- ✓ Tweezers
- ✓ Plastic bowls that can get dirty – at least 2
- ✓ Funnels or plastic bottle cut in half to act as a funnel
- ✓ Plastic bottles with the bottoms cut off work well as bowls to play with the mixtures



Procedure — How you perform the experiment

1. We will try to separate three different mixtures today as fast as we can. The challenge will be to show your teacher the separated substances
2. Your teacher could prepare the mixtures ahead of time and let you work to separate them any way you can.
3. You can use the materials above any way you want to separate the mixtures

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Curriculum Connection
A1.2, A1.4, A1.5

Separating Mixtures

Mixtures

Create the mixtures below and then separate the substances

1) Mix different sized rocks – have three categories (large rocks, medium sized, and small). Separate all three.

2) Mix a handful of dirt, sand, gravel, and water in one bowl. Separate the water from the sand and gravel. Then try to separate the sand from the dirt and gravel.

3) Mix 1 tablespoon of salt with 1 tablespoon of sand. Separate the sand from the salt. This is

Hint – your solutions and consider adding water to separate the sand from the salt

PREVIEW

Results

below

1) How did you separate the differently

2) How did you separate the dirt, sand, gravel, and water?

3) How did you separate the salt from the sand?

Name: _____ 77

Curriculum Connection
A1.1, A2.2, A3.1, A3.2, A3.3

Chemistry and Automation

What is Automation?

Automation is the use of robotics and programming to develop technologies that can take over for humans. Automation is becoming more and more important in the manufacturing industry as machines are interacting with each other to complete boring, u work that humans use to have to d



Auto

Chemiss the stances and their interacti ot e field of chemistry is important as chemists make medicines, pow aning nd even plastics. Chemists mix substances and make solutions that us ay lives.

When we look ar ms th ines are now doing many of the jobs humans use to do. At the gr ore ut machines now sell food to customers.

In chemistry labs, it is no differe ots ar labs more efficient, more productive, and more creative. This is b use ro can rm simple tasks that humans use to have to do. For example, when subs e temperature of the solvent has a big impact on the dissolving p s. emperature sensors allow the temperature of a solvent to be m stantl t it can be changed if the dissolving rate is not what the scientist b

PREVIEW

Laboratory Automation Safety

Artificial intelligence (AI) is being used in chemistry laboratories t safer for humans. The AI has pre-set limits that are constantly monitored so If a human is getting close to one of these limits, an alarm is sounded or the machine is shut-down. The accidents by user-error are reduced as robotics won't make mistakes because they didn't get enough sleep last night!

Automation – More Productivity

Mixing substances and changing temperatures is something all chemists do. It is a tedious task as every combination needs to be remembered and noted. In addition, the order of when the substances were mixed also needs to be recorded.

Good news though, AI is now performing these tasks more efficiently, leading to more productivity. It is estimated that using AI can cut down chemistry processes from days and weeks to mere hours.

Name: _____ 78

Curriculum Connection
A1.1, A2.1, A2.2, A3.1, A3.2, A3.3

Chemistry and Automation

Questions Answer the questions below using evidence from the text

1) What is automation? How is it taking the jobs of humans?

2) How [illegible] helping chemists?

PREVIEW

Coding Use if/else codes to p[illegible]the j[illegible]ow

Make a saltwa[illegible]tion	
if water is not [ ]	E[illegible]
then add a tablespoon of [ ]	[illegible]p a[illegible]

Make a supersaturated saltwater solution	
if water is not [ ]	Else
then turn up [ ] and add [ ]	stop adding [ ] and [ ]

Make an unsaturated saltwater solution	
if solution is [saturated]	Else
then add 1 tablespoon of [ ]	[ ]

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Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

STEM - Making Cough Medicine

You own a company that makes cough medicine. You're tired of paying chemists to mix the substances, so you're developing a cough medicine making machine.

Your all natural medicine only has three ingredients – lemon, honey, and ginger. The ingredients are mixed to the following ratio

1:2:1
(lemon to honey to ginger)



When the [illegible]ter adds too much lemon or honey, it needs to add more ginger. Lu[illegible] know how to write code to balance the mixture.

IF/[illegible] Write code for your invention

If there is 2 pa[illegible]n to 4 [illegible]ney to 1 part ginger

THEN

If there are 5 parts lemon to 5 parts [illegible] 5 p[illegible]inger

THEN

If there are 3 parts lemon to 12 parts honey to 6 p[illegible]er

THEN

If there are 4 parts lemon to 2 parts honey to 2 parts ginger

THEN

If there are 8 parts lemon to 16 parts honey to 1 part ginger

THEN

If there are 6 parts lemon to 10 parts honey to 5 parts ginger

THEN

PREVIEW

Name: _____ 81

Curriculum Connection
A2.1, A2.2, A3.1, A3.2

STEM - Making Cough Medicine

Questions | Answer the questions about your machine below

1) How does your medicine making machine work?

2) How does y[illegible] use [illegible] Write an example line of code for the machine to process.

3) How much does it cost to make the medicine [illegible]?

4) How much will you sell your medicine for?

5) If the machine cost $10,000 to make, how many bottles of medicine will you need to sell to earn back the $10,000?

6) How many bottles will you need to sell to earn $1 million?

PREVIEW

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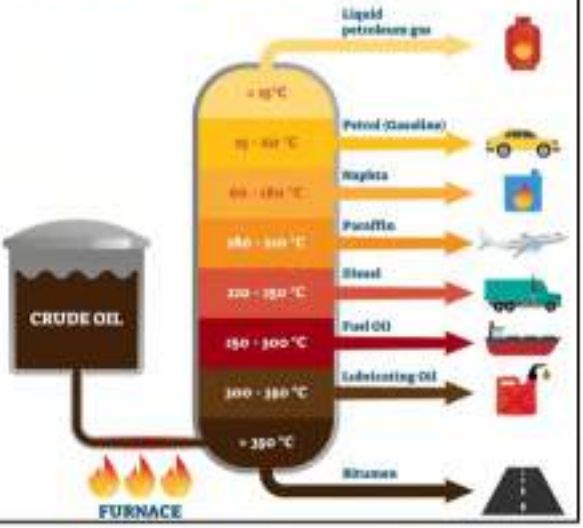
Curriculum Connection
A2.1, A2.2, A3.1, A3.3

Oil Refinery - Coding

A computer is programmed at an oil refinery in Alberta. The refinery heats up crude oil to 400° C. The computer uses temperature sensors on a feedback loop to keep the temperature at 400° C.

Example of feedback loop for a self driving vehicle

Run infi loop
if s elow 100
u 100
if speed is 0
then slow peed t



PREVIEW

Coding Write your own ... k lo ... oil refinery computer to keep the temperature at 40...

IF/THEN Write the if/then statements for the code below, showing what will be made from the crude oil at the temperatures below

If the temperature is between 250 – 300 ° C
THEN

If the temperature is between 220 – 250 ° C
THEN

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Workbook Preview

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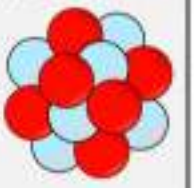
Curriculum Connection
E2.1

Particle Theory

Particle Theory
The **particle theory** states that all matter is made up of tiny particles that are constantly moving. The speed the particles move depends on which state of matter they are in.

Solids
Particles in solids are held tightly together. They are strongly attracted to each other, meaning they move slowly. These particles vibrate instead of move, but they are not still.

Liquids
Particles in liquids are fairly close together with some attraction between them. They move around in all directions, but they can't move too far because they are attracted to the particles near them.



Gases
Particles in gases have hardly any attraction between them. They move rapidly in all directions. They collide with each other and the walls of the container they are in.

Preview of 55 pages from this product that contains 157 pages total.

Fill

All things we can touch are made up of _____. Particles are _____ compounds that make up _____. The particle theory states that small particles are _____ constantly. They move faster based on which _____ of matter they are in. Particles in _____ have the strongest attraction and particles in _____ have the _____. Particles in _____ are fairly close together. The _____ the attraction, the less the particles will move, like in solids.

Part 2 Add particles (dots) to the beakers to represent which state of matter it is



Gas **Liquid** **Solid**

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Name: _____ 9

Curriculum Connection
E2.1, E2.3

Heat Transfer and The Particle Theory

Heat Transfer and The Particle Theory

Heat transfer from one thing to another happens in different ways for different forms of matter. In order to understand how heat is transferred we have to go back to the particle theory of matter. Heat transfers in solids mainly through conduction. Heat transfers in liquids and gases by convection and heat can travel through gases, liquids, or no matter at all by radiation.

Matter

Matter is a hat has mass and takes up space. All matter can be classified as either a or a mixture. All matter is made up of tiny particles.

The Parti Theo

Matter can be ord its physical characteristics. The particle theory of matter helps to e he ph acteristics of matter. The particle theory can be used to explain h eat s.



1. Everything is made of p
2. There are spaces between t par
3. Particles are attracted to each ot
4. Temperature affects the speed at w parti mov
5. Particles are always moving because they kineti
6. There are different kinds of particles, but a tic nce are identical.

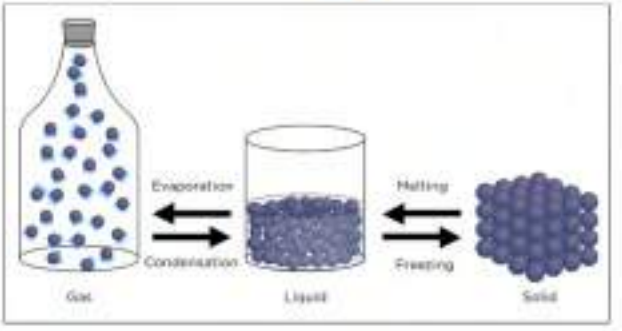
PREVIEW

Solids

In solid form, particles are close together. The particles are very d to each other. They are locked in a pattern and vibrate in place. Solids ha ed shape and volume. The spaces between the particles are small.

Liquids

In liquid form, particles are slightly farther apart. Particles are less attracted to each other and are able to slide past each other. The spaces between the particles are larger than in a solid.



Gas

In gas form, particles are far apart and can move in any direction because the attraction forces between them are weak. Gases have no fixed shape and no fixed volume. They expand to fill their container.

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Curriculum Connection
E2.1, E2.3

Heat Transfer and The Particle Theory

Questions

Answer the questions below using evidence from the text

1) How are the particles arranged in the different states of matter?

2) Give a [illegible] matter can change states. Explain why it changed states.

PREVIEW

Summarize

What is the main [illegible]ing and supporting details

True or False

Circle whether the statement is true or false

1. Most things we can see are made of particles	True	False
2. Heat transfer happens in solids through conduction	True	False
3. The particle theory can be used to explain how heat transfer happens	True	False
4. Particles in all matter are close together	True	False
5. Temperature affects how fast particles move	True	False

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Curriculum Connection
E2.1, E2.3

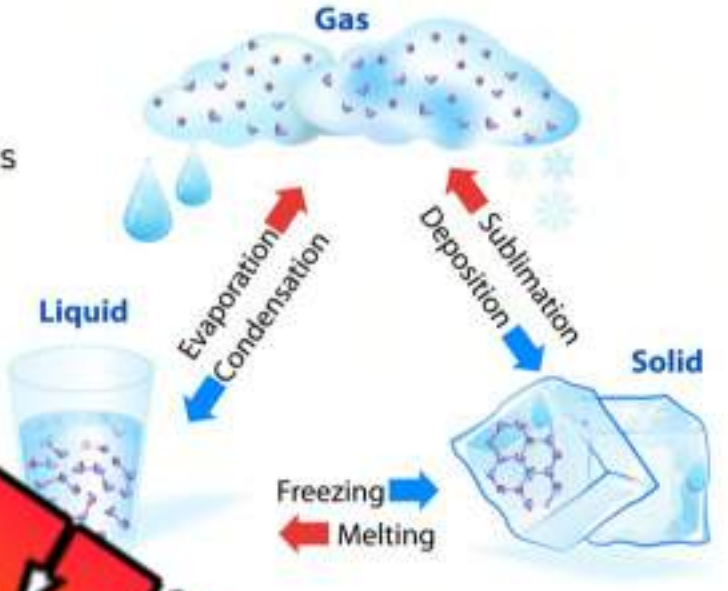
Changes in State - Physical Changes Involving Heat

Changes in State – Physical Changes

When a solid, liquid or gas changes state, they have completed a physical change. Changes in state are reversible because no new substance is formed. The matter's chemical [illegible] is the exact same.

[illegible] has the chemical makeup [illegible] and oxygen (H_2O).

It does not matter if the [illegible] is in liquid form, gas form [illegible] form, it still has the same chemical [illegible]



PREVIEW

Changes in State Involve Heat

When matter changes state, it can be reversed by adding or removing heat. When matter absorbs heat, it could undergo the process of evaporation, melting (fusion), or sublimation.

When matter releases heat, it could undergo the process of freezing (solidification), condensation or deposition.

Heat changes the particles in matter by changing the attractions between particles. When heat is absorbed by matter, the particles in the matter lose attraction and begin to move faster. They collide with each other and spread out, changing the state to a liquid or a gas.

When heat is released by matter, the particles in the matter gain attraction and get closer together. If enough heat is released, the particles may slow down and begin to vibrate instead of move, causing a change of state to a solid.

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Curriculum Connection
E2.2

How Heat is Generated

How Heat is Generated

Heat can be generated in many different ways. It is produced by the sun, fire, mixing chemicals, electricity and friction.

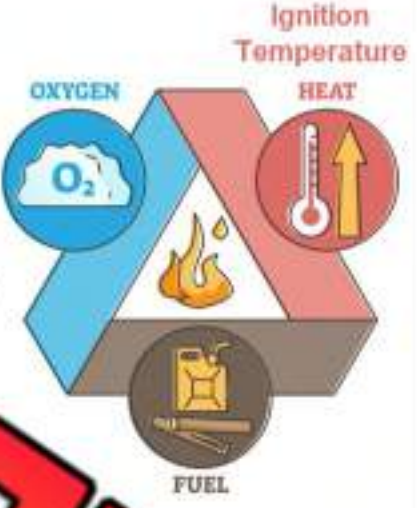
The Sun

Heat is pro[illegible]d by the Sun through a process called nuclear fusion. Inside the core of the Sun, hydr[illegible]ing converted into helium. This process creates heat, as four hydrogen atoms[illegible]one helium atom.

PREVIEW

Fire

Fire is a chemi[illegible] that [illegible] fuel and oxygen into carbon dioxide and w[illegible]. The[illegible]eated from the reaction produces light an[illegible]ls a[illegible]le materials that have low ignition temperatu[illegible]. The[illegible]**ture** is the lowest temperature that a fuel will [illegible]st – lig[illegible]e.



Mixing Chemicals

A **chemical reaction** is when substances are combi[illegible] [illegible]s[illegible] is formed. Hand warmers create heat by mixing chemicals. When yo[illegible]ur [illegible]arm[illegible] the oxygen in the air reacts with the iron, salt, and carbon in the po[illegible]ch. [illegible] substances are combined, the result is thermal energy.

Electricity

We can use the flow of electrons to create heat, like in baseboard heaters. When electrons flow through a circuit, they meet a resistor, which is a smaller wire. The flow slows down, and the electrons hit each other. This creates heat as there is friction between electrons.

Friction

Rub your hands together and you will feel heat. The energy from your muscles and food is being transformed into heat. The particles on the surface of your skin move faster from the frictional force you created.

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Curriculum Connection
E2.2

How Heat is Generated

Questions

Answer the questions below using evidence from the text

1) How does fire generate heat? What fuels do you think are used to create fire and heat?

2) How [illegible]rate heat?

PREVIEW

Visualizing

Draw what you were pic[illegible]re reading. Explain the picture

True or False

Is the statement true or false?

1) The Sun generates heat from nuclear fission	True	False
2) Nuclear fusion is when hydrogen is converted into helium	True	False
3) Electricity generates heat from moving electrons through a resistor	True	False
4) Friction generates heat as particles move faster	True	False
5) As particles move slower, they generate more heat	True	False

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Curriculum Connection
E2.2

Thermal Energy From The Sun

The Sun – The Best Thermal Energy Source



Every second, the sun releases more thermal energy than all humans consume in an entire year! We need the thermal energy from the sun in order to survive.

Look around, you need sunlight and heat, your friends do too, and so do the plants and animals outside. The thermal energy provided by the sun is just the right amount for things to grow and survive.

PREVIEW

How the Sun Releases Thermal Energy

The sun is a massive ball of hydrogen gas that creates an enormous amount of heat. The sun is not just massive, it's extremely large. You could fit 109 Earths inside of the sun.

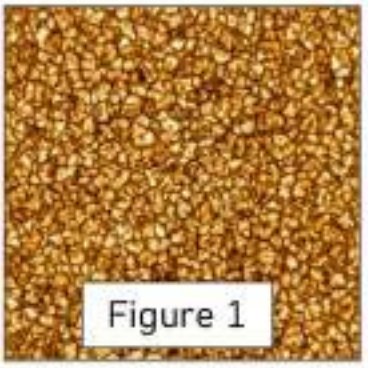


Figure 1

The sun is so hot that it has a lot of pressure inside of it. The pressure is so great that all of the hydrogen atoms are constantly moving and bumping. When the atoms collide, they create thermal energy.

Thermal energy is also created by nuclear fusion in the sun's core. This happens when hydrogen atoms fuse (change) into helium atoms. It takes four hydrogen atoms to fuse into one helium atom. This process creates thermal energy. The thermal energy is radiated in waves all the way to the Earth, where it keeps us warm.

Figure 1 is a real closeup picture of the sun. You can see all the tiny hydrogen atoms bouncing off each other.



Solar Energy

The sun is constantly providing the Earth with a tremendous amount of energy. Scientists have created solar panels that can convert the sun's thermal and light energy into electricity. Electricity is very useful for humans because it is used to give energy to our machines.

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Curriculum Connection
E2.2

Thermal Energy From The Sun

Questions

Answer the questions below using evidence from the text

1) Why do we need the sun's thermal energy?

2) How does the sun produce thermal energy?

PREVIEW

True or False

Is the statement true or false?

1) The sun is 109 times bigger than the Earth	True	False
2) Living things need the sun to survive	True	False
3) The sun is a massive helium ball	True	False
4) All of the nuclear fusion happens on the outside of the sun	True	False
5) Solar panels convert the sun's light and heat energy to electricity	True	False

Visualizing

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

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Curriculum Connection
E2.3

Thermal Expansion and Contraction

Thermal Expansion and Contraction

When solids, liquids or gases are heated, the particles which they are made of speed up. This means they have more kinetic energy. The faster moving particles take up more space. This makes the substance increase in volume. This is called **thermal expansion**.



Likewise, when you cool solids, liquids or gases, they decrease in volume. This is called **thermal contraction**. When substances contract, their particles travel shorter distances, so they take up less space.

Mass and Volume

Mass is a measure of the amount of matter in an object. Mass is usually measured in grams (g) or kilograms (kg). **Volume** is the three-dimensional space occupied by matter or enclosed by a surface. Volume is usually measured in cubic centimeters or litres.

When thermal expansion or contraction occurs, the mass of the substance stays the same, but the volume increases or decreases. The change in volume happens because the spaces between the particles expand in thermal expansion and decrease in thermal contraction. For any given change in temperature, gases expand and contract more than liquids and solids. Liquids expand and contract more than solids.



Examples of Thermal Contraction

An example of thermal contraction in solids is the lid on a jar. In a fridge, the metal lid contracts more than the glass. This makes the lid too tight for the jar. If you run the lid under hot water for a minute, it will heat and expand, making it easier to twist off. Another example is when power lines snap in cold weather as they contract too much.

An example of thermal contraction in gases happens with our car tires. During the winter, tires are more likely to become flat as the air pressure inside the tire lessens. The particles slow down and get closer together.

In liquids, if you fill your car with gas on a cold day, the gas has contracted already. If it warms up, the gas will expand in the tank and could overflow due to thermal expansion.

PREVIEW

Name: _____ 20

Curriculum Connection
E2.3

Thermal Expansion and Contraction - Questions

Questions

Answer the questions below using evidence from the text

1) What is the difference between mass and volume?

2) Write o[illegible]e of how thermal contraction affects solids, liquids, and gases

Soli[illegible]	
Liquids	
Gases	

PREVIEW

Visualizing

Draw what you were pic[illegible]hile [illegible]e reading. Explain the picture

True or False

Circle whether the statement is true or false

1) Thermal expansion makes substances weigh more	True	False
2) Volume is measured by weight	True	False
3) Mass is a measured by weight	True	False
4) Car tires will become more flat during the summer months	True	False
5) Matter expands in the summer heat and contracts in the winter cold.	True	False

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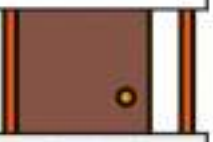
Curriculum Connection
E2.3

Thermal Expansion and Contraction

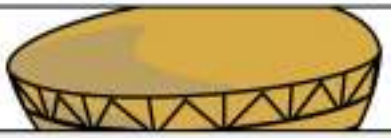


Explain Why might the situations below happen? Explain.

1) Shane filled up his engine coolant last night before he went to bed. He just checked the levels before he left in the morning and it has overflowed. What happened?



2) The door in Abby's hous[illegible] to [illegible] summer than in the winter. It feels like it is sticking or hitting on the [illegible]me



3) Melanie just broke a ceramic bowl. She took it out of the fridge and removed the food from it. Then she tried washing it with really hot water. Unfortunately, the bottom of the bowl fell right through! What happened?

PREVIEW

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Name: _____ 23

Curriculum Connection
E2.4, E2.5, E2.6

Convection, Conduction, Radiation

Heat Transfer
Heat Transfer occurs in 3 different ways - conduction, convection, and radiation. Study the diagrams below and answer the questions.

Mechanisms of Heat Transfer



1) What are some ways that the heat transfers from the source (stovetop)?

_____

_____

_____

_____

_____

2) Which form of heat transfer happens when direct contact with the heat source

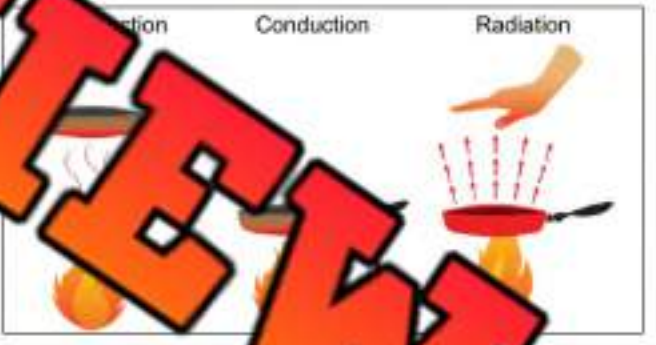
_____

3) Which form of heat transfer happens when heat is transferred by moving air.

_____

4) Which form of heat transfers in waves or rays

_____



PREVIEW

Practice

Label the pictures - convection, conduction, or radiation


_____


_____


_____


_____


_____


_____


_____


_____

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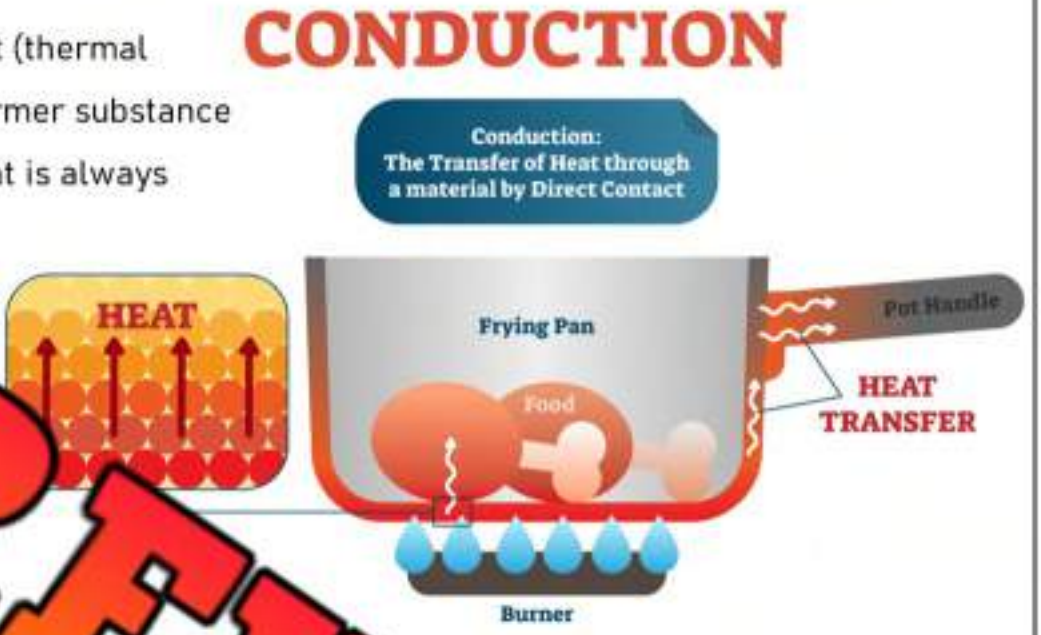
Name: _____ 24

Curriculum Connection
E2.4, E2.5, E2.6

Heat Transfer - Conduction

Heat Transfer

Heat transfer is when heat (thermal energy) moves from a warmer substance to a cooler substance. Heat is always transferred in the direction o... temperat... to co... happens by con... convection and ...



PREVIEW

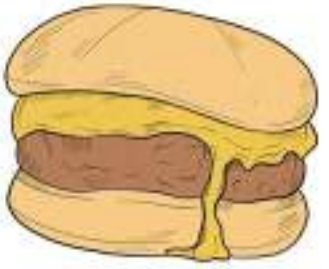
Conduction

In solid matter, heat transfers ...uct... ...ction, the particles which make up a solid, for example the bottom of a pan, ...d. W... particles are heated, they begin to vibrate faster. These vibrating pa...icles col... with ...rticles next to them. These collisions cause these particles to begin ... fast... ...up.

The fast-moving particles continue to bump into ...les be... ...em making them speed up and spreading the heat evenly across the b... th... ...he sides.

Examples of Conduction

- Touching a metal spoon in a cup of hot liquid
- Putting a heating pad on your back
- Ironing clothes
- Walking barefoot on hot sand
- Using a frying pan on a stove
- Cheese melting on a warm cheeseburger
- Grabbing the black monkey bars on a hot day
- Sitting on the hood of a black car





Name: _____ 27

Curriculum Connection
E2.4

Thermal Conductivity

Questions

Answer the questions below using evidence from the text

1) Define the terms below – thermal conductivity and thermal resistivity?

Thermal Conductivity	
Therm Resi	

2) How does a [illegible] help keep drinks hot or cold?

PREVIEW

You Choose

Is the matter a thermal [illegible] [illegible]istor?



1) Metal spoon	Conductor	
2) Oven mitt	Conductor	
3) Tin can	Conductor	Resis
4) Ceramic mug	Conductor	Resistor
5) Log of wood	Conductor	Resistor
6) Metal frying pan	Conductor	Resistor
7) Rubber shoe	Conductor	Resistor
8) Black car	Conductor	Resistor
9) White t-shirt	Conductor	Resistor
10) Glass lightbulb	Conductor	Resistor







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Curriculum Connection
E2.5

Heat Transfer - Convection

What is Convection?

Heat transfer in liquids and gases happens by convection. Because the particles in liquids and gases are not attached to each other, when they are heated, they move around faster, rather than simply vibrating like in solids.

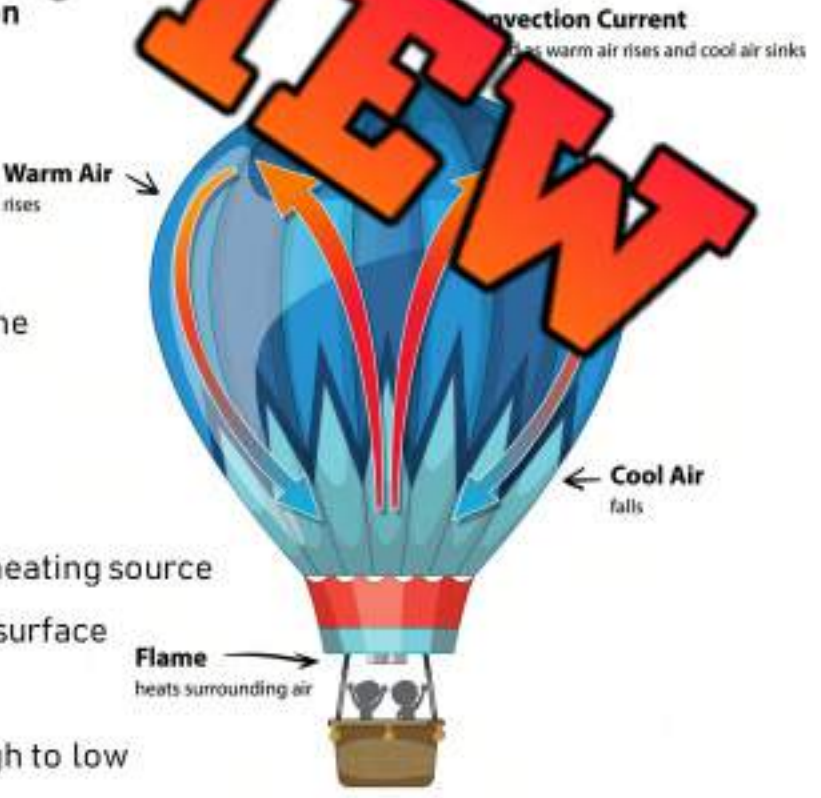
The particles move away from the warmer region to the cooler area. The particles are farthe[illegible]t in the warmer region and are less dense. The less dense particles rise above th[illegible]ly distributed cooler particles and as they move away from the heat[illegible]be[illegible]ool.

Wh[illegible]n they[illegible]ec[illegible]e denser and sink to the bottom of the container where the heat source[illegible]liquid o[illegible]was being heated rises and this creates a current called a **con[illegible]on** of particles rising when heated and falling when cooled as they move[illegible]m th[illegible]ce continues as long as the container is being heated by the heat sou[illegible]

PREVIEW

Convection Currents in Hot Air Balloon

The continuous cycle of hot air rising from a heat source to cold air falling towards the heat source is a convection current. You can see the cycle in action in the diagram of the hot air balloon.



Examples of Convection

- Air movement in our home from heating source
- Water in a pool is warmer on the surface
- Pot of water boiling
- Wind – air moves from area of high to low pressure (colder air to warmer areas as warm air rises, colder air moves in)

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Curriculum Connection
E2.5

Heat Transfer - Convection

Question Answer the question below using evidence from the text

What is convection? What happens when convection heats up gases or liquids?

Diagrams Fol... draw two diagrams of gases and liquids being heated

1) Draw and label a diagram showing what happens when water is heated in a pot	2) Draw and label a ... a room with a heating source ... a radiator heating up the air

PREVIEW

True or False Circle whether the statement is true or false

1. Convection currents are the continuous cycle of warm and cold air moving	True	False
2. Heat transfer happens in liquids through convection	True	False
3. Convection requires contact for heat transfer	True	False
4. When you touch something hot, convection is transferring the warm air	True	False
5. Warm particles rise and cool particles sink	True	False

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Curriculum Connection
E2.6

Heat Transfer - Radiation

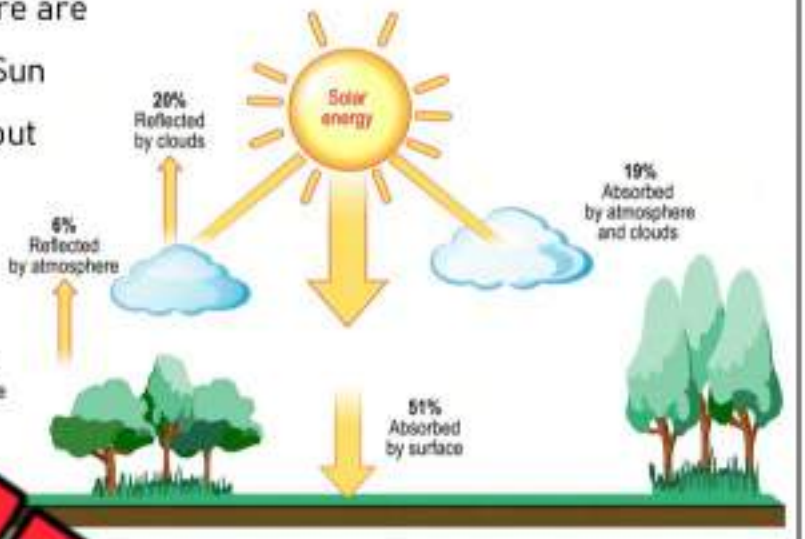
Radiation

The Earth is warmed by the Sun, but there are no particles between the Earth and the Sun outside of the Earth's atmosphere. Without particles, h[illegible]t cannot transfer by conductio[illegible]vection. Heat travels [illegible]omagnetic radiat[illegible]aves or[illegible]

Radiatio[illegible]er [illegible] of energy through [illegible] with[illegible] needing matter (air, soli[illegible]s). Ra[illegible] can be in the form of heat, sound and light. We call heat that has be[illegible]ate[illegible]**iation.**

Heat radiation is transferred in st[illegible]es a[illegible]eed of light in all directions from one body to another. The waves can be reflec[illegible] ab[illegible]. When a colder object absorbs the waves, the object becomes warme[illegible]he h[illegible]transferred.

Solar radiation



PREVIEW

Absorbing and Reflecting Radiation Heat

Some objects are better at absorbing or reflecting heat than others[illegible]f will absorb heat better than a white t-shirt, which means the heat has tra[illegible]ed better to the car.

We all emit heat through radiation. The warmer you are, the more thermal radiation you will emit. After gym class, a friend who didn't participate will likely feel the heat you are emitting. The classroom after gym class will also be warmer as you and your classmates are heating up the class by emitting heat through thermal radiation.

The Sun is sending thermal radiation at the speed of light in all directions. The clouds, atmosphere, and surface reflect 30% of this heat back towards the Sun. The remaining 70% is absorbed, which heats up our planet.

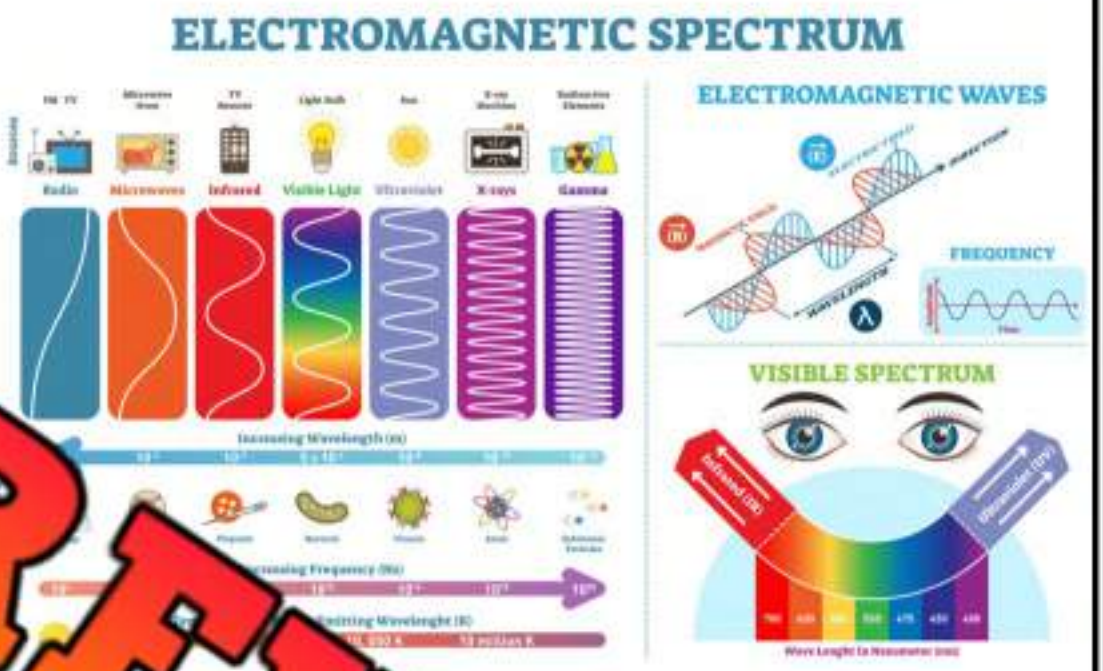
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Curriculum Connection
E2.6

Electromagnetic Radiation

Radiant Heat



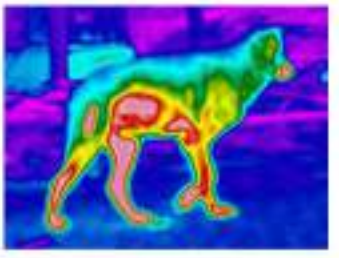
Heat that is transferred by radiation is called thermal radiation or radiant heat. All matter that is abov[illegible]lute zero (minu[illegible] Celsiu[illegible] thermal e[illegible]rgy. Yo[illegible] for example, hav[illegible] body temperature of [illegible] degrees Celsius, so you are [illegible]herm[illegible]heat.

The particles inside matter [illegible]mov[illegible]less the matter is below absolute zero. When the particles move, they bou[illegible]each o[illegible]it radiant heat in the form of electromagnetic waves. These waves do not travel t[illegible]gh gas[illegible]ds, or solids. Instead, the waves will travel through space depending on whe[illegible]y fa[illegible]agnetic spectrum.

Electromagnetic Radiation

Humans can only see wavelengths that fall within the visible ligh[illegible]spec[illegible] wavelengths get longer (infrared) or shorter (ultraviolet), they are no[illegible]human eye. The Sun sends radiant heat in the form of ultraviolet rays that we cannot se[illegible]t we can feel as heat. A flame emits both visible light and infrared radiation that we cannot see, but we can feel.

Humans Emitting Radiation



Yes, humans emit electromagnetic radiation. Right now, you are emitting thermal radiation, but you can't see it. That is because it is outside of our visible spectrum. The heat waves you emit are infrared rays.

Some animals, like pit viper snakes, can see infrared rays. This means they can see the radiant heat coming from animals that are up to one metre away. The radiant heat will light up the shape of other animals nearby, giving them a big advantage at night.

PREVIEW

Name: _____ 36

Curriculum Connection
E2.4, E2.5, E2.6

Convection, Conduction, Radiation

Questions Read the descriptions and label them convection, conduction, or radiation

1) Heat from a fireplace warming up a room.



2) An ice cube melts after holding it in your hand.



3) The ...irculates rapidly

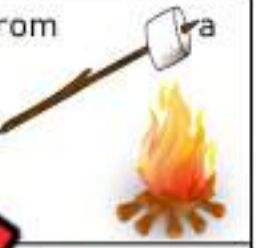
4) Your hot chocolate heats the air above it.



5) A spoon in a cup of hot coffee ...s ho...



...mallow is heated from ...a campf...



7) An egg is cooked in a frying pan.



8) A cell phone ...ets h... your ear.



9) A microwave heats up food.



10) A curling iron heats up hair to curl it.



PREVIEW

Name: _____ 37

Curriculum Connection
E2.4, E2.5, E2.6

Assignment - Heat Transfer Infographic

Create an infographic that explains how the heat transfer method you choose works. You can choose one of the three methods – convection, conduction, or radiation. Include the following in your infographic.

- A diagram that shows an example of the heat transfer method
- Short texts or labels that explain the heat transfer method
- Pictures or designs that make the infographic visually appealing

Research

Answer the questions below to help organize your infographic

PREVIEW

1) Which heat transfer method are you choosing?	

2) How is heat transferred in the method you chose? Does it use a state of matter? Explain.

3) What are some examples of this form of heat transfer in our everyday life? List 3.

1)	
2)	
3)	

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Curriculum Connection
E2.7

The Sun and The Water Cycle

The Sun and The Water Cycle

All living things on Earth need water to survive. Water is not made in nature; it is recycled through the water cycle. The Sun's heat energy drives the water cycle.

Water exists on the Earth in all three of its states, liquid, solid as ice and as water vapour. Water changes easily from one state to another by evaporation, melting, freezing, sublimation, condensation and deposition. Each of these changes requires a transfer of energy.

Evaporati process of water changing from a liquid into water vapour. It is the most co t liquid water moves back into the water cycle.

Melti id ice becoming liquid by adding heat.

Freezing the p ing solid ice by loss of heat.

Sublimation: i s of g solid ice to water vapour without first becoming liquid. Sublimation sed h being absorbed.

Condensation: is the pro er va ning into liquid. This happens when the vapour is cooled.

Deposition: is the process when w er v ectly into a solid without becoming a liquid first. This happens hi e atm where temperatures are very low. Another example is frost. Deposition s a resul eat



and
subli pen eat energy is absorbe nsa and deposition h pen decrease in the he ss) in the water particles.

In the water cycle, water moves from the surface of the Earth into the air and back to the surface of the Earth over and over again. This continued movement of water Is only possible because of heat energy from the Sun. Without the Sun's heat energy, water would not evaporate and all water on Earth would freeze.

When water molecules are heated, they exchange freely with the air in a process called evaporation. Ocean water is constantly evaporating, increasing the temperature and humidity of the surrounding air to form rain and storms that are then carried by trade winds. In fact, almost all rain that falls on land starts off in the ocean. The tropics are particularly rainy because heat absorption, and thus ocean evaporation, is highest in this area.

PREVIEW

Name: _____ 42

Curriculum Connection
E2.7

The Sun and The Water Cycle - Questions

Questions Answer the questions below using evidence from the text

1) What are the 6 processes that change water from one state of matter to another?

2) How d[illegible] from the Sun drive the water cycle?

PREVIEW

Summarize What is t[illegible]ain [illegible]ding and supporting details

True or False Circle whether the statement is true or false

1. Melting, evaporation and condensation happen when there is heat loss in the water particles	True	False
2. The water cycle recycles the same water repeatedly	True	False
3. Water evaporates and forms clouds, which are moved by winds. This is one way water moves from one place to another	True	False
4. Deposition is when water is deposited into an ocean	True	False
5. Most of the rain that falls on land started in the ocean	True	False

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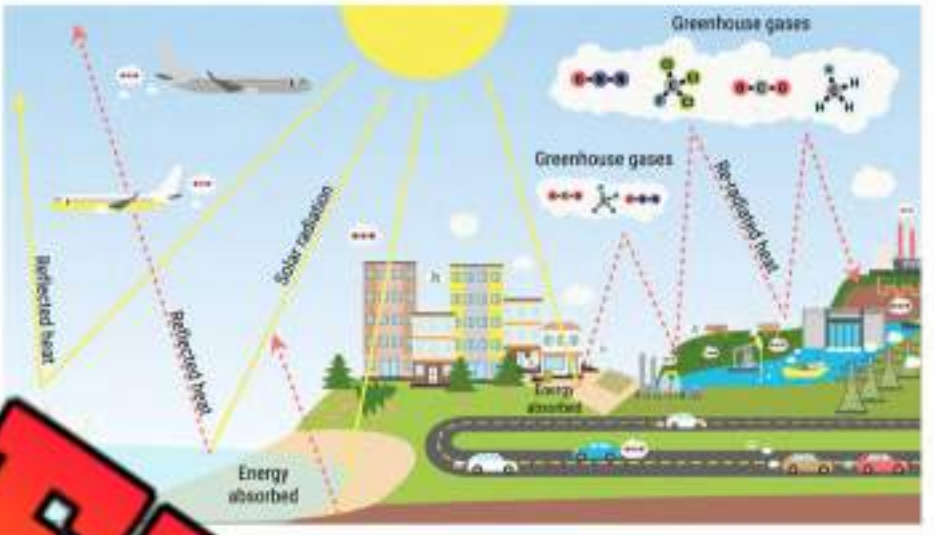
Curriculum Connection
E2.7, E2.8

Greenhouse Gas Effect

What is in the Air we Breathe?

The Earth's atmosphere is made up of 78% nitrogen, 21% oxygen and 1% other gases including, carbon dioxide, argon, helium, hydrogen and ozone. Plants use nitrogen to make protein. People and animals need oxygen to breathe. Pl produce oxygen du tosynthesis.

Th eople and a un breathe eplace oxygen that pl s is an important When humans cut down t ny trees, we disturb the ba ygen ir needed to keep the air we breathe healthy for humans.



PREVIEW

Greenhouse Gas Effect

A greenhouse is a building made of gl t is us plants indoors when the weather is too cold for them to survive outside. T n sh rough the glass greenhouse and warms the air and contents in t nig Sun is not shining the greenhouse stays warm because the glass w and at inside.

The greenhouse gas effect works the same way e arth. er of greenhouse gases acts the same way as the glass walls ee ing heat inside the Earth's atmosphere.

Greenhouse Gases

The best-known greenhouse gases in the Earth's atmosphere are carbo xide, methane, and nitrous oxide. They work together to allow the right amount of solar heat in and to trap some of the heat in the Earth's atmosphere to keep the Earth warm. This is called the greenhouse effect.

The problem is that when human activities produce extra greenhouse gases, mainly carbon dioxide, the thickness of the gases is trapping more heat than what is naturally supposed to happen. This is leading to global warming and climate change.

<u>Human activities that produce greenhouse gases include:</u>

- burning fossil fuels which makes carbon dioxide (driving, airplanes, factories)
- raising huge numbers of cattle which produce methane gas
- Cutting down trees which would have absorbed carbon dioxide
- creating landfill sites that give off methane

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Curriculum Connection
E2.7, E2.8

Greenhouse Gas Effect - Questions

Questions

Answer the questions below using evidence from the text

1) Describe the balance between oxygen and carbon dioxide used by plants and animals.

2) Wh[illegible] s you do that create greenhouse gases?

PREVIEW

Visualizing

Draw what you we[illegible] pic[illegible] ere reading. Explain the picture

True or False

Circle whether the statement is true or false

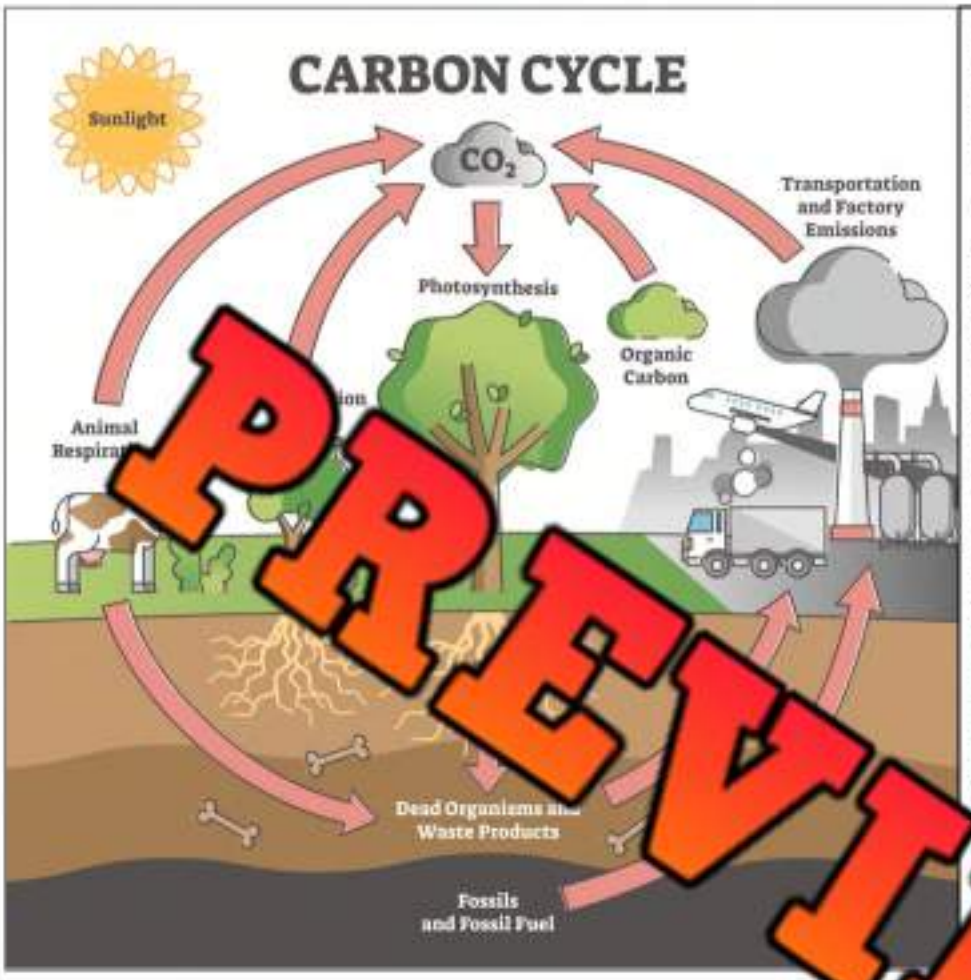
1) The Earth's atmosphere contains equals parts oxygen and carbon dioxide	True	False
2) Some greenhouse gases occur naturally, and some are human made	True	False
3) Planting trees helps reduce greenhouse gases	True	False
4) Oxygen is an important greenhouse gas	True	False
5) Examples of greenhouse gases are carbon dioxide, methane, nitrous oxide	True	False

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Curriculum Connection
E2.8

Greenhouse Gases - Carbon Dioxide



Greenhouse Gases
There are three main greenhouse gases that are released into our atmosphere when we burn fossil fuels.

1) Carbon Dioxide – 82%
2) Methane – 9%
3) Nitrous Oxide – 6%

Carbon Cycle
Carbon dioxide is released into the atmosphere in natural ways, like when animals exhale. This natural release of carbon keeps our planet healthy as it blankets our Earth keeping it the right temperature. But, when we add unnatural amounts of carbon from factories and icles, we make the blanket k. This is called the e **effect**.

PREVIEW

Questions

Answer the questions below usin se f e text

1) What is the greenhouse effect? What do you think a thickening bl

2) What human activities are causing the greenhouse effect? What can we do to stop it from getting worse?

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Curriculum Connection
E1.2

Solar Energy



What is Solar Energy?

Solar energy is energy given off by the sun's rays. The sun has been providing humans with solar energy for thousands of years. The sun has given us thermal energy to keep us warm and dry our clothes, and light energy to allow us to see.

As t gies advance, humans are now using solar energy to create electricity. Using so f electricity means the sun is powering our electronics, machines, elec s and m



Solar en wa energy source because we cannot use it up. It is an esour g the supply is endless.

How Solar Energy Wor

Solar energy is harnessed by ne and store the sun's energy. The stored energy is p ener used on demand. Solar panels are made of many solar cells tha e all co ed.

The solar cells have two sides. One side l ctron sitively charged and the other side has a negative charge. When the su kes the cell, the energy knocks the electrons loose and they begin to flow e si r, creating an electrical circuit. We can plug our electronics into a sol e flowing electrons can continue through the circuit inside the electronic d

PREVIEW

Benefits and Drawbacks to Solar Energy

Benefits	Drawbacks
Renewable energy we won't run out of	Solar energy can only be collected when it is sunny. Cloudy, rainy days will slow down energy storage
No greenhouse gases (no air pollution)	Batteries store the solar energy. Batteries don't decompose, meaning they will end up in landfills when they no longer work
Once setup in homes, the cost is free to use electricity	It costs a lot to install solar panels

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Curriculum Connection
E1.2

Using Energy - Effect on Environment

Why We Generate Electricity



Electricity is an energy source we rely on in our everyday lives. It is used for lighting, heating, cooling, refrigeration, appliances, computers, electronics, and even electric vehicles. When the electricity has gone out, you've [illegible] felt this reliance to it!

Generati[illegible]t Effect on Environment

In Ca[illegible]eneratio[illegible]city produces far less air pollution than other countries, like the United Stat[illegible]r 8[illegible]f the electricity Canadians use comes from sources that produce no air po[illegible]These[illegible]e hydroelectricity, wind, solar, and nuclear.

This is not to say [illegible]ng el[illegible]y has no effect on the environment. The creation of hydroelectric dam[illegible]an[illegible], and nuclear power plants all have an effect on the environment.

PREVIEW

Hydroelectric Dam	• The dams block the flow of w[illegible]and t[illegible]ase some water from time to time. This changing [illegible]onme[illegible]ard for wildlife living in the water to survive. • The structure itself is massive. It [illegible]of lan[illegible] • Many of the dams are built in the nor[illegible]rts[illegible]here the Indigenous have rights to the land
Wind	• Pose a threat to flying wildlife like birds and ba[illegible] • They also change ecosystems with their large struct[illegible] • Noise pollution as the spinning blades are loud
Solar	• They need a lot of land to generate a significant amount of electricity • These panels get very hot and cause a threat to birds that land on them
Nuclear	• When a nuclear accident happens, radioactive pollution enters our air. It is poisonous to humans • Radioactive waste is created in the process of generating electricity. The waste is being buried underground • The nuclear power plants release their used water back into rivers, lakes, or oceans they are near. They filter it, but many believe the water is still contaminated

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Curriculum Connection
E1.2

Heating our Homes - Questions

Questions

Answer the questions below using evidence from the text

1) Do you think the Government of Canada made a good decision to phase our coal fired electricity generation? Why or why not?

2) Wh ssil fuels when we can expect to run out in 30 years?

PREVIEW

Summarize

What is t ain ding and supporting details

True or False

Circle whether the statement is true or false

1. Electricity is clean renewable energy	True	False
2. Natural Gas is the cleanest burning fossil fuel	True	False
3. Non-renewable energy sources are convenient and affordable	True	False
4. In Canada we use more solar energy than wind energy	True	False
5. Fossil fuels are non-renewable energy resources	True	False

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Curriculum Connection
E1.2

Heating our Homes - Renewable/Non-Renewable Energy

Renewable versus Non-renewable Energy Sources

Renewable energy is energy that will not run out. Renewable energy sources include, burning wood, solar, wind, hydroelectricity, geothermal and biomass. Wood burning or pellet stoves use wood, which is a renewable source of energy as long as we manage our forests. Trees can take 40 to 150 years to reach maturity depending on their species, so if we do not [illegible] planting trees to replace those we cut for fuel, we could exhaust our forests.

[illegible] pellets creates greenhouse gas emissions which contribute toward [illegible] play an important role in absorbing carbon dioxide [illegible] for fuel can have an additional negative [illegible] because trees help clean our air. Trees also [illegible] erosion, so cutting trees has a negative effe[illegible]



Hydroelectricity is clean energy th[illegible] of greenhouse gas emissions, but it takes a lot of land because rivers [illegible] dammed and reservoirs created to ensure a steady stream of [illegible] droelectricity is distributed through power lines that are strung along h[illegible] lots of land. Hydroelectricity is convenient and affordable.

Solar and wind energy are renewable forms of energy that re[illegible] lots of land to build wind turbines and solar farms. Manufacturing the solar panels creates toxic substances that may cause water pollution. Wind and solar are less reliable forms of energy because if the wind does not blow, energy is not produced, and solar power is not produced at night. When there is heavy cloud cover or on a rainy-day, solar panels generate approximately 75% less energy than on a sunny day.



Solar and wind energy can be fed into the power grid, or it can be stored in batteries. Small home solar panels, often mounted on the roof of the home can create power for individual homeowner use.

PREVIEW

Name: _____ 64

Curriculum Connection
E1.2

Renewable/Non-Renewable Energy - Questions

Questions

Answer the questions below using evidence from the text

1) What are the advantages and disadvantages of solar energy?

2) What 4 types ble energy?

PREVIEW

Questioning

Write 3 que you h e reading

1)	
2)	
3)	

True or False

Circle whether the statement is true or false

1. Renewable energy is energy that can be reused over and over again.	True	False
2. When well managed, a renewable energy source will not run out.	True	False
3. Renewable energy sources do not cause greenhouse gas emissions.	True	False
4. Hydroelectricity creates lots of greenhouse gases.	True	False
5. Solar and wind energy are clean energy sources.	True	False

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Name: _____ 65

Curriculum Connection
E1.2

Heating our Homes - Geothermal

Geothermal Energy

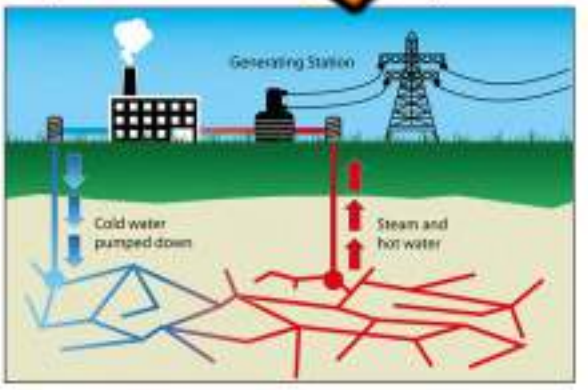


Geothermal energy is renewable energy using the heat that is within the Earth. The heat below the surface of the Earth is so plentiful that what is used for geothermal energy does not decrease what is available. Geothermal energy has been used by Native North Americans for bathing and cooking fo[illegible]sands of years.

Ge[illegible]nergy exists everywhere on Earth [illegible]sible in certain areas. We g[illegible]rectly from hot springs, from heat pumps and from geotherm[illegible] powe[illegible]cel[illegible]d because the heat is so close to the Earth's surface most homes a[illegible]n ge[illegible]al energy. In fact, 26% of Iceland's energy comes from geothermal[illegible]rmal[illegible]ost accessible along tectonic plate boundaries. The Pacific Ring of F[illegible]an[illegible]hermal energy is easily accessed. These areas where volcanic eru[illegible]earth[illegible]ccur are suitable for geothermal power plants.

In North America many homes us[illegible]mal[illegible]umps to heat and cool their homes. If you dig down into the Earth, t[illegible]ther do[illegible]g[illegible]he warmer the temperature is. At 10 feet below the Earth's surfac[illegible]tem[illegible]e is a constant 10-15 degrees Celsius. A heat pump works by pumpin[illegible]thro[illegible]id underground. In the winter the Earth warms the liquid in the pipes [illegible]brought back into the house where the heat is transformed into ener[illegible]

In the summer it works the opposite way. When temper[illegible]es [illegible] above 22 degrees C, the liquid is pumped underground where it is c[illegible] degrees C. The cool liquid is brought back into the house where it ab[illegible]bs [illegible]om the home and circulates it back into the Earth. The heat pump does not do th[illegible]e job of heating or cooling the house, but it helps work with the furnace and air conditioning and reduces energy consumption.



Disadvantages of Geothermal

- Geothermal plants may emit greenhouse gases
- Water flowing through the underground systems may pick up toxic chemicals such as arsenic and mercury
- Geothermal plants require a lot of land
- Individual home systems are expensive but depending on the system, they will pay for themselves in energy savings in 5 to 10 years.

PREVIEW

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Curriculum Connection
E1.2

Heating our Homes - Geothermal - Questions

Questions Answer the questions below using evidence from the text

1) What are the advantages and disadvantages of geothermal energy?

2) Ho[illegible] both heat and cool homes?

PREVIEW

Visualizing Draw what you we[illegible] ere reading. Explain the picture

True or False Circle whether the statement is true or false

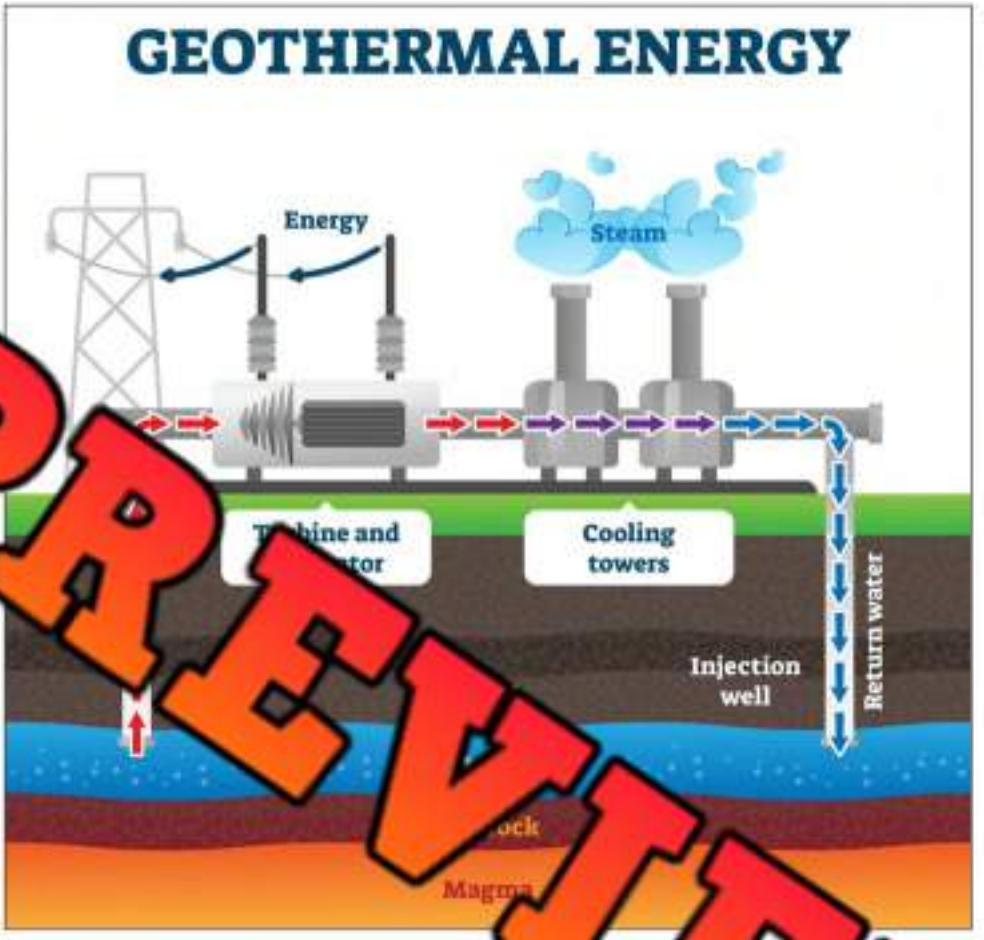
1. Geothermal energy is a new type of energy.	True	False
2. Geothermal plants are most often built along tectonic plate boundaries.	True	False
3. Geothermal energy comes from the heat inside the Earth.	True	False
4. Geothermal energy does not have any negative impact on the environment.	True	False
5. Geothermal energy is a sustainable form of energy.	True	False

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Curriculum Connection
E1.2

Geothermal - Generating Electricity



PREVIEW

Explain Answer the questions below

1) Describe how geothermal energy works based on the diagram

2) Do you think geothermal energy is good for the environment? Explain.

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Curriculum Connection
E1.2

Nuclear Power



Nuclear Power

Nuclear energy is produced by splitting a uranium atom into two smaller atoms. This process releases heat from the nucleus of the atom that is used to create steam. The steam is used to turn turbines that create electricity.

Nuclear Fission of a Uranium Atom

In Canada there are 19 nuclear reactors, 18 in Ont[illegible] in [illegible]nswick. Nuclear energy provides 15% of Canada's energy needs. N[illegible]ear e[illegible] se[illegible]ond largest producer of low carbon emission energy after hydroele[illegible] [illegible]lear [illegible]s creates 10% of the energy used worldwide. Nuclear energy i[illegible] enew[illegible]y because it uses Uranium which is a finite resource. There are [illegible]y [illegible]lear energy:

- It does not use large a[illegible] f la[illegible]ate power-solar power uses 450 times more land to genera[illegible]e sa[illegible] power.
- It is a stable consistent source of [illegible]y- it c[illegible] [illegible]uced around the clock while solar and wind only produce energy [illegible] perc[illegible] the day depending on weather conditions and whether it is day [illegible]t.
- The waste from nuclear is contained. It is regula[illegible] [illegible]tored [illegible] in steel and concrete capsules or buried underground. Waste f[illegible] [illegible]l f[illegible] [illegible] emitted into the air as air pollution.
- It is efficient 1kg of uranium produces the same amount of energy [illegible]ning 10,000 kg of oil or 14,000 kg of coal.
- Nuclear energy does not emit greenhouse gases.

<u>Nuclear energy is controversial because:</u>

- the same raw materials used to create nuclear power could also be used to create nuclear weapons.
- the risks of an accident at a generating station that could cause damage to people and the environment.
- the used uranium is radioactive for thousands of years and must be disposed of carefully to avoid contamination.



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Curriculum Connection
E1.2

Nuclear Power - Questions

True or False

Circle whether the statement is true or false

1. Nuclear energy is renewable energy.	True	False
2. Nuclear energy uses fission to generate heat.	True	False
3. Nuclear energy generates less air pollution than burning fossil fuels.	True	False
4. Fear of n accidents is why people are against using nuclear energy	True	False
5. Nuclea widely used.	True	False

Summ ze

ize the reading by writing the important information

Questions

Use information from the text to t

1) Do you think we should build more nuclear power generating sta ? Why or why not?

2) What are the benefits of nuclear power?

PREVIEW

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Curriculum Connection
E1.2

Nuclear Power Accidents

Nuclear Power Accidents - Overview

There have been three major accidents involving nuclear generating stations:



1) In 1979 - Three Mile Island in the United States had an accident with no loss of life or significant health affects however it did cause a slowdown in nuclear power plants being built.



2) In 1986 - Chernobyl in the USSR now Ukraine, Had an accident resulting in the exposure of people died from radiation poisoning and 15 people died years later from Thyroid cancer. 335,000 people, who lived within a 30 km radius from the plant had to leave their homes.

3) In 2011 - Fukushima Daiichi in Japan had an accident caused by the Tohoku earthquake and tsunami. There were no deaths attributed to the nuclear accident although 18,500 people died as a result of the earthquake and tsunami. One cancer death of a nuclear station employee has since been blamed on the accident. 154,000 people were evacuated from a 20-kilometer radius of the generating station.



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Curriculum Connection
E1.2

Nuclear Power Accidents - Questions

Questions Use information from the text to support your answer

1) Which accident was the worst?

2) Does [illegible]sion have long lasting effects? Explain.

PREVIEW

Visualizing Draw what you [illegible] were reading. Explain the picture

True or False Is the statement true or false?

1) The Chernobyl accident was the most recent	True	False
2) Many people have died from nuclear power accidents	True	False
3) The radiation created from accidents cause people to move away	True	False
4) In the USA, the Three Mile Island accident lead to less nuclear plants	True	False
5) In Japan, a hurricane caused the nuclear power plant accident	True	False

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Curriculum Connection
E1.1

Energy Efficient Homes

Losing Heat



When we heat our homes, we want the heat to stay inside the home. This can be difficult to achieve as homes are built by piecing materials together. If the seal between the pieces are not airtight, hea find its way to the cooler areas outside of

f the heat is lost through t walls (ed by the roof (25%), doo or (15 indows (10%).

PREVIEW

Insulation

Insulation is used to prevent t f h to or out of a certain area. Your lunchbox is likely insulated so that heat you box cannot easily pass through the insulated materials. This keeps the co tems in unc

You have probably seen pink insulation be your en the walls. It is used to keep the heat inside your house in the winter, a t outs our house in the summer.



Walls and Attic

Since most of the heat is lost through the walls and the roof, most homeowners should focus on these two areas to add insulation.

R-values tell homeowners how much insulation they need. The higher the R-value, the better the area is insulated. In an attic, you should have an R-value of R38-R49. To achieve a higher R-value, you will need to layer the insulation, which prevents heat from passing through.

Some materials provide better R-value ratings than other, meaning you can use less to achieve a higher R-value. Spray foam is a good choice because it expands into all gaps.

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Curriculum Connection
E1.1

Energy Efficient Homes

Questions

Answer the questions below using evidence from the text

1) What is insulation and how does it help conserve energy?

2) Wh[illegible] re is the highest R-value needed?

PREVIEW

Making Connections

What d[illegible] read[illegible] you of in your life?

True or False

Is the statement true or false?

1) The lower the R-value, the better the house is insulated	True	False
2) Most of the heat in a house escapes out of the roof	True	False
3) Spray foam insulation is good as it expands into gaps	True	False
4) Spending money to insulate your home is a waste of money	True	False
5) Insulation only keeps heat inside a home or container	True	False

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E1.1

Net Zero Homes

What is a Net-Zero Home?

A **net-zero home** produces as much energy as it consumes and is up to 80% more energy efficient than a normal home. Therefore, net-zero homes must produce their own renewable energy sources and they need to use energy efficiently so that energy is not wasted.



PREVIEW

Features of Net-Zero Homes

- ✓ Air-tight construction – thermal leakage when heat is lost because of poor construction or inefficient materials. Triple-pane windows, new insulation, and new age materials that provide strong insulation ratings more than homes have. These construction materials allow a tiny furnace or air conditioner to maintain the ideal temperature inside the home. A furnace the size of a hair dryer can heat many net-zero homes to heat the entire house!
- ✓ Renewable energy systems – solar energy is the main renewable energy source used in net-zero homes. The solar panels used on the roof produce as much power as the household uses. The house is still connected to the power grid. That way if the solar panels cannot generate enough energy, the house can utilize power from the grid. If the house produces more energy than it needs, the energy is given to the energy grid for other houses to use. This produces a net-zero amount of energy used.
- ✓ High-efficiency appliances and LED lighting – appliances are becoming greener and more energy efficient each year. Using new appliances reduces the amount of energy used, which keeps the house net-zero.

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STEM INVESTIGATION AND COMMUNITICATION SKILLS

Heat in the Environment

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Grade 7 Science Unit

Strand A - STEM Investigation and Communication Skills

	Curriculum Expectations	Pages That Cover the Expectations
A1.1	use a scientific research process and associated skills to conduct investigations	101 - 104
A1.2	use a scientific experimentation process and associated sk conduct investigations	83 – 86, 89 – 90
A1.3	neering design process and associated skills to test devices, models, structures, and/or	87 – 88, 91 – 94
A1.4	safety procedures during ions, including wearing d clothing and safely	83 – 94
A1.5	communicate their fin chnology vocabulary and formats that ar cific audiences and purposes	83 – 94
A2.1	write and execute code in investigation hen modelling concepts, with a focus on plann programs	– 100, 103
A2.2	identify and describe impacts of coding and of emergi technologies, such as artificial intelligence systems, on everyday life, including skilled trades	103
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	95 – 102
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	95 – 102, 104
A3.3	analyse contributions to science and technology from various communities	95 – 102

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Curriculum Connection
A1.2, A1.4, A1.5

Thermal Energy Experiment

Research Question
What are we learning about?

Atoms and molecules act differently when they are warm, cold, or room temperature. But how do we know? Complete this lab to find out!

Materials
What you will need for the experiment

1. 3 cup[illegible] (clear cups are the best, or you can w[illegible]
2. Hot water
3. Cold water (w[illegible] witho
4. Room temperature w[illegible]
5. Masking tape to label the
6. Food colouring (any colour)



PREVIEW

Method
How you will [illegible]tete [illegible]ment

1) Fill the three cups with the cold, warm, and room temperature water
2) Label each cup with the appropriate label (warm, cold, room temperature)
3) When you are ready to observe, put 5 drops of food colouring into each cup of water.
4) Watch closely what happens to the food colouring. Does the food colouring travel faster in warm, cold, or room temperature?
5) Record your results and check your hypothesis. Fill in your answers below.





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Curriculum Connection
A1.2, A1.4, A1.5

Thermal Energy Experiment

Hypothesis In which cup of water will the colouring move the fastest?

Observa What happened?

What ha ned? D colouring move faster in any of the cups?

Results What happened? r th ns below.

1) Why do you think the food colouring moved faster i wate lower in the cold water?

2) If you mixed chocolate syrup in hot and cold water, which would the syrup mix better in?

PREVIEW

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Curriculum Connection
A1.2, A1.4, A1.5

Science Experiment - Convection

Convection currents can be seen not only in gases, but in liquids as well. The movement of water particles are affected by the temperature of the water. This happens in our ocean currents. Today, you will be creating your own convection current using water.

Materials



- Ice tray
- Water
- Food colouring (dark colour best)
- Clear cup or jar

Procedure

1) Mix the food colouring and water to make a dark colour. Use enough food colouring so that the water is a dark colour.
2) Pour the coloured water into the ice cube tray
3) Put the ice cube tray into the freezer and wait until it is frozen
4) Fill a clear glass with warm water
5) Add one ice cube to the glass of water
6) Observe the action! What happens to the warmer water versus the colder water?



PREVIEW

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Curriculum Connection
A1.2, A1.4, A1.5

Insulation Lab Report

Information | What is this lab about?

Heating and cooling are two of the main uses of energy in the world. We heat and cool our homes and our food all the time. Insulation is important in limiting the amount of heating and cooling we need to do as it allows objects to retain their temperatu

Som rials are better at insulating than others. Today we will test different ability to insulate.

Resea uestion

Which of the fol eria is the best insulator: sand, shredded paper/ newspaper, co wool tin foil?

PREVIEW



Materials

1. Sand
2. Paper/Newspaper
3. Cotton Sock
4. Wool Sock
5. Tin Foil
6. Cups full of warm water
7. Thermometer

Method

1. Wrap the insulating materials around each cup. One materia
2. Fill the cups with warm water.
3. Use the thermometer to measure the temperature of each cup. Record it below.
4. Wait 1 hour and test the temperatures again. Record the temperatures below.
5. Fill in the table to figure out which water stayed the warmest.

Hypothesis – Which insulating material will keep the water the warmest? Why?

_____

_____

_____

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Curriculum Connection
A1.2, A1.4, A1.5

Insulation Lab Report - Questions

Results What happened during the experiment?

Insulating Material	Starting Temperature	Temperature After 1 Hour	Difference in Temperature
Sand			
Shredded p			
Cotton So			
Wool			
Tin Foil			

PREVIEW

Questions

1. Which material is the be or? Ho know based on this experiment?

2. Was your hypothesis correct or incorrect? Why?

3. If you were a pizza delivery person, what material might you use to kee zza warm?

4. What do you think would happen if you did the same experiment with an ice cube in the cups instead of warm water? Which insulator would keep the ice frozen the longest?

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Curriculum Connection
A1.3, A1.4, A1.5

Experiment - Greenhouse Gas Effect

Research Question

What are we learning about?

Is the temperature rising on Earth because of a thick carbon blanket? Will the temperature in a bottle rise more if we wrap it in plastic wrap?

Materials

What you will need for the experiment

1) Pla
2) ttles – with the tops cut off will work
3) Two therm ca the bottles
4) Heat lamp, r or su
5) Elastic
6) Water
7) ~8 Ice cubes
8) Clay or tape – optional



Method

How you will compl xperim

1) Fill the two bottles about one-quarter full of water
2) Add equal amounts of ice cubes to both bottles. Mark the water level
3) Put the thermometers inside the bottles. You can use the clay to balan e the thermometers or tape the thermometers to the side of the bottles
4) Make sure the thermometers are visible so you can read the temperatures throughout the experiment
5) Wrap plastic wrap over one of the bottles to simulate the greenhouse effect. Wrap the elastic around to secure it.
6) Place the two bottles under a heat source, making sure they receive the same amount of heat.
7) Check the temperatures periodically over the next couple of hours. See if there is a difference in temperature

PREVIEW

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Curriculum Connection
A1.3, A1.4, A1.5

Experiment - Greenhouse Gas Effect

Hypothesis

Which bottle will have a higher temperature? Explain why.

Observati

What happened?

Which ? Did the ice melt faster in one bottle? Did the water levels rise or lo either b

Results

Answer estion

1) Explain why the bottle with the plastic wrap ter.

2) How does this represent the greenhouse gas effect?

3) What is happening with our glaciers on Earth? How was this represented in the experiment?

PREVIEW

Name: _____ 93

Curriculum Connection
A1.3, A1.4, A1.5

Experiment - Carbon Dioxide Effects

Research Question — What are we learning about?

How does carbon dioxide affect the air temperature on Earth? If we add carbon dioxide to an environment, will it heat up faster than an undisturbed environment?

Materials — What you will need for the experiment

1) Tw[illegible] bottl[illegible]
2) Two ther[illegible]e[illegible] [illegible]at [illegible]n the bottles. Glass thermometers [illegible]k w[illegible] [illegible]ermometer
3) Heat lamp, radiator, [illegible] day
4) 2-4 seltzer tablets



Method — How you wil[illegible]ete t[illegible]ent

1) Fill the two bottles about one-quarter full of w[illegible]
2) Take the lids off the bottles and cover one of them with du[illegible]
3) Make a hole in the duct tape using scissors. Put the thermomet[illegible]rough this hole
4) Drop the seltzer tablets into the second bottle. Cover it immediately using the duct tape. Cut a hole in this tape as well and stick the thermometer in.
5) Place the two bottles under a heat source, making sure they receive the same amount of heat. You could take them outside on a hot, sunny day or use a heat source.
6) Check the temperatures periodically over the next couple of hours. See if there is a difference in temperature

PREVIEW

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Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Coding - Thermostat

A **thermostat** is a computer that uses code to turn our heating and air conditioning on and off. When a thermostat heats our house up to the right temperature, it turns off to save energy. When the house gets cold again, it turns back on.

An **HVAC technician** is an expert in the heating and cooling of buildings. They install thermostats, air conditioners, furnaces, and the ductwork that air travels through.

You can program your thermostat to different temperatures depending on when you are hom. In the winter, you don't want to let your heat turn off completely because your pipes freeze. Instead, you would turn the temperature down to above freezing, but not to you'll be wasting heat (around 16°C).

T ogram uses coding to work. First, you need to define the time. Then th erature for that time. The backend of the cod l look ike this:



define 00:00

set time 1

PREVIEW

Directions Help program Kyle's ther host per you think are best for the winter

define time1 as 00:00 – 07:

set time 1 to

define time2 as 07:01 – 08:30

set time 2 to

define time3 as 08:31 – 16:00

set time 3 to

define time4 as 16:01 – 22:00

set time 4 to

define time5 as 22:01 – 23:59

set time 5 to

Name: _____ 99

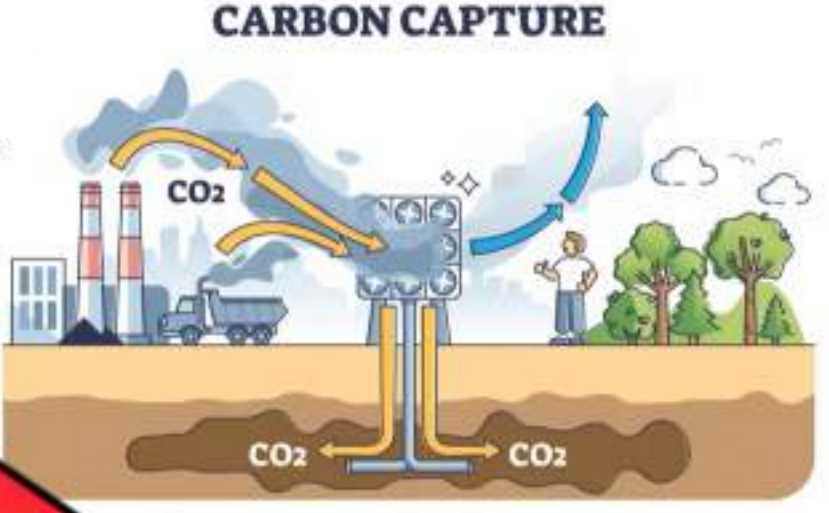
Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Carbon Capture Technologies

What is Carbon Capture and Storage?

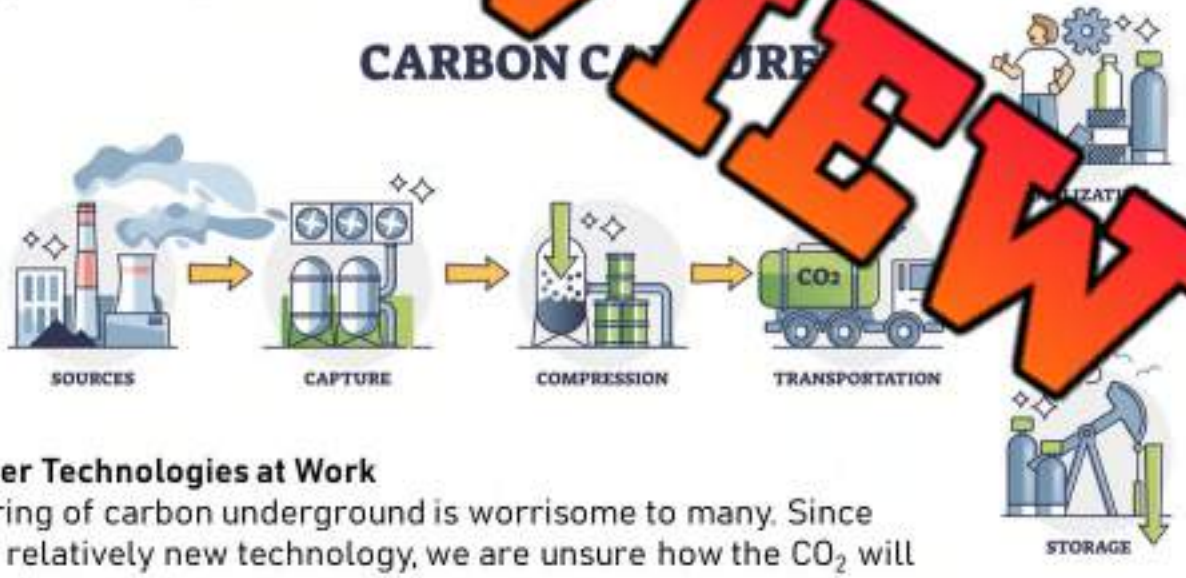
We've learned that the release of carbon dioxide from factories, transportation, and other human activities is creating global warming. Leaders around the world are working to [illegible]duce these emissions through n[illegible] such as the carbon ta[illegible]

[illegible]working to re[illegible] new technol[illegible] has b[illegible] capture carbo[illegible] from factories.



In the diagram [illegible] releasing CO_2. Beside the factory is a gigantic fan that is suckin[illegible]O_2. The[illegible] a filter in it that releases clean air back into our atmosphere. The co[illegible]O_2 i[illegible] underground.

In fact, after the CO_2 has [illegible] col[illegible] compressed to take up less room. The compressed CO_2 is useful in some [illegible] fillin[illegible]ray bottles.



Computer Technologies at Work

The storing of carbon underground is worrisome to many. Since this is a relatively new technology, we are unsure how the CO_2 will react underground.

The company Shell is currently sending their CO_2 emissions 2 kilometres underground. Shell is acting responsibly by monitoring these underground reservoirs filled with CO_2. They have installed sensors in the underground reservoirs to monitor whether the reservoir is saturated or if there is room for more CO_2 storage.

Coding is used to monitor how full the reservoirs are. When a reservoir is full, it will alert the employees who manage the CO_2 storage.

PREVIEW

Name: _____ 100

Curriculum Connection
A2.1, A2.2, A3.1, A3.2, A3.3

Carbon Capture Technologies

Questions Answer the questions below using evidence from the text

1) Explain how carbon capture and storage works. How will it help decrease greenhouse gas emissions?

2) Ho ience a logy helping decreasing carbon dioxide emissions?

PREVIEW

Directions Write defined counts and r e to ca hen the alarm should go off

Defined C

set [sq metres] of reservoir to [ ]

set number of kilograms of [CO_2] that can fit in a square meter

run square metres * CO_2

print [ ]

if [ ] kilograms of CO_2 are put into the reservoir

then [ ]

else [ ]

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Curriculum Connection
A1.1, A3.1, A3.2, A3.3

Assignment - Heating and Cooling Invention

Whether it is scorching hot or snowing outside, the average temperature inside buildings is likely around 20°C. To heat or cool an entire building uses a massive amount of energy. Furthermore, it is a huge waste of energy to heat or cool rooms that no one is using.

That is why we need you to research and develop a heating and cooling technology that only heats the people in a building, not the entire building itself. You can research these ideas online by typing in: "Technologies that heat or cool people, not buildings"

Some of these ideas include:

- ✓ A heat[illegible]d cooling robot that follows people around buildings
- ✓ Wear[illegible]ing that heats and cools
- ✓ Heat[illegible]office chairs



Think [illegible]ve[illegible] designing a heating and cooling technology below

1) How does your [illegible]logy [illegible]oes it heat or cool people, not buildings?

2) What kind of technologies does your invention use? Does [illegible] fa[illegible] recognition to know what to heat and cool? Does it use temperature[illegible]ng? Explain.

3) What will the name of your invention be?

PREVIEW

Name: _____ 103

Curriculum Connection
A1.1, A2.1, A2.2

Assignment - Heating and Cooling Invention



Coding | Write the code that allows your technology to work

How will your invention use code? If your technology uses buttons, it will need code for the buttons to know what to do. Write code for each button or function that the technology does. Even if it doesn't use buttons, it will likely need temperature sensors that tell the technology when to heat or cool.

Write if/el[illegible]tements below for each of the functions your invention does. Consider using defi[illegible]ts to define variables that help your technology work.

PREVIEW