



Preview – Information



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Workbook Preview



Grade 6 Science – Curriculum

Biodiversity

	Curriculum Expectations	Pages	
B1.1	assess the benefits of biodiversity and the consequences of the diminishing of biodiversity	12-23, 31-32, 137-151, 153-154, 156-162	
B1.2	analyse a local issue related to biodiversity while considering different perspectives, plan a course of action in response to the issue, and act on their plan	24-27, 143-149	
B2.1	describe the distinguishing characteristics of different groups of organisms, and use these characteristics to further classify these organisms using a classification system	33-75, 88-91, 94-95, 99-105	
B2.2	Preview of 100 pages from this product that contains 242 pages total.		8-32, 114
B2.3			129
B2.4	describe ways in which biodiversity within and among communities is essential for maintaining the resilience of these communities	138-136	
B2.5	describe interrelationships within species, between species, and between species and their natural environment, and explain how these interrelationships sustain biodiversity	137-142	
B2.6	explain how invasive species reduce biodiversity in local environments	143-149	
B2.7	explain how climate change contributes to a loss of biodiversity, and describe the impact of this loss	150-155	
B2.8	describe the importance of biodiversity in supporting agriculture, including Indigenous agriculture around the world	156-159	

NAME: _____

BIODIVERSITY



Organisms, Species, and Communities

What is a Habitat?

A **habitat** is the place where an organism or a community of organisms live.

An **organism** is a single plant or animal. Think of you as an organism.

A **species** is a group of organisms that share the same species, and you are a member of that species.

Lastly, a **community** is a group of different species that live in the same area (habitat). This means you are a community with other humans, other animal species like dogs and squirrels, and other plant species.

Habitats provide the basic needs for all organisms that live there. For example, humans live in areas where food can grow and water is available. No humans live in Antarctica because the habitat in Antarctica does not provide the things humans need to survive.

Example of a Habitat

In the photo of a habitat in an African savanna, three different species live together in the same community. The organisms share the watering hole so that can all survive.



You can see a single Rudu Antelope organism as well as two Suni Antelope organisms with no horns. A White-Backed Vulture also shares the watering hole. In the picture, there are no plant species visible.

Organism	Species	Community	Habitat

Definitions

What do each of the terms below mean?

Organism	
Species	
Community	
Habitat	

Questions

Answer the questions below using evidence from the text.

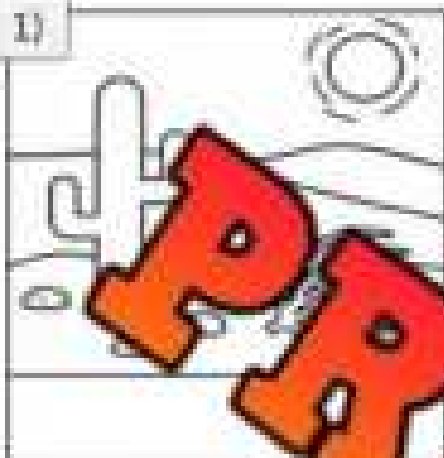
1) What animal species live in the community you live in?

2) What kinds of non-living things can you find in your habitat?

Organism, Species, Community, Habitat**Label**

Is the picture an example of an organism, species, community or habitat?

1)



2)



3)



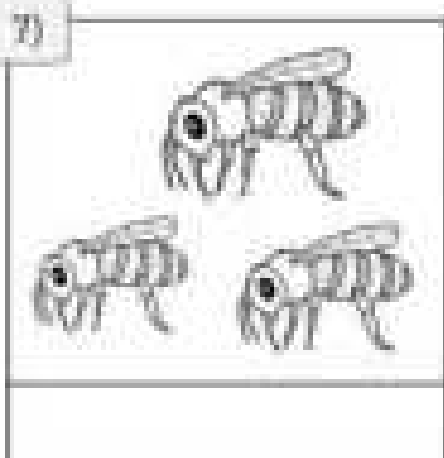
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8)



9)



What is Biodiversity?

What is Biodiversity?

When you look outside, you will see many different plants and animals. We need all of these different living things to keep the balance of life. **Biodiversity** is the variety of living things in a given place. Scientists study biodiversity in different areas to make sure plant and animal populations are healthy.

There are thousands upon thousands of plant and animal species living on the Earth. They are all changing and trying to survive in the environment around them.

Why Study Biodiversity?

It is important to learn about the different species on our planet so we can understand how we need each other in order for all living things to be healthy on Earth. We need to understand the balance between species so we do not lose any of which.

For example, most consider snakes varmints that kill rats. Snakes feed on rats, which means if we kill all of the snakes, we will have a rat population that could get out of control.

Therefore, we need biodiversity, and the variety of animals in our different environments to maintain the balance of life.

Another reason we need biodiversity is for human health. Around 80% of all medicine is derived from natural sources. If we disrupt the balance of biodiversity by killing snakes, we could potentially affect the growth of important plants that are needed for medicines.



Questions Answer the questions below using evidence from the text.

1) What is biodiversity? Why is it important to study biodiversity?

2) What would happen if we killed off a species? Come up with your own scenario like the snake and the turtle in the reading.

Visualizing Draw what you saw in your mind as you were reading. Explain the picture.

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

1. Biodiversity is the study of one plant or animal in an environment.	True	False
2. If one animal goes extinct, it can affect other plants and animals.	True	False
3. Scientists study biodiversity to protect plants and animals.	True	False
4. We need many different plants for medicines.	True	False
5. We are only connected to the other humans in our environment.	True	False

Activity – Making a Bird Feeder

Research Question

What are we learning more about?

If I build a bird feeder and put it in the right spot, can I promote the biodiversity of birds in a habitat near me?



Materials

What do we need for our experiment?

1) Determine the type of bird feeder chosen. Common building materials include:

- ✓ Wood
- ✓ Rope
- ✓ Wood food gl
- ✓ Plastic pipe
- ✓ Milk carton

2) Bird seed

Method

How do we complete the experiment?

- 1) Research different types of bird feeders online.
- 2) Type in "homemade bird feeder" to find ideas.
- 3) When you find one that you think you can make, draw a picture and determine which materials you will need.
- 4) Collect materials and begin building your bird feeder.
- 5) Hang your bird feeder in an area
 - ✓ close to natural shelter, such as trees or shrubs. These places offer resting spots for birds while they are feeding on seeds.
 - ✓ About eye level or slightly above
 - ✓ High enough that squirrels can't jump on them
 - ✓ Away from noisy areas
 - ✓ Choose a different spot than your friends.
- 6) Observe your feeder. Take note what times birds enjoy your feeder.
- 7) Compare the biodiversity at your feeder versus your classmates. Why is it different?

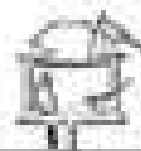
Name _____

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Observation Worksheet
M.I. 501

Journal Observations

What did you notice each day?



Day 1 Observations - What did you notice today?

Day 2 Observations - What did you notice today?

Day 3 Observations - What did you notice today?

Day 4 Observations - What did you notice today?

Day 5 Observations - What did you notice today?

PREVIEW

Name _____

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Journal Observations
ELL 101

Journal Observations

What did you notice each day?



Day 6 Observations - What did you notice today?

Day 7 Observations - What did you notice today?

Day 8 Observations - What did you notice today?

Day 9 Observations - What did you notice today?

Day 10 Observations - What did you notice today?

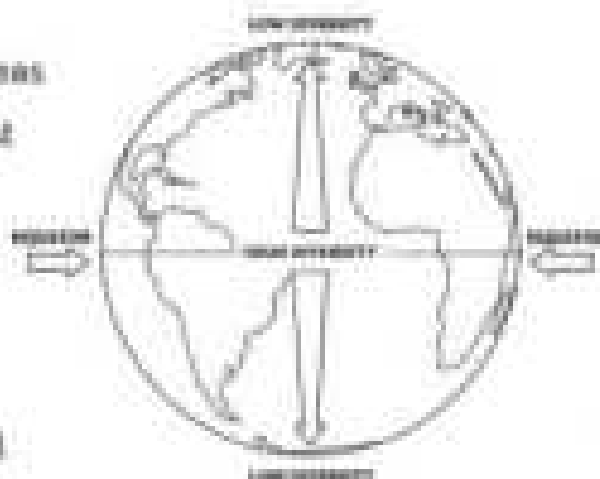
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Longitudinal Biodiversity Gradient

Biodiversity on Earth

The **latitudinal biodiversity gradient** shows which areas around the globe have the most biodiversity, or most variety of different species.

As you see from the gradient, the most biodiversity is found along the equator. This is because the equator is the most moist, warm, sunny, windy, and rainfall. These conditions are all relative and vary throughout the year.



As you get further from the equator, the climate changes from mild to extreme. The climate on the poles is very cold, and the temperatures go from -29°C to 23°C . Organisms that live in these climates are adapted so they can survive in extreme cold temperatures and relative humidity as well.

Biodiversity in Canada

In Canada, we live closer to the poles than to the equator. This makes it difficult for many different species to survive in. We don't have the biodiversity that is found in countries closer to the equator. In Canada, there are around 80,000 different species of plants, animals, bacteria and viruses.

One major reason for this is our temperate climate with four different seasons. Humans use technologies to survive in the winter and summer (ex. furnaces and air conditioning), but other species and organisms do not have these luxuries. Instead, some migrate or hibernate to survive the extreme changes in weather.

Amazon Rainforest

The Amazon Rainforest is home to the most biodiversity in the world. In fact, there are over 2.6 million different species living on only 6.7 million square kilometres. Compare this to Canada's land area of almost 10 million square kilometres.

Questions

Answer the questions below using evidence from the text.

1) Why is there more biodiversity in ecosystems closer to the equator?

2) Why is it harder for plants and animals to live in mild climates than extreme climates?

Questioning

Write 3 questions about biodiversity.

1)	
2)	
3)	

True or False

Circle whether the statement is true or false.

1) The equator has extreme climates that change by season.	True	False
2) In Canada, we have a temperate climate with changing seasons.	True	False
3) The Amazon Rainforest has less biodiversity than Canada.	True	False
4) Wildlife can survive easier in climates near the equator.	True	False
5) Humans can only survive in mild climates.	True	False

Exit Cards

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

Name: _____

Mark

Is the statement true (T) or false (F)?

1) Biodiversity is usually highest near the equator.	T	F
2) The climate near the equator is cold and dry for most of the year.	T	F
3) Biodiversity generally decreases as you move farther away from the equator.	T	F
4) Canada has more biodiversity than countries located close to the equator.	T	F
5) Some Canadian species migrate or hibernate to survive changes in weather.	T	F

Name: _____

Mark

Is the statement true (T) or false (F)?

1) Biodiversity is usually highest near the equator.	T	F
2) The climate near the equator is cold and dry for most of the year.	T	F
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Name: _____

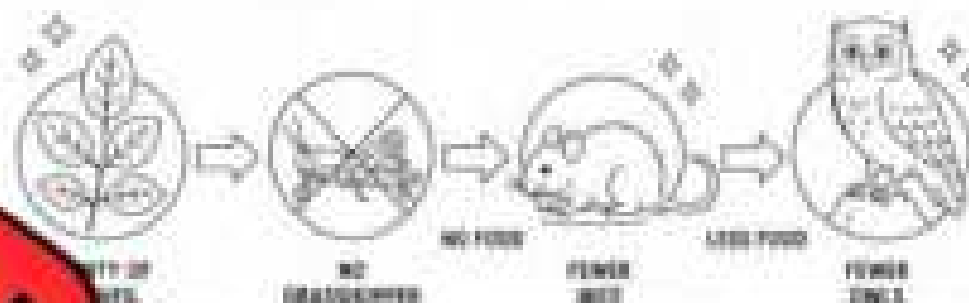
Mark

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3) Biodiversity generally decreases as you move farther away from the equator.	T	F
4) Canada has more biodiversity than countries located close to the equator.	T	F
5) Some Canadian species migrate or hibernate to survive changes in weather.	T	F

Altering the Food Chain

IMPORTANCE OF THE FOOD CHAIN



Changes

When we change one part of a food chain, we can sometimes cause unintended changes to food chains that can happen in many different ways. In the basic example above, you can see that if we get rid of the grasshoppers, the plant population will grow drastically while the mice population will shrink. With fewer mice, the owl population will also shrink.

Altering the Food Chain - Real Life Example

In Borneo, DDT was used as a pesticide to help control mosquitoes that spread malaria. Malaria is a disease caused by a parasite that mosquitoes spread. Malaria can be deadly, but usually causes flu-like symptoms.

The problem with using DDT was that it didn't just kill the mosquitoes; it also killed all the other insects in the region it was used. This meant the food chain was disrupted. Lizards were the main food for lizards. The number of lizards dropped dramatically. As the number of lizards dropped, the number of cats that ate the lizards also dropped. 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.

Questions

Answer the questions below using evidence from the text.

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

2) Give an example of a food chain. Discuss what would happen if humans affected one of the organisms.

Summarize

What happens if you go

True or False

Circle whether the statement is true or false.

1) When humans get rid of pests, it can have an effect on 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

5 Kingdom of Living Things

5 Kingdoms of Living Things

All living things can be classified into 5 different categories: Monerans, Protists, Fungi, Plants, and Animals. That means that all living things will belong to one group.

Living Things

Monerans

- Single cells
- Have a cell wall
- No chloroplasts
- May or may not move
- Example – Spirilla



Spirilla

Protists

- Single cells
- Have chloroplasts
- Example – Amoeba

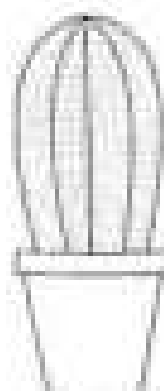
Fungi

- Multiple cells
- Have chloroplasts
- Example – Mushroom



Plants

- Multiple cells
- Don't move
- Have a cell wall
- Example – Cactus



Animals

- Multiple cells
- Can move
- No cell walls
- Have no chloroplasts
- Example – Human



**Which
Classification?**

Read the description of the living thing and write which classification you would put them in.

Description of Living Thing	Classification
1) Has no cell wall but is made of multiple cells	
2) Has a cell wall but is made of multiple cells and no chloroplasts	
3) Is a single celled organism with no chloroplasts or cell wall	
4) Has a cell wall, is made of multiple cells and chloroplasts	
5) Is made of multiple cells, doesn't move, and has cell walls	
6) Doesn't move, has chloroplasts	
7) Single celled, may or may not move, has chloroplasts	

Question

Use information from the table to supply the answer.

1) What are the five kingdoms of living thing?

2) What is the difference between monerans and protists?

3) What is the difference between plants and animals?

Activity – Kingdoms of Life Jeopardy

Objective

What are we learning about?

Students will deepen their understanding of the five kingdoms of living things—Monerans, Protists, Fungi, Plants, and Animals—through a fun and competitive Jeopardy game. They will identify characteristics and examples of organisms from each kingdom, reinforcing their knowledge of biological classification.

Materials

What do you need for the activity?

- Jeopardy board (see page 45)
- Buzzer or bell



Instructions

How will you complete the activity?

1. Print the Jeopardy board on the next page.
2. Divide the class into two teams.
3. Ask one team to go first by selecting a point value.
4. Read the question aloud from the point value.
5. The first team to ring the bell or buzzer gets to answer.
6. If they answer correctly, award them the points. If not, another team can answer.
7. Continue the game until all questions have been answered.
8. Tally the points to determine the winning team.
9. Conclude by discussing what they learned about the topics in the questions.

Jeopardy Question

Ask students the questions below.

1 Points	2 Points	3 Points	4 Points	5 Points
What is the simplest type of living thing? (Monera)	What are single-celled organisms called? (Protista)	What kingdom includes mushrooms? (Fungi)	What kingdom includes flowering plants? (Plants)	What is the most complex kingdom? (Animals)
What kingdom includes bacteria? (Monerans)	What kingdom includes amoeba? (Protists)	What kingdom includes molds? (Fungi)	What kingdom includes conifers? (Plants)	What do plants have that fungi lack? (Chloroplasts)
Which two kingdoms have chloroplasts? (Protists and Plants)	What kingdom includes jellyfish? (Animals)	What do protists use for movement? (Cilia/flagella)	What do plants have that animals lack? (Cell walls)	A spirilla belongs to which kingdom? (Monerans)
What do the simplest living things lack? (Lack a nucleus)	What do protists have that the simplest living things lack? (Nucleus)	What do fungi lack that plants have? (Cell walls)	What do plants have that animals lack? (Prokaryotic)	What do plants use for support? (Cell walls)
What kingdom includes ferns? (Plants)	Where do protists live? (Water)	What kingdom includes trees? (Plants)	Where do plants live? (Chlorella)	Which two kingdoms have no cell walls? (Animals and Protists)

Microscopic Organisms

Microscopic Organisms

An **organism** is an individual animal, plant or single-celled life form. This means an organism is any living thing. That means we are all individual organisms.

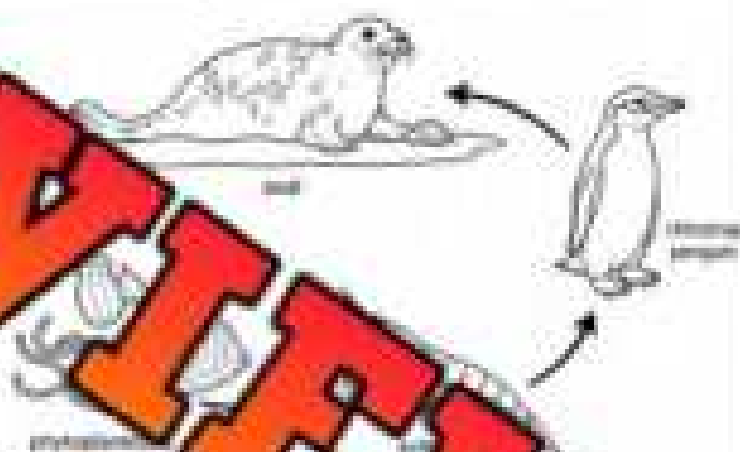


A **microscopic organism** is an organism that is so small that people cannot see it with their naked eye. Therefore, humans, cats, dogs, and snakes are not microscopic organisms because we can see them with our unaided eyes.

There are over 100 million different species of organisms that are microscopic. Wow, that's more than the visible organisms we can see! We can classify microscopic organisms into different categories.

Using a Microscope

Just because we can't see microscopic organisms with our naked eye, doesn't mean we don't know they exist. Scientists use an instrument called a microscope to magnify their view by several hundred times.



Microscopes use lenses to make really small objects look bigger to see microscopic organisms.

Scientists have discovered phytoplankton, which is a microscopic plant found in water. Phytoplankton is very important because it provides a food source to small fish at the bottom of the food chain. Without phytoplankton, larger animals would not survive!



Questions

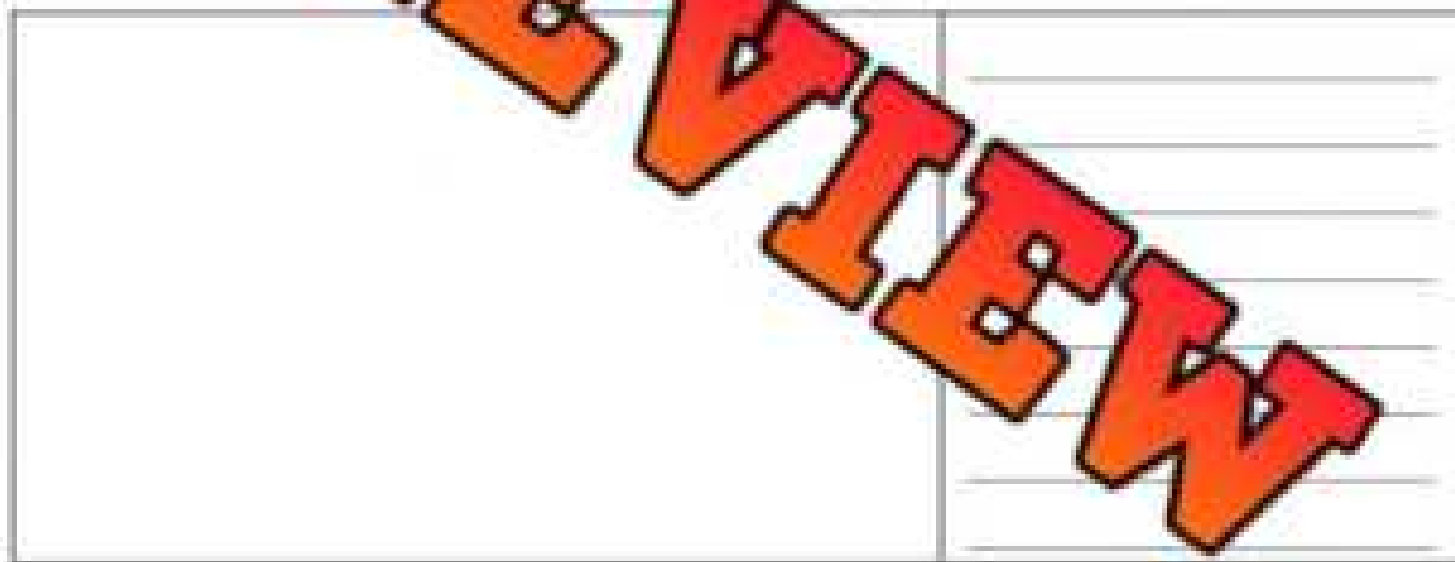
Answer the questions below using evidence from the text.

1) What are microscopic organisms? How do we see them?

2) Why is the microscope such an important instrument? Explain.

Visualizing

Draw what you've learned while you were reading. Explain the picture.

**True or False**

Circle whether the statement is true or false.

1. All animals are visible.	True	False
2. All plants are microscopic.	True	False
3. A microscopic organism is one that we can't see with an unaided eye.	True	False
4. A microscope uses lenses to magnify our view by several hundred times.	True	False
5. We need microscopes to see most organisms in the world.	True	False

Exit Cards

Cut Out

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

Name: _____

Are the statements below true or false?

1) Without microscopes, we would not be able to study cells in detail.

True

False

2) Without phytoplankton, larger animals would still survive.

True

False

3) All microscopic organisms are harmful to humans.

True

False

Name: _____

Are the statements below true or false?

1) Without microscopes, we would not be able to study cells in detail.

True

False

2) Without phytoplankton, larger animals would still survive.

True

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True

False

2) Without phytoplankton, larger animals would still survive.

True

False

3) All microscopic organisms are harmful to humans.

True

False

Animal Classification - Vertebrates

Animal Kingdom - Vertebrates vs. Invertebrates

We can divide the animal kingdom into two categories: Vertebrates and Invertebrates.

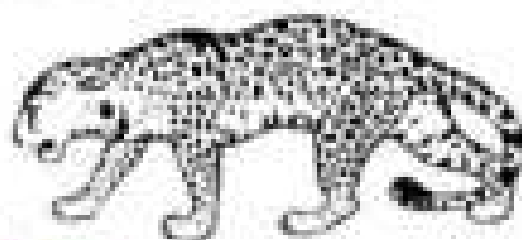
Vertebrate animals have a backbone, while invertebrate animals do not.

Animal Classification - Vertebrates

Vertebrates include mammals, reptiles, birds, amphibians, and fish. Each class has certain characteristics that make them belong to their class.

Mammals

- Have hair or fur
- Give birth to live young
- Mammal mothers nurse their young with milk
- Warm-blooded



Reptiles

- Usually lay eggs but sometimes produce live young
- Have scales, not fur
- They have dry skin
- Cold-blooded

Birds

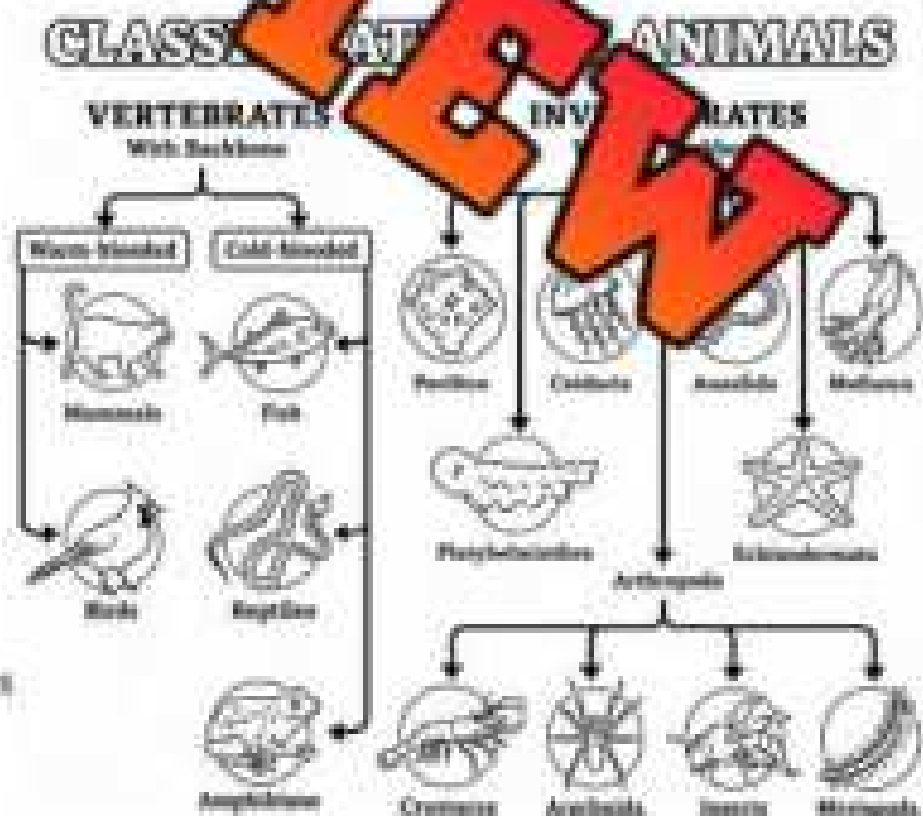
- Have feathers and wings
- Lay eggs
- Warm-blooded

Amphibians

- Live on land and in the water
- Cold-blooded
- Lay eggs
- Moist skin
- Webbed feet

Fish

- Breathe underwater using gills
- Have scales and fins
- Cold-blooded
- Lay eggs



Characteristics of Vertebrate Animals

Compare

Compare the different classifications of vertebrate animals.

1. Which animals have hair or fur?

2. Which animals give birth to live young?

3. Which animals have feathers or scales?



5. Which animals are cold-blooded?

6. Which animals are warm-blooded?

Question

What is the difference between a vertebrate and an invertebrate animal?

Drew

Draw a picture of what you were picturing while you were reading.

Vertebrate Animals

Backbone or Not?

Circle the vertebrate animals.

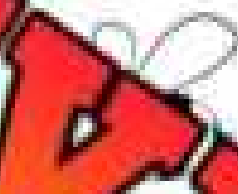
1)



2)



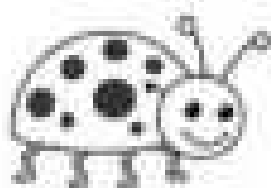
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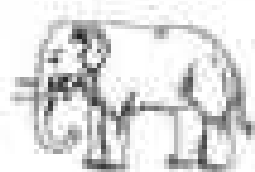
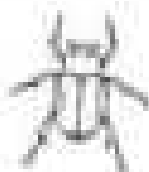
4)



5)



6)



7)



Characteristics of Invertebrate Animals

Invertebrates

Invertebrates are animals that do not have backbones. Vertebrate animals are mammals, amphibians, reptiles, fish, and birds. These animals have backbones and makeup only 4% of the total animal species in the world. That means 96% of the total animal population are invertebrates!

List of some Invertebrate Animals

The following is a list of some of the types of invertebrate animals.

Marine

There are thousands of animals found exclusively in marine environments. These species include jellyfish, jellyfish, anemones, and starfish.

Mollusks

The word mollusk is soft to remember because mollusks are soft animals. They do not have an exoskeleton. Some have shells made of calcium carbonate. Examples include octopus, slugs, squids, and snails are all mollusks.

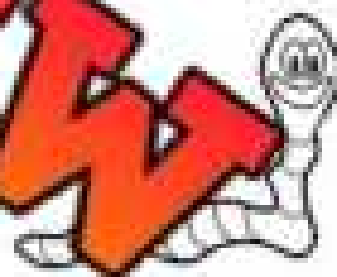


Crustaceans

Most crustaceans live in the sea and include animals such as crabs, shrimp, barnacles, and crabs. However, two types live on land - insects and millipedes. Crustaceans are arthropods because their skeletons are on the outside of their bodies.

Worms

A worm is an elongated soft-bodied invertebrate animal. The earthworm is the most well known worm, however, there are hundreds of thousands of different worm species that live in habitats other than soil.



Insects

Insects make up the largest group of invertebrates in the world. There are over 1 million species of insects! Insects have exoskeletons and three main body parts: head, thorax, and abdomen. Examples of insects are grasshoppers, dragonflies, and butterflies.



Spiders, Centipedes, and Scorpions

These animals are all part of the arthropod phylum, which means they have an exoskeleton. Spiders and scorpions are arachnids because they have eight legs. Centipedes and millipedes are myriapods and have lots of legs! Tarantula's and Black Widows are examples of spiders.

True or False

Circle whether the statement is true or false.

1. Mollusks are soft animals who don't have a skeleton or exoskeleton.	True	False
2. There are over 1 million different marine species.	True	False
3. Arthropods are invertebrate animals who have an exoskeleton.	True	False
4. Mammals, amphibians, reptiles, fish, and birds are invertebrates.	True	False
5. 96% of animal population are invertebrates.	True	False
6. The largest group of invertebrates are insects.	True	False
7. Jellyfish are mollusks.	True	False
8. Worms live in the soil.	True	False
9. Crustaceans and arthropods often live in the water.	True	False
10. Insects have exoskeletons and three main parts: head, thorax, abdomen.	True	False

Question

What are invertebrate animals? How many on Earth?

Questioning

Write 3 questions you have about invertebrate animals.

1)	
2)	
3)	

Invertebrate Animals**Backbone or Not?** Circle the invertebrate animals.

1)



2)



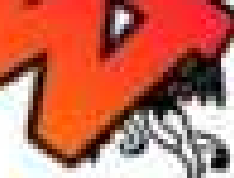
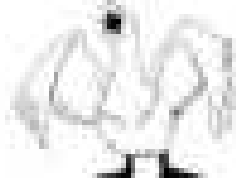
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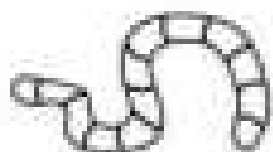


7)



Vertebrate or Invertebrate?**Backbone or Not?**

Circle whether the animal is a vertebrate or invertebrate.

Vertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
InvertebrateVertebrate
Or
Invertebrate

Exit Cards

Cut Out

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

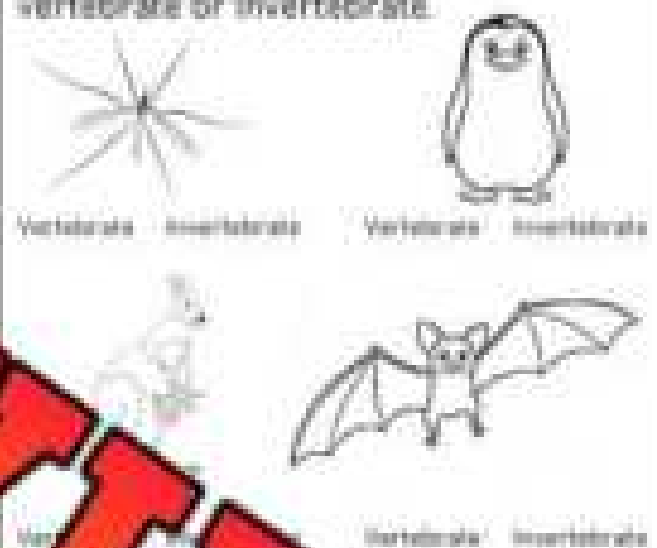
Name: _____

Circle whether the animal is a
vertebrate or invertebrate.



Name: _____

Circle whether the animal is a
vertebrate or invertebrate.



Name: _____

Circle whether the animal is a
vertebrate or invertebrate.



Name: _____

Circle whether the
vertebrate or invertebrate.



Crossword

Complete the crossword puzzle by using the clues to fill in the correct words about vertebrate and invertebrate animals.



Across	Down
3. These vertebrates can live on land and water and have moist skin.	1. Animals without a backbone are called _____.
6. Animals that have a backbone are called _____.	2. These vertebrates have hair or fur and feed milk to their young.
7. Snails, clams, mussels, and octopuses belong to this group.	4. These vertebrates have feathers and wings.
8. These cold-blooded vertebrates have scales but no fur.	5. These soft-bodied invertebrates include earthworms.
10. These animals have scales, breathe using gills, and live in water.	9. These invertebrates have six legs and three main body parts.

Experiment – Vertebrates vs Invertebrates

Research Question

What are we learning more about?

Can invertebrates or vertebrates support more weight?



Materials

What do we need for our activity?

- 1) Playdough to make animals
- 2) One pipe cleaner
- 3) Weights – wooden blocks or weights



Method

How do we complete the experiment?

- 1) Make an animal like the one in the picture above.
 - i. Make 4 legs
 - ii. Make a body
 - iii. Attach the legs to the body
 - iv. Put a head on the body
- 2) Make another animal using the same steps as above.
- 3) Put a pipe cleaner through the body to act as a backbone.
- 4) Put one block on each animal and observe.
- 5) Keep adding blocks until one of the animals collapses.



Observations

How many blocks did each type of animal hold?



	Number of Blocks
Vertebrates	
Invertebrates	

**Results** Answer the questions below.

1) Which type of animal held more weight?

Vertebrates

Invertebrates

2) Which type of animal do you think is really bigger?

Vertebrates

Invertebrates

3) Why do you think the bigger animals are vertebrates?

4) If an invertebrate animal gained a lot of weight, what could happen?

5) Write examples of both vertebrates and invertebrate animals below.

Vertebrates

Invertebrates

Memory Game: Animal Kingdom Memory Match

Objective

What are we learning about?

To help students understand and recall various terms related to the diversity within the Animal kingdom, focusing on both vertebrates and invertebrates.

Materials

What will you need for the activity?

- Memory game cards (provided) with the terms on one set and definitions on another set.
- A flat surface like a table to lay out the cards.



Instructions

How will you complete the activity?

1. Divide the class into groups of 3 or 4. Give each group a set of Memory Game cards. (Provided)
2. Have each group lay all the cards face down in a grid on a flat surface.
3. The students take turns flipping over two cards at a time, looking for 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 why these terms are important to understand and how they relate to the diversity of animal types in various environments.

Cards

Terms related to animal kingdom

Terms	Definition
Vertebrates	Animals with a backbone, like birds, fish, and mammals.
Invertebrates	Animals without a backbone, like insects and worms.
Sponges	Aquatic animals that live in water.
Worms	Long, slender animals without legs, like earthworms.
Mollusks	Soft-bodied animals, often with shells, like snails.

Cards

Terms related to animal kingdom

Terms	Definition
Arthropods	Animals with jointed legs and segmented bodies, like spiders and insects.
Warm-blooded Animal	Keeps a steady body temperature on its own
Cold-blooded Animal	Animals that cannot control their own inner body temperature
Crustaceans	Hard-shelled arthropods, like crabs and lobsters.
Amphibians	Vertebrates that live on land and water, like frogs.

Cards

Terms related to animal kingdom

Terms	Definition
Reptiles	Cold-blooded vertebrates with scales, like snakes.
Birds	Vertebrates with feathers and beaks.
Mammals	Warm-blooded vertebrates with fur.
Primates	A member of the animal group that includes humans, apes, monkeys, and lemurs
Insects	Make up the largest group of invertebrates in the world

Cards

Terms related to animal kingdom

Terms	Definition
Fish	Animals that swim and breathe with gills.
Clam	Shellfish that have two matching shells.
Snails	Slow-moving animals with a hard shell.
Spiders	Bugs with eight legs and no wings.
Tapeworms	Long, flat worms that can live inside other animals.

Herbivores, Carnivores, Omnivores

Herbivores

Consumers that are herbivores eat only plants. Examples of herbivores are cows, deer, goats, gorillas, butterflies, camels, horses, rabbits, rhinos, and sheep.



Carnivores

Consumers that are carnivores eat only other animals for energy. Examples are tigers, lions, sharks, walrus, platypus, penguins, wolves, owls, alligators, and foxes.

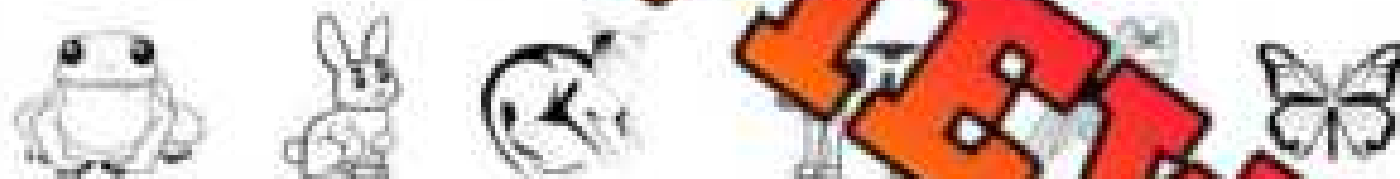
Omnivores

Consumers that are omnivores eat both plants and animals. They eat whatever they can find! Examples are birds, pigs, chickens, squirrels, rats, bears, raccoons, coyotes, and almost humans.

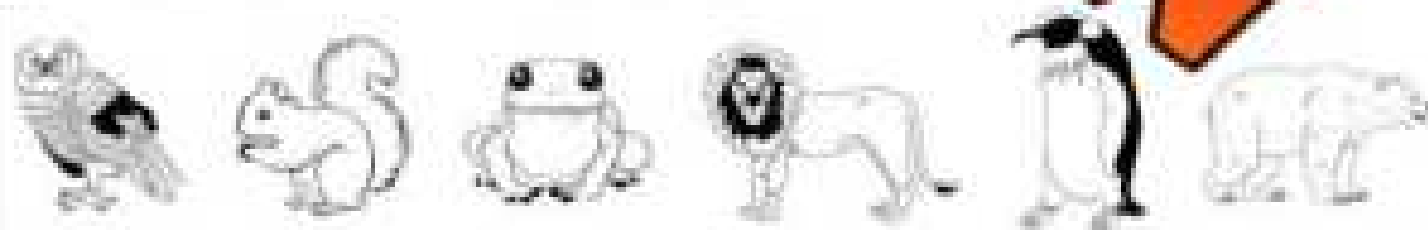
Questions

Answer the questions by

1) Circle the animals that are herbivores.



2) Circle the animals that are carnivores.



3) Circle the animals that are omnivores.



Name: _____

69

Animals, Carnivores
503

Directions

Is the organism, a carnivore, herbivore or omnivore?

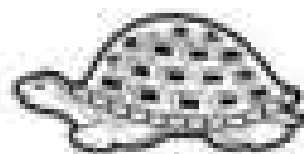
Elephant



Bird



Turtle



Snake



Skunk



Chipmunk



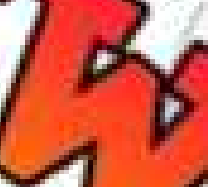
Frog



Fish



Spider



Alligator



Camel



Beaver



PREVIEW

Exit Cards

Cut Out

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

Name _____

Is the organism a carnivore, herbivore or omnivore?

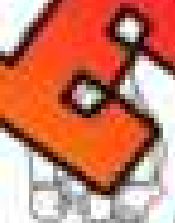


Shark

Giraffe



Human



Chimpanzee

Name _____

Is the organism a carnivore, herbivore or omnivore?



Shark



Giraffe



Human



Chimpanzee

Name _____

Is the organism a carnivore, herbivore or omnivore?

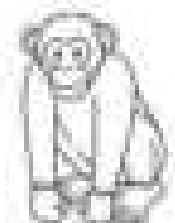


Shark

Giraffe



Human



Chimpanzee

Name _____

Is the organism a carnivore, herbivore or omnivore?



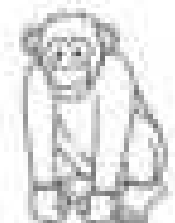
Shark



Giraffe



Human



Chimpanzee

Classifying Organisms**Research**

Fill in the table about the animal in the first column.

Animals	Producer, Consumer, Decomposer	Herbivore, Omnivore, Carnivore	Primary Producer or Primary, Secondary, Tertiary, Quaternary Consumer
 Eagle			
 Grass			
 Rabbit			
 Bear			
 Fox			
 Deer			

Research

Fill in the table about any animal that you want to learn more about.

Animals	Producer, Consumer, Decomposer	Herbivore, Omnivore, Carnivore	Primary Producer or Primary, Secondary, Tertiary, Quaternary Consumer

PREVIEW

Experiment – Designing a Zoo Enclosure

Research Question

What do animals need to survive?

You work at a zoo and need to choose an animal to buy to bring to the zoo. You'll need to understand what that animal needs in their enclosure to survive.

Materials

What do we need for our activity?

- 1) A box – the animal's home
- 2) A box – the animal's home
- 3) Pipe cleaners
- 4) Toothpicks or wire
- 5) Straws
- 6) Construction paper



Method

How do we complete the experiment?

- 1) Decide which animal you want to buy for your zoo.
- 2) Research what the animal needs 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 animal has everything it needs.
- 6) Begin making the model of your zoo enclosure.
- 7) Complete the extension activity – math connection.

Planning

Answer the questions below.

1) What does your animal need to survive?



2) What will you put in your enclosure so that the animal can survive?

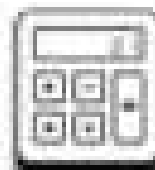
3) What could you put in the enclosure so that the animal has fun?

PREVIEW

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
Clay	\$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 below.

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

Zoo Enclosures – 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.



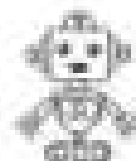
1) Is it fair to lions to have humans behind glass in their enclosure? Explain.

2) What is used?

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

STEM – Working at the Zoo - Coding

EVA is a robot that works at the zoo. The staff needs your help to program her to get her work done. Write commands for EVA to do.

**Zoo**

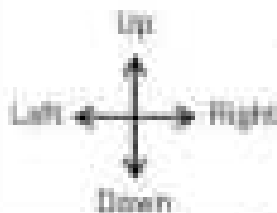
Use this map to write code on the next page.



Name: _____

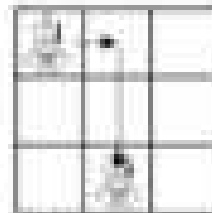
83

Destination: _____
All 1



Commands - Use the example below to learn the code:

Move 1 right.
Move 2 down.



Directions:

Tell EVA where to go to get her work done.

1) EVA needs to check on the bears and then feed the snakes.

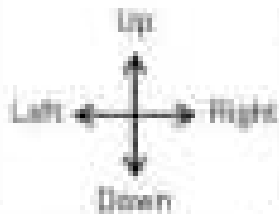
2) EVA needs to make money from the lions.

3) EVA needs to get a drink, ride an elephant, and get bamboo for the panda.

Name: _____

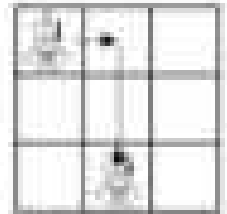
84

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Commands - Use the example below to learn the code:

Move 1 right
Move 2 down



Directions

Tell EVA where to go to get her work done.

4) EVA needs to play with the giraffes, feed the lions and sharks, and then clean the bath.

5) EVA needs to check on the gorillas, sharks, bears, snakes, and mandas, and then get a drink. Write as few lines of code to get all the animals and then get a drink.

Coding

How does coding help zoos?



1) How does having a robot like EVA help the workers at the zoo?

2) Timers are used at zoos to keep track of when animals need to be fed. Codes are used to make the lights go off at different times.

If you was to code for monkeys, lions, and otters, what times would you feed them?

Monkey

Lions

Otters

3) For some animals, they can press a button to get food or water. The code to work the machine would be:

if animal presses button
then open door to food

How would using a code like this help zoo workers?



4) When you buy tickets to the zoo, you can now buy them online. Write what the code could be below:

Experiment – Animal Scat

Research Question

What is the difference between carnivores, omnivores, and herbivores?

Animal scat is the poop that animals produce as waste from the food they eat. Depending on your diet, animals will have differently sized, coloured, and shaped scat.

Materials do we need?

- ✓ Brown playdough or clay
- ✓ Plastic toy insect or small animal
- ✓ Grass clippings and/or leaves
- ✓ Raisins or other dried fruits



Method

How do we complete the experiment?

- 1) Mold the brown playdough into scat. You can think of an animal and research their size of scat or model something like the one in the picture.
- 2) If it is an herbivore, add plants to the scat.
- 3) If it an omnivore, add plants and animals to the scat.
- 4) If it is a carnivore, add just the animals to the scat.



Herbivore Scat

Name _____

87

Observation Worksheet
All 1-40 2-411-412

Observations

What happened?

1) What size of scat did you make? What animal might have scat that looks like this?

2) Describe scat for each of the consumers below.

Herbivore

Carnivore

Omnivore

Research

Answer the questions below.

1) Can hunters track animals based on their scat? Explain.

2) Draw the animal's scat below.

Rabbit - Herbivore

Fox - Carnivore

Raccoon - Omnivore

Seed Plant – Life Cycle

Seeds vs Bulbs

All plants begin their life as seeds, however, some plants will live underground in the form of a bulb. A **bulb** is a plant that lives underground and has its leaves grow up through the surface. Garlic is an example of a bulb. All forms of plants are seed plants.



Some plants live one or two seasons, and most bulb plants are perennials, which means they live more than 2 seasons. This is because they have different life cycles.

Life Cycle of a Seed Plant

1. **Seed** – The seed plant begins its life as a seed. The seed has a hard shell that protects the embryo inside.
2. **Germination** – The seed falls to the ground and needs the water and warmth from the air and the soil. This stage is called germination, which is when a plant grows from a seed to a seedling. The seed will swell and split in the soil and a sprout will form.
3. **Growth** – The plant will keep growing through the process of photosynthesis. The plant provides its own food and will grow if it receives its basic needs.
4. **Reproduction** – The flowers on a plant will produce seeds when they have been pollinated. In fruit producing plants, fruit will grow on the flowers at this stage.
5. **Spreading Seeds** – The seeds from the fruit or from the flowers will spread as animals eat them or as the wind blows them away. This begins the life cycle of a plant all over again!



Questions Answer the questions below using evidence from the text.

1) What is the difference between a bulb plant and a seed plant?

2) What does germination of a seed mean?

Ordering Put the stages of a plant in order from first to last - 1 to 5.



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

1) Germination is when the seed coat splits open.	True	False
2) A seed plant will continue to grow year after year.	True	False
3) A perennial plant is a plant that grows for more than 2 seasons.	True	False
4) A plant will continue growing even if it doesn't have its basic needs met.	True	False
5) Only the wind spreads seeds on the soil.	True	False

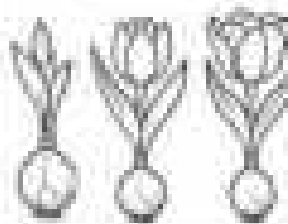
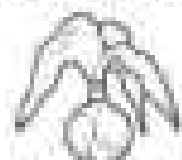
Bulb Plant – Life Cycle

Bulb Plants

A bulb plant lives through the winter inside the ground. A bulb will continue to grow year after year until it is harvested (pulled out of the ground). Bulb plants complete their life cycle underground.



Life Cycle of Bulb Plants - Stages

	1) Dormant The bulb prepares for winter by forming roots in the ground. It gathers energy from the soil around it. The bulb is in the half-asleep as they don't grow in size but are still alive. But they do quietly work away at growing and roots.
2) Waking Up 	As the temperature warms in the spring, the bulb begins to grow. You will see the shoot grow through the soil.
3) Bloom 	The bulb blooms after spending the winter and several months gathering energy. It has rested and gotten enough light, water, and warmth to bloom. This means it will turn into a plant that we can see above the ground.
4) Falling Asleep 	The bulb plant will fade into the ground as the temperatures get colder. The bulb is not dying! It is saving and gathering energy so it can grow again next year.

Matching

Write the letter from the description beside each stage.



	Dormant	a) The bulb feels the warmer weather. It will grow a shoot.
	Waking Up	b) The bulb prepares for winter. It is half asleep as it doesn't grow.
	Bloom	c) The plant grows bigger. The flower will open up.
	Falling Asleep	d) The bulb feels the cold air and the shorter days.

Questions

Answer the questions below.

1) Where does a bulb spend most of its life cycle?

Underground

2) What is the difference between a dormant bulb and a growing bulb?

Visualizing

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

Describe your picture.

Experiment – Basic Needs of Plants

Research Question What do plants need to survive?

Will plants survive in any environment? Will seeds grow better in the dark or in the light? Will they grow better with water or without?



Materials What do we need for our experiment?

- 1) 6 small plant seeds
- 2) 5 cups
- 3) Soil
- 4) Fridge
- 5) Shredded paper
- 6) Seeds - lettuce, bean, corn, and cauliflower germinate the fastest

Method How do we do the experiment?

- 1) Fill 5 cups with soil.
- 2) In the 6th cup, do not add soil. Instead add shredded paper.
- 3) Add your seeds to the soil, about 2 cm deep (2 seeds for each cup).
- 4) In one of the cups with soil, add a lot of seeds.
- 5) Place one cup in a closet, where it won't get sun or light.
- 6) Place another cup in the fridge, where it is cold.
- 7) Place four cups in a window where it will get the most sun. One of them should be the one with a lot of seeds and one should be the shredded paper.
- 8) Water each of the cups two times a day. Do not water one of the two cups that are in the window (you should water the one cup with a lot of seeds).
- 9) Monitor the results by checking the cups each day.

Hypothesis In which cup will the seed(s) grow the fastest?

Cup 1 In the Closet	Cup 2 In the Fridge	Cup 3 A lot of Seeds	Cup 4 Window with Water	Cup 5 Window no Water	Cup 6 Shredded Paper

Observations

Have any of the seeds sprouted? Put a (S) or an (X)



Day	Cup 1	Cup 2	Cup 3	Cup 4	Cup 5	Cup 6
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
15						
20						

Needs of Plants – Making Connections

Help!

Andy needs help solving the problems below so his plants can grow.



1) It is supposed to be very cold tonight. It might even snow! Andy has a plant outside getting sunshine. What should he do?

2) Andy has a plant in a pot. He put it under a big tree so it would have a friend. Why won't it grow? What should he do?

3) Andy loves corn! He wants a lot of corn plants, so he put 100 seeds in his small pot. Oh no, no corn is growing! What should he do?



4) Andy's sunflower is growing well in a pot in his house. Andy is going on vacation for 2 weeks. He wants his sunflower to keep growing. What should he do?

Plant Classification – Flowering/Non-Flowering

What are Flowering Plants?

Simply put, **flowering plants** are plants that make a flower. Some of these flowers are bright and beautiful, while others are dull and small. Either way, flowers have the important purpose of making seeds. More specifically, flowering plants produce fruits that have seeds in them. Producing seeds allows flowering plants to reproduce, making new plants from their seeds.

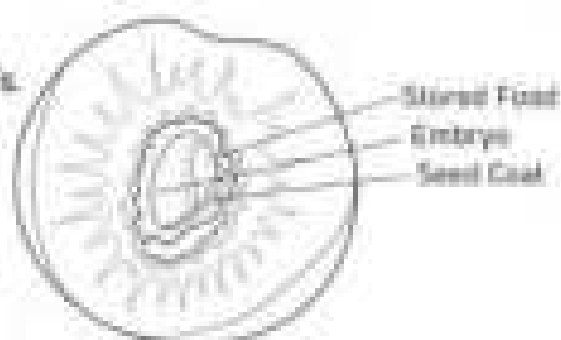
Flowering plants are also known as angiosperms.

Angiosperms have seeds enclosed inside a fruit.

Around 90% of all flowering plants are angiosperms.

Most trees are flowering plants, and many are angiosperms.

Some flowering plants produce flowers, like broccoli.



What are Non-Flowering Plants?

Non-flowering plants are plants that do not produce flowers. They usually reproduce through spores.

Non-flowering plants include cryptogams and gymnosperms. Cryptogams have no flowers, fruits, or seeds. Examples of cryptogams are ferns, mosses, lichens, algae, and fungi. Gymnosperms have seeds, but with no fruit, so the seeds are unprotected. Instead, the seeds are on the outside of the plant. Examples of gymnosperms are woody shrubs and trees like pine, spruce, fir, and ginkgoes.

Differences Between Flowering and Non-Flowering Plants

Flowering Plants	Non-Flowering Plants
• Commonly known as angiosperms	• include cryptogams and gymnosperms
• Have seeds and flowers	• Cryptogams have no seeds or flowers
• Seeds are protected in a fruit	• Gymnosperms have unprotected seeds
• Have roots, leaves, and stems	• Most have no stems, roots, or leaves
• Examples: orchids, grasses, sedges	• Examples: mosses, ferns, conifers

Questions

What is the difference between a flowering plant and a non-flowering plant?

Flowering

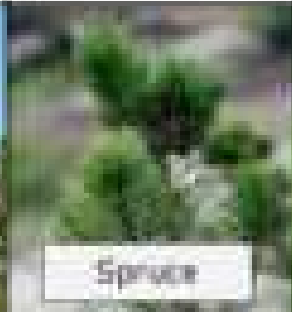
Flowering

Is the description flowering or non-flowering?

1) Includes angiosperms	Flowering	Non-Flowering
2) Known as gymnosperms	Flowering	Non-Flowering
3) Has their seeds protected	Flowering	Non-Flowering
4) Has their seeds protected by a fruit	Flowering	Non-Flowering
5) Has roots, leaves, and a stem	Flowering	Non-Flowering
6) Mosses, ferns, and conifers	Flowering	Non-Flowering
7) Examples include spruce, pine, and firs	Flowering	Non-Flowering
8) Grasses are an example	Flowering	Non-Flowering
9) 80% of all plants are...	Flowering	Non-Flowering
10) Includes cryptogams that have no seeds	Flowering	Non-Flowering

Flowering or Non-Flowering?

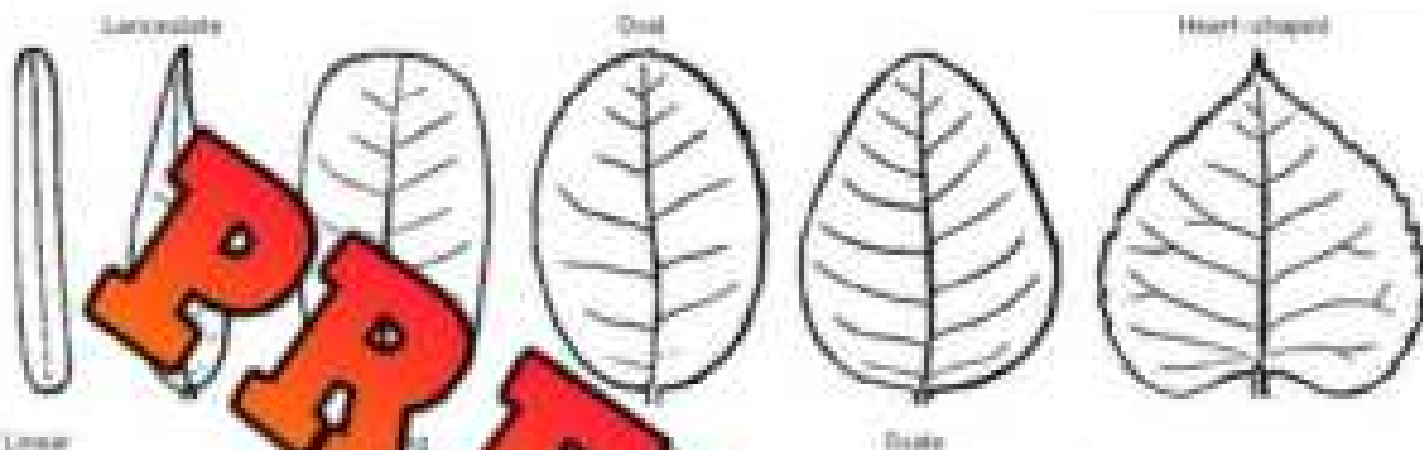
Is the plant flowering or non-flowering?

				
White Pine	Spruce	Grass	Fern	Strawberry

Classifying Leaf Shapes

Leaf Shapes

Check out the different leaf shapes below. There are many different leaf shapes, but here are six examples of common leaf shapes we see in our environment.



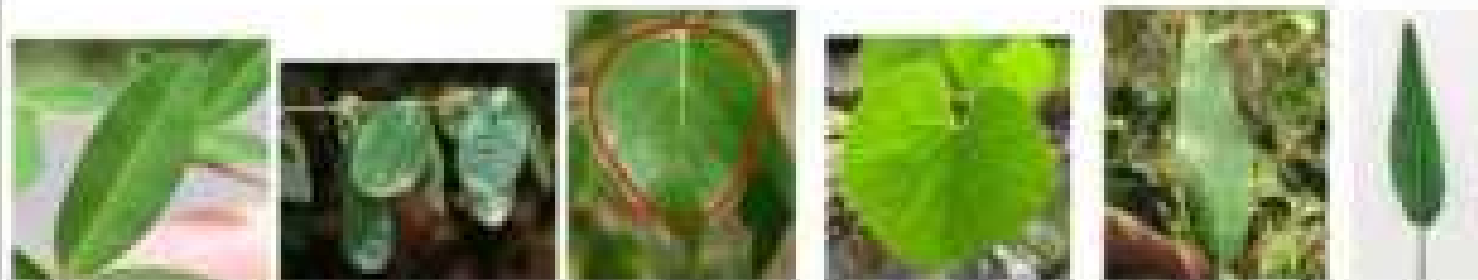
Describe

Describe the leaves below. Look like below.

Shape	Description (pointed, rounded, symmetrical, long, short, etc.)
Linear	
Lanceolate	
Oblong	
Oval	
Ovale	
Heart-shaped	

Label

Label the leaves below. Do not use a name more than once.



Investigating Leaf Shapes

Go outside and search for differently shaped leaves. Draw pictures of the leaves and describe their shape.

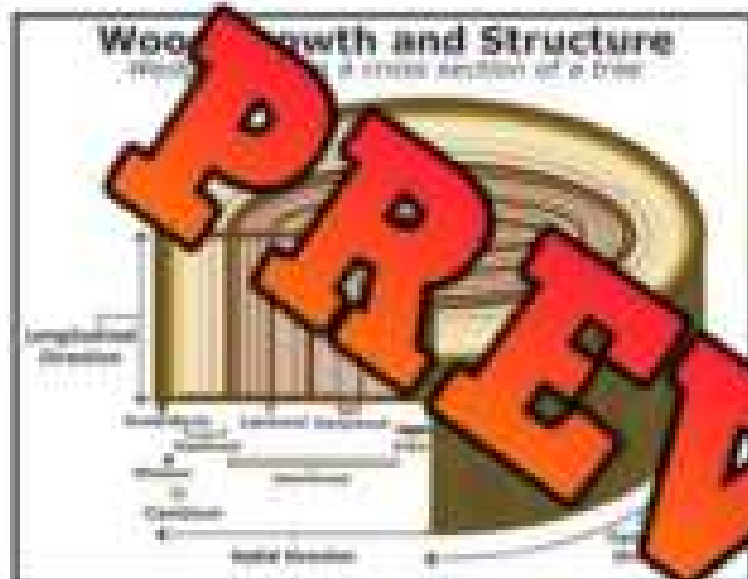
Investigate Find differently shaped leaves and draw/describe them below.

	Drawing	Description
1)		
2)		
3)		
4)		

Growth and Scars of Trees

Tree Cookies

A scientist can learn a lot about the history of a tree by examining a tree cookie. A **tree cookie** is a cross-section slice of a tree trunk. Tree cookies are also called **dendrodiscs**. We can determine the tree's age, growing conditions, and how the tree was treated by looking at the tree's dendrodisc.



Feature	What It Tells Us
Rings	The number of rings on the tree tells us the age of the tree. Each year of growth is one light ring and one dark ring. The light ring represents how the tree grew in the spring and summer. The dark ring represents it growing in the winter and fall.
Growing Conditions	If the rings are close together, it means the tree grew in poor conditions like less sunlight, moisture, and nutrients. This means the tree grew slowly. Wider rings meant the tree had optimal sunlight, water, and nutrients.
Scars	We can see scars in a tree cookie that tell us if the tree was in danger. If a tree was on fire, a scar will be circular. If there was insect damage, the tree will show a scar that cuts through a couple layers. Even a branch being broken off will leave a scar. The photo above to the right shows a scar of a tree that had a dead branch broken off.

Questions

Answer the questions below using evidence from the text.

1) How do we know how old a tree is?

2) How can we tell what growing conditions a tree lived through? How do we know if the tree was

Questioning

What questions do you have about the information?

1)

2)

True or False

Circle whether the statement is true or false.

1. One ring is one year of growth for a tree.	True	False
2. When a branch is broken off a tree, the tree will show a scar.	True	False
3. A wider ring means the tree struggled to get enough sunlight, water, or nutrients.	True	False
4. A narrow ring means the tree grew slowly.	True	False
5. A tree cookie is known as a dendrodisc.	True	False

Tree Rings - Investigation

Research Question

What are we learning about?

We can learn a lot about a tree by looking at its rings. When a tree has been cut down, you can examine the tree stump to see how old the tree was, how much damage the tree experienced, and the trees growth conditions.

Use the reading to help you investigate a stump.



Materials

What do we need for the investigation?

- ☐ An old tree stump
- ☐ A computer if no tree stump
- ☐ The recording page
- ☐ The reading on page 94



Procedure

How will you complete the investigation?

- 1) Go outside and find a tree stump. If you can't find one outside, search for a tree stump online.
- 2) Look for a stump that has clear rings that you can investigate to learn more about.
- 3) Use the reading to help tell you about what the rings means.
- 4) Answer the questions on the next page.



Name: _____

111

October 2020
10.1.2020

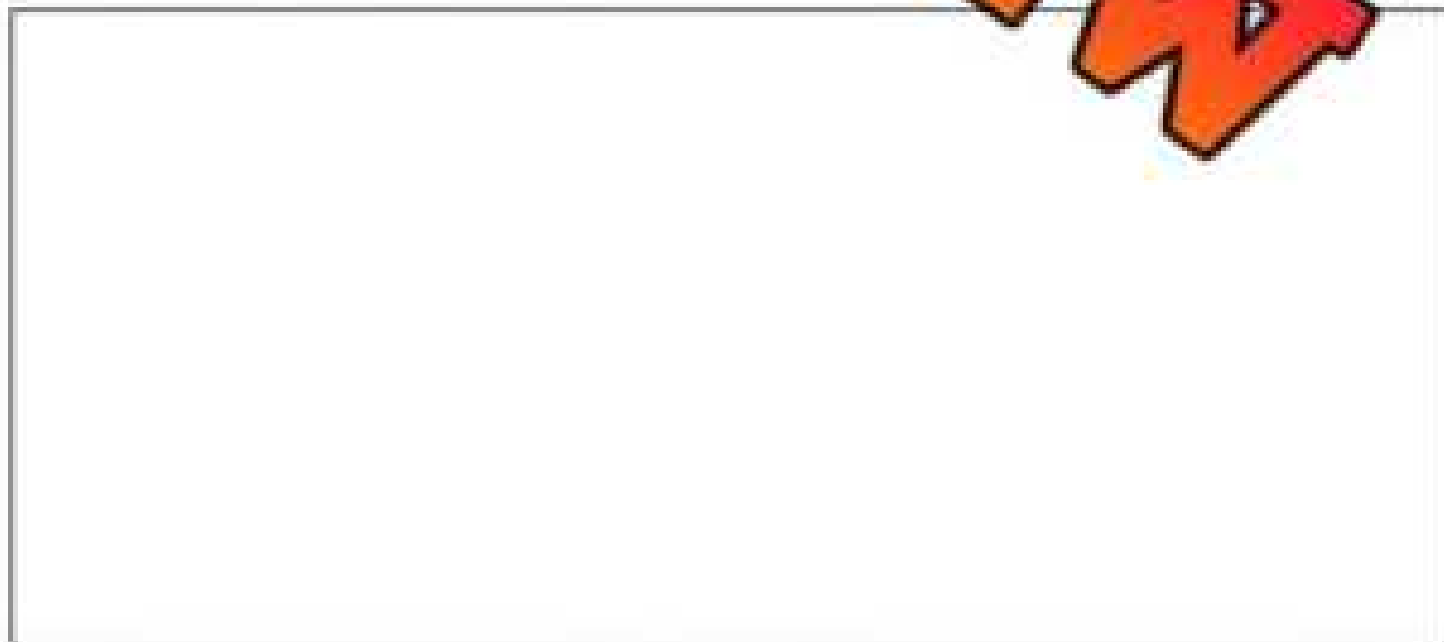
Observations

Fill in the table explaining what you learned about the tree:

	How Do You Know?
Age	
Growth Condition	
Trauma	

Diagram

Draw the tree stump showing the number of rings and colors present.



Wildlife Population and Communities

Wildlife Population

Scientists that study biodiversity are interested in wildlife population. **Population** means how many members of the same type of living thing there is in an area. The population of your city or town is how many humans live there.

Scientists need to track the population of plants and animals so they can see if any are at risk of extinction. **Extinction** means that an entire species is no longer living. Sometimes we need to help plants and animals. This is why scientists monitor their populations.



Wildlife Communities

A wildlife community is the different populations living in an area together. In your community, you live in an environment with many different plants and animals. You all belong to the same community.

Some Animal Populations in Ontario

	Year - 2000	Year - 2010	Year - 2020
Beavers	3,600	3,500	4,000
Raccoons	22,000	17,000	14,000
Canada Geese	34,000	35,000	36,000
Coyotes	4,500	2,800	2,300
Black Bears	140,000	160,000	150,000



Reflection

Which two animals are in danger of extinction? Explain why.

True or False

Circle whether the statement is true or false.

1. Population is the number of different animal communities in an area.	True	False
2. Population is how many members of one species live in an area.	True	False
3. Extinction is when the population of a species is healthy and steady.	True	False
4. Scientists study populations in communities so they can help them.	True	False
5. A community is how many different populations live in an area.	True	False

Direction

Start at the top left box. Read each statement and choose TRUE or FALSE to follow the path. Keep going until you reach the FINISHED box.



Adapting Species

What Does Adapting Mean?

Plants and animals are designed to live and thrive in their habitat. They have **adapted**, which means their bodies have changed to allow them to survive in the conditions they live in.

Over time, species will change so they have characteristics that help them survive. Evolution is the word that explains how animals adapt. **Evolution** is the process by which different animals grow and adapt into more advanced versions that allow them to survive in the conditions they live in.

Charles Darwin

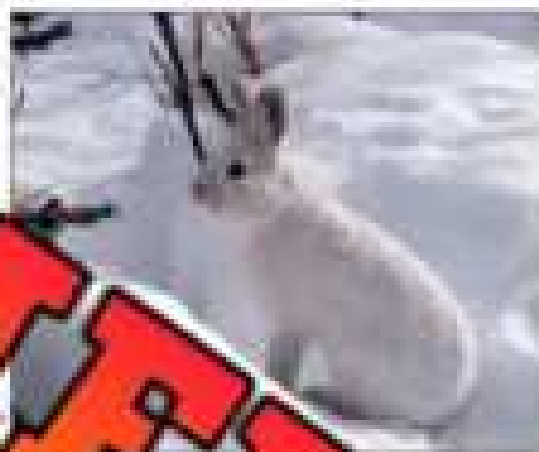
In 1859, Charles Darwin wrote a book about evolution. He believed that animals evolved through natural selection. **Natural selection** is the process where certain individuals of a species are better at surviving than others and will therefore, survive and have more children (reproduce).

When they have children, their children are like them. For example, rabbits live all over and have dark or white fur. In places where there is a lot of snow, white fur would be an advantage as the rabbits could hide from predators easier. Only the white rabbits surviving in places with heavy snowfall, more white furred rabbits have babies and their babies will also have white fur. Eventually all the rabbits living in a cold place will have white fur as they are the ones who survive.

Survival of the Fittest

The phrase **survival of the fittest** refers to the animals who are best able to survive in their environment. The white furred rabbits are the fittest bunnies for an environment that receives heavy snowfall.

The white furred rabbit has adapted to its habitat. Its adaptation is its white fur.



True or False

Circle whether the statement is true or false.

1. Adapting to an environment means animals change so they can survive.	True	False
2. Not all plants and animals can survive in all environments.	True	False
3. A white furred rabbit will survive best in desert environments.	True	False
4. Charles Darwin came up with his theory of evolution in 1859.	True	False
5. All animals species are the same (all rabbits are the same).	True	False

Questions Write questions you have after reading the information?

1)	
2)	

Questions

Use information from the text to support your answers.

1) How do animals adapt to be able to survive in their environment?
2) What does natural selection and survival of the fittest mean?

Darwin's Finches

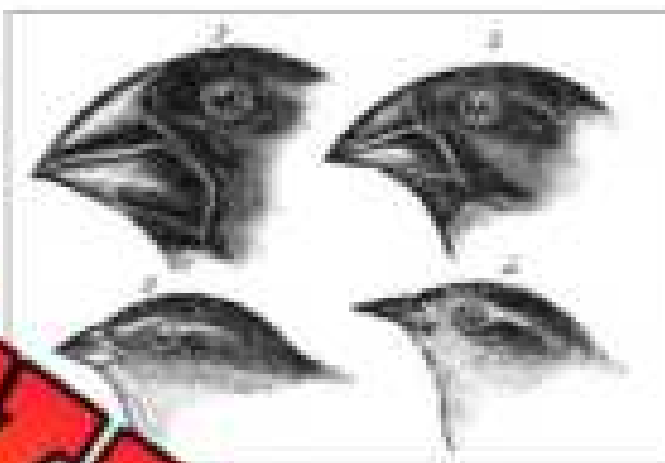
Charles Darwin

In 1831, a naturalist named **Charles Darwin** boarded a ship called the *Beagle* from England to South America. When he landed in the Galapagos Islands, he noticed very similar-looking songbirds on each of the different islands. These birds looked a lot like a finch he had seen on a main island of South America. Darwin took these birds to examine them more closely.

Darwin's Finches

Upon further examination, Darwin realized that each of these birds had different differences between them. The finches on each island showed distinct variations in overall body shape, and claw size. These differences in the bird's traits were a result of the food available on each island.

For example, on one of the islands, only snails were available to eat. The finch on this island had short claws and a long beak that it used to dig into the ground to eat the insects. On another island, the finches had large powerful beaks that were suitable for cracking tough nuts to eat.



Evolution by Natural Selection

Since the islands were quite far apart, breeding between finches was unlikely. Instead, Darwin realized that only the finches who could find food would survive. He founded the idea of evolution as he explained that only the animals that could survive would reproduce and have children.

Within a species, individual organisms are slightly different. On each island, only the organisms that had the suitable traits for their environment survived. This is what Darwin named **evolution**, and more specifically, **natural selection**.

True or False

Circle whether the statement is true or false.

1. Charles Darwin was a naturalist from Spain.	True	False
2. Darwin collected finches and brought them back to England.	True	False
3. Darwin coined the terms evolution and natural selection.	True	False
4. Darwin figured the different finches must have reproduced together.	True	False
5. Each finch had traits that allowed them to survive on their island.	True	False

Summary Write important points from the reading in jot notes (not full sentences).

1)	
2)	
3)	
4)	

Questions

Use information from the text to support your answers.

1) Why is it important that organisms in a species are a bit different? What might happen if everyone was the exactly the same?

2) If all rabbits were brown, what might happen to the rabbits in the arctic?

Genetic Variation – Evolution

What is Genetic Variation?

We use the term **genetic variation** to describe the variation in the DNA sequence in each of our genomes. Genetic variation is what makes us unique individuals with different hair colour, skin colour, body shapes and more. Organisms of a species have similar characteristics, but they are rarely identical.

Inheritance

The colour of our eyes and face shape are all determined by our genes. We inherit our genes from our parents. In random which genes we will inherit from which parent. This is why we have a mix of traits like our parents.

Genetic Variation – Natural Selection

If all the organisms of a species were identical, natural selection would not exist. No changes could happen over time as everything would be the same. Without natural selection, species would not adapt to their changing environment. There would be less biodiversity as many species would go extinct.

Over time, the habitat a species lives in can change. This can impact which organisms in a species will survive.

For example, the Black Peppered Moth survived more than the White Peppered Moth after the Industrial Revolution due to pollution. The black moths could hide on carbon covered trees better than white moths.

This genetic variation led to the black moths becoming more successful and evolving from the traditional white moths. Their genetic differences allowed the Peppered Moth to survive. If all the Peppered Moths were white, they would have went extinct as their predators would have eaten them all as they stood out against the black carbon soot.



Black Peppered Moth

True or False

Circle whether the statement is true or false.

1) The White Peppered Moth survived better than the Black Peppered Moth.	True	False
2) Natural selection leads to more biodiversity.	True	False
3) Without natural selection, species wouldn't adapt to changing habitats.	True	False
4) The Peppered Moths adapted to their new carbon covered habitats.	True	False
5) Humans have the same genetics with no genetic variation.	True	False

Genetics: Do you share any genetics from anyone in your family?

Hair	
Eye-Colour	
Skin Tone	
Body Shape/Height	

Questions

Use information from the text to support your answer.

1) Why do we not all look the same?

2) What would have happened to the Peppered Moth if they were all white and had no genetic variation?

Newspaper Article: Discovering Our Feathered Past

Ancient Wings Take Flight: Discovering Our Feathered Past

Published Date: June 15, 2024

In an extraordinary discovery that bridges the gap between our present and prehistoric worlds, researchers have unearthed striking similarities between the fossilized remains of the archaeopteryx, a dinosaur-like creature, and the skeletal structure of modern-day birds. This remarkable connection sheds light on the evolutionary lineage leading to the birds we see today.

The archaeopteryx, with its blend of dinosaur-like teeth and bird-like feathers, has long fascinated scientists. Recent fossil studies show that this creature not only had feathers but also wings similar to those of contemporary birds. "The archaeopteryx's wings were highly developed, suggesting it could glide or even fly short distances, much

like many birds today," explained Dr. Helena Barr, a paleontologist at the National Museum of Natural History.

Further analysis reveals that, unlike most modern birds, archaeopteryx had teeth and a long bony tail, features that were common among dinosaurs. "These features highlight a significant evolutionary transition from reptiles to birds," Dr. Barr added.

As scientists continue to study these ancient creatures, the pieces of our planet's vast historical puzzle gradually come together, offering a glimpse into the transformations over millions of years that led to the wildlife we know and love today.



True or False

Is the statement true or false?

1. Archaeopteryx had feathers like modern birds.	True	False
2. Fossils can show evolutionary transitions.	True	False
3. Paleontologists have found direct descendants of archaeopteryx alive today.	True	False
4. The study of fossils can reveal animal behaviour.	True	False
5. Fossil evidence does not support bird evolution from dinosaurs.	True	False

Questions Write down any questions you have about the text.

1)	
2)	

Questions

Answer the questions below.

1) What evidence do paleontologists use to study ancient animals?

2) Why is the discovery of archaeopteryx important for understanding bird evolution?

Biodiversity Between Species

Biodiversity Between Species

In a community, many different species of organisms live together. In many instances, an animal will have many different species.

For example, a bear is an animal with many different species. The biodiversity between different species ensures bears can live in different living conditions without the genetic variations between different species of bears below:



Bears	Colour	Weight	Diet
Polar	White	300 - 400 kg	Carnivore (seals)
Sun	Black with horseshoe shaped orange coloured patch on its neck	65 - 100 kg	Omnivore (honey)
Sloth	Black long fur that is shaggy	80 - 112 kg	Herbivore (ants, termites)
Brown	Brown	152 - 217 kg	Omnivore (mice, fish, berries)
Spectacled	Black with white face	65 - 115 kg	Herbivores (nuts, fruit, bamboo)
Giant Panda	White head with black eyes. White and black bodies	100 - 115 kg	Herbivore (bamboo)
Asian Black	Black	85 - 135 kg	Omnivore
American Black	Black	41-250 kg	Omnivore

True or False

Circle whether the statement is true or false.

1) There is only one species of bear.	True	False
2) There are 8 species of bears that allow bears to live in different habitats.	True	False
3) All bears are carnivores.	True	False
4) Carnivores would have the easiest time surviving in any environment.	True	False
5) The largest species of bear is the Brown Bear.	True	False

Paragraph 4: Write 4 things you learned from the reading in your own words.

1)	
2)	
3)	
4)	

Questions

Use information from the text to supply answers.

1) What would happen if all bears had the same characteristics? Consider different environments?

2) Which bear would not survive in a habitat that has no snow and not many other animals, only plants? Explain why.

Relationships Within Species

Interrelationships Between Plants and Animals

All species are interconnected, meaning they depend on each other. Forests, which are plants, provide homes for animals. Animals eat plants and the plants need healthy soil to grow. Fungi helps to decompose organisms to fertilize the soil. Bees and other insects carry pollen from one plant to another, which allows them to reproduce and create more plants.

An ecosystem allows these important connections. If a species (human) ever picks out and hunted a plant or animal population, they could disrupt the biodiversity in the ecosystem. As you can imagine, the connections between plants and animals could weaken and break, which would harm all the species in the ecosystem.

Examples of Interrelationships

Within a species, the relationship between animals is important. For example, wolves travel in packs to defend their territory. Each wolf in the pack depend on each other to survive.

In a wolf pack, the alpha wolf makes the important decisions for the pack. The beta wolf is second-in command, taking over if the alpha wolf dies.

On the bottom rung of the ladder, the omega wolf is the weakest and the least cared for in the pack. They are bullied by other members, but they have the important role of easing tensions when things get out of control. They do this by starting to play when tensions get high between wolves.

The interrelationships within a species is important for their long-term survival. The organisms in the wolf pack all have their specific roles that allow the species to survive. If these organisms didn't fulfil their role, their species could die off which would decrease biodiversity.



Questions

Answer the questions below using evidence from the text.

1) Describe the relationships in a wolf pack?

2) How do relationships within species help biodiversity?

Questioning

Write _____ about relationships within species.

1)	
2)	
3)	

True or False

Circle whether the statement is true or false.

1) The alpha wolf gets bullied.	True	False
2) The omega wolf gets the least amount of respect.	True	False
3) The omega wolf does not have an important role.	True	False
4) The beta wolf will take over if the alpha wolf dies.	True	False
5) The beta wolf is in charge of the wolf pack.	True	False

Symbiotic Relationships

Examples of Interrelationships between Species

Just like we need our best buddies, animals have friends as well! Sometimes, they have friends from other species. Have you ever seen a squirrel playing with a chipmunk?

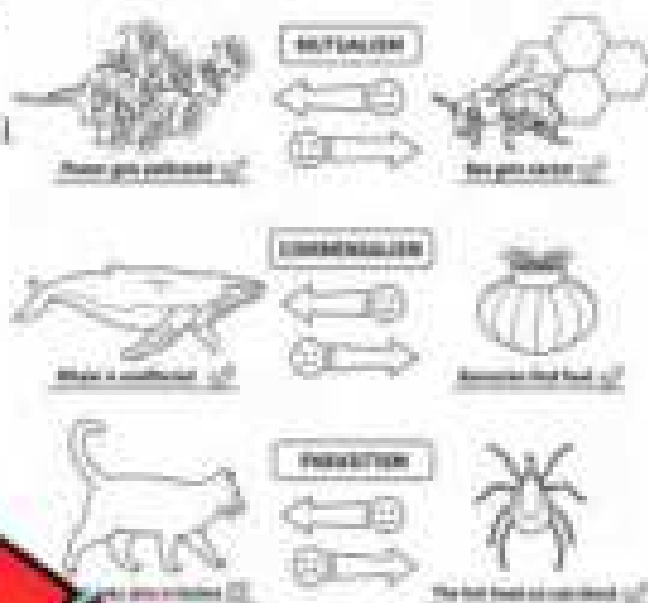
A **symbiotic relationship** is when two or more organisms within an ecosystem have a relationship with each other. There are three types of symbiotic relationships: mutualism, commensalism, and parasitism.

Mutualism – Both partners in the relationship benefit. One example of a mutualistic relationship is the oxpecker (a kind of bird) and the rhinoceros or zebra. Oxpeckers land on the rhinos or zebras and eat ticks and other parasites that live on their skin. The oxpeckers get a meal and the rhinos or zebras get pest control.

Commensalism – One organism benefits from the other without harming it. Tree frogs have a commensalism relationship with plants because they hide behind plants. They do not damage them but need them to survive. Another example is that Goby fish live on other sea animals, often changing colour to blend in with their host. This gains them protection from predators.

Parasitism – One organism (the parasite) gains, while the other (host) suffers. The deer tick is a parasite that attaches to a warm-blooded animal and feeds on its blood.

SYMBIOSIS



Questions

Answer the questions below using evidence from the text.

1) What are symbiotic relationships between species?

2) When female mosquitos bite humans, what is the relationship between humans and mosquitos? Explain.

Making Connections

Describe a symbiotic relationship you have seen.

Relationships

Which type of symbiotic relationship is Mutualism, Commensalism, or Parasitism?

1) Grey wolves and striped hyenas hunt together - both get to eat.

2) Lice live off the blood of another animal.

3) Crabs carry venomous sea urchins on their backs - Free ride for the sea urchins and protection for the crab.

4) The remora fish rides attached to sharks and other types of fish.

5) Golden jackals, once they have been expelled from a pack, will trail a tiger to feed on the remains of its kills.

Invasive Species Reducing Biodiversity

What is an Invasive Species?

An **invasive species** is a species that causes problems in a new environment where it is not native. Quite often, an invasive species is a species 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 natural predators that control their population. The invasive species population grows out of control.



Invasive Species - Zebra

Zebra Mussels are an invasive species in Ontario that came from the Black and Caspian Seas. The Zebra Mussels came in the ballast water of a ship coming from a European port.

When the ballast water was released into Lake Ontario, Zebra Mussels were accidentally brought into a new environment where they spread quickly.

- 1) Zebra Mussels eat phytoplankton which causes clearer water, allowing light to penetrate deeper. This forces light-sensitive fish, such as walleye, to move into darker waters.
- 2) The phytoplankton were food for many other species, which means they now have less food to eat.
- 3) 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. The birds and fish who feed on Zebra Mussels are dying. Also, many species at the bottom of the food chain now have less food to eat as the phytoplankton is eaten by Zebra Mussels.

True or False

Circle whether the statement is true or false.

1) An invasive species is an organism that lives in a new area.	True	False
2) A native area is an area that an organism already lives in.	True	False
3) Invasive species help biodiversity by bringing new species to an area.	True	False
4) Invasive species usually have a lot of predators.	True	False
5) Zebra Mussels are an invasive species in Ontario.	True	False

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

	_____

Questions

Use information from the text to support your answers.

1) What is an invasive species? How do they affect biodiversity?

2) How were the Zebra Mussels introduced to the waters in Ontario? Why are they an invasive species?

Climate Change - Biodiversity

What is Climate Change?

Climate change is the changes in the Earth's weather patterns for a long period of time. Having an unseasonably cool few days in the summer is not part of climate change as it is only a few days. But, when we notice changes in weather over the past year, we can chalk it up to climate change.

In fact, over the last 100 years, the Earth has warmed 1°C. This number is increasing by degrees Celsius per decade. At this rate, you can see that we are warming at an unsustainable rate.

2020	2030	2040	2400	2500	2600	2700	2800	2900	3000
±0	+1.4	+2.6	9.6	11.6	13.6	15.6	17.6	19.6	

Effects of Climate Change

We have learned that all animals need at surviving in their ecosystem. They have characteristics that allow them to thrive in certain conditions. But, if we cause changes to their environment, those conditions might not be suited for them to survive. Below are some of the problems climate change affecting living things:

- ☐ More forest fires that destroy plant and animal habitats.
- ☐ Melting glaciers and arctic ice, making it harder for animals like polar bears to hunt.
- ☐ More extreme weather – droughts, floods, and severe storms.
- ☐ Animals must adapt to new temperatures. Warm-blooded organisms can regulate their temperature, but it has been discovered that animals like the possum cannot control its body temperature when it rises above 30°C. An extended heat wave could kill off many possums.
- ☐ Warmer ocean temperatures are causing coral bleaching. **Coral bleaching** is the whitening of coral. When corals are stressed, they release algae, which gives them their colourful look. When they've released too much algae, they turn white. Bleached white corals are not dead but are at risk of starvation and disease. Without corals, scientists believe that more than one million species around the world will be homeless!



True or False

Circle whether the statement is true or false.

1) Climate change is increasing temperatures by 2 degrees every decade.	True	False
2) Droughts and floods are extreme weather that destroy habitats.	True	False
3) Corals are home to over one million different species.	True	False
4) Melting glaciers and sea ice reduces biodiversity.	True	False
5) Extreme weather will not affect biodiversity.	True	False

Making a connection

What does the reading remind you of in your life?

Questions

Use information from the text to answer the questions.

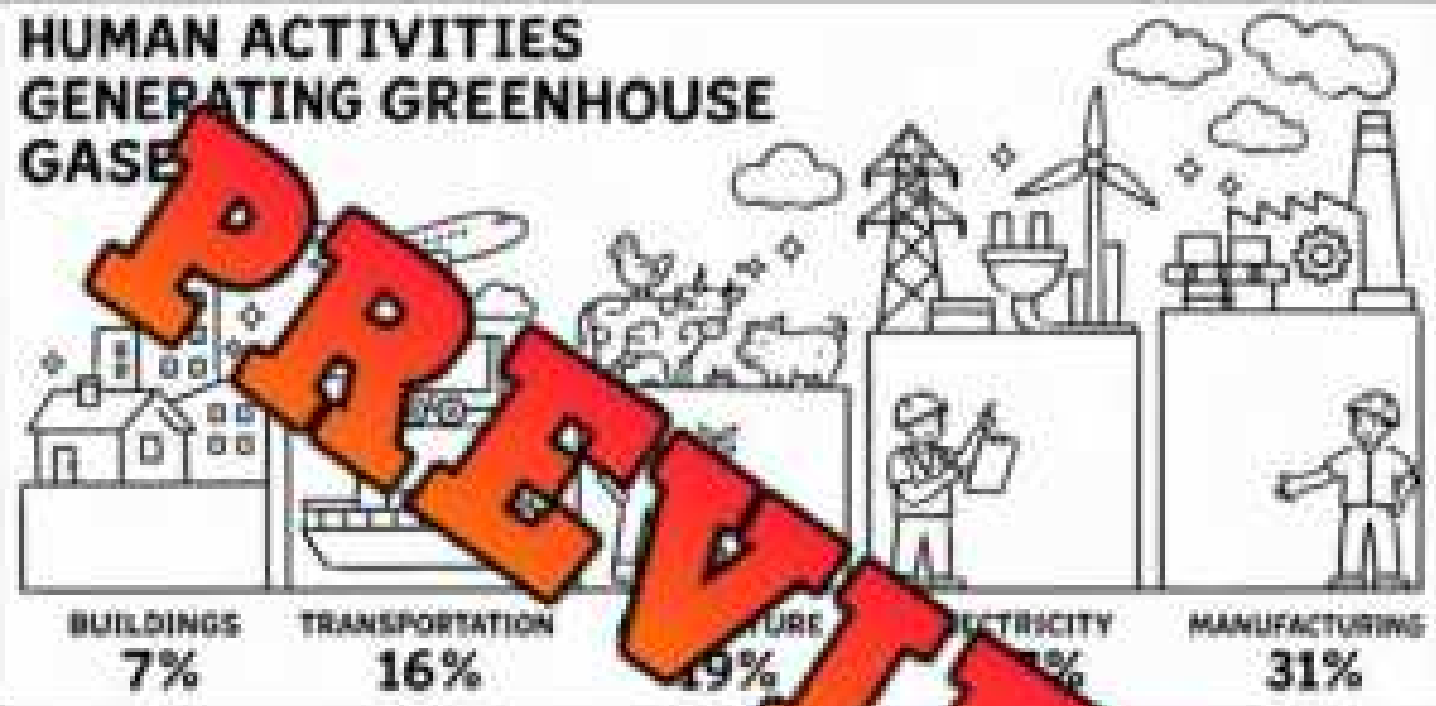
1) How much is the climate changing? What does this mean for

2) Which effect of climate change do you think is the worst for organisms? Explain.

Human Activities – Greenhouse Gases

The infographic below shows which human activities are polluting our atmosphere, causing global warming.

HUMAN ACTIVITIES GENERATING GREENHOUSE GASES



Research

How do the human activities create greenhouse gas? Explain below.

Buildings	
Transportation	
Agriculture	
Electricity	
Manufacturing	

Effects of Melting Glaciers

Effects of Melting Glaciers

Rising Sea Levels

Since 1961, glacial melting has caused the sea levels to rise 2.7 cm. The world contains around 670,000 islands that are home to thousands of different species. With many endangered species living on these islands, the rising sea levels put them at risk of extinction. If the sea level rises too high, it will flood many islands. Coastal regions around the world will also be underwater.



Impact on the Climate

As glaciers are melting at the north and south poles, the oceanic currents are slowing, causing a changing climate. This leads to more extreme weather events, like hurricanes, typhoons, floods, and droughts. These events are destroying habitats and making living conditions unbearable for many animals.

Disappearance of Species

Glacier melting is causing the extinction of many species. Glaciers provide a natural habitat to many animals, including penguins, seals, and polar bears. Almost all penguins are found in Antarctica, where they live on glaciers. Icebergs provide habitats for these animals to take a rest as they travel around their ecosystem. Without these glaciers, many of these animals will become extinct.



Less Freshwater

The slow melting of glaciers helps supply the river systems on our Earth with freshwater that we use to drink. Scientist believe that by the year 2100, 85% to 100% of all arctic ice in Canada will be lost. When this water quickly melts, a lot of it will end up in oceans, where it will mix with undrinkable saltwater.

With less freshwater, animals including humans, will have less drinking water. This will cause problems for many species, leading to less biodiversity as species go extinct.

Questions

Use information from the text to support your answer.

1) How are rising sea levels causing less biodiversity?

2) Why will animals become extinct if glaciers continue to melt?

Summarize

Paraphrase each in one sentence.

Rising Sea
LevelsImpact on
ClimateDisappearance
of SpeciesLess
Freshwater

Activities – Glaciers and Climate Change

Word Search

Find the words from the word bank.



Ice	Cap	Shelf	Iceberg	Sea
Fossil	Fuels	Carbon	Emissions	Cryosphere
Glacier	Melting	Freshwater	Climate	Change



Word Scramble

Unscramble the words from the word bank.



IFOSSL		BEREDGI	
HESCEORPYR		ABCORN	
HEARSTWRFE		ENGILTM	
ELHSF		AELIGRC	
SEDINSISM		ULFSE	

Biodiversity and Indigenous Groups

Importance of Biodiversity for Indigenous Groups

The Indigenous groups in Canada have relied on the biodiversity in their home territories for the last 10,000 years and probably longer. This is because they live off the land and utilize the resources they have direct access to.

The Indigenous had diets based on a combination of salmon and other fish, gamebirds and birds' eggs, berries and other fruits, root vegetables, and the inner bark of trees.

Biodiversity was essential in providing energy, medicine, building materials, and food. If biodiversity was no longer available to them due to over-hunting or over-picking, they would have no option to order more online or ship some from a different location. It would mean that they would live with less food and have to move locations.



Biodiversity as Medicine

Plants and some animals as well as fungi are used by Indigenous groups for most of medicines for maintaining health and for treating injuries. Therefore, biodiversity was important in providing health and well-being.

Biodiversity as Tradition and Culture

The Indigenous have a strong connection to the plants and animals in their territory. Some plants, animals, and fungi are prominent in the belief systems of the Indigenous. Their art, songs, and ceremonies often include wildlife that are important to them.

The Northwest Coast First Nation have an intense connection with biodiversity as their artforms represent stylized animals, birds, fish and other beings in wooden sculptures, totem poles, masks and dishes, as well as jewelry and paintings.



True or False

Circle whether the statement is true or false.

1) More biodiversity means more different medicines and food.	True	False
2) The Indigenous didn't really use wildlife in their lives.	True	False
3) The Indigenous lived off the land and used wildlife available to them.	True	False
4) The Indigenous honoured different animals on totem poles and in art.	True	False
5) Cedar tea is cedar leaves mixed with hot water.	True	False

Make a connection What does the reading remind you of in your life?

Questions

Use information from the text to answer the questions.

1) How does biodiversity help Indigenous groups find medicine?

2) In what ways is biodiversity used in the traditions and culture of Indigenous groups?

Technologies Stopping Invasive Species

What is the Invasive Species Forecasting System (ISFS)?

The Invasive Species Forecasting System (ISFS) is a technology used to predict where invasive species will spread. The ISFS is a

supercomputer that uses tens of thousands of field sampling measurements to see where past invasive species have spread, which allows it to predict where they will grow in the future.

The supercomputer uses NASA satellite images in combination with the field data

mentioned above. The ISFS helps scientists where invasive species will spread to so that we can manage and prevent invasive species from harming our biodiversity.



Questions

Answer the questions below.

1) How is the ISFS helping manage the spread of invasive species?

2) How is science and technology helping biodiversity in this example?

3) Finish the If/Then statements below to either place a dot on the map or not.

If zebra mussels are found in location 1

If no zebra mussels are found in location 2

Then _____

Then _____

The map below of North America shows a coordinate plane. Using computer programming, we can create a model that shows the whereabouts of invasive species in North America.

Mapping

Colour the squares using the program on the previous page.



Name: _____

Date: _____

Unit Test - Biodiversity

Multiple Choice

/10

1. Vertebrate animals have...	2. Birds...
a) No backbone	a) Have fur
b) A backbone	b) Lay eggs
c) 2 legs	c) Are cold-blooded
d) More than 4 legs	d) None of the above
3. Mollusks...	4. A primate is a type of...
a) Are invertebrates	a) Insect
b) Animals with shells on the outside	b) Reptile
c) Soft animals	c) Mammal
d) All of the above	d) Bird
5. Which of the following is an invasive species?	6. Which of the following is an example of mutualism?
a) Zebra Mussels	a) Commensalism
b) Tree Frogs	b) Mutualism
c) Wolves	c) Parasitism
d) Starfish	d) Non-competitive
7. Which type of plant can't grow tall?	8. Which of the following is an invertebrate organism?
a) Vascular	a) Fish
b) Non-Vascular	b) Sponges
c) Flowering	c) Worms
d) None of the above	d) Mollusks
9. A group of organisms that have similar characteristics is called a...	10. An individual animal is called a...
a) Species	a) Species
b) Organism	b) Organism
c) Population	c) Population
d) Community	d) Community

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

/3

Term	Definition (what does it mean)
Biodiversity	
Invasive Species	
Organism	

Short Answer Questions (2 marks each)

1) How do invasive species damage biodiversity?

2) Describe the biodiversity in your local area. Which plants and animals are there?

3) Why is biodiversity important? What could happen if too many plants or animals went extinct?



Workbook Preview



Grade 6 Science

2022 Curriculum

Flight

	Curriculum Expectations	Pages		
01.1	assess the impacts on society of aviation technologies, while considering both local and global perspectives	9-13, 92-93, 100-103, 107-109		
02.1	Preview of 80 pages from this product that contains 173 pages total.		91	
02.2			possible	37, 91
				104-106
02.3	describe ways in which flying machines and various organisms use balanced and unbalanced forces to control their flight	33-37, 42-46, 49-64, 75-83, 89-91		
02.4	describe ways in which the four forces of flight can be altered	33-35, 44-46, 49-61, 75-85, 104-106		
02.5	describe characteristics and adaptations that enable organisms to fly	62-74		

Grade 6 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	88, 110-111
A1.2	use a scientific experimentation process and associated skills to conduct investigations	15-18
A1.3	use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	38-41, 47-48, 86-88, 94-99
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	15-18, 38-41, 47-48, 86-88, 94-99
A1.5	communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	15-18, 38-41, 47-48, 86-88, 94-99
A2.1	write and execute code in investigations and when modeling concepts, with a focus on obtaining input in different ways for a variety of purposes	110-114
A2.2	identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	110-114
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	110-111
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	110-111
A3.3	analyse contributions to science and technology from various communities	110-111

NAME: _____

FLIGHT



Flight - Background

What is Flight?

The term **flight** refers to the action or process of flying through the air. For example, an eagle is in flight when they are soaring above trees. An eagle is an example of an animal that occurs naturally in our environment.

The Wright Flyer - 1903



Flight also refers to man-made structures called aircrafts. Examples of aircrafts are airplanes, helicopters, and drones. Aviation is the flying of an aircraft.

History of Aviation

It took thousands of years for humans to learn to fly. Birds around them, it wasn't until December 17, 1903 that the famous Wright brothers invented the first successful airplane that flew only 120 feet. The aircraft was named the Flyer.

Interesting Facts about Flight

- Today's Boeing 787 airplanes can fly 16,000km on a full tank of fuel, which is the length of a flight from New York City to Sydney, Australia.
- The largest airplane is called the Stratolaunch with a wingspan larger than a football field.
- The Concorde is a special aircraft that takes passengers up to 60,000 feet, which is over 16km into the air. Passengers can see the curvature of the Earth!
- More than 80% of the population is afraid of flying.
- Airplanes are crucial to today's world. Businesses send their products across the world using airplanes, militaries use planes to defend their territories, and people travel across the world to travel or visit friends and family.
- A Boeing 747 has a maximum speed of 955km/h.
- Only 5% of the world's population have ever been on an airplane.

Questions

Answer the questions below using evidence from the text

1) How have airplanes changed today's world?

2) Which part of the flight did you find most surprising or interesting? Explain.

Questioning

3 questions you have about the reading

1)

2)

3)

True or False

Is the statement true or false?

1) The first flight humans took was in 1803

True

False

2) Humans have been flying for a very long time

True

False

3) A Boeing 747 can fly from New York to Australia with one tank of gas

True

False

4) Most humans are afraid of flying

True

False

5) Most people in the world have been on an airplane

True

False

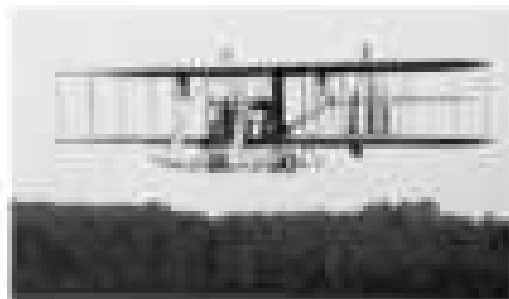
Trial and Error – Wright Brothers

Trial and Error

When inventing a new mechanical system, trial and error is a method used to achieve a goal. The Wright Brothers invented a powered flying system through trial and error. Trial and error means you make educated guesses when experimenting with something new. If it is successful, you build on your results. If it fails, you learn from the error and try something different.

Wright Brothers Trial and Error

The Wright Brothers determined to build the first powered airplane. They made over 1000 flights and Orville received 8 patents.



- 1) The brothers built a glider, which is a non-powered flying machine. In 1900, their small glider was a success. In 1901, they increased the size of the glider, but had serious problems. Their glider could not achieve lift like their last glider could. Wilbur Wright rode the glider and achieved glides longer than 90 metres.
- 2) The 1902 glider had a third set of narrowing wings, which led to more efficiency. The changes made them to glide over 300 metres. These flights won them world records.
- 3) To design the first powered airplane, changes to the glider were made. The new flying machine was called the Flyer. To carry the weight of the engine and propellers were added to the machine. The engine was 90 kilowatts. The aircraft and pilot, the entire machine would weigh around 2500 pounds.
- 4) The completed Flyer was 125 pounds heavier than expected. The engine provided 50% more thrust than expected, which the brothers hoped to compensate for the extra weight.
- 5) On December 14, 1903, the brothers flipped a coin to see who would pilot their creation a try. Wilbur won and climbed into the pilot's seat. Unfortunately, the Flyer lurched up, stalled, and smashed into the sand, slightly damaging the forward elevator. The Flyer was only airborne for 3.5 seconds.
- 6) On December 17, 1903, Orville took the controls. He lifted off and darted up and down before slowly sailing down to the sand. He had successfully flown 120 feet, a 12-second flight.
- 7) The brothers made more changes to the elevator position. They made the first circular flight on September 20, 1904, lasting 96 seconds. From 1903 to 1904, the brothers experimented with changes and made a total of 49 flights.
- 8) By 1905, the brothers' experiment period ended. They now routinely made flights lasting several minutes.

True or False

Is the statement true or false?

1) Inventions are usually perfected the first time they are made	True	False
2) Trial and error means you try new things and learn from any mistakes	True	False
3) The Wright Brothers never crashed their planes	True	False
4) A glider plane has a propeller and engine	True	False
5) The Wright Brothers made over 1000 flights	True	False

Making Connections Do you have a trial-and-error experience? Have you seen one in action or read about one? Explain.

PREVIEW

Questions

Answer the questions below using information from the text

1) What is trial and error? Why is it important in developing new things?

PREVIEW

2) What problems did the Wright Brothers face when they were trying to achieve flight?

Properties of Air

What is Air?

Air is the invisible gas that surrounds the earth. It is a mixture of mainly oxygen and nitrogen. Air is a fluid that is made of different air particles that are loosely held together in a gas form. A **fluid** is any substance that flows, which means air is a fluid as the gas flows in our atmosphere. The following 6 properties of air allow flight to be possible as objects and animals fly through the air.

Match Draw a line from the property of air to its explanation



PREVIEW

Property	Explanation
Air takes up space	Air particles have a lot of space between them so they can be squeezed together.
Air has weight/mass	Air exerts the same amount of force in all directions.
Air is affected by heat	Blowing on a balloon makes the balloon expand.
Air exerts pressure	An empty balloon weighs less than a blown up balloon.
Air can be compressed	Air will heat up and cool down. When air heats up, the air particles move faster and when they cool, they slow down.
Air is affected by altitude	The higher you are, the lower the air pressure. Climbers need oxygen tanks on tall mountains.

Experiment – Power of Air Pressure

Background

Does air pressure actually exist?

Most of the time, we can't feel air pressure. But, did you know that right now there is about 15 pounds of air pressure pushing down on every inch of your body? We don't feel it because we have air pressure in our bodies as well that is pushing outwards at the same pressure. This means the air pressure is equalized.

Sometimes the air pressure acting on us becomes unbalanced. When we take an elevator to the 10th floor of a building, the air pressure around us decreases, but the air pressure in our bodies doesn't decrease as fast. The pop you feel in your ears is your body rushing to equalize the air pressure inside your body with the lower air pressure outside.

Research Question: Is air pressure strong enough to hold water?

If we fill a cup 1/4 full of water, can we hold the water in the cup when it is tipped upside down? The air pressure inside the cup is less than the air pressure outside the cup.

Hypothesis

Will the card or _____ hold the water in place?

Materials

What you need for this experiment:

- Water
- Cup
- Card that is large enough to cover the opening of the cup

Procedure

What to do:



1. Fill the cup one quarter full of water
2. Put the card over top of the opening of the cup
3. Walk over to a sink (or do this outside)
4. Tip the cup upside down – Did the card hold the water in the cup or did it spill?
5. If the water spills, try it again using less water

Diagram

Draw a picture of the experiment. Label the air pressure using arrows. Use smaller arrows for lower air pressure and larger arrows for higher air pressure.

**Results**

What happened during the experiment?

1) Was your hypothesis correct? Did the water spill or not?

2) Why wouldn't the water fall out of the cup? Explain using the following terms: gravity, air pressure, higher, lower.

3) Why do our ears pop when we travel to higher elevations? (airplane, in elevator)

4) When have you felt different air pressures in your life? Explain.

Experiment – Air Compression

Background

Can we squeeze air and compress it?

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

Research Question

Can we compress air?

Can we compress the air inside a reusable water bottle by squeezing the end of the bottle while the lid is on? How much air will still be in the bottle, but the bottle will be smaller? What will happen when we release the bottle's lid?

Hypothesis

What do you think will happen when the air is compressed? What will happen with the lid?

Materials

What you need for this experiment:

- Empty plastic water bottle (reusable bottle that you can screw the lid on)

Procedure

What to do



Put the lid on tight

Squeeze this end

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

Diagram

Draw two diagrams:

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

**Results**

What is your conclusion from the experiment?

1) What is air compression? What does it lead to compression?

2) Was your hypothesis correct? Was the air compressed inside of the bottle? If yes, how do you know?

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

Four Forces of Flight

The Four Forces of Flight

In order for an aircraft to maintain a steady flight, it needs balance. Balance is achieved through an equilibrium of all forces acting upon the aircraft. Weight, lift, thrust, and drag are the acting



forces on an aircraft. To maintain a straight and level flight, lift must

be equal to weight. Drag will produce speed depending on the amount of drag. If any forces change, the aircraft will accelerate, decelerate, or change direction.

Thrust (Propulsion) – Thrust is the force that creates the thrust that propels the plane forward. The engine pushes the air backward, creating the same force that the plane moves forward. This is in accordance with Newton's 3rd Law of Motion where a force in one direction produces an equal force in the opposite direction.

Drag – Drag is unwanted in flight as it forces the plane to work harder. When you stick your hand out of a window while you are driving, you feel the air pushing against your hand. You are causing a small amount of drag that affects your car's speed. To reduce drag and increase efficiency, planes are streamlined and made aerodynamic.

Lift – Lift is a force generated by solid objects moving through a fluid. There are many parts to generate lift but the wings do most of the work as the plane moves through the air. As the airplane travels at fast speeds on a runway, the wings deflect the air downwards which in turn sends the wings upwards. This is Newton's 3rd Law of Motion. The Bernoulli effect also explains how changes in air pressure generates more lift for airplanes. Together, these theories explain how lift is achieved for many aircrafts.

Weight – Weight is the force of gravity that acts in a downward direction, towards the center of the Earth. The weight of an aircraft affects how much lift and thrust an aircraft will need in order to fly. This is why airplanes have rules on how much weight passengers can have in their suitcases on board the plane.

Questions

Answer the questions below using evidence from the text.

1) How does an aircraft fly? Explain using the forces of flight.

2) What happens when the forces acting on an aircraft become unbalanced?

Fill in the blanks

Use the bank words to fill in the blanks.

UPWARD

DOWNWARD

ACCELERATE

DECELERATE

1) If the lift becomes greater than the weight, the aircraft will _____.

2) If the weight becomes greater than the lift, the aircraft will _____.

3) If the thrust becomes greater than the drag, the aircraft will _____.

4) If the drag becomes greater than the thrust, the aircraft will _____.

Diagram

Draw a diagram of an airplane and the four forces acting on it.

Exit Cards

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

Name: _____		Mark:	
Is the statement true (T) or false (F)?			
1) Lift is the force that helps an aircraft move upward.	T		
	F		
2) Drag helps an aircraft move forward through the air.	T		
	F		
3) Thrust is produced by the engine and helps move the aircraft forward.	T		
	F		
4) Weight is the force of gravity pulling an aircraft downward.	T		
	F		
5) For straight and level flight, lift should be equal to weight.	T		
	F		

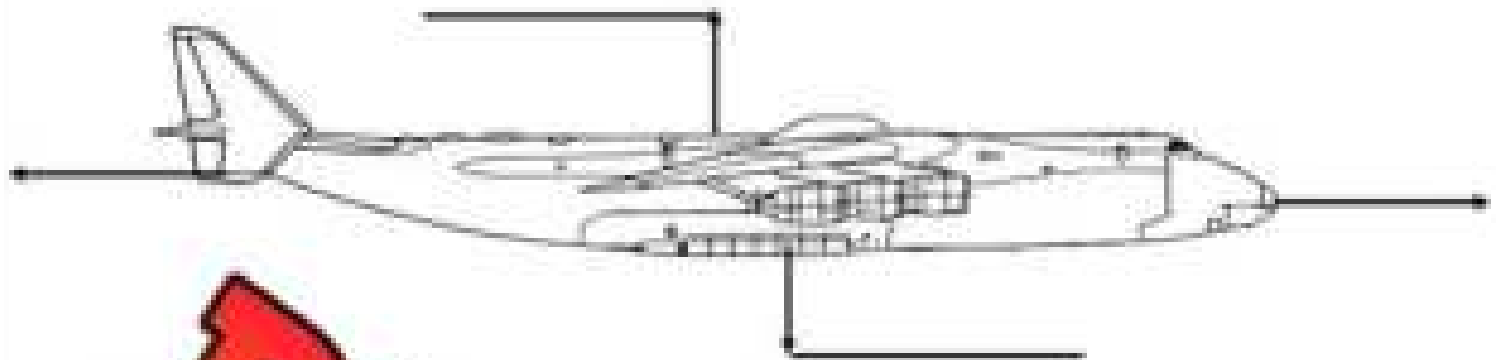
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	F		
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	F		
5) For straight and level flight, lift should be equal to weight.	T		
	F		

Name: _____		Mark:	
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	F		
3) Thrust is produced by the engine and helps move the aircraft forward.	T		
	F		
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	F		
4) Weight is the force of gravity pulling an aircraft downward.	T		
	F		
5) For straight and level flight, lift should be equal to weight.	T		
	F		

Diagram

Label the 4 forces of flight: Weight, Thrust, Lift, Drag



Inst. Follow the instructions below

1. Using a piece of paper, make a paper airplane.
2. Draw arrows on your plane showing the 4 forces acting on your plane during flight.
3. Throw your plane and observe its flight.

Questions

Answer the questions below

1) How was the thrust created in your paper airplane? Can you add much thrust into your plane? Explain.

2) Why did your plane eventually fall? Use the terms: weight, thrust, lift, and drag.

3) Did your airplane have any drag? How could you change the shape to lessen the drag?

Bernoulli's Principle

What is Bernoulli's Principle?

Bernoulli's principle helps explain how an aircraft uses its wings to achieve lift. Remember, air is a fluid, which means the wings are cutting through the fluid as they fly through the air. The wings are shaped so that air flows faster over the top of the wing and slower underneath. Moving air creates low pressure, while slow-moving air creates high pressure. The high pressure under the wing pushes the aircraft up through the lower air pressure.

An airplane's wings are usually curved at the upper part which causes the wind to rush over the top and speed up. This decreases the air pressure on the top of the wing.

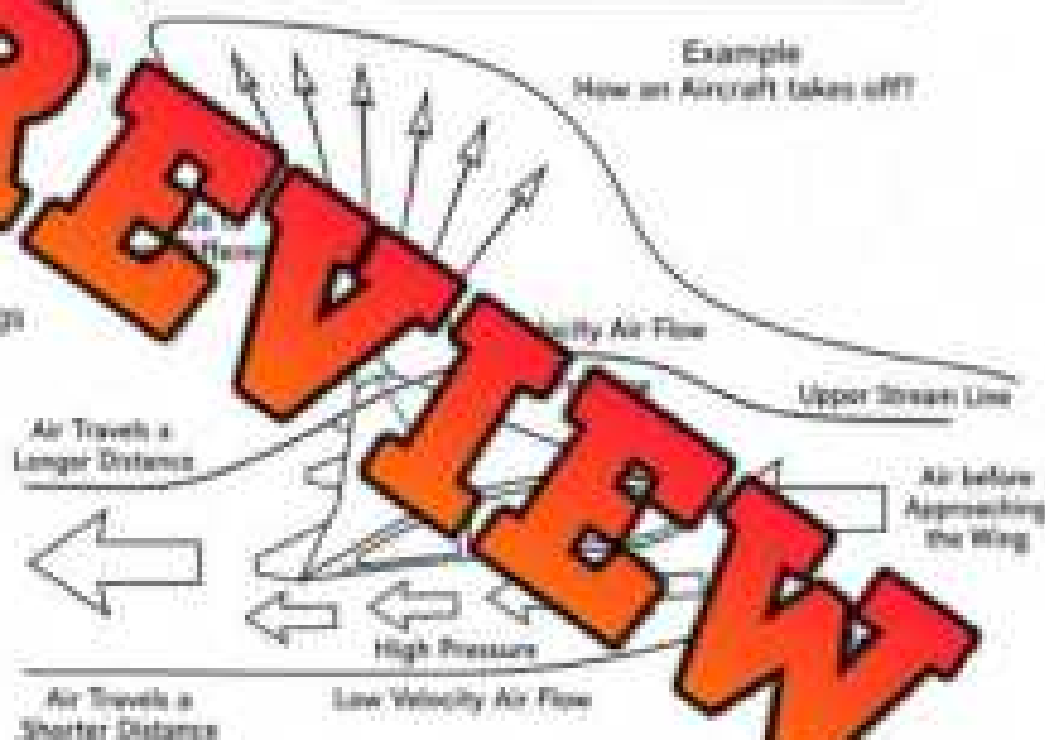
The bottom of the wing is generally flat which causes the air to move in a straighter line, which keeps a consistent lower speed and higher pressure. Since high pressure always moves towards low pressure, the air below the wing pushes upward towards the air above the wing.

The wing, which is in the middle of a plane, is then lifted by the force of the air and this causes the entire plane to lift and travel upwards. The faster the plane moves, the more lift there can be.

Bernoulli's Principle

The higher the flow velocity, the lower the pressure

Example
How an Aircraft takes off



Questions

Answer the questions below using evidence from the text.

1) How are airplanes designed to achieve lift?

2) How do air pressure affect lift?

Visualizing

Draw what you think you were reading. Explain the picture.

True or False

Is the statement true or false?

1. Bernoulli's principle explains how airplanes use their wings to achieve lift	True	False
2. Air flows faster below the wings on an airplane	True	False
3. Faster moving air creates low air pressure	True	False
4. The high air pressure under the wings pushes the plane upwards	True	False
5. The wings on an airplane are usually in the front of a plane	True	False

Bernoulli's Principle – Wing Cross-Section

Direction

Complete the diagram of the wing below. Draw arrows to show airflow above and below the wing. Label where the air moves faster and slower. Colour the high-pressure and low-pressure zones using the key below. Then, write one sentence to explain why the wing generates lift.

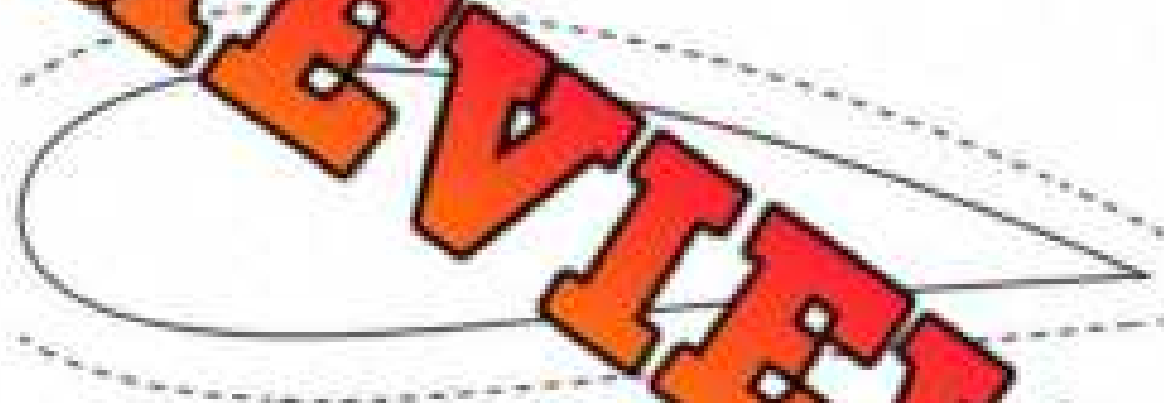
Key:



Low Pressure



High Pressure



Explain in one sentence why the wing generates lift.

Bernoulli's Principle - Sprayers

Bernoulli's Principle

Many inventors and innovators have used Bernoulli's principle to make popular products that we see and use everyday. Bernoulli's principle states that when a fluid travels faster, it will have less pressure. Conversely, areas of lower fluid speed will have higher air pressure. The differences in air pressures causes objects and substances to move. This helps explain why wings on a plane move aircrafts and how paint moves out of a paint sprayer.

Example - Bernoulli's Principle

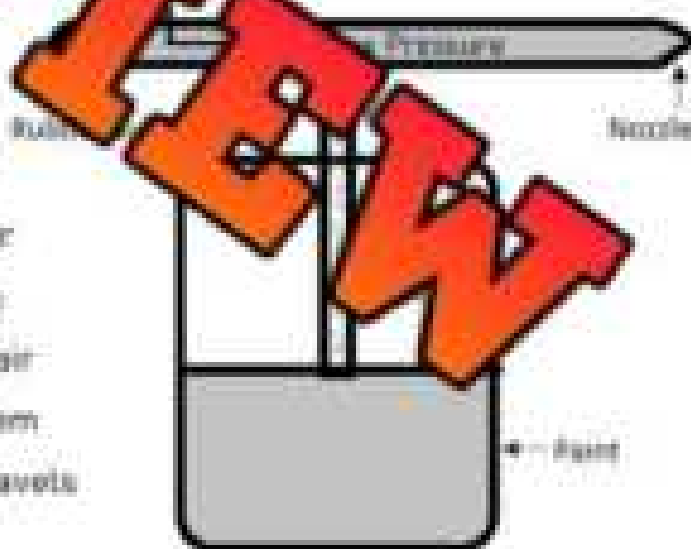
We can witness Bernoulli's principle in the following example:

Using a hairdryer to blow a ping pong ball. If you increase the air pressure under the ball, the ball will lift upwards. If you blow air from the other side of the ball at the same time. This makes the air above the ball have a lower pressure than the air pressure below the ball.

Paint Sprayer

A paint sprayer has a reservoir half-filled with paint. Connected to the reservoir is a tube that has a rubber squeeze bulb and to change the air pressure and a nozzle to spray the paint. When you squeeze the rubber bulb, you are blowing air into the tube. This creates a low-pressure system inside the sprayer when the high velocity air travels forward.

When the air pressure inside the sprayer changes to a low-pressure system, the paint in the reservoir from the high-pressure area is pushed up the tube and into the low-pressure system. Then the fast-moving air takes the paint out through the nozzle. The air pressure outside of the paint sprayer will be different than the pressure inside the nozzle, which will also help in moving the paint out of the sprayer.



Questions

Answer the questions below using evidence from the text.

1) What is Bernoulli's principle?

2) How does it work? Explain.

Visualizing

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

True or False

Is the statement true or false?

1) When a fluid moves faster, it has a higher air pressure.	True	False
2) Substances and objects will move due to changes in air pressures.	True	False
3) The paint in a canister moves from areas of high pressure to low pressure.	True	False
4) In a sprayer, the liquid doesn't move until you move the fluid (air).	True	False
5) The air pressure outside of a sprayer is the same as inside the sprayer.	True	False

Bernoulli's Principle - Carburetors

Carburetors and Bernoulli's Principle

A carburetor is a device found in many older or small engines, like those in lawn mowers and older cars, that mixes air and fuel for internal combustion. The process begins when air is drawn into the carburetor through a tube called the throat.

Carburetors and Bernoulli's Principle

The throat of a carburetor has a narrow section called the venturi. As air passes through this narrow part, its velocity increases. According to Bernoulli's Principle, an increase in the speed of a fluid occurs simultaneously with a decrease in pressure. In the carburetor, as air speeds up in the venturi, the air pressure drops.

At the venturi, the air pressure drops and causes the air pressure to drop. The lower pressure at this point is responsible for the fuel being drawn into the airstream. This happens because the fuel is stored in a small chamber (the fuel bowl) and the pressure difference between the chamber and the venturi causes the fuel to flow into the airstream.

The fast-moving air breaks the fuel into tiny droplets, mixing it thoroughly with the air. This creates a fine mist of fuel and air that is then drawn into the engine's cylinders for combustion. The proper mix of air and fuel is what allows the engine to run efficiently and produce power.

Key Steps in the Carburetor Process:

- 1) Air is drawn into the carburetor throat.
- 2) Air speeds up as it passes through the venturi.
- 3) Increased air speed causes a drop in air pressure.
- 4) Lower pressure pulls fuel into the airflow.
- 5) Fast-moving air breaks fuel into tiny droplets.
- 6) Fuel and air mix thoroughly and enter the engine's cylinders.

Importance of Fuel-Air Mixture

The carburetor's ability to mix air and fuel accurately is vital for engine performance. If the mixture is too rich (too much fuel), the engine can flood and fail to run properly. If it is too lean (too little fuel), the engine may overheat or run poorly. By using Bernoulli's Principle, the carburetor ensures a balanced mixture, which is essential for efficient combustion and smooth engine operation. Understanding this principle not only highlights the elegance of physics in engineering but also underscores the importance of scientific knowledge in maintaining and innovating technology.



True or False

Is the statement true or false?

1) Carburetors mix air and water.	True	False
2) Air speeds up in the carburetor venturi.	True	False
3) Lower pressure in the venturi pulls in fuel.	True	False
4) Bernoulli's Principle causes air pressure to increase.	True	False
5) Fuel droplets mix with air in the throat.	True	False

Question

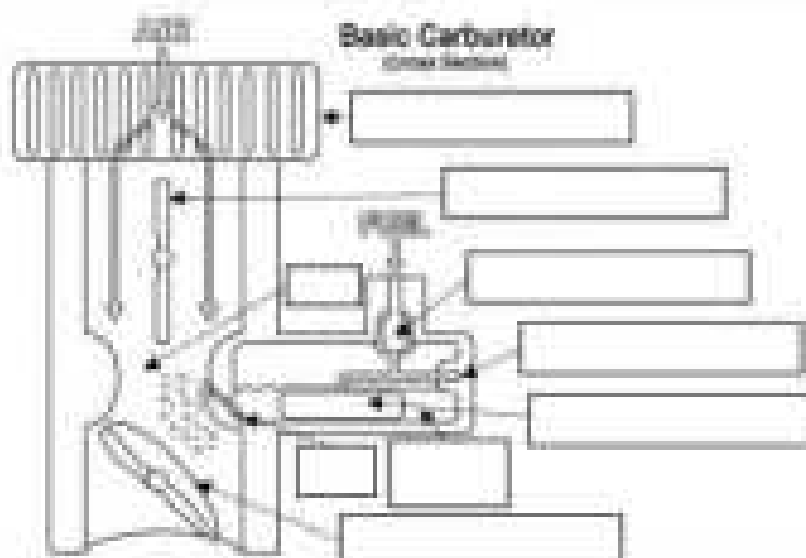
Answer the questions below

1) What is the purpose of a carburetor in an engine?

2) Explain how a carburetor works.

Diagram

Label the components of a carburetor

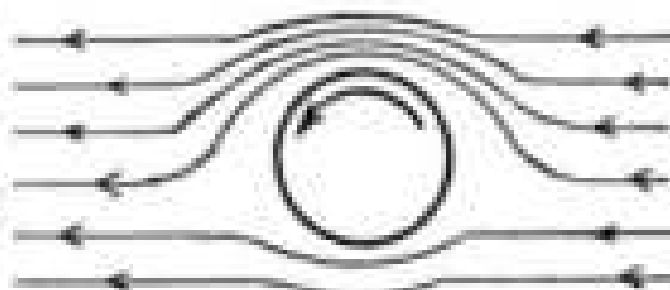


1	_____
2	Float
3	Choke Valve
4	Air Cleaner
5	Float Arm
6	Float Chamber
7	Float Valve
8	Throttle Valve
9	Jet

Lift – Bernoulli's vs Newton

Two Different Theories of Lift

Sir Isaac Newton and Daniel Bernoulli each have theories of how an aircraft can lift off the ground and how they stay off the ground. Both theories are commonly used to explain lift and both are debated as the reasons lift occurs. Which theory makes more sense to you?



Achieving Lift – Bernoulli's Principle

Lift is the force that keeps an airplane in the air and also holds it there. Bernoulli's principle explains how lift is generated. The air pressure under the wing is higher than the air pressure over the wing.

Higher pressure underneath pushes the wing up and produces lift. Looking at the example above, the air must meet at the trailing edge at the same time. This means the air must move faster over top of the wing to get there first. This causes the lower air pressure above and the higher air pressure below the wing.

Achieving Lift – Newton's Theory

According to Newton, airplanes fly because their wings deflect air downward so that the plane is forced upwards. Newton's third law of motion states that for every action, there is an equal and opposite reaction.

Newton's law suggests that to generate lift, the wing must divert air down so that the plane can go up. This is done by creating a wing that is shaped to push air under it. The issue is that we need a lot of air to be diverted down in order to generate lift. This is why planes must have an extremely fast takeoff speed as they need to push a lot of air down to lift off the ground.



Questions

Answer the questions below using evidence from the text.

1) Which theory of lift makes more sense to you? Bernoulli's or Newton's? Explain.

2) How is air pressure affected by the shape of an aircraft's wing?

Questioning

Questions to ask yourself while reading

1)

2)

3)

True or False

Is the statement true or false?

1. The faster the air moves, the lower the air pressure.

True

False

2. If the air pressure is lower on top of the wing, the plane will lift.

True

False

3. Bernoulli's principle states that for every action there is an equal reaction.

True

False

4. The takeoff speed must be high in order to push a lot of air down.

True

False

5. Both theories explain how aircrafts generate lift.

True

False

Lift – Angle of Attack

Angle of Attack

Angle of attack is the angle a wing makes with oncoming airflow. Increasing the angle of attack will result in the plane going upwards and decreasing the angle of attack will result in the plane going downwards.

The chord line is the straight line from one side of the wing to the other. The relative wind is the air that the wings will travel through. With air being a fluid, the plane and the air particles are deflected through the air particles.

When an airplane takes off, it travels along the runway. While it is on the ground, its wing angle will be very small. As it picks up enough speed, the nose of the airplane will lift off, increasing the angle of attack to around 15 degrees. This will cause liftoff for the airplane.

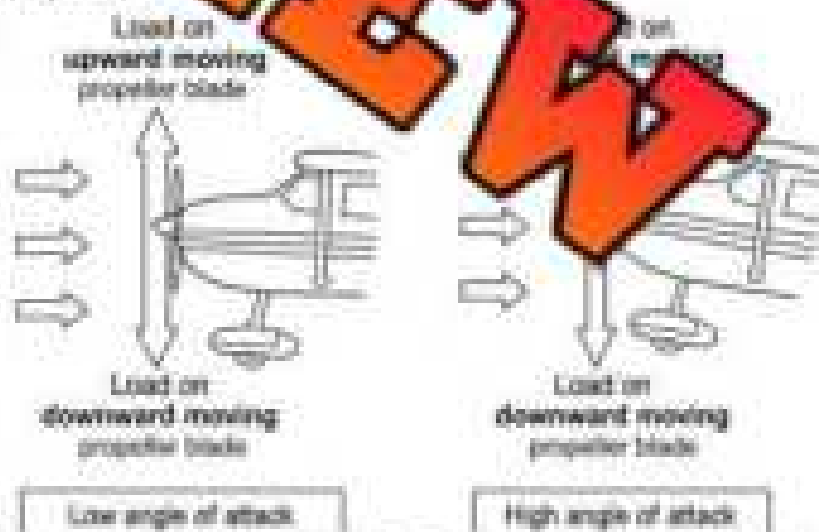
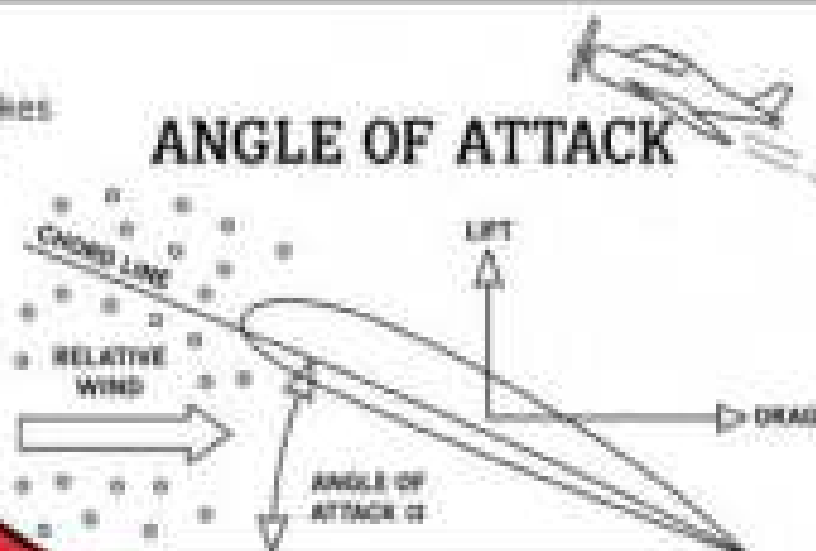
Once the airplane is in flight at an appropriate altitude, its angle of attack needs to become much less than 15 degrees, or it could stall. The airplane will settle around 6 degrees while it is in flight.

Stalling means the aircraft has lost or reduced its lift because its angle of attack was increased

too much. The angle where an aircraft will stall is called the critical angle of attack.

Stalling means air cannot travel above the wing as it strikes the front of the wing causing a lot of drag.

ANGLE OF ATTACK



Questions

Answer the questions below using evidence from the text.

1) What does angle of attack mean? How does it help generate lift?

2) What does it mean for an aircraft to stall? Why does it happen?

Visualizing

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

True or False

Is the statement true or false?

1) The angle of attack is around 3 degrees before take off	True	False
2) When the nose goes up, the angle of attack decreases	True	False
3) As a plane takes off, its angle of attack gets to around 15 degrees	True	False
4) Reaching the critical angle of attack could lead to an airplane stalling	True	False
5) When an airplane stalls, its angle of attack was not large enough	True	False

Paper Airplane – Drag Experiment

Research Question

Can we make a parachute that slows down an objects fall?

Paper airplanes are simple to make, but it can be challenging to make ones that fly well. Some paper planes fly better than others. One factor is the design of the plane. In this activity, you'll get to build a paper plane and change its basic design to see how it affects its flight.

Materials you need for this experiment.

- Sheet of paper
- Ruler
- Tape
- Scissors
- Paper Clips



Procedure

What to do

1. Make a standard dart paper airplane. Make your folds as shown.
2. Throw your plane 5 times from a spot you've marked with tape on the ground. Use the same amount of force (thrust) to throw the plane.
3. Once you have a good idea of how far it can fly, change the shape to increase how much drag it experiences. Do this by cutting slits that are about 3-5cm long on the wings. You can also make more folds that will produce a drag effect for the plane.
4. Retest your plane with the new changes. Record your observations below.
5. Add paper clips to the planes to see if that makes them fly better. Put them on different parts of the plane. Record your results below.

Instructions

Step-by-step instructions for a paper plane



Instructions

Step-by-step instructions for a paper plane



A Paper Plane

Hypothesis

How will creating drag and using extra weight affect the flight?

After Creating
DragAfter Adding
Paper Clips**Observe**

What happened?

Design Statement

I want to see if it fly better or worse than the original design?

After Creating
DragAfter Adding
Paper Clips**Results**

What did we learn?

1) Did the drag slow down your plane? Why do you think this happened?

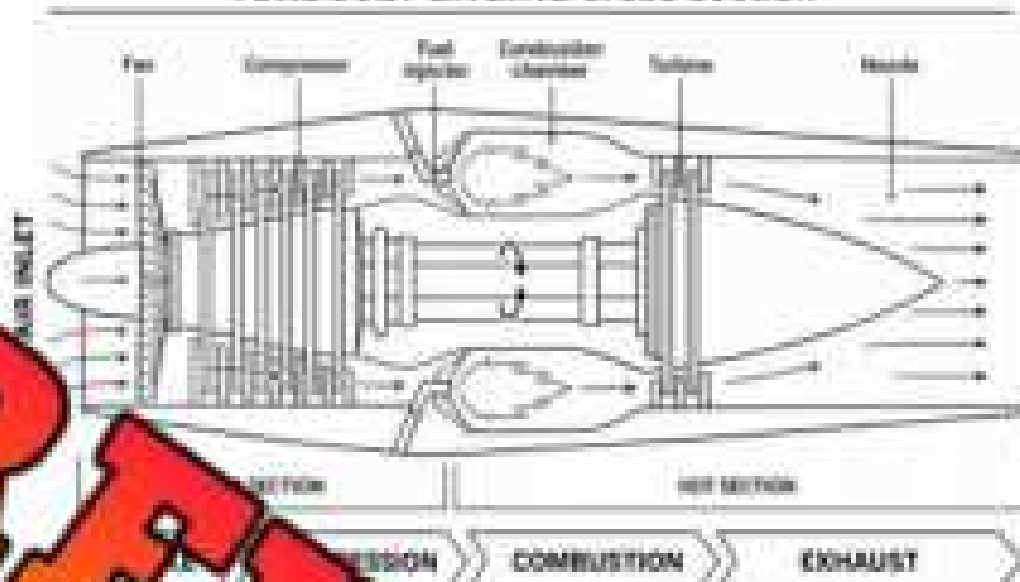
2) Did the paper clips help the plane fly? Why do you think this happened?

Propulsion - Thrust

What is Propulsion?

Propulsion is the force which moves an aircraft through the air. Propulsion is also called thrust. Thrust is needed to overcome the drag of the plane and the weight of the aircraft. Thrust generated by engines.

TURBOJET ENGINE cross section



A **jet engine** is a machine that converts fuel into a powerful pushing force. Jet engines create thrust by sucking in air through the front and then compressing it. Compressors raise the pressure of the air. As the pressure rises, the compressed air is mixed with fuel by the fuel injector. This creates an electric spark that starts the fire. The burning gases expand and blast out through the nozzle. As the exhaust shoots backwards out of the nozzle, the aircraft is pushed forwards.

Pilots can accelerate the aircraft by adjusting the throttle. The throttle is a mechanical device to add more fuel to the engine's system, which creates more thrust. Pushing backwards. This causes an equal opposite reaction of propelling the aircraft forwards.

Propeller

A propeller can generate thrust for aircrafts to fly. A **propeller** has spinning blades that generate differences in air pressure between the front and back surfaces of the blades.

A propeller works the same way as a screw. When you turn a screw into a wall, it goes further in as it grabs the wall and travels further with each turn. A propeller works the same way as it spins with the help of an engine. The blades pull the air (fluid) behind which results in the aircraft being pushed forwards. The more air that is pulled behind the propeller, the more thrust is generated.

Smaller aircrafts will use a propeller on the front to generate thrust. As aircrafts get larger, they require more thrust. These larger aircrafts use multiple jet engines to create this additional thrust needed for long trips with heavy loads.

Questions

Answer the questions below using evidence from the text.

1) What does propulsion/thrust mean? What force does it overcome?

2) How does an engine work?

Diagram

Draw a diagram of an engine and label the important parts

True or False

Is the statement true or false?

1. A propeller has spinning blades that create lift	True	False
2. Thrust opposes drag to move an aircraft	True	False
3. An engine uses fuel to move and accelerate faster	True	False
4. An engine uses the 3 rd law of motion – every action causes an opposite reaction	True	False
5. A propeller spins on its own, causing the lift of an aircraft.	True	False

Exit Cards

Cut Out

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

Name: _____

Mark

Draw a line to match each term to its correct description.

Thrust

Jet engine

Propeller

- ☐ Uses spinning blades to push air backwards
- ☐ The force that moves an aircraft forward
- ☐ Converts fuel into a powerful pushing force
- ☐ The force that moves an aircraft through the air

Name: _____

Mark

Draw a line to match each term to its correct description.

Thrust

Jet engine

Propeller

Propulsion

- ☐ Uses spinning blades to push air backwards
- ☐ The force that moves an aircraft forward
- ☐ Converts fuel into a powerful pushing force
- ☐ The force that moves an aircraft through the air

Name: _____

Mark

Draw a line to match each term to its correct description.

Thrust

Jet engine

Propeller

Propulsion

- ☐ Uses spinning blades to push air backwards
- ☐ The force that moves an aircraft forward
- ☐ Converts fuel into a powerful pushing force
- ☐ The force that moves an aircraft through the air

Name: _____

Mark

Draw a line to match each term to its correct description.

Thrust

Jet engine

Propeller

Propulsion

- ☐ Uses spinning blades to push air backwards
- ☐ The force that moves an aircraft forward
- ☐ Converts fuel into a powerful pushing force
- ☐ The force that moves an aircraft through the air

Activity – Building a Propeller

Background

How does a propeller work?

A propeller is just like a spinning wing. Most aircraft propellers have 4 wings that attach to a centre nose. When the propeller spins, the rotary motion creates a difference in air pressure between the front and back surfaces of the blades. Behind the propeller has a higher air pressure than in front of the propeller which has lower pressure. Air always moves from high pressure to lower pressure. This difference provides thrust or propulsion that pushes the aircraft forward.

Materials – What you need for this experiment

- Thin cardboard (or paper and stock)
- Scissors
- Plastic Lid (5-10 cm diameter)
- Glue or tape (hot glue is best)
- Wooden skewer or straw



Procedure

What to do

1. Cut the cardboard into 8 rectangles about 3cm wide and 10cm long.
2. Cut the bottoms of the rectangles at a slant so they are curved.
3. Make a hole in the middle of the plastic lid (get a hole punch if you have one).
4. Stick the skewer through the hole (or use the straw).
5. Glue the rectangles to the lid with the pointed ends on the outside.
6. Twist the skewer to simulate the propeller rotating. Do you feel air blowing? Record your results below.
7. Now bend the wings on the propeller.
8. Rotate the propeller again and feel for air blowing. Record your results below.

Observations

What happened?

Design	Observations – Did you feel wind or air movement from the propeller spinning? Which design created more wind?
Flat wings on propeller	
Curved/bent wings on propeller	

Results

What happened during the experiment?

1) Which propeller produced more air movement? Why do you think more air moved with that version of propeller?

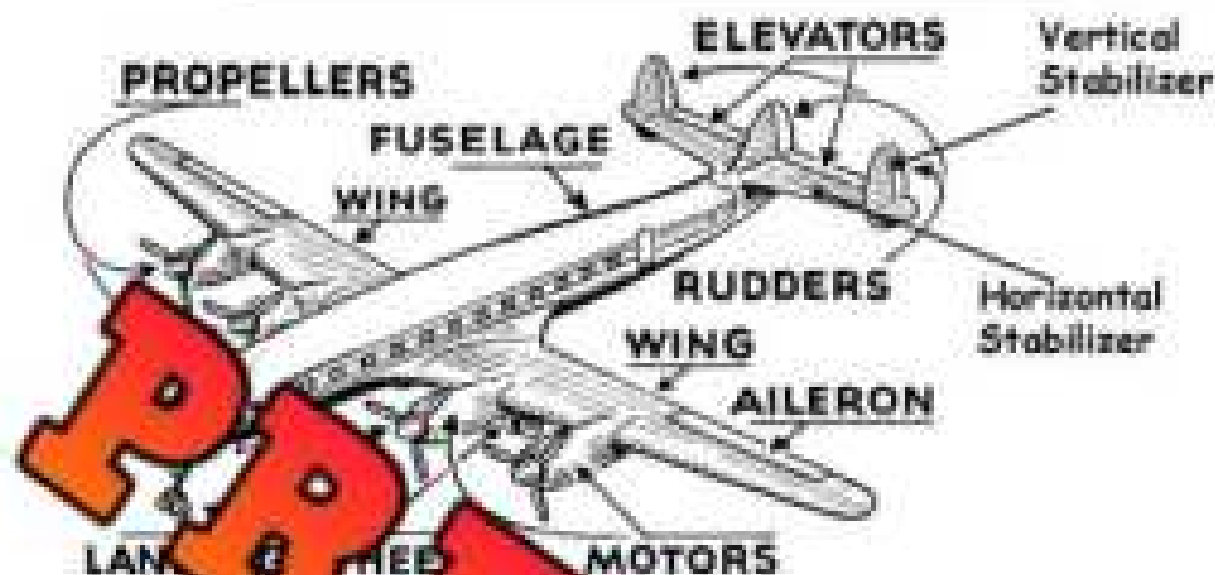
2) How do propellers generate thrust for an aircraft?

3) A fan and a propeller both move air. How does a fan move air while a propeller moves an aircraft through still air? Explain the difference in your own words.

4) Why is the shape of a wing important on a propeller?

5) Draw an aircraft with a propeller. Label the following: wings, nose, low air pressure, high air pressure, and the direction of the aircraft versus the direction of the air. Use arrows to show the movement.

Control Surfaces of a Plane



Aircraft Part	Function - What It Does
Elevators	Controls the pitch of the aircraft. Pitch means going up or down. When the elevators go up, the aircraft goes up. When the elevators go down, the aircraft goes down.
Rudders	Controls the yaw of the aircraft. Yaw is the side to side movement of the nose of the aircraft.
Wing	Controls the lift of the aircraft. The wings generate lift off the ground. The wings also generate drag.
Aileron	Controls the lateral balance by rolling the aircraft left or right. When the right aileron goes up, the left aileron goes down, and the aircraft can roll using the ailerons.
Motor	Controls the thrust to lift the plane into the air. The motor also pushes the plane forward.
Landing Wheels	Allows the plane to land safely.
Fuselage	The centermost piece of the aircraft that holds the cargo and passengers. Most aircrafts can hold up to 500 passengers and 200,000 pounds of cargo.
Propellers	Controls some of the thrust the plane needs to go forwards. Also controls pitch by tilting the propellers up or down.
Horizontal Stabilizer	Helps control pitch. Keeps the aircraft's equilibrium when flying up and down.
Vertical Stabilizer	Helps control yaw by preventing lateral movements of the craft. Needed for complete control of the plane.

Label the Airplane Below Using the Word Bank Words
Horizontal Stabilizer Vertical Stabilizer Wing Fuselage Aileron
Rudder Elevator Engine/Motor



Question

Follow the instructions.

1) How does a pilot make sure the plane doesn't roll? Which controls can they use?

2) How does a pilot make sure the plane doesn't lose control vertically? Which controls do they use to maintain a proper pitch?

3) What is the function of the propeller and/or the engines? (function = what it does)

Memory Game: Flight

Objective

What are we learning about?

To enhance students' understanding of key vocabulary related to the study of flight by engaging them in a fun memory game.

Material

What you will need for the activity

- Memory game cards (provided) with the terms on one set and definitions on another set.
- A flat surface like a table to lay out the cards.



Instructions

How you will complete the activity

1. Divide the class into groups of 3 or 4. Give each group a set of Memory Game cards. (Provided)
2. Have each group lay all the cards face down in a grid on a flat surface.
3. The students take turns flipping over two cards at a time, trying to find 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 why these terms are important to understand and how they relate to the context of flight.

Cards

List of terms related to flight.

Term	Definition
Fluid	Any substance that can flow, such as air or water.
Drag	The force exerted by a fluid on a surface.
Lift	The upward force that allows an aircraft to rise and overcome gravity.
Gravity	The force that pulls everything on earth toward the center of the planet.
Thrust	The forward force that propels an aircraft through the air.

Cards

List of terms related to flight.

Term	Definition
Drag	The resistance force that acts opposite to the direction of the movement.
Bernoulli's principle	A principle that states faster moving fluid has lower pressure than slower moving fluid.
Propulsion	The action of driving or pushing
Unbalanced Forces	Forces that cause a change in the motion of an object.
Aerodynamics	The study of how gases interact with moving bodies, like aircraft.

Cards

List of terms related to flight.

Term	Definition
Velocity	The speed of something in a given direction.
Drag	The frictional force air exerts against a moving object.
Terminal Velocity	The fastest speed that a freely falling object eventually reaches when the resistance prevents further acceleration.
Glide Ratio	The distance an aircraft can travel horizontally compared to the decrease in altitude.
Wing Span	The distance from one wingtip to the other wingtip of an aircraft.

Cards

List of terms related to flight.

Term	Definition
Jet Engine	An engine that moves the aircraft forward by ejecting a high-speed stream of gases.
Fuselage	The main body of an aircraft.
Tailwind	Wind that blows in the same direction as an object is moving.
Headwind	Wind that blows against the direction of movement, slowing down the object.
Flaps	Movable panels on the wings of an aircraft that help control lift and speed.

Unbalanced Forces Steering Through the Skies

What are Unbalanced Forces?

Unbalanced forces occur when two forces acting on an object are not equal in size, causing the object to change its state of motion. This concept is crucial in aviation and space travel, where precise movement and direction are necessary.

How Aircraft Use Unbalanced Forces

Aircraft use unbalanced forces to steer through the air. The pilot adjusts flaps and ailerons to change the direction.

- **Ailerons:** Located on the wings that lift one wing while lowering the other, causing the aircraft to roll.
- **Rudder:** Located on the tail that moves side to side, pushing the tail in a left or right direction and turning the aircraft.
- **Elevators:** Panels on the tail that move up or down, changing the angle of the nose to climb or descend.

Steering Spacecraft with Unbalanced Forces

Spacecraft operate in a vacuum where traditional air control surfaces like rudders or ailerons won't work. Instead, they use thrusters:

- **Thrusters:** Small rockets around the spacecraft that fire short bursts to push it in different directions.
- **Gyroscopes:** Devices inside that help change the spacecraft's orientation without using fuel.

Key Points to Remember

- Aircraft and spacecraft must overcome gravity and inertia to change direction.
- Unbalanced forces are essential for precise movements in both air and space.



True or False

Is the statement true or false?

1. Unbalanced forces keep objects motionless.	True	False
2. Gyroscopes change a spacecraft's direction.	True	False
3. Elevators help an aircraft to turn.	True	False
4. Unbalanced forces can change an object's speed.	True	False
5. Birds use unbalanced forces to fly.	True	False

Questions

Write two questions you have about the text.

1)	
2)	

Questions

Answer the questions.

1) Describe how unbalanced forces are used in flight.

2) Write a short paragraph comparing how airplanes and spacecraft use unbalanced forces.

How Do Animals Fly?

Flying Animals

The only animals that can truly fly are birds, insects, and bats. Many other animals can glide for a short period of time, but cannot generate lift from the ground. Almost all birds can fly because they have most of the following physical features:

- Lightweight - makes it easier for them to achieve lift
- Lightweight bones - a bird's bones are almost hollow which makes the bird lighter
- Strong muscles - that allow the flapping of wings
- Wings that create the needed force for lift
- A streamlined body to reduce the force of drag

How Birds Fly

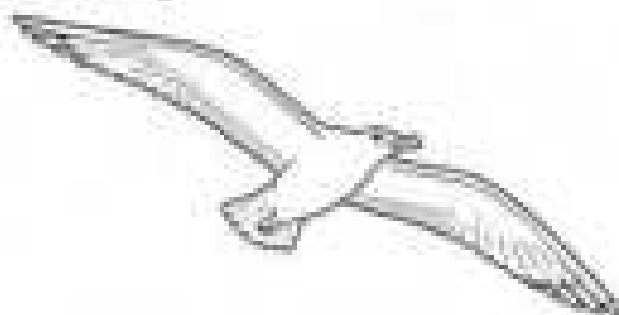
A bird will flap its wings to create lift from the ground. The curved shape of a bird's wings allows air to flow over the top surface of the wing, which lowers the air pressure. This generates lift as the bird will move into the area of lower air pressure.

The angle of the wing will also be tilted, which causes an opposite reaction of the wing and body moving upwards.

Larger wings produce more lift than smaller wings. The wings of a hummingbird with smaller wings will need to flap more to generate the same amount of lift. Hummingbirds are tiny birds that will flap their wings up to 80 times per second, even when they are just hovering. This is because they cannot glide while hovering.

Gliding

When a bird is gliding, it is not working at all. Its wings are open to its sides cutting through the air at a slight angle, which deflects the air downwards causing the body to move or stay upwards. As drag acts on their body, they will lose some lift and will need to increase their wings-angle of attack so they can fly upwards.



Questions

Answer the questions below using evidence from the text

1) How do birds fly?

2) What physical characteristics that allow birds to fly?

Inference

Why do they can't fly?

Diagram

Draw a diagram of a bird flying. Label the air pressures and parts of the bird

Exit Cards

Cut Out

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

Name: _____

List three physical features that enable birds to fly.

1) _____

2) _____

3) _____

Name: _____

List three physical features that enable birds to fly.

1) _____

2) _____

Name: _____

List three physical features that enable birds to fly.

1) _____

2) _____

3) _____

Name: _____

List three physical features that enable birds to fly.

1) _____

2) _____

3) _____

Animal Adaptations – Propelling in Air/Water

Animal Adaptations

Animals need to adapt to be able to survive in their environment.

Adapting means they need to change. Therefore, **animal**

adaptations are the changes in animals that allow them to

survive in their environment. Dolphins and birds have

adapted to have the ability to propel themselves through water and air.

Dolphins Streamline

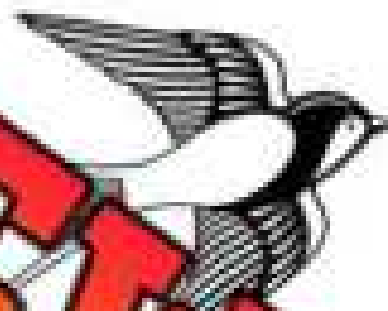
Dolphins and barn swallows have streamlined bodies that are shaped to reduce air resistance when moving in motion. Resistance is also known as drag, which is the force of air pushing or pulling against an object moving through it. Both dolphins and barn swallows have teardrop shaped bodies that reduce friction drag in water and air.

Friction drag happens when two objects are in contact. A flat faced organism will feel more friction drag when moving through the air or the water. The flat shape has a large surface area that the air strikes and has to travel relatively further distances to pass by it. Adapted animals like swallows and dolphins have less friction drag acting against them, which allows them to move easier in the fluid they live in.

Helicopter Motion

Maple trees drop their seeds in helicopter shaped "samaras". The maple tree plant has adapted to dropping these helicopter seeds to ensure that their seeds will be spread near and far from the plant they fell from. The seed falls in a helicopter motion as it has wings attached to the seed.

As a result, when the seed falls, it spins as the wings cut through the air. The wings have a wider side and a narrower side that make them spin due to Bernoulli's principle.



Questions

Answer the questions below using evidence from the text.

1) What does animal adaptation mean?

2) Why do dolphins and birds have a streamlined shape?

Making Connections

How does this reading remind you of in your life?

True or False

Is the statement true or false?

1) Air resistance is the force of air that objects have to move through	True	False
2) Flat surfaced objects are aerodynamic, moving easily through the air	True	False
3) A dolphin has a teardrop shape to cut through the liquid fluid	True	False
4) Maple trees drop samaras that are shaped like helicopters	True	False
5) Air and liquids are both fluids	True	False

Activity – Flight and Gravity – Poster Making

Objective

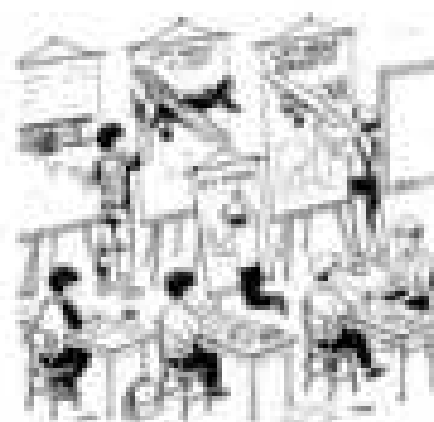
What are we learning about?

To help Grade 6 students educate about how different creatures and machines achieve flight by overcoming gravity.

Materials

What you will need for the activity:

- Fact sheet on various flying creatures and machines.
- Poster board.
- Markers, colored pencils, and paint.
- Blue and scissors.



Instructions

How you will complete:

1. Start by discussing the fact sheet on various flying creatures and machines. Talk about why understanding this concept is important for engineering and natural sciences.
2. Select one creature or machine from the fact sheet to focus on for your poster project.
3. On your poster board, draw the creature or machine you selected. Make it as realistic as possible so others can recognize it.
4. Write down key information around your drawing, such as how lift is generated, the role of gravity, and any specific adaptations or technologies that assist in flight. Use the fact sheet for accurate details.
5. Add any additional images or decorations to your poster to make it informative and eye-catching.
6. Once your poster is complete, prepare to present it to the class. Practice explaining the concepts of lift and gravity, and how your chosen subject utilizes these forces to fly.

Fact Sheet

Here's a simple fact sheet about flying creatures and machines

Category	Mechanism of Flight	Adaptations/Design Features	Example
Birds	Flap wings to push air downwards, wings create lift by changing air pressure.	Lightweight bones, streamlined feathers for lift.	Eagle: Broad wings for soaring.
Insects	Flap wings rapidly to create lift, wings are attached to thorax.	Exoskeleton for strength, wings connected to high-speed flapping muscles.	Butterfly: Large wings for controlled flight.
Airplanes	Fixed wings with shaped airfoil for lift, engines provide forward thrust.	Aerodynamic shape, engines on wings.	Commercial Jet: Large engines for heavy loads.
Helicopters	Rotating blades act like wings, rotor blade tilt controls lift and direction.	Rotors for lift, tail rotor for stability and orientation.	Helicopter: Designed for precision and stability.
Gliders	Glide on air currents, launched high enough to catch air; use long, wide wings for lift with minimal airspeed.	Light structure, long wings relative to body for maximum lift efficiency.	Sport Glider: Relies on thermal currents for flight.

Poster

Fill the following poster about flying creatures/flying machines

Title: _____**Picture****Description**

PREVIEW

Adaptations

Reflection

Answer the questions below

1) What did you find most interesting about your chosen creature or machine from the fact sheet?

2) How do weight (mass) of your subject influence its ability to fly?

3) What did you understand about the principles of flight?

4) What was the most surprising fact you discovered?

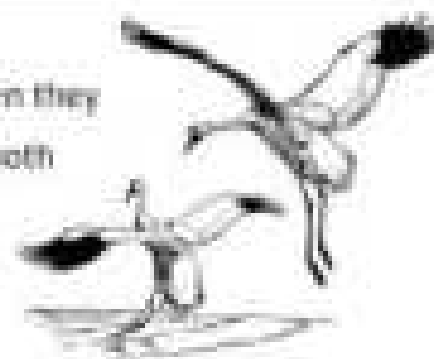
5) How can sharing this poster help others?

PREVIEW

Design Features – Adapting Drag

Adapting Drag Using Design Features

Drag is not always a bad thing as it helps things slow down when they are travelling at high speeds. Airplanes and birds both fly and both are designed to decrease drag. However, both need to be able to increase drag in order to slow down to land safely.



Increasing Drag

An airplane can increase drag of air flow over its wings by using flaps. If you've ever looked at an airplane, you will see flaps on both wings that are usually down when the plane is taking off. When it is time to slow down for landing, these flaps will open up, increasing the drag on the wings and slowing the airplane down. With the flaps open, the plane has a larger surface area for the air to hit and resist.

A bird will also use its wings to increase drag. When a bird is landing, they will increase the drag on their bodies by opening their wings and legs, making them less aerodynamic when flying through the air.

Skydivers will also increase the amount of drag they have by using their arms. When they want to increase the drag on their bodies, they open their arms and spread their legs to make them as big as possible. With a larger surface area, they create more drag and a slower, more enjoyable fall. Opening a parachute will increase the drag even more because the surface area is larger. This creates more air resistance and a much slower fall.

Decreasing Drag

Airplanes are made aerodynamically and will close their flaps to decrease drag. A bird is unique because they will tuck their wings when they are diving from high altitudes to lower altitudes to find prey. This decreases drag as they cut right through the air.



Questions

Answer the questions below using evidence from the text.

1) Is drag always bad? Why or why not?

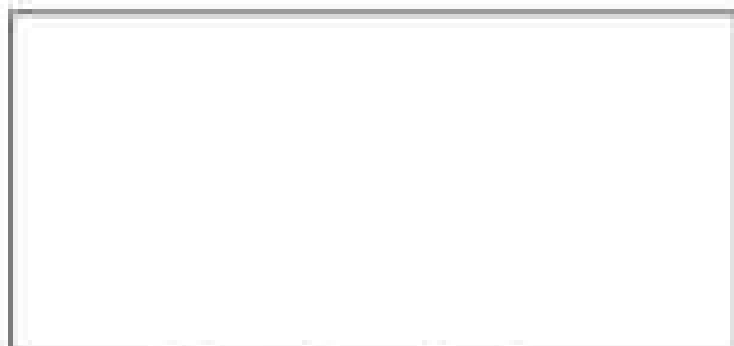
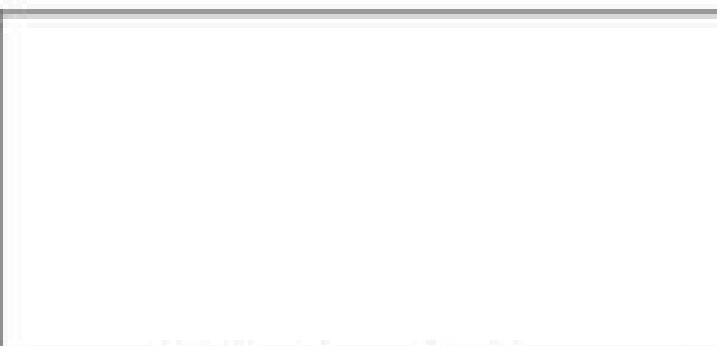
2) How do birds or airplanes use drag to slow down and speed up?

Summarize

Summarize the reading and supporting details

Draw

Draw a picture of a bird diving and a bird landing

	
Diving - Decreasing Drag	Landing - Increasing Drag

What is Parachute?

What is a Parachute?

A parachute is a device that is used to slow down an object that is falling towards the ground. When someone goes skydiving, they use a parachute to counter the force of gravity pulling the person to the ground.

Gravity is the force that pulls all matter to the centre of the earth.

Why Use a Parachute?

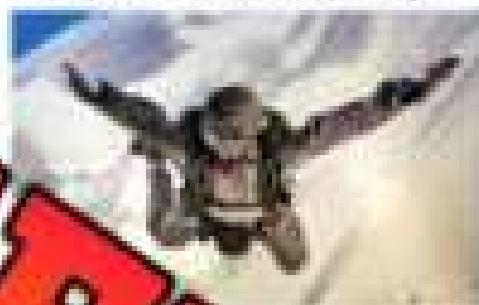
We can slow down the force of gravity. We do this by increasing another force, air resistance. When we fall to the ground, our body shape and aerodynamics will have some effects on the force of gravity. If you are skydiving, you can open up your body in a spread position to increase your air resistance. This will slow you down by increasing drag and counteracting the force of gravity.

Gravity will be too strong for you if you are in a spread position with your belly facing the earth. In fact, skydivers fall at a speed of approximately 200 km/h in this position. They can increase their speed to 290 km/h when in a diving position with their arms and legs tucked in. In order to slow the force of gravity, we can use a parachute to increase air resistance. When using an open parachute, the skydiver will slow to about 5 km/h to hit the ground safely.

How a Parachute Works

A parachute works the same way that our bodies work when we startle while falling. Parachutes provide more surface area for a falling object or person to use to increase the air resistance while falling. Remember, there is gas all around us. It is a fluid that we travel through. When we increase our surface area that needs to travel through the air, we create more air resistance and this slows us down or makes it harder to travel through.

Imagine running your hand through water. When you slice through the water with your hand, it is easier to move your hand quickly, but when you open your hand up and move it through the water, there is more resistance, and it is slower. Water and air are both fluids and the same principles apply.



Questions

Answer the questions below using evidence from the text.

1) What is a parachute? Why do we use them?

2) How do parachutes work? How much can they slow us down?

True or False

Answer true or false?

1. Opening your parachute decreases the amount of air resistance during skydiving	True	False
2. When a skydiver falls during a freefall, they can turn up or down	True	False
3. We can position our bodies like a starfish to increase air resistance	True	False
4. Increasing air resistance while falling will slow our fall	True	False
5. Water is a fluid but gas is not	True	False

Visualizing

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

Testing a Parachute

Research Question

Can we make a parachute that slows down an object's fall?

The reason we use a parachute is to slow down an object's fall to the ground. We can overcome the force of gravity pulling us to the centre of the earth by using a parachute that increases our surface area. The increased surface area increases our air resistance and slows down our fall. Let's see if we can design a parachute that will slow down an object's fall to the ground.

Materials

What you need for this experiment

- A small object (figure 1)
- Scissors
- String
- A small object (figure 2)
- Stopwatch



Procedure

What

1. Find a high spot that you can drop your object from.
2. Have one person use the stopwatch to time how long it takes the object to hit the ground. Have another person drop the object. How many seconds on this page.
3. Cut a large square out of the plastic bag to use as a parachute.
4. Trim the edges so the square now looks like an octagon.
5. Cut small holes near the edge on each side (8 total).
6. Attach 8 pieces of string that are the same length to the holes.
7. Tie the pieces of string to the object you are using as the weight.
8. Drop the object with the parachute from the same spot. Have someone time it. How many seconds on this page.
9. Drop it 4 times total and record the rest of your results.

Observations

What happened?

Drop Attempt	How many seconds did it take to fall to the ground?
No parachute	
1	
2	
3	
4	

Diagram

Follow the instructions below

Draw a diagram of your object falling. Label the diagram using the following terms: gravity, parachute, object, and air resistance. Use arrows to show which direction gravity is pulling and which direction the air resistance is resisting.

**Results**

What did you learn from your experiment?

1) Did your parachute work? What was



2) Why was your parachute successful? How could you improve it? What doesn't very successful?



3) Extend: Do you think parachutes are aerodynamic? Explain why or why not using the terms: air resistance and drag.



Benefits of Aviation

Benefits of Aviation

There are numerous benefits of aviation that have helped people and the economy. Check out some of the benefits below.

- Aviation Creates Jobs

Over 65 million people work in the aviation industry. The entire aviation industry earns \$3.5 trillion worldwide. Employees include pilots, luggage handlers, stewards, mechanics and more.

- Aviation Protects Us

The Royal Canadian Air Force has 100 aircraft in operation. There are also 10,000 members of the air force.

Members of the air force monitor the air above us as well as do missions in other parts of the world to keep us safe.

- Aviation Transports Goods

Each year, around \$7 trillion worth of goods are shipped worldwide using aviation. In addition, approximately 35% of all goods are sent using airplanes. That means more than 1 out of three things in your room were likely sent by airplane!

- Aviation Supports Tourism

In an average year, more than 500 million people travel by air for a vacation. Tourism is important as it brings money into other countries. Many tourist countries, like Jamaica, Cuba, and the Dominican Republic need this money for their economy.

- Visiting Friends and Family

Having the option to fly around the world in a matter of hours allows us to visit friends and family that live far away. Before flying, a ship was the only way to travel around the world. The average trip on a ship from Canada to Europe used to take over 30 days!



Questions

Answer the questions below using evidence from the text

1) What do you think are the most important benefits of aviation?

2) What jobs do you think have that work in aviation?

Making Connections

How does this text remind you of in your life?

True or False

Circle whether the statement is true or false

1) The aviation industry doesn't employ many people	True	False
2) The cost is too high for people to send goods on airplanes	True	False
3) Each year, more than 500 million people vacation using an airplane	True	False
4) It used to take over 30 days to get from Canada to Europe on a ship	True	False
5) More than half of all goods are sent using an airplane	True	False

Activity – Making a Glider

Background

What is a glider and how do they work?

A glider is an aircraft that soars through the air without the use of a motor. A glider is often called a sailplane because it is shaped to take advantage of the air. A glider cannot generate its own thrust because it has no engine. Instead, hang glider pilots often run and jump off the side of a hill or a cliff to get going.

Some gliders can descend for hours from high distances because they are shaped perfectly to soar through the air and they take advantage of rising air called updrafts. These updrafts help them to increase their altitude.

Materials

What do you need for this experiment?

- Straws
- Tape
- Newspaper or other large paper

Procedure

What to do

1. Make a triangle shape frame using 3 straws
2. Connect the straws using tape
3. Put the frame on the paper
4. Tape the paper to the frame. Cut all excess paper off to keep the glider light
5. Hold the front edge of the glider plane and give it a quick push forward to make it fly
6. Record how far the plane went below
7. Make changes to the glider. Try adding paper clips, straws, paper to enhance your design. Test after you make a change and record the distance and changes you made.



Name: _____

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October 2020
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Observations

What happened?

Attempts	Distance	Changes Made
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

PREVIEW

Activity – Designing and Building a Glider

Research Question

Can you make a glider that flies far and stays in the air longer?

Glider cannot stay in the air as long as an airplane because they can't generate their own thrust. Once they are in the air, they need to find thermals, which are rising air currents to help them generate lift. If they don't, they will descend to the ground. Some gliders that are piloted can stay in the air for up to 8 hours! A glider pilot often has two goals: one is to stay in the air longer, and two is to travel farther. Can you make a glider that stays in the air longer and travels far?

Materials

What you need for your experiment

- Straws
- Tape
- Newspaper or other large paper
- Cardboard
- Paperclips
- Stopwatch
- Tape measure
- Any other materials that might improve your glider



Procedure

What to do

1. Research paper gliders to find one you would like to make.
2. Design your paper glider by drawing it on the backside of this page.
3. Write down the materials you need to build the glider.
4. Begin building your glider once you have filled in the materials you need and designed the glider.
5. Test the glider for two things: distance and time spent in the air. Have one partner throw the glider and the other time how long it is in the air for using a stopwatch.
6. Record your results.

Name: _____

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Get the Super Simple Science
All Access

Design

Draw your glider

Materials

Observations

What happens

Attempts	Distance	Time in the Air
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Results

What happened during the experiment?

1) How successful was your glider? How far did it go and how long was it in the air?

2) What changes did you make to improve the glider from the last glider you made? Why do you think your glider go farther or stay in the air longer?

3) Compare your glider to another glider. What do you like about their glider?

4) How could you improve the design of your glider even more?

Draw your new design

PREVIEW

Negatives of Aviation

Drawbacks of Aviation

Aviation has changed our lives for the better since the first flight in 1903. However, there have been some drawbacks that come along with aviation. Check out the list of drawbacks below.

● Jetlag

When traveling around the world quickly, people will experience jetlag. Jetlag happens when you cross time zones and your normal sleep pattern is disturbed. Jetlag usually means you will need a few days of adjusting to the new time.

● Air Pollution

Aircrafts burn fuel and emit carbon dioxide, water vapour, nitrogen oxides, carbon monoxide, and soot. All of these things pollute the air, creating unsafe air for us to breathe. The gases are greenhouse gases that are contributing to global warming.

● Noise Pollution

The noise created from aircrafts is deafening if you live near an airport or under a flight path. According to a survey completed by researchers in Poland, living under a flight path could increase a person's chances of suffering a heart attack. They found that the flight noise led to people having high blood pressure, hypertension and an altered heart structure. The noise pollution causes stress if it is repeated for a long period of time.

● Contrails Leading to Global Warming

Contrails are the trails of water vapour that we see in the sky when an aircraft goes by. According to studies, the water vapour is trapping heat that would otherwise be released from the Earth. This is making global warming worse.



Questions

Answer the questions below using evidence from the text.

1) What do you think is the biggest negative of aviation?

2) Would you want to live under a flight path? Explain why or why not.

True or False

Write true or false?

1) Living under a flight path brings more noise for business	True	False
2) Aviation doesn't produce any greenhouse gases	True	False
3) Contrails are smoke streams in the sky	True	False
4) Contrails stop heat from escaping our atmosphere	True	False
5) Jetlag happens when you fly for a few hours to somewhere close	True	False

Visualizing

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

Assignment – Aviation Infographic

Take a stance on whether you think aviation is good or bad. Create an infographic that shows people your opinion. Use statistics to strengthen your opinion. Add illustrations to make your infographic stand out.

An infographic has:

- Convincing statistics, illustrations, and text written in large letters.



Research statistics by answering the questions below.

1) Which side do you think is winning?

2) What statistics will you use to convince people of your opinion? List at least 5. You may need to do some research to find statistics.

1

2

3

4

5

3) What drawings will you use for your infographic? Practice them below:

4) Draw a rough flow of your infographic. Plan where you will write your text and draw your pictures.

PREVIEW

Canada's Contributions to Aviation

The Contributions of Canadians to Aviation

The Silver Dart

The story of Canadian aviation begins with the flight of the Silver Dart. This remarkable event took place in 1909 in Baddeck, Nova Scotia, marking the first controlled, powered flight in Canada.



The Silver Dart was designed and built by the Aerial Experiment Association, a team that included Canadian engineer J.D. McCurdy and the famous inventor Alexander Graham Bell. During the Silver Dart's historic flight, soaring as high as 9 meters and covering a distance of nearly 800 meters.

This achievement marked a significant milestone in Canadian aviation history and sparked further interest in aviation in the country.

Bush Pilots and Aviation in the North

Another significant contribution to aviation in Canada came from the bush pilots who helped open up the vast northern regions of the country. These pilots, often flying small, rugged aircraft, navigated the treacherous and often uncharted wilderness, connecting remote communities in these areas. The rugged terrain, and remote communities in these areas posed significant challenges for transportation. However, it was in these conditions that bush pilots demonstrated their resilience and ingenuity.



Bush pilots, like the legendary Wop May and Fred McCall, were more than just pilots – they were pioneers who took to the skies in small aircrafts, delivering mail, supplies, and providing medical services to isolated communities. Their planes were often equipped with floats or skis, allowing them to land on water or snow – a necessity given the lack of proper landing strips in the remote regions.

These pilots also played an essential role in mapping Canada's vast landscape. Their daring and adventurous spirit not only contributed significantly to the development of these regions but also laid the foundation for today's air travel infrastructure in northern Canada. The contributions of these brave bush pilots continue to inspire pilots today, reminding us of Canada's rich aviation history.

Questions

Answer the questions below using evidence from the text.

1) What significant event did the Silver Dart mark in Canadian aviation history?

2) How do bush pilots contribute to the development of northern Canada?

True or False

Write true or false?

1) The Silver Dart flight took place in 1909.

True

False

2) Bush pilots delivered mail and supplies to isolated communities.

True

False

3) The Silver Dart was designed by J.A.D. McCurdy.

True

False

4) Bush pilots' planes were usually equipped with wheels and landing gear.

True

False

5) Bush pilots played a role in mapping Canada's vast landscape.

True

False

Making Connections

What does the reading remind you of in your life?

Coding – Auto Pilot on Planes

Auto-Pilot

Planes today are built to fly themselves. The reason is because most plane crashes are a result of human error. Auto-pilot is used for cruising at altitude, while pilots taxi the airplane to the runway, land the plane, and perform take offs.

How Does Autopilot Work?

A computer system monitors all sensors and components of the airplane through feedback loops. The computer is constantly sending and receiving if/else statements through the sensors.



For example:

if the right wing is not balanced		then	balance the wing	else	continue flying
-----------------------------------	--	------	------------------	------	-----------------

The autopilot works to monitor speed, altitude, and more. All of this is done without the pilot lifting a finger.

Pilots Role

The pilot's job is to monitor the autopilot system. Problems can arise. Pilots need to stay alert at all times. They can correct or disengage the autopilot if it's glitchy, or in order to perform a manual landing.

As of 2022, pilots perform 99% of landings, although autopilot can perform landings as well. In cases where visibility is an issue, autopilot can take over safely.

When a plane is being flown by a pilot, passengers will notice a bump or a bumper. This is because a computer can fly more efficiently than human. Computers can perform tasks quickly and gradually so that the passenger doesn't feel the plane's movement. For example, after a gust of wind, a plane's angle might be off. A pilot will likely take 30 seconds to level the plane. Autopilot can level the plane in 15 seconds, about half of the time.



Future For Pilots

So, will pilots be needed in the future? Yes, pilots will always be needed to monitor the autopilot program. However, the job is changing. No longer are pilots only required to fly a plane.

Today, pilots need to also understand coding and more science and technology as they have to understand how autopilot works so they can troubleshoot problems that could arise.

True or False

Circle whether the statement is true or false.

1) Autopilot lands most planes	True	False
2) Pilots do most of the flying throughout a flight	True	False
3) Autopilot works because of coding and feedback loops	True	False
4) A pilot can fly a plane better than autopilot	True	False
5) We won't need pilots in the future for flying planes	True	False

Our task is to answer the questions below using evidence from the text.

1) Why is autopilot better than a pilot flying manually?

2) How is the flying industry changing? Is a pilot still needed?

Coding

Write if/else statements based on the information below.

Are there strong wind currents straight ahead?

if	Else
Then	

Is the plane decreasing speed?

if	Else
Then	



Direction

Code the airplane around the obstacles (strong winds, other planes) and land it at the airport. Write as few lines of code as possible.

**Example Code**

- fly right 3
- fly up 4
- fly down 2
- fly left 5



Code

Unit Test - Flight**Multiple Choice**

/10

1. Which of the four forces of flight opposes weight? a) Propulsion/Thrust b) Drag c) Lift d) All of the above	2. Which of the four forces of flight opposes drag? a) Propulsion/Thrust b) Weight c) Lift d) All of the above
3. When a person jumps out of a plane with a parachute, they are using which force? a) Propulsion/Thrust b) Weight c) Lift d) Drag	4. Bernoulli's principle helps describe which of the four forces of flight? a) Propulsion/Thrust b) Weight c) Lift d) Drag
5. Aerodynamics improves which of the four forces of flight? a) Propulsion/Thrust b) Weight c) Lift d) Drag	6. A steep angle of attack will lead to what? a) The plane following a level trajectory b) The plane falling to the ground too quickly c) The plane going up too quickly d) None of the above
7. When fluids travel faster, it creates... a) Low pressure b) High pressure c) No change in pressure d) None of the above	8. Aerodynamic vehicles use which force? a) Thrust b) Lift c) Drag d) Weight
9. A plane with too much weight needs more... a) Thrust b) Lift c) Drag d) Weight	10. Which law states that for every action, there is an equal and opposite reaction? a) Newton's First Law b) Newton's Second Law c) Newton's Third Law d) Newton's Fourth Law

Define

What do the terms below mean? (1 mark each)

/3

Term	Definition (what does it mean)
Thrust	
Aerodynamic	
Drag	

Short Answer

Answer in 2 lines (2 marks each)

1) What is air? Why is it considered a fluid?

2) How does the weight of an aircraft affect its flight?

3) How does a hot air balloon achieve lift?

Long Answer

Answer the questions below - Each question is worth 5 marks.

1) How do the 4 forces of flight lead to an aircraft achieving lift and maintaining lift throughout its flight?

PREVIEW

2) What are the benefits and drawbacks of aviation? (4 marks)



Workbook Preview



Grade 6 Science – 2022 Curriculum

Electricity

	Curriculum Expectations	Pages
C1.1	assess the short- and long-term impacts of electrical energy generation technologies in Canada on society and the environment, including impacts on First Nations, Métis, and Inuit communities, and on climate change	94-108, 114-118, 122-123
C1.2	assess choices that reduce personal use of electrical energy from both renewable and non-renewable sources, and advocate for the responsible use of electrical energy by the school community	13-15, 17-20, 92-93, 124-129
C2.1	Preview of 100 pages from this product that contains 209 pages total.	
C2.2		
C2.3	identify materials that are good conductors of electric current and materials that are good insulators	45-49
C2.4	describe how technologies transform various forms of energy into electrical energy	9-16, 98-100, 114-118
C2.5	describe ways in which electrical energy is transformed into other forms of energy	76-78, 81-87
C2.6	explain the functions of the components of a simple electrical circuit	47-49, 52-54, 56-60
C2.7	distinguish between series and parallel circuits, and identify common uses of each type of circuit	50-51, 56-60, 65-67, 70-71, 109-113

Grade 6 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	68-69
A1.2	use a scientific experimentation process and associated skills to conduct investigations	33-35
A1.3	use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	61-64, 68-69, 72-75, 79-80, 119-121
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	33-35, 61-64, 68-69, 72-75, 79-80, 119-121
A1.5	communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	33-35, 61-64, 68-69, 72-75, 79-80, 119-121
A2.1	write and execute code in investigations and when modelling concepts, with a focus on obtaining input in different ways for a variety of purposes	130, 132-135
A2.2	identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	131-135
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	131-135
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	131-135
A3.3	analyse contributions to science and technology from various communities	131-135

NAME _____

ELECTRICITY



Forms of Energy

Forms of Energy

There are two types of energy – kinetic and potential. These types of energy take the form of chemical, electrical, thermal, mechanical or nuclear energy.

Chemical Energy

Chemical energy is stored in matter. **Matter** is everything around us that has mass and takes up space. Therefore chemical energy is stored in things like batteries, and gasoline. Chemical energy can produce heat and light as well. Wood contains chemical energy that is stored in its bonds. When the wood is burned, the chemical energy that was stored in the wood transforms into thermal energy and heat.



Electrical Energy

Electrical energy is the energy that makes machines to work. When we plug in our favourite electronic device, it provides electrical energy. Electrical energy comes from different sources of energy like the burning of fuels or the energy from natural resources like wind and solar power. Electrical energy often transforms into thermal energy, think of a hair dryer, it gets hot or how a cell phone will heat up after being used for a long time.

Thermal Energy

Thermal energy is energy that is moved between objects that are at different temperatures. Heat is the flow of thermal energy. The sun's thermal energy creates wind as the movement of heat from warmer areas to cooler areas. This energy can be harnessed by wind turbines. The sun's thermal energy also creates winds.



Mechanical Energy

Mechanical energy is the kinetic and potential energy an object has. Wind turbines are a form of mechanical energy because they move or will move when the wind acts on it. A drawn bow and arrow has mechanical energy in the form of elastic potential energy.

Nuclear Energy

Nuclear energy comes from splitting atoms in a reactor. **Atoms** are the smallest unit of matter. All solids, liquids, and gases are composed of atoms.

There is potential energy inside of atoms that can be used to heat water into steam, which can turn a turbine. This allows electricity to be made. Nuclear fission is the process of splitting atoms resulting in the release of energy.

Questions

Use information from the text to support your answer.

1) What is chemical energy? When have you used chemical energy?

2) What is electrical energy?

Questioning

Write 3 questions you can ask about this.

1)	
2)	
3)	

Type of Energy

What are the types of energy below?

1) Energy that is stored in atoms.	Electrical	Nuclear
2) When energy moves from one object to another.	Heat	Chemical
3) Using a portable battery in my phone.	Chemical	Mechanical
4) Solar energy from a solar panel on someone's roof.	Mechanical	Thermal
5) Plugging in my T.V. to a wall outlet.	Mechanical	Electrical

Electricity

How Does Electrical Energy Work?

Power plants are responsible for taking different forms of energy, like solar and fossil fuels and transforming them into electrical energy. **Electrical energy (electricity)** is the most common form of energy used as it can be delivered from place to place easily.

Wires are excellent energy conductors that carry energy away from a power plant to houses and schools. When we plug a cord into an outlet, we are connecting to the wires that connect to the power plants. The power plants charge us money for using their electricity. They also show how much energy we are tapping in to.

Power Plants

Electricity is made from a variety of different energy sources. The most popular forms of power plants are fossil fuel power plants (oil, coal, natural gas), and renewable resource power plants.

Nuclear power is one form of power plant that uses machines called nuclear reactors. Heat is produced by these reactors which is an important part. The heat is then used to boil water and create steam. The steam is used to produce electricity.

Fossil fuels are another form of power plant that use machines to make heat water and create steam to turn turbines. Solar, wind, and water are **renewable resources** that are also used to produce electricity. The power plants are responsible for transforming the natural energy sources into electricity.

Electricity Transforming

When we plug machines into these outlets, the electrical energy often changes form to provide us with heat, light, or sound.

Think of how a television uses electrical energy to provide light and sound energy to the viewer. It also provides heat energy as I'm sure you have noticed when a TV gets warm after being on for an extended period of time. The energy begins as electrical energy, but transforms into thermal, light, and sound energy.



Questions

Use information from the text to support your answer.

1) How does electricity work and how do we get access to it at home?

2) Describe the role of the shaft in the operation of a windmill.

Summarize

Write a summary from the reading passage.

Matching

Draw a line from the term to the description.

Term	Description
Nuclear Energy	Burned to provide energy that is converted to electricity.
Fossil Fuels	Used to turn turbines and generate electricity.
Renewable Energy	Nuclear reactors split atoms to heat water and produce steam.
Outlet	Energy that will come back after it is used.
Steam	A device that allows people to have access to electricity.

Exit Cards

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

Name: _____	Mark
Is the statement true (T) or false (F)?	
1) Electrical energy is created inside household outlets.	T F
2) Power plants change other energy forms into electricity.	T F
3) Electricity can only change into light energy.	T F
4) Nuclear power plants use heat from split atoms.	T F
5) Renewable energy sources will never run out.	T F

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5) Renewable energy sources will never run out.	T F

Electrostatic Force

Electrostatic Force

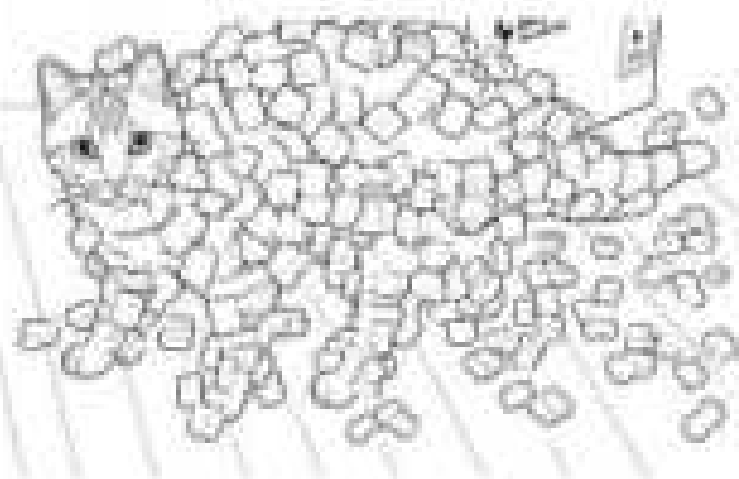
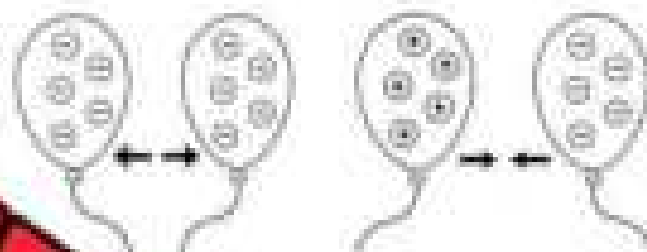
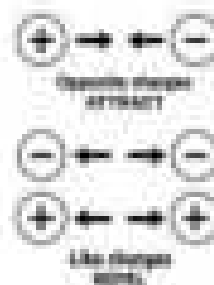
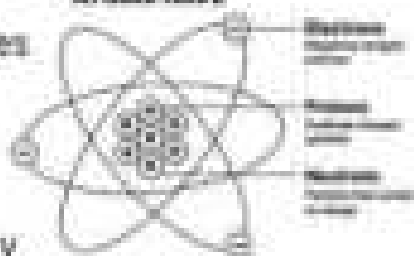
Everything is made up of tiny particles that are too small to be seen. These tiny particles can have an electrical charge, either positive or negative.

When charges are the same, they repel away from each other. If they are opposite, they attract to each other.

Most objects are neutral, which means they have the same number of positive and negative charges. When two objects touch or nearly touch, charged particles can move from one object to the other and can affect whether the object will repel or attract. When objects move due to their charge, it is called an electrostatic force.

STATIC ELECTRICITY

ATOMS HAVE



The Cat

This poor cat has to look out for itself. This is an example of an electrostatic force. The styrofoam and cat have opposite charges, which means they are attracted to each other.

This is a non-contact force because the styrofoam is moving without being touched. The styrofoam is being pulled towards the cat's body. You may have experienced this on a trampoline when your hair moves and sticks straight up.

Questions

Answer the questions below using evidence from the text.



1) What does electrostatic force mean?

2) What happens with the cat in the photo? Explain.

3) What do the terms below mean?

Repel

Attract

Word Search

Find the words in the wordsearch.

Static	Repel
Attract	Object
Positive	Negative
Cat	Charge
Pull	Particles

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

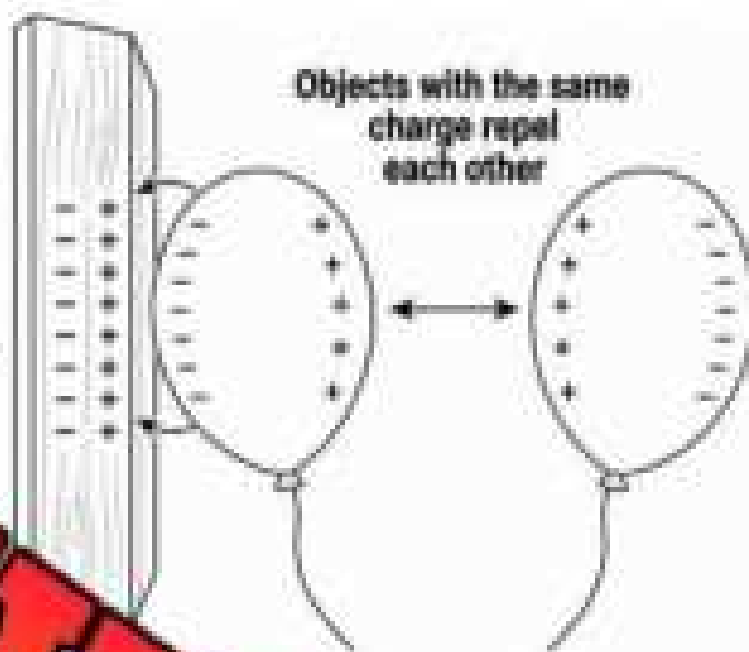
Static Electricity

Static Electricity

When electrical charges move from one object to another, they can cause static electricity. Picture this, you rub your hair on a balloon. The negative charges in your hair move to the balloon causing negative charges in the hair.

The extra negative charges on the balloon create what is called a buildup of negative charges.

You can't see the extra negative charges but hanging that balloon near a wall. The extra negative charges in the balloon are attracted to the positive charges in the wall and they will stick together.



This is painful because our nerves do not like the electricity passing through us. You might feel pain, tingling, numbness, or weakness when you get a shock.

Zap - Static Electricity

When you shake hands, or touch a door handle, you may feel a zap or a shock due to static electricity.

This happens because the electrical charges are jumping from one object to the other. Ouch!



Questions

Answer the questions below using evidence from the text.

1) Why does static electricity happen?

2) What happens with the electrical charges when you feel a zap?

Visualizing

Draw what you see in your mind as you were reading. Explain the picture.

Multiple Choice

Circle the correct answer.

1) Objects with the same charge will	Attract	Repel
2) Objects with difference charges will	Attract	Repel
3) We sometimes feel a shock because of static	Electricity	Movement
4) Which will stick to your hair because of static?	Rock	Balloon
5) When we feel a shock, electric charges are	Staying	Jumping

Dangers of Static Electricity

Problems of Static Electricity

Static electricity can be problematic and dangerous in our day to day lives. Static can be a nuisance when dust and dirt are attracted to insulators such as computer monitors or TV screens.

It can be a problem when our clothes cling to each other or to our hair. Often, clothes are static after they've been in a tumble dryer.

People can use anti-static sprays, liquids, and clothes to prevent the build-up of charge. They prevent the charges in the clothing to jump to the spray or liquid. This neutralizes the clothing.

Dangers of Static Electricity

The most dangerous example of static electricity is lightning. Lightning is caused when static electricity builds up in clouds and causes a discharge to form between the ground and the clouds. The result is a lightning strike that is really just the flow of charges through the air.



Examples of the Dangers of Static Electricity

Some objects will have a large electric charge on it, like a live wire with electricity flowing through it. If you touch a live wire, the charge will flow through your body causing an electric shock.



Most of the time, static electric shocks result in a small zap that doesn't hurt too bad. But sometimes, this can cause burns or even stop your heart. People have died from static electric shocks!

Questions

Answer the questions below using evidence from the text.

1) Why is static electricity dangerous?

2) How can you stop static electricity?

Visualizing

Draw what you picture in your mind as you were reading. Explain the picture.

Word Scramble

Unscramble the words below using the word bank.

STATIC

DANGER

SAFE

LIGHTNING

CLING

CLOTHING

GLINTGHN

EGDRAN

TASCTI

HGTNOCIL

LNCIG

EFSA

Exit Cards

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

Name: _____

Put a checkmark (✓) on the correct answer!

Mark

The most dangerous example of static electricity?	
☐ Lightning	☐ Toy rolling on the floor
☐ Balloon sticking to a wall	☐ Magnetizing a paper clip
Static electricity is most often felt as...	
☐ A loud explosion	☐ A bright rainbow
☐ A small zap	☐ A strong smell

Name: _____

Put a checkmark (✓) on the correct answer!

Mark

The most dangerous example of static electricity?	
☐ Lightning	☐ Toy rolling on the floor
☐ Balloon sticking to a wall	☐ Magnetizing a paper clip
Static electricity is most often felt as...	
☐ A loud explosion	☐ A bright rainbow
☐ A small zap	☐ A strong smell

Name: _____

Put a checkmark (✓) on the correct answer!

Mark

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Mark

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☐ Balloon sticking to a wall	☐ Magnetizing a paper clip
Static electricity is most often felt as...	
☐ A loud explosion	☐ A bright rainbow
☐ A small zap	☐ A strong smell

Static Electricity Activities

Magic Spoon

What are we learning more about?

Materials

- ✓ 1 Teaspoon salt
- ✓ 1 Teaspoon pepper
- ✓ Plastic spoon
- ✓ Dish
- ✓ Black paper (optional)

Procedure

- 1) Mix salt and pepper on the black piece of paper
- 2) Rub the spoon on your hair for about 10 seconds
- 3) Hold the spoon over the salt and pepper mixture
- 4) Watch for the salt and pepper to be pulled up to the spoon



Observations

Did you

1) What happened to the salt and pepper when you held the spoon over the mixture?

2) Did more of the salt or pepper cling to the spoon? Why not?

3) How could you use this method to separate mixtures?

4) Why did the salt/pepper cling to the spoon?

Static Electricity Activities

Bending Water

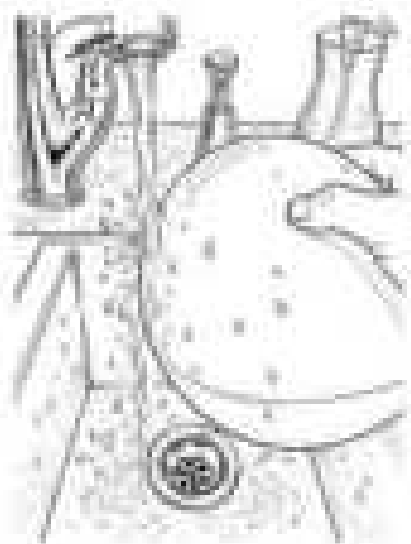
What are we learning more about?

Materials

- ✓ 1 balloon
- ✓ Sink with faucet

Procedure

- 1) Rub the balloon on your hair or the balloon
- 2) Turn on the faucet and let a small stream of water flow. The smaller the better, but it needs to be a continuous stream, not just drips.
- 3) Hold the balloon near the stream but not touching it.
- 4) Watch the water bend toward the balloon.



Observations

1) What happened when the balloon was near the stream of water?

2) Why did the water bend?

3) Did the water move closer to the balloon or further away? Explain.

4) What happened to the charge on the balloon? How did this affect the water?

Experiment – Rolling a Can

Research Question

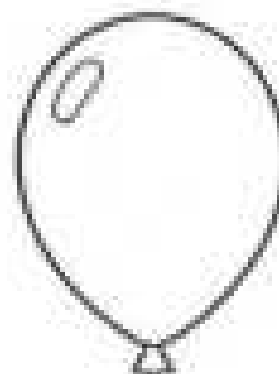
What are we learning about?

To learn about static electricity by making a can roll without touching it.

Materials

What do I need to do the experiment?

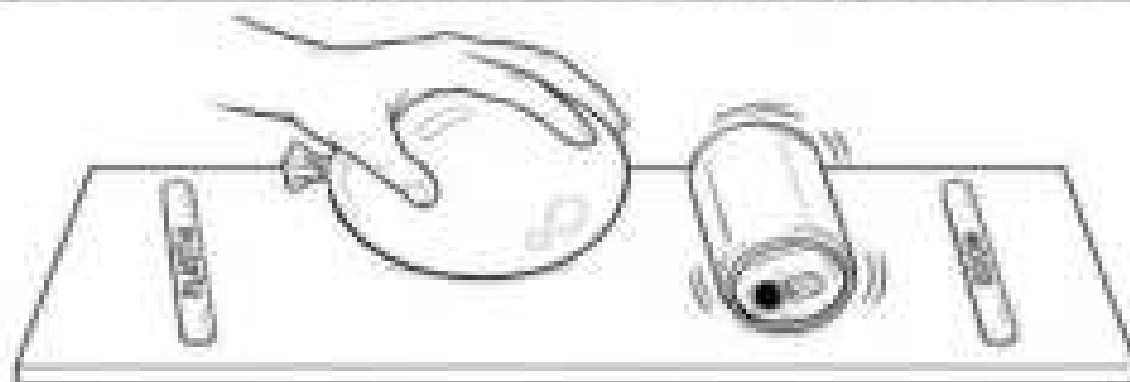
- ✓ An empty soda can
- ✓ Ten clothespins or hair ties
- ✓ Tape – optional
- ✓ Balloon



Method

How do we do the experiment?

- 1) Make sure the soda can is empty.
- 2) Place the soda can on its side on a flat table.
- 3) Blow up the balloon and tie it closed.
- 4) Rub the balloon quickly back and forth on the hair with clothespins. This will create static electricity!
- 5) Hold the balloon close to the soda can without touching it. What happens?
- 6) Optional: create a start and finish line using tape. Then have students time how long it takes for them to get the can from the starting line to the finish line.



How Electricity Works

Basics of Electricity - The Atom

Atoms are small particles that make up all matter. Inside of an atom are even smaller objects called protons, neutrons, and electrons. Electrons have a negative charge and protons have a positive charge. The protons and neutrons stay inside the nucleus of the atom (middle) and the electrons spin fast around the outside of the atom.

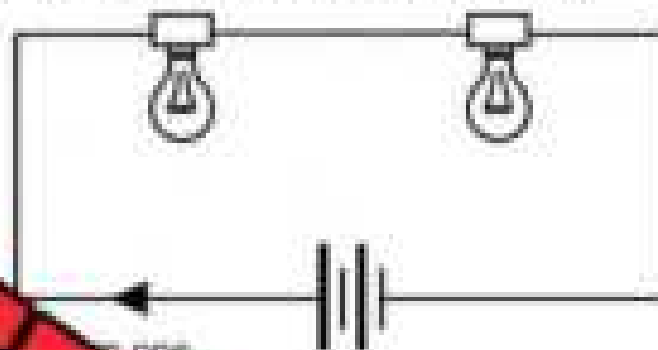
What is electricity?

All matter is made of atoms. In some materials, electrons can move freely. These materials are called conductors. In other materials, electrons are stuck in place. These materials are called insulators. Electricity is the flow of electrons from one atom to another. In other words, it is the flow of electrons through a conductive material, like a wire. We can create electricity by using an electrical circuit.

Example of an Electrical Circuit

The light switch in your classroom is an example of an electrical circuit. The circuit must use a conductor of electricity (wire) and it must be a closed circuit, meaning it needs to be connected throughout the entire circuit.

When you turn the light switch off, you open the circuit by creating a gap in the conducting material. This means the electrons stop at the gap and can no longer pass through the circuit. The lightbulbs need the flow of electrons to generate light. When you turn the light switch on, you close the circuit and allow the flow of electrons to the light bulb.



Questions

Answer the questions below using evidence from the text.

1) What do atoms have to do with electricity?

2) How do electrical circuits work?

True or False

Is the statement true?

1) An electrical circuit needs a material that is a conductor of electrons.	True	False
2) If a circuit is open, the light bulb will light up.	True	False
3) If a circuit is closed, the light bulb will turn on.	True	False
4) Electricity is the flow of electrons from one atom to another.	True	False
5) Atoms are made from protons, neutrons, and electrons.	True	False

Visualizing

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

Current Electricity Vs Static Electricity

What is Current Electricity?

Current electricity is the flow of electrons through a conductive material, like a wire.

Current electricity is used in circuits that use wires and an energy source, like a battery.

There are two types of current electricity – direct current (DC) and alternating current (AC).

Direct Current (DC)

Batteries use direct current.

There are many batteries.

use direct current.

With direct current, the

electrons move in one direction.

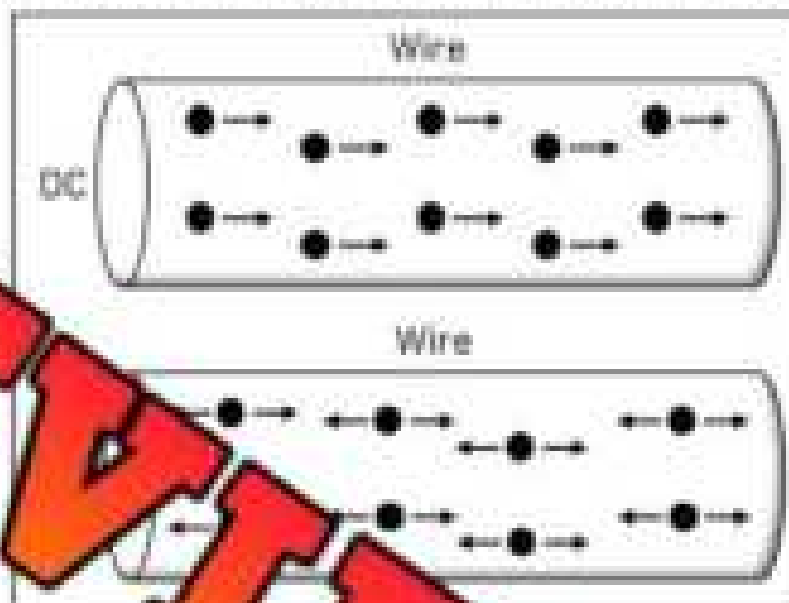
around the circuit.

Alternating Current (AC)

In alternating current electricity, the

flow of electrons flow in both

directions. Power plants produce AC electric current for our homes. When you plug in an electronic to an outlet, you are using alternating current.



Difference Between Current and Static Electricity

Static electricity happens when the atoms inside a material become electrically charged. This usually happens because of friction, when two materials rub against each other. One material may become positively charged because it lost electrons while the other may become negatively charged as they gained electrons.

Current electricity happens when electrons flow in a path along conducting materials, like a wire.

Both static and current electricity relate to the movement of electrons. Static electricity happens naturally in our environment, like when we see lightning strike. Current electricity on the other hand, was invented by humans to provide electrical devices with the energy they need to work.

Define

What do the terms below mean?

Direct
CurrentAlternating
CurrentCurrent
ElectricityStatic
Electricity**Compare/Contrast**

What is the difference between static and current electricity?

Static or Current

Is the example static or current electricity?

1) Lightning strikes.

2) A computer runs on AC electricity.

3) You feel a zap when you open a door handle.

4) A power plant produces this type of electricity.

Dangers of Current Electricity

Why is Current Electricity Dangerous?

The human body is a good conductor of electricity. This means that the flow of current electricity will flow easily through our bodies. The main reason for this is because our bodies are 70 percent water, and water is a conductor of electricity.



Electricity

What

If you are not careful with electricity, you could expose yourself to its flow of electrons and be badly hurt. Some things could happen:

- Muscles tighten and you are unable to pull away from the circuit
- Lungs constrict, making it hard to breathe
- Heartbeat is interrupted and you could die
- Burns on your skin
- Internal organ damage
- Death

How to Stay Safe

We all use electricity daily, so here are some tips to use it wisely:

- 1) Don't plug too many things into one outlet or extension cord. It could cause a fire!
- 2) Make sure all electrical cords are tucked out of the way so no pets or babies are tempted to chew on them.
- 3) Don't play near or on a green transformer box. These boxes send and receive a strong voltage of electricity that could seriously hurt you.
- 4) Don't yank an electrical cord from the wall. Instead, pull from the plug so you don't damage the cord. A damaged cord can cause electrocution when touched.
- 5) Don't fly drones or kites near power lines. The kite and its string could conduct electricity, sending it right through you to the ground.

Questions

Answer the questions below using evidence from the text.

1) Why is current electricity dangerous?

2) How can I stay safe from electricity?

True or False

Is the statement true?

1) The human body is a good conductor of electricity.

True

False

2) Misusing electricity can lead to death.

True

False

3) Always unplug electronics by pulling on the cord.

True

False

4) Don't fly kites near power lines.

False

5) You can use all the plugs on an extension cord or power bar.

False

Making Connections

What does the reading remind you of in your life?

Dangers of Short Circuits

What is a Short Circuit?

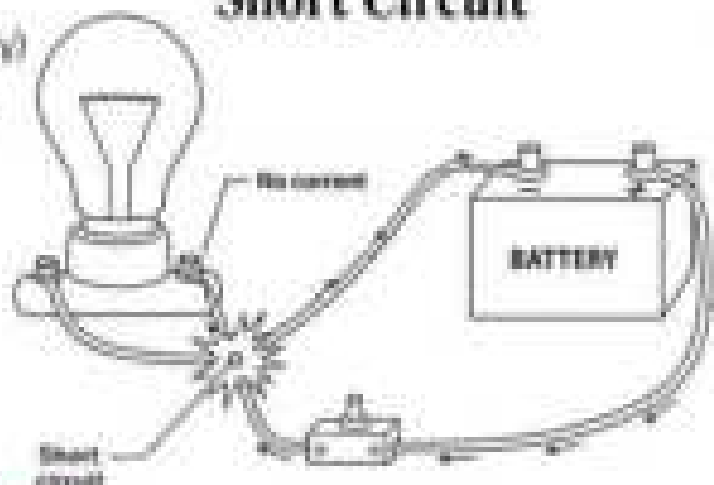
A well built circuit will have a cell (battery) that provides an electrical current along a path (wire), to a load (bulb) which then connects with the other side of the cell. The load receives some of the power drop because the load uses the electricity to power and

When this happens, the voltage on the other side of the cell is reduced.

In a short circuit, the current means there is no power drop. This can happen if a wire to the load is loose or the wires are improperly wired. When the same voltage from the cell flows back to the other side of the cell, the high voltage will heat up the wires and they could catch fire.

In the diagram, you can see that the battery is connected with an electrical current. The green arrows show the current travelling in a circle. The problem is that this circuit has crossed wires, so the current is not travelling to the load. Because the same voltage is returning back to the battery, the circuit will heat up and could start a fire.

Short Circuit



Dangers of a Short Circuit

- Wires can heat up and cause a fire
- Connecting one side of a battery to the other side will cause a short circuit. This will heat up the battery and wire. It will also waste the energy in the battery very quickly.
- If there is enough voltage, a short circuit can cause an explosion called an arc flash.
- Circuit breakers and fuses in our houses are devices that detect short circuits and shut the power off before any damage can be done.

Questions

Answer the questions below using evidence from the text.

1) What is a short circuit? Why do they happen?

2) What are the dangers of short circuits?

True or False

Is the statement true?

1) A short circuit happens when the circuit is designed correctly.	True	False
2) A short circuit can happen when wires get damaged.	True	False
3) Short circuits happen when no load uses any voltage.	True	False
4) A short circuit could be a battery connected with wires to a light bulb.	True	False
5) Short circuits are not dangerous.	True	False

Summarize

Summarize the main idea and supporting details of the reading.

Conductors and Insulators

Conductors

A **conductor** is a material that allows electricity to flow easily through it. Metals are good conductors, which is the reason they are used for electrical wiring. Copper is a great conductor of electricity and it is also inexpensive, which is why it is commonly used in homes today.

Insulators

An **insulator** is a material that does not carry electricity. Insulators are used to work with electricity safely. For example, when they handle potentially dangerous wires, they use an insulating material like rubber gloves. Plastic and wood are also good insulators.

ELECTRICAL CONDUCTORS



Wood

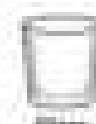


Gold

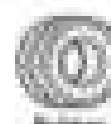


Copper

ELECTRICAL INSULATORS



Glass



Rubber



Plastic



Water

Insulator or Conductor?

Write insulator or conductor for each example.

Example	Insulator or Conductor
Wood	
Fabric	
Silver	
Cork	
Paper	
Water	

Example	Insulator or Conductor
Gold	
Diamond	
Oil	
Car Key	
Leaf	
Soccer Ball	

Your Turn

Write your own examples of insulators and conductors.

Conductors	
Insulators	

Resistors

What is a Resistor?

A resistor is a part in an electrical circuit that limits the power of the electrical current. Circuits need a resistor to reduce the amount of electricity traveling through a circuit. This ensures that the right amount of electricity is provided to an object that needs electricity to work.



Resistor

All materials allow electricity to flow if the voltage is strong enough. Even air, which is normally an insulator, becomes a conductor if a big enough voltage passes through it. This is why a lightning strike strikes through the air. Materials can be described based on how much voltage they let through.

A resistor works the same way. It lets some electricity through. A good conductor would make a poor resistor because it would let too much voltage through. A strong insulator would also be a bad resistor because it would not let enough voltage through for a device to work.

How a Resistor Works

When someone makes a circuit to power a device, they need a precise amount of resistance. They will choose a resistor that reduces the current by a specific amount.

A resistor looks like a short tube with colored stripes on the side. It has two connections, which can be hooked into a circuit. Inside a resistor, there are tiny wires wrapped around a tube. The skinnier the wire, the less electrical current can pass through.

Imagine a hose that is pouring water. The thicker the hose, the more water you can pour. The same works inside a resistor. Electricians will use a thicker wire inside a resistor to let more voltage through. The resistors have a specific size and length of wiring inside to slow down the voltage.



Questions

Answer the questions below using evidence from the text.

1) What is a resistor? Why is they used?

2) How do resistor work?

True or False

Is the statement true or false?

1) Every material can be a conductor.

True

False

2) A good conductor is resistant to electrical current flowing through it.

True

False

3) Air is a good conductor as it allows lightning to travel through it.

True

False

4) A resistor has long and skinny wires that affect its resistance.

True

False

5) The skinnier the wire, the more resistant it is and less voltage is needed to get current through it.

True

False

Draw

Draw a circuit with a battery, lamp, wires, and a resistor.

Exit Cards

Cut Out

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

Name: _____

Are the statements below true or false?

1) Electricians use thinner wires inside resistors to let more voltage through.

True

2) Resistors do not have a fixed resistance value; they vary.

True

3) A resistor can completely stop the flow of electricity in a circuit.

True

False

Name: _____

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True

False

3) A resistor can completely stop the flow of electricity in a circuit.

True

False

Series Vs Parallel Circuits

Series and Parallel Circuits

There are two basic ways we can connect two or more circuit components: a *series circuit* or a *parallel circuit*. When we connect two lightbulbs or a light bulb and a fan to a battery, we can use a series circuit or a parallel circuit.

Series Circuit

A *series circuit* is a basic type of circuit that has only one path for the electrical current to flow through. In the example below, the electrical current is generated by the battery through the wire leading to the lightbulbs and then back to the battery. The flow continues in the same direction until the circuit is opened.

The key thing to remember is that a series circuit has only one path for the current to flow through. If one bulb goes out, the electrical current will stop and the circuit will be turned off.



Series Circuit



Parallel Circuit

Parallel Circuit

A *parallel circuit* allows the flow of electricity to pass through multiple paths throughout a circuit. The flow will always travel in the same direction, but it can take multiple paths before it returns back to the battery to complete the circuit.

In the example, the battery generates the flow of electricity through two lightbulbs. Both light bulbs will light up assuming the battery has generated enough electricity. The flow of electricity will be split equally between the two paths, which means they do not affect each other. If one bulb goes out, the other bulb will continue to light up.

Questions

Answer the questions below using evidence from the text.

1) What is the difference between a series circuit and a parallel circuit?

2) What is the advantage of using a parallel circuit?

True or False

Answer true or false?

1) In a series circuit, only one component can use the circuit.	True	False
2) In a parallel circuit, if one component breaks, the others can work.	True	False
3) In a series circuit, if one component breaks, the others can work.	True	False
4) The electricity in a parallel circuit gets split between the components of the circuit.	True	False
5) The flow of electricity in a series circuit will continue until the circuit is opened.	True	False

Draw

Draw a series and parallel circuit

Series	Parallel

Components of an Electrical Circuit

An electrical circuit requires certain materials in order to function. Research the following components and provide an explanation of what they are.

Research

Explain what the following terms mean.

Component	What is it? How does it work in a circuit?
Battery	
Wire	
Switch	
Light bulb	
Fan	

Questions

Use information from the text to support your answers.

- 1) Which of the components provides the power? _____
- 2) Which of the components carries the electrical current to the load? _____
- 3) Which of the components are the load that needs the electrical current to function?

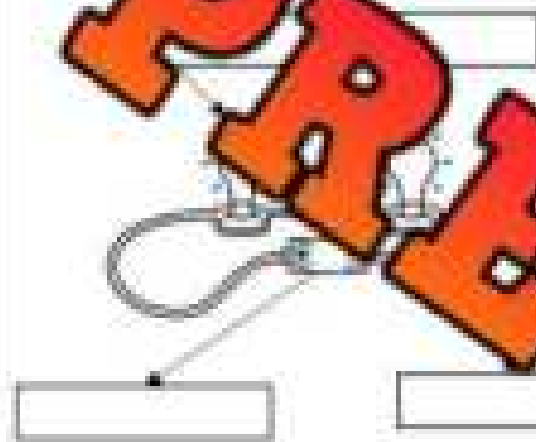
Exit Cards

Cut Out

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

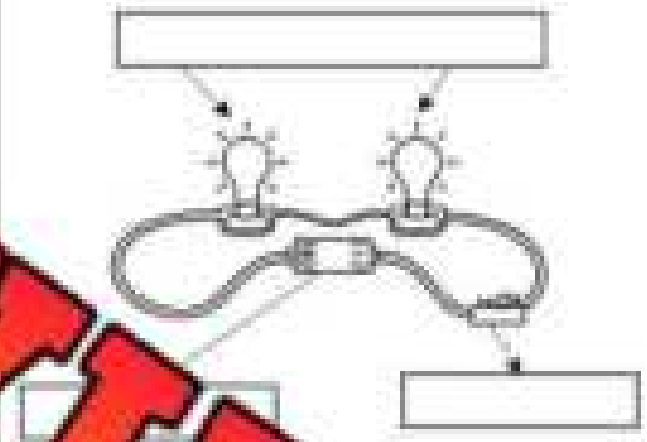
Name: _____

Name the components of the electric circuit below.



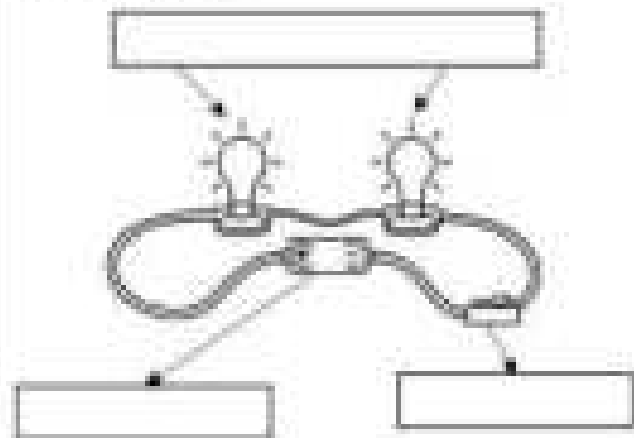
Name: _____

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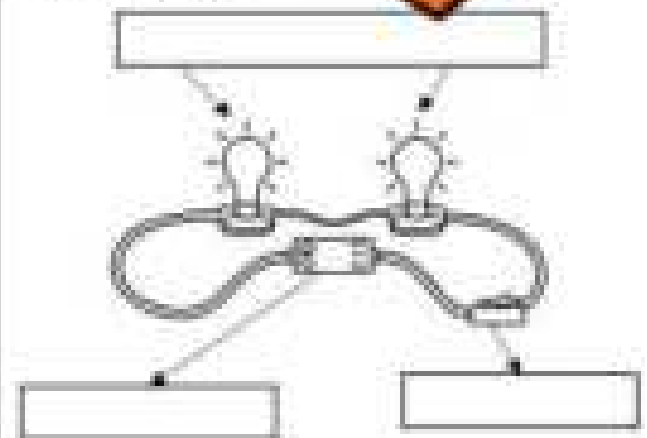
Name: _____

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Name: _____

Name the components of the electric circuit below.



Drawing Circuit Diagrams

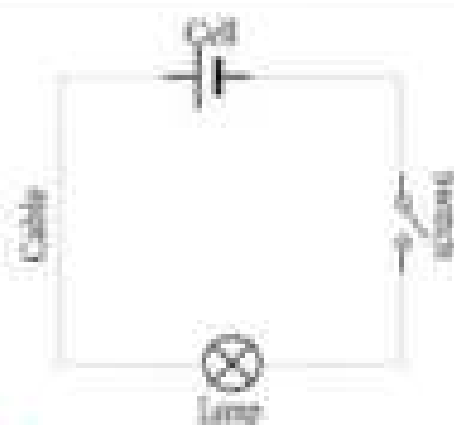
When an electrician is planning the circuits they will use, they often draw them out beforehand. Check out the symbols they use to draw their circuit diagrams.

Circuit Symbols



Example

- Circuit with a cell, a switch, and a lamp (light)



Draw

Draw the following circuits.

1. Circuit with one switch, a battery, a light (lamp) and a motor (fan).

2. Circuit with one switch, a battery, 2 lights (lamp) and a motor (fan).

Draw Draw parallel and series circuits with each of the components listed.

1) Circuit with one switch, 2 batteries, 2 lights (lamp) and 2 motors (fans).

	Parallel

2) Circuit with one switch, 2 batteries, 2 lights (lamp), 1 motor (fan) and a resistor.

Series	Parallel

3) Circuit with two switches, 3 batteries, 5 lights (lamp) and 3 motors (fans).

Series	Parallel

Interpreting Circuit Diagrams

Interpret

Answer the questions below.

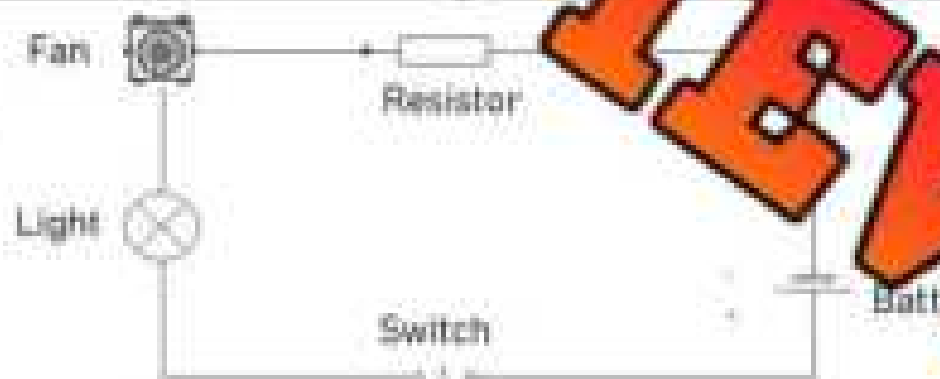
1)



1 a) Is this a parallel circuit?

b) Will this circuit light up?

2)



2 a) What is happening in this circuit?

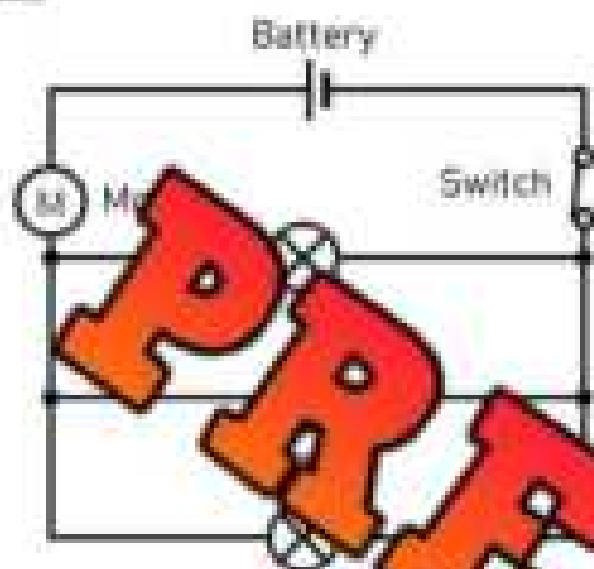
b) Is this a series or parallel circuit?

c) Is this a series or parallel circuit?

Interpret

Answer the questions below

3)



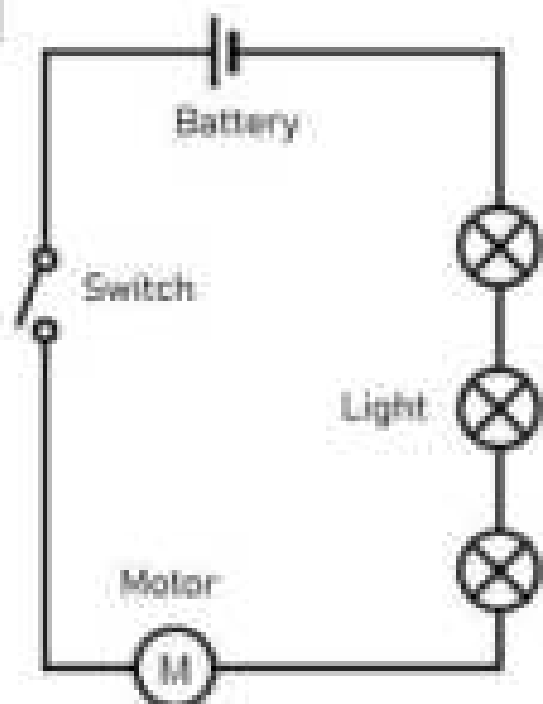
3. a) What is happening in this circuit?

b) Is this a series or parallel circuit?

c) Will the motor and lights work? Explain.

d) What problems might occur if the battery isn't strong enough?

4)



a) What is happening in this circuit?

b) Is this a series or

c) Will the motor and lights work? Explain.

d) How could you get this circuit to work?

Exit Cards

Cut Out

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

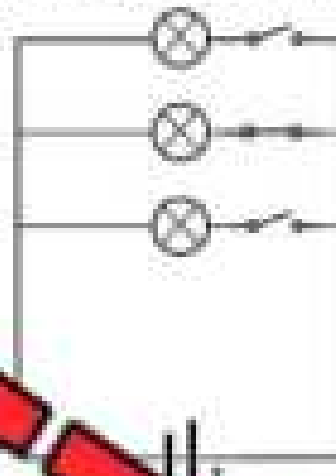
Name: _____

Determine if the bulb is glowing or not by writing "on" or "off" next to the bulb.



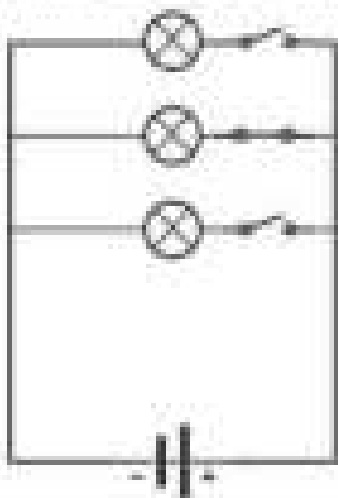
Name: _____

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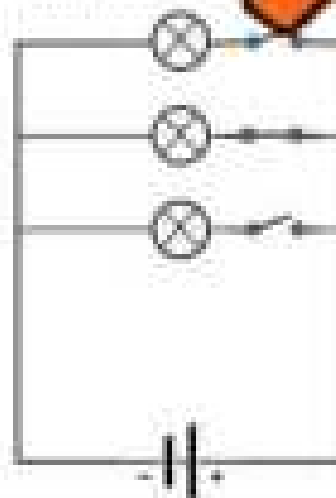
Name: _____

Determine if the bulb is glowing or not by writing "on" or "off" next to the bulb.



Name: _____

Determine if the bulb is glowing or not by writing "on" or "off" next to the bulb.

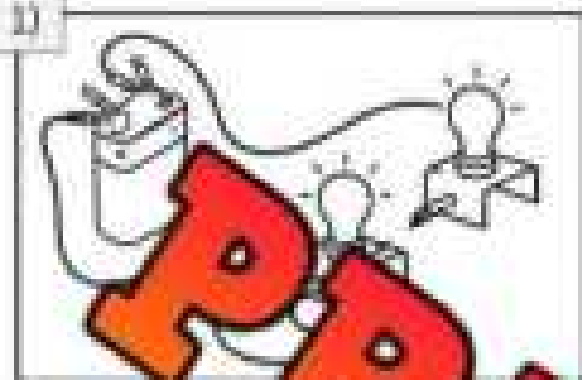


Drawing Circuit Diagrams

Draw

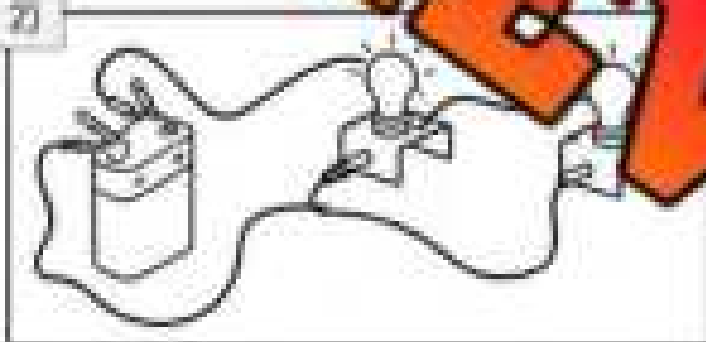
Draw a circuit diagram that represents the picture.

1)



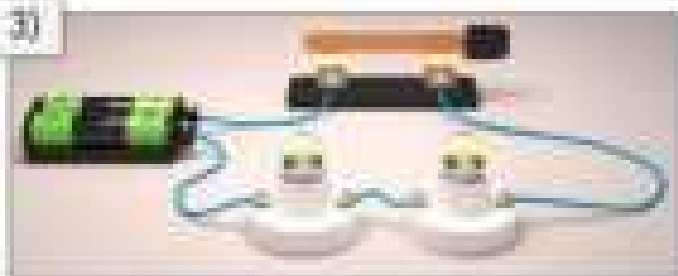
Circuit Diagram

2)



Circuit Diagram

3)



Draw

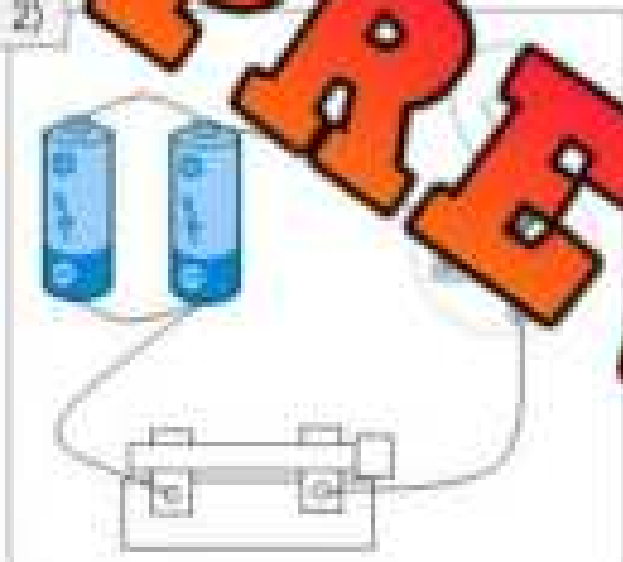
Draw a circuit diagram that represents the picture.

1)



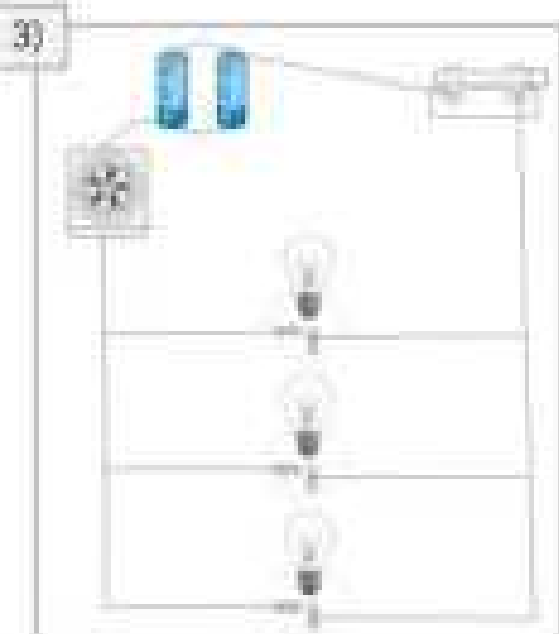
Circuit Diagram

2)



Circuit Diagram

3)



Circuit Diagram

Experiment – Series Circuit

Research Question

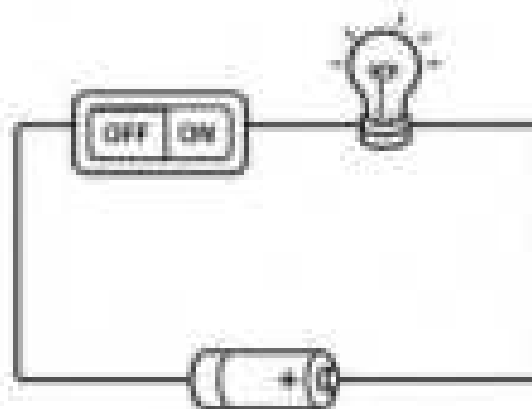
What are we learning more about?

Can you make a series circuit that uses a battery, light, and a switch?

Materials

What do we need for our experiment?

- 1) Battery
- 2) Light bulb
- 3) Switch
- 4) Wires

**Method**

How do we complete our experiment?

- 1) Use a wire to connect the battery.
- 2) Connect the light bulb to the switch.
- 3) Connect the battery to the switch.
- 4) Turn on the switch.
- 5) Once the circuit is closed, the light bulb will turn on.

Observations

What did you notice?

1) Why is this a series circuit?

2) Draw a diagram of your circuit to show proof that you made it!

Experiment – Series Circuit

Research Question

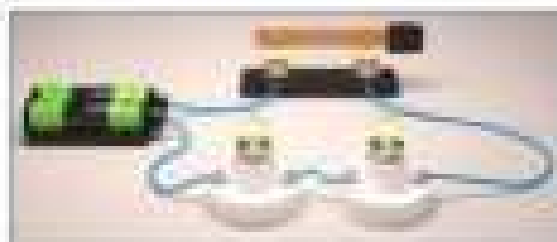
What are we learning more about?

Can you make a series circuit that uses multiple lights or fans, batteries, and a switch?

Materials

What do we need for our experiment?

- 1) Batteries
- 2) Light bulbs and/or fans
- 3) Wires
- 4) Switch



Method

How do we do the experiment?

- 1) Connect the components in a manner that keeps it a series circuit.
- 2) Make sure to use at least 2 light bulbs or fans (or combinations); 2 batteries, and 1 switch

Observations

What did you notice?

- 1) If you rearranged the order of your series circuit, would it still work?

- 2) Draw a diagram of your circuit to show proof that you made it!

Experiment – Parallel Circuit

Research Question

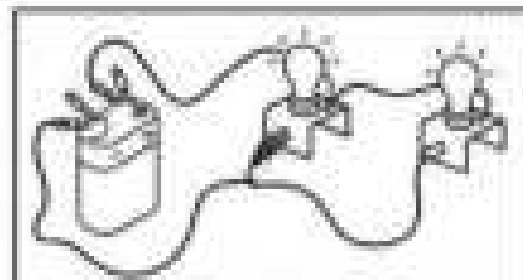
What are we learning more about?

Can you make a parallel circuit that uses a battery, two lightbulbs, and a switch?

Materials

What do we need for our experiment?

- 1) Battery
- 2) Two lightbulbs
- 3) Wires
- 4) Switch

**Method**

How do we complete the experiment?

- 1) Create a parallel circuit with two lightbulbs.
- 2) Disconnect one wire that goes to one lightbulb. Write down what happens below.

Observations

What did you notice?

1) Why is this a parallel circuit?

2) What happened when you disconnected one of the lights? Did the other one still work?

3) Draw a diagram of your circuit to show proof that you made it!

Experiment – Parallel Circuit

Research Question

What are we learning more about?

Can you make a parallel circuit that uses multiple lights or fans, batteries, and a switch?

Materials

What do we need for our experiment?

- 1) Battery
- 2) Light bulbs and/or fans
- 3) Wires
- 4) Switch



Method

How do we do the experiment?

- 1) Connect the components in a manner that makes it a parallel circuit.
- 2) Make sure to use at least 2 light bulbs or fans (or combinations), 2 batteries, and 1 switch

Observations

What did you notice?

- 1) If you rearranged the order of your parallel circuit, would it still work?

- 2) Draw a diagram of your circuit to show proof that you made it!

Uses of Parallel and Series Circuits

Uses of Series Circuits

A series circuit is used commonly in battery powered electronics. These electronics are fairly simple, with one main function of the device.

For example, a flashlight might use two batteries that are connected in series to provide electricity to the light. Even a power tool, like a drill will likely use several lithium-ion batteries that are wired in series. If the tool needed 48 volts, it would use 12 cells that each provide 4 volts.

It can also be helpful to use a series circuit for additional safety. For example, an electronic device might have a handle that acts as a switch to the electrical circuit. But, when the handle is down, the lawn mower won't start. This is because there is another switch that will need to push both switches at the same time (often you hold the handle and push a button switch). If you release the handle, the circuit is opened, and the mower won't start.

Lastly, some Christmas lights use series circuits. This can be frustrating if one light breaks, as all the lights after will not work.

Use of Parallel Circuits

Most circuits in buildings use parallel circuits. The outlets and light switches in your house will be on parallel circuits. This is important because the outlets are never turned off. You can tap into the parallel circuit anytime by plugging in an electronic. If you do, the electrical current will now flow through the electronic and back into the outlet. Light switches will also be on a parallel circuit allowing you to turn on or off the lights without affecting the rest of the electrical devices on the same circuit.

If outlets were on a series circuit, if they were not in use, the electricity would stop at the outlet, shutting down the electricity for anything wired on the same circuit.

Each home has an electrical panel. An average electrical panel has 20 parallel circuits running through it. When one circuit "trips", the flow of electricity is stopped. This sometimes happens when too much electricity is being used on that circuit.



Explain

When are parallel and series circuits used?

Series Circuits	Parallel Circuits

True or False

Is the statement true or false?

1) Parallel circuits are used in battery-powered electrical devices.	True	False
2) Series circuits are used in simple electrical devices.	True	False
3) Houses will use parallel circuits to provide electrical lights.	True	False
4) In a typical house, there are around 20 parallel circuits.	True	False
5) A circuit usually trips when not enough electricity is being used.	True	False

Making Connections

What does the reading remind you of in your life?

Exit Cards

Cut Out

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

Name: _____

How does the safety feature of an electronic lawn mower using a series circuit work?

Name: _____

How does the safety feature of an electronic lawn mower using a series circuit work?

Name: _____

How does the safety feature of an electronic lawn mower using a series circuit work?

Name: _____

How does the safety feature of an electronic lawn mower using a series circuit work?

PREVIEW

Experiment – Electricity Assignment

Assignment

What are we learning more about?

Electricity is a fun topic to learn more about. There are countless experiments you can perform to learn more about how it works.

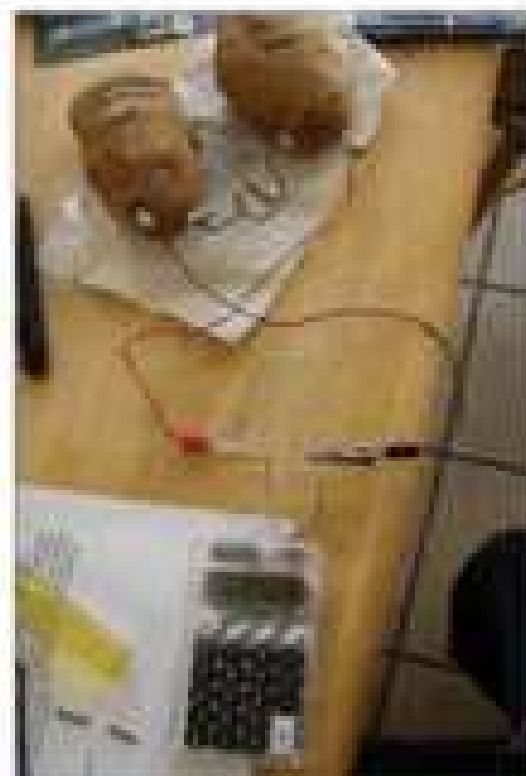
Today, you will research an idea online that showcases something interesting about electricity. It could be what materials conduct electricity. It could also be objects that produce electricity.

Once you come up with an idea, you will gather the materials you need and perform the experiment to the class. Depending on how your teacher wants to organize the performances, you could run it like a science fair where people walk around to observe or do individual presentations to the class.

Ideas

Check out some options below for experiment.

- You could use the materials available to you in class to make a series or parallel that is interesting?
- Potato electric circuit
- Playdough conducting electricity
- Build a wizard wand with a light on the end of the wand.
- Index card flashlight
- Does water conduct electricity?
- Build a lemon clock.
- The possibilities are endless! Have fun and find an interesting experiment.



Planning

Explain the experiment you chose.

1) What is the name of the experiment?

2) Describe how the experiment works.

3) What materials will you

4) What will your classmates learn from your experiment?

PREVIEW

Blog Post: Factors that Affect Bulb Brightness in Circuits

Factors that Affect Bulb Brightness in Circuits

Date: June 28, 2026

Author: By: Jamie Lin

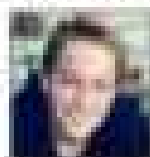
3-minute read

When it comes to lighting up a bulb, not all circuits are created equal. In this blog, we'll dive into what makes bulbs brighter or dimmer by exploring simple series and parallel circuits. The three main factors we'll look at are the number of bulbs, the number of batteries, and the placement of these components in the circuit.

- 1) **Number of Bulbs:** In a series circuit, adding more bulbs will usually make each bulb dimmer because they share the voltage from the battery. In contrast, in a parallel circuit, adding more bulbs won't affect their brightness; each bulb gets full voltage from the battery.
- 2) **Number of Batteries:** Adding more batteries can mean more voltage. In both series and parallel circuits, increasing the number of batteries, assuming they are correctly aligned, the overall voltage can increase.
- 3) **Placement of Bulbs:** The order of components is crucial. In series circuits, the order of bulbs and batteries doesn't change the outcome. However, in parallel circuits, ensuring each bulb is directly connected to the battery can maintain optimal brightness.

Till next time,
Jamie Lin

Comments:



Ian Reynolds - June 29, 2026

Interesting post, Jamie! However, I think it's important to note that adding too many batteries in a series could potentially shorten the life of the bulbs due to excessive voltage, even though they might appear brighter.

[Like](#) [Reply](#) 1d ago



Lisa Cho - June 30, 2026

Actually, Katie, it depends on the use! Welding is super strong for metal, but it wouldn't work on paper or wood. That's why choosing the right method to join materials is important. Plus, some glues are designed to hold up under water or in extreme temperatures!

[Like](#) [Reply](#) 2hr ago

True or False

Is the statement true or false?

1) Series circuits divide voltage among bulbs.	True	False
2) Parallel circuits decrease each bulb's brightness.	True	False
3) Battery alignment affects series circuit brightness.	True	False
4) Bulb order changes series brightness.	True	False
5) Parallel connections ensure full voltage to bulbs.	True	False

Questions

Write down any questions you have about the text.

1)	
2)	

Questions

Answer the questions below.

1) How does increasing the number of batteries affect a parallel circuit?

2) Why might adding too many batteries in a series be harmful?

Experiment – Testing Battery Power

Research Question

What are we learning more about?

How does adding light bulbs affect the circuit? Is there a limit to how much electricity a battery can supply?

Materials

What do we need for our experiment?

- 1) Battery
- 2) Light bulbs or fans
- 3) Wires



Method

How can we conduct our experiment?

- 1) Connect the battery to one light bulb and observe how bright the bulb is.
- 2) Connect the battery to two light bulbs and observe how bright the bulbs are.
- 3) Connect the battery to three light bulbs and observe how bright the bulbs are.
- 4) Now add multiple batteries to the circuit and observe how bright the light bulbs. Did it change the brightness of the bulbs?

Observations

What did you notice?

Test	Description Of The Circuit – How Bright Were The Bulbs?
1 Lightbulb	
2 Lightbulbs	
3 Lightbulbs	
Multiple Batteries	

Results

Is there a limit to how much electricity a battery can provide? How do you know?

Activity – Design Your Own Doorbell Circuit

Objective:

What are we learning about?

To understand the design process and construct a basic electrical circuit that functions as a doorbell.

Materials:

What will you need for the activity?

- Battery
- Buzzer
- Switch (push button)
- Wires
- Tape and card
- A diagram sheet for circuit design
- Aluminum foil (optional)

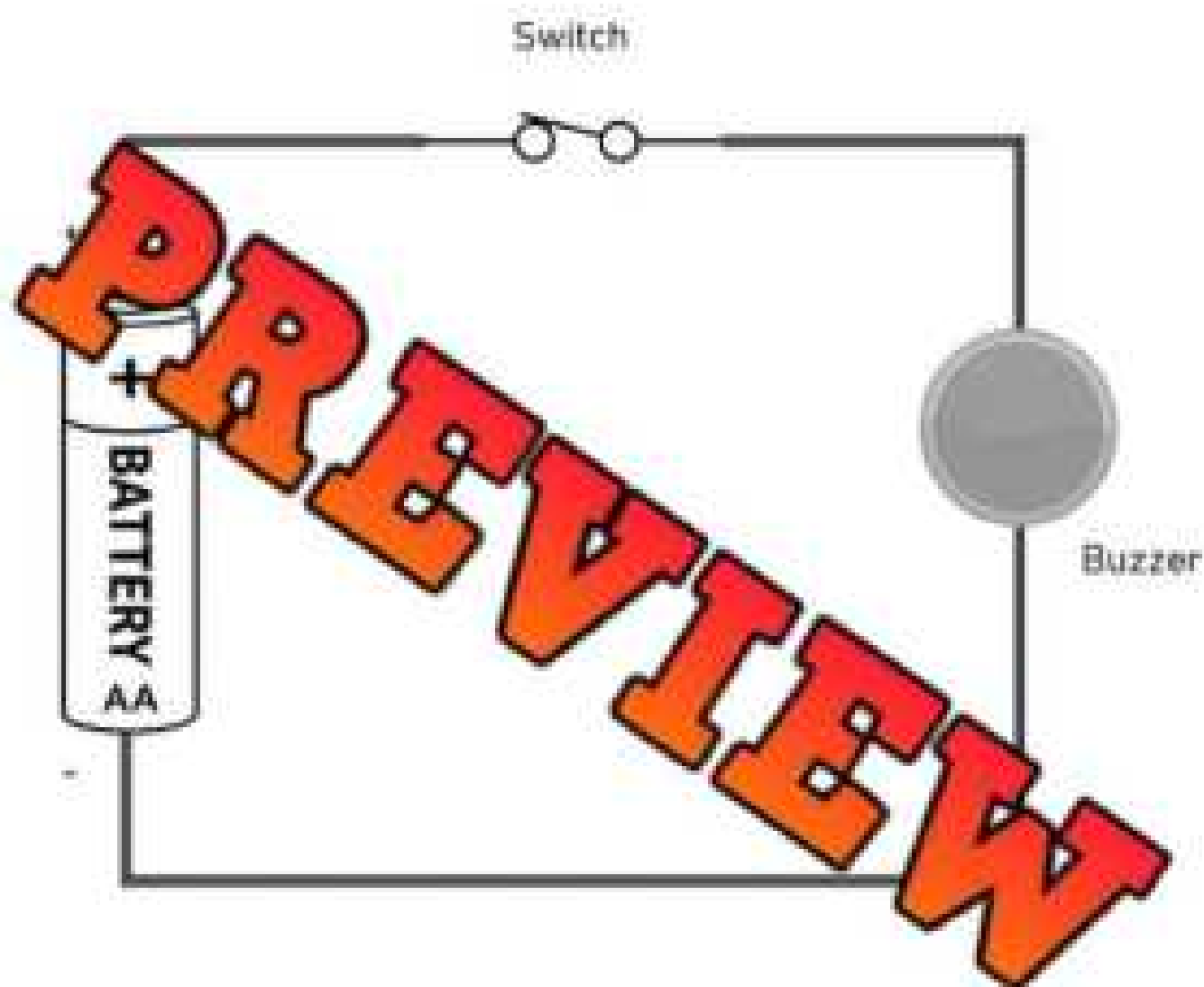
**Instructions:**

How will you complete the activity?

- 1) Refer to the provided diagram of the doorbell circuit and understand the connections.
- 2) Connect one end of a wire to the positive terminal of the battery.
- 3) Attach the other end of this wire to one terminal of the push button switch.
- 4) Connect a second wire from the other terminal of the switch to one terminal of the buzzer.
- 5) Attach another wire from the second terminal of the buzzer back to the negative terminal of the battery.
- 6) Test the switch by pressing it; the buzzer should sound, mimicking a doorbell.
- 7) Mount the battery, switch, and buzzer onto a piece of cardboard to create a stable platform.
- 8) Use tape to secure all components and wires, ensuring that connections are not loose.
- 9) Place your doorbell at a door or entrance to demonstrate its functionality.

Reference Diagram

Circuit diagram for a doorbell experiment.



Use this diagram as your guide to connect each part correctly and ensure your doorbell works properly.

Reflection

Answer the questions below.

1) How does the push button switch control the operation of your doorbell?

2) What if you replaced the buzzer with another type of indicator, like a light? Would you need to change anything else in your circuit?

3) How could you modify your doorbell to make it more fun?

4) Reflect on the importance of each component in your circuit. What happens if you remove one of the parts?

PREVIEW

Electromagnetic Force

Electromagnetic Force – What is it?

The electromagnetic force begins in the atom, which makes up all matter in the world. It is a fundamental force in nature, like gravity. The electromagnetic force can be applied to electrons to attract them to each other.

This is why when you plug batteries in an electronic device, they need to be put in correctly. If they are not aligned properly to be attracted to each other, this would stop the flow of electrons. Electrons wouldn't flow.

Electromagnetism and Electricity

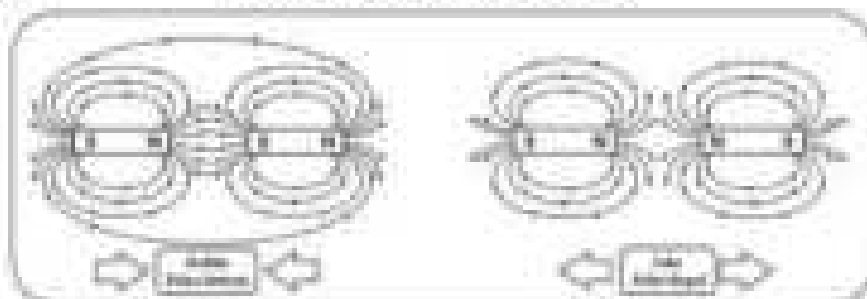
The term **electromagnetism** is a process where a magnetic field is created when an electrical current passes through a conducting material, usually a wire.

A **magnetic field** is an area where charged particles feel an electric force. It is able to move magnetic materials closer or further away. This magnetic field is also known as magnetism, and it is the reason a fridge magnet sticks to another magnetic material.

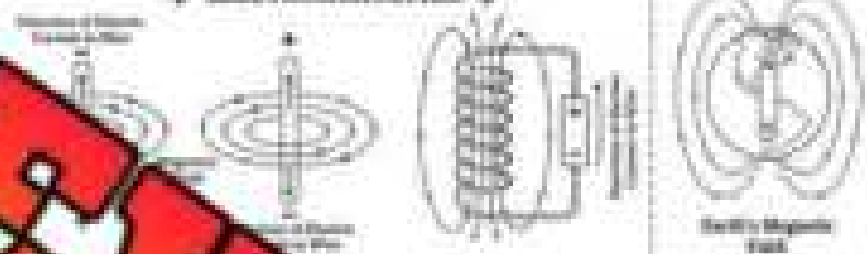
An **electromagnet** uses electricity to create a magnet. Inventors use electromagnetic forces to their advantage. When they create an electrical circuit, they use an electromagnet to create a magnetic field. This means the electricity is creating the movement of magnetic materials.

Using electricity to make things move allows us to have fans, electric lawn mowers, and electric bells. The electricity is being transformed into mechanical energy that can do work.

MAGNETIC FIELD



← ELECTROMAGNETISM →



Definitions

Explain what the following terms mean.

**Electromagnetic
Force****Magnetic field****Questions**

Answer the questions below using evidence from the text.

1) How does electricity make a magnet?

2) Why do batteries need to be put in correctly?

True or False

Is the statement true or false?

1) Magnetism is the force that can attract or repel objects.

True

False

2) An electrical circuit creates a magnetic field.

True

False

3) An electromagnet uses electricity to create a magnetic field.

True

False

4) Matter is made up of atoms.

True

False

5) Electricity cannot be transformed into mechanical energy (movement).

True

False

Exit Cards

Cut Out

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

Name: _____

Circle the best answer.

- 1) What is an example of electricity being transformed into mechanical energy?
 - a) A candle
 - b) A fan
 - c) A book
 - d) A pencil
- 2) Why must batteries be placed correctly in a device?
 - a) To save energy
 - b) To align electrons properly
 - c) To change their colour
 - d) To increase voltage

Name: _____

Circle the best answer.

- 1) What is an example of electricity being transformed into mechanical energy?
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 - b) To align electrons properly
 - c) To change their colour
 - d) To increase voltage

Electromagnetic Lab Experiment

Information

What is this lab about?

Background

Electricity is the flow of electrons through a circuit. **Magnetism** is a field generated by the position of the electrons and their charges. **Electromagnetism** is the combination of electricity and magnetism as we need both in order for the other to work.

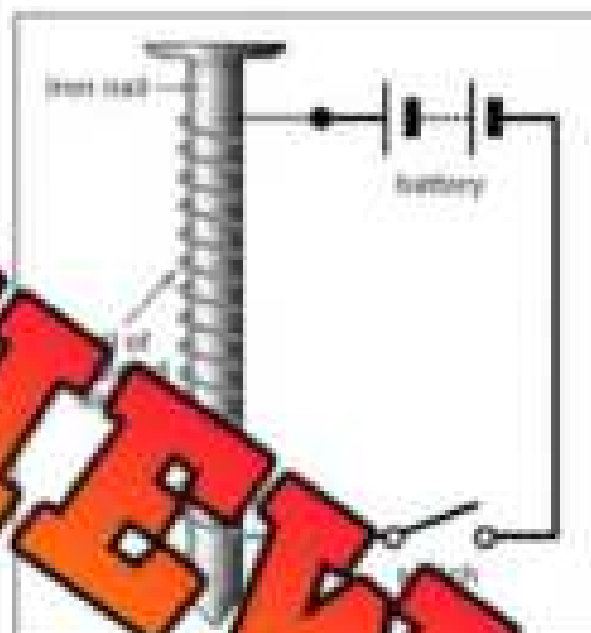
Research

Can we make a magnet out of non-magnetic materials?

Materials

What do we need for the lab?

- A large iron nail (15cm)
- Approximately 1 metres of wire
- A fresh D size battery
- Paper clips or other metal objects
- Tape (optional)



Procedure

How to complete the lab

- 1) Try to pick up the paper clips using just the nail.
- 2) Leave about 20 cm of wire loose at one end of the nail.
- 3) Wrap most of the remaining wire around the nail. Do not overlap the wire.
- 4) With the remaining wire (around 20cm), connect both ends of the wire to both sides of the battery (using a switch is optional).
- 5) Tape the wire to the battery.
- 6) Try to pick up the paperclips with the copper wrapped nail.

*** Be careful as the battery will be used up quickly and will heat up and become warm. Disconnect the wires as soon as you are finished.

Hypothesis

Will you be able to pick up the paper clips with the copper wire wrapped nail? Why or why not?

Results Answer the questions below.

1) Why does the nail not have a magnetic field?

2) What happened when you disconnected the wire? Is the nail still magnetic? Explain.

Diagram

Draw a diagram of your electromagnet. Label the poles.

Transforming Electricity – Electric Bell

Components of an Electric Bell

An electric bell is used commonly as a doorbell.

The doorbell is connected to a circuit,

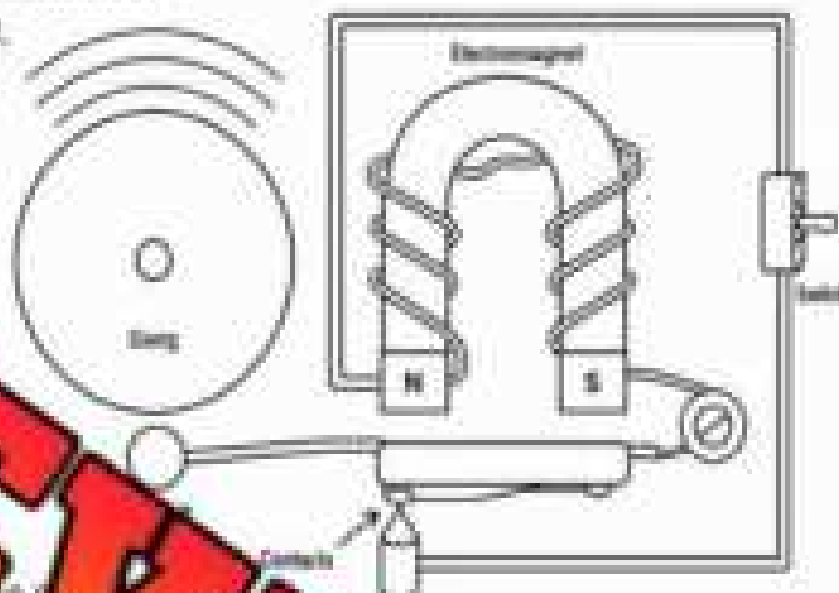
providing the doorbell with

electricity. An electric bell has

the following components:

- An electromagnet that creates a magnetic field
- A hammer that goes towards the gong
- A gong that creates a loud sound when struck
- A switch that opens and closes the circuit

ELECTRIC BELL



How an Electric Bell Works

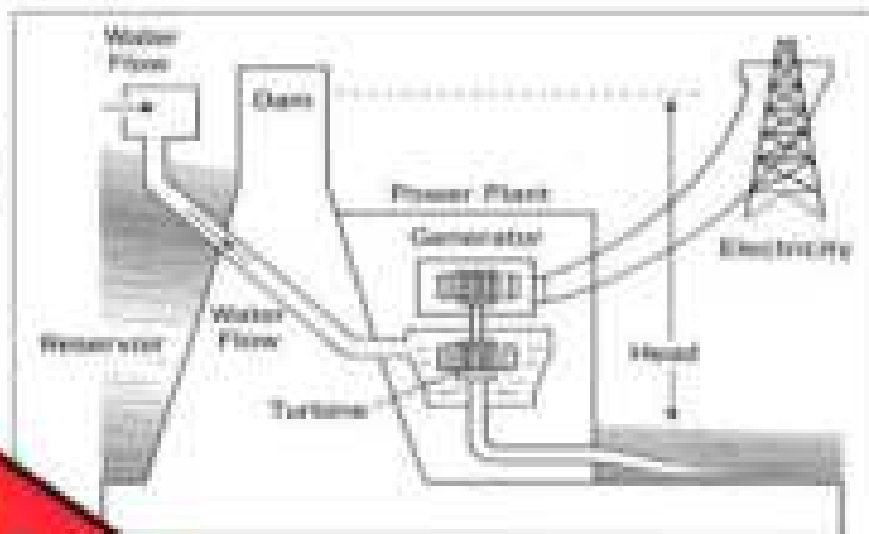
An electric bell works in the following steps:

- 1) The switch is turned on when a person pushes the doorbell button.
- 2) The circuit is closed, meaning electricity flows through the circuit.
- 3) The electromagnet now creates a magnetic field and it pulls the hammer towards it.
- 4) The hammer strikes the gong.
- 5) Sound vibrations travel through the gases in the air and into our ears.
- 6) When the hammer strikes the gong, the contact between the rod that the hammer is attached to and the bottom part of the diagram is broken. Since they are no longer connected, the circuit is open and electricity stops flowing through the circuit. See the arrow for help with this step.
- 7) The hammer will only strike the gong once because the circuit is open. This means the electric bell is returned to its original position.
- 8) If the switch is pressed again, the same process will repeat.

Generating Electricity

Generating Electricity

Electricity must be generated in order for us to use it. **Generating electricity** simply means, making electricity. Canada is 4th in the world for generating electricity. We generate more electricity than other countries.



How we Generate Electricity

Electricity is generated when energy is harnessed and used to rotate a turbine. We can use a variety of methods to spin a turbine and generate electricity.

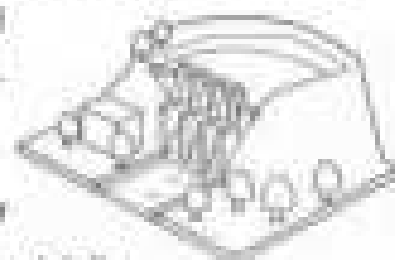
One of the oldest methods for spinning a turbine is using falling water. When water pours over a waterfall, we can harness the power of this moving water by funnelling the water through a tube that has a turbine in it. The water flows through the tube that is shaped like a wheel. As the turbine spins, it connects to a generator and converts mechanical energy into electrical energy by forcing the electrons through an electrical circuit.

Sources of Electricity

A turbine can be used to generate electricity from several sources of energy. Canada is second in the world in terms of how much electricity is generated from the movement of water (hydro). In fact, 59% of all electricity Canadians use comes from hydroelectricity.

Wind turbines provide Canadians with 3.5% of the electricity we use. Solar farms produce less than one percent of our total electricity.

The burning of fossil fuels produces 20% of our electricity. Coal (9.5%), natural gas (8.5%) and petroleum (2%) are the sources of fossil fuels used in Canada.



Questions

Answer the questions below using evidence from the text.

1) What does generating electricity mean? What sources of mechanical energy do we use?

2) What is a turbine? How can we generate electricity with a turbine?

True or False

Is the statement true or false?

1) Canada is fourth in the world in amount of electricity produced.	True	False
2) Canada doesn't produce much hydroelectricity.	True	False
3) Most of Canada's electricity comes from hydroelectricity.	True	False
4) Canada doesn't burn fossil fuels for electricity as it's bad for environment.	True	False
5) Canada uses mostly solar farms for electricity.	True	False

Questioning

Write 3 questions you have about the reading.

1)	
2)	
3)	

Electromagnetism and Turbines

What is a Turbine?

A **turbine** is an engine that turns the movement of a fluid (such as water or air) into energy. The moving fluids push the blades so that they can spin around with the shaft.

When the shaft spins, it often is used to turn a generator that creates electricity through the electromagnetic force. Common examples of turbines that have been used for many years are windmills and water wheels.

How

A generator is a machine that is used to produce electricity. It often uses a turbine that spins the shaft of water or wind.

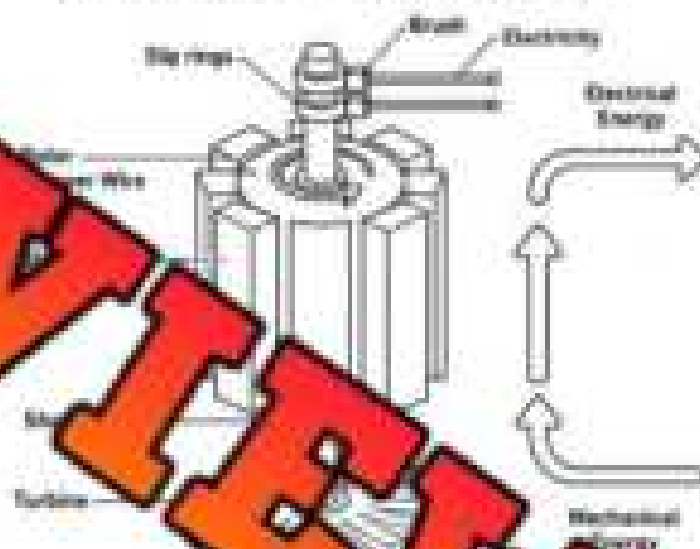
When the turbine spins, it turns a shaft rapidly. Attached to the shaft is a coiled copper wire that also spins. As it spins near the stator magnets, the electrons in the wire move due to the force from the stator magnet. The electrons line up and travel up the shaft, and out through the slip rings.

Once the electricity has been created, it is sent to a transformer that increases or decreases the strength of the electricity so that it can be used in our houses and buildings. The strength of the electricity is called the **voltage** of the electrical current.

Sources of Electricity

To make electricity, mechanical energy is needed to spin the turbine. In Canada, moving water creates 59% of our electricity. Wind creates 3.5% of our electricity and burning fossil fuels creates 20%. When fossil fuels like coal are burned, the heat is used to boil water and create steam. The pressure from the steam turns the turbine, providing mechanical energy that is transformed into electricity.

Electric Generator



Questions

Answer the questions below using evidence from the text.

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

2) What sources of mechanical energy are used in Canada to make electricity?

True or False

Is this statement true or false?

1) A turbine uses fluids to generate electricity (electrical energy).	True	False
2) Steam is used to produce small amounts of electricity.	True	False
3) The strength of electricity is called voltage.	True	False
4) Examples of basic turbines are windmills and water wheels.	True	False
5) A transformer changes the voltage so that it works in our homes.	True	False

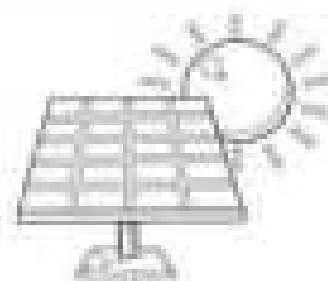
Making Connections

What does the reading remind you of in your life?

Solar Energy – Generating Electricity

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 technologies advance, humans are now using solar energy to create electricity. Using solar energy to create electricity means the sun is powering our electronics, machines, electric cars, and more.

Solar energy is a renewable energy source because we cannot use it up. It is an abundant resource and the supply is endless.



How Solar Energy Works

Solar energy is harnessed by solar panels and stored. The stored energy is then used on demand. Solar panels are made of many solar cells that are all connected together.

The solar cells have two sides. One side has a positive charge and the other side has a negative charge. When the sun's rays hit the cell, the energy knocks the electrons loose and they begin to flow, creating an electrical circuit. We can plug our electronics into a solar panel and the flowing electrons can continue through the circuit inside the electronic device.

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.

Questions

Answer the questions below using evidence from the text.

1) What is solar energy?

2) How does solar energy work?

Benefits and Drawbacks

Benefits and drawbacks of solar energy.

Benefits

Drawbacks

--	--

Reaction

Do you think we should use more solar energy? Explain.

Questions

Answer the questions below using evidence from the text.

1) Why does wind happen?

2) How does wind energy work?

Benefits and Drawbacks

Benefits and drawbacks of wind energy

Benefits

Drawbacks

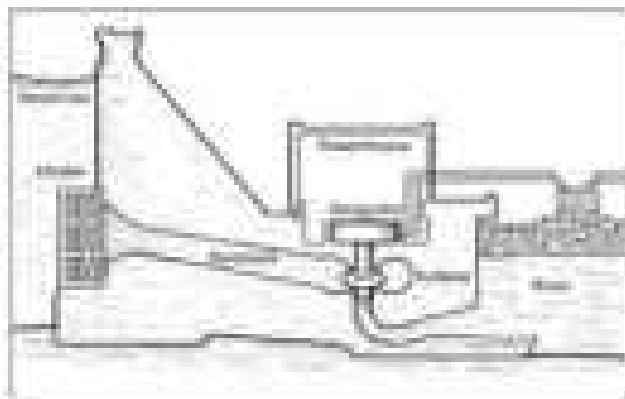
Reaction

Do you think we should use more wind energy? Explain.

Hydro Energy

What is Hydro Energy?

Hydro energy is energy that is harnessed from the flow and movement of falling water. You have likely noticed in a stream or river that there is a current that sends water downhill. This movement of water can be harnessed to create energy for humans in the form of electricity.



Hydro energy is one of the oldest forms of energy. Watermills were first used in the 2nd century by the Romans. The movement of water would spin a watermill that would spin a pipe. The pipe would connect to a machine that could do work.

How Hydro Energy Works

A hydroelectric dam is built across a river. The water is built up in a reservoir that acts like a lake. The water stored in the reservoir at high altitudes is potential energy. At the bottom of the concrete wall, there is an intake that allows water to travel down the penstock. The water then spins the turbine and generating electricity.

Hydroelectric Dams in Canada

The Canadian government is serious about using less fossil fuels for energy and more renewable forms of energy. This is why there are over 15,000 dams in Canada. Hydro creates 59% of all electricity used by Canadians! Canada makes the second-most hydroelectricity, behind only China.

Benefits and Drawbacks

Benefits	✓ Renewable source of energy that we won't run out of ✓ The energy is clean because it doesn't emit greenhouse gases ✓ It's the most reliable form of renewable energy as water always flows
Drawbacks	✓ It has an impact on fish because the dam stops the natural flow of water ✓ Can only be built in certain areas where water flows already. It can be difficult to get the electrical energy to big cities from remote locations ✓ High cost to build dams

Questions

Answer the questions below using evidence from the text.

1) What is hydro energy?

2) Does Canada use hydroelectricity? Why do you think they do?

Benefits and Drawbacks

List the benefits and drawbacks of hydro energy

Benefits

Drawbacks

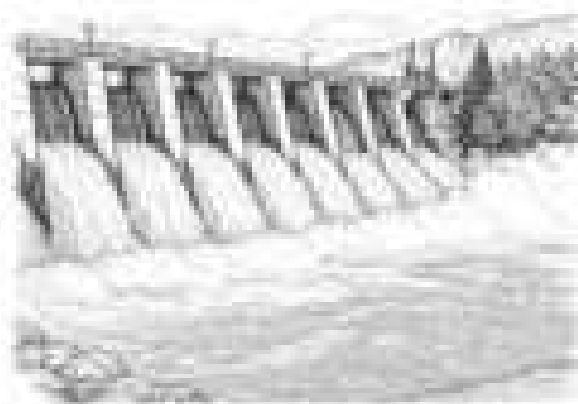
Reaction

Do you think we should use more hydro energy? Explain.

Generating Electricity – 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 felt this reliance to it!



Generating Electricity's Effect on Environment

In Canada, generating electricity produces far less air pollution than other countries, like the United States. However, the electricity Canadians use comes from sources that produce no air pollution. These are hydroelectricity, wind, solar, and nuclear.

This is not to say that generating electricity has no effect on the environment. The creation of hydroelectric dams, wind farms, and nuclear power plants all have an effect on the environment.

Hydroelectric Dam	- The dams block the flow of water and keep some water from flowing from time to time. This changing environment is not good for wildlife living in the water to survive. - The structure itself is massive. It blocks the land. - Many of the dams are built in the north. The First Nations and the Indigenous have rights to the land.
Wind	- Pose a threat to flying wildlife like birds and bats. - They also change ecosystems with their large structures. - 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.

Explain

Write the effects of each energy source in your own words.

Hydroelectric
Dam

Solar

Nuclear

PREVIEW**Reaction**

Which energy source(s) do you think is best for the environment? Explain.

Exit Cards

Cut Out

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

Name: _____

Mark

Draw a line to match each energy source to its environmental effect.

Hydroelectric dam

Wind power

Solar energy

☐ Can release radioactive pollution during accidents

☐ Changes river flow and affects wildlife

☐ Can harm birds and create noise

☐ Requires large land areas and heats nearby land

Name: _____

Mark

Draw a line to match each energy source to its environmental effect.

Hydroelectric dam

Wind power

Solar energy

Nuclear power

☐ Can release radioactive pollution during accidents

☐ Changes river flow and affects wildlife

☐ Can harm birds and create noise

☐ Requires large land areas and heats nearby land

Name: _____

Mark

Draw a line to match each energy source to its environmental effect.

Hydroelectric dam

Wind power

Solar energy

Nuclear power

☐ Can release radioactive pollution during accidents

☐ Changes river flow and affects wildlife

☐ Can harm birds and create noise

☐ Requires large land areas and heats nearby land

Name: _____

Mark

Draw a line to match each energy source to its environmental effect.

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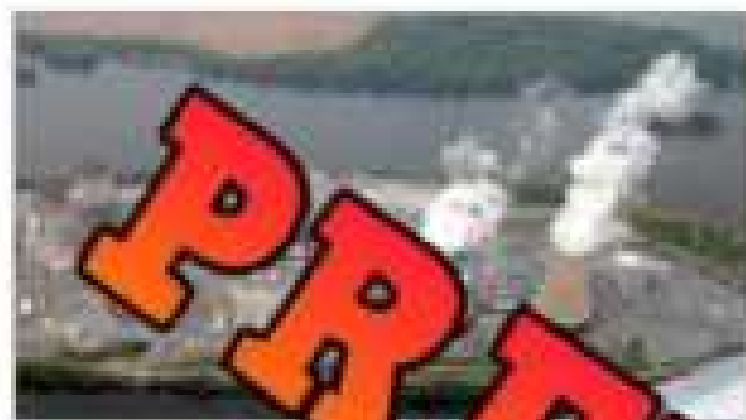
☐ Can harm birds and create noise

☐ Requires large land areas and heats nearby land

Nuclear Power Accidents

Nuclear Power Accidents - Overview

There have been three major accidents involving nuclear generating stations:

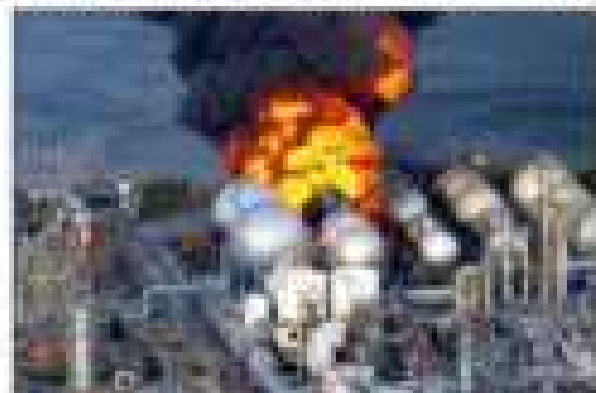


- 1) In 1979 - Three Mile Island in the United States had an accident with no loss of life or significant health effects however it did cause a slowdown in nuclear power plants being built.

2) In 1986 - Chernobyl in the USSR had an accident resulting in two explosions. 28 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 accident 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.

Questions

Use information from the text to support your answer.

1) Which accident was the worst?

2) Does a nuclear explosion have long lasting effects? Explain.

Visualizing

Draw what you see in your mind as you 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

Memory Game: Electricity Matching

Objective

What are we learning about?

Students will review important electricity vocabulary by matching each electricity term with its correct definition, or real-life example.

Material

What will you need for the activity?

- Memory game cards (provided) with the terms on one set and definitions on the other set.
- A flat surface like a table to lay out the cards.

**Instructions**

How will you complete the activity?

- 1) Divide the class into groups of 3 or 4. Give each group a set of Memory Game cards. (Provided)
- 2) Have each group lay all the cards face down in a grid on a flat surface.
- 3) The students take turns flipping over two cards at a time, trying to find 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 these different electrical components and materials are used in circuits and in everyday life.

Cards

List of electricity vocabulary

Electricity Term	Short Definition
Electricity	A form of energy caused by moving electric charges.
Electric current	The flow of electric charge through a circuit.
Static Electricity	Electric charge that builds up on an object.
Circuit	A complete path through which electricity can flow.
Battery	A source that provides electrical energy to a circuit.

Cards

List of electricity vocabulary

Electricity Term	Short Definition
Wire	A material that carries electric current through a circuit.
Switch	A device that opens or closes a circuit.
Light Bulb	A device that changes electrical energy into light energy.
Conductor	A material that allows electricity to flow through it easily.
Insulator	A material that does not allow electricity to flow through it easily.

Cards

List of electricity vocabulary

Electricity Term	Short Definition
Closed Circuit	A complete circuit that allows electricity to flow.
Open Circuit	An incomplete circuit where electricity cannot flow.
Series Circuit	A circuit where electricity travels along one path.
Parallel Circuit	A circuit where electricity can travel along more than one path.
Electromagnet	A magnet made by electricity flowing through a coil of wire.

PREVIEW

Cards

List of electricity vocabulary

Electricity Term	Short Definition
Generator	A device that changes mechanical energy into electrical energy.
Renewable Energy	Energy from sources that can be naturally replaced.
Non-renewable Energy	Energy from sources that cannot be replaced or run out.
Solar Energy	Energy that comes from sunlight.
Wind Energy	Energy from moving air that can be used to generate electricity.

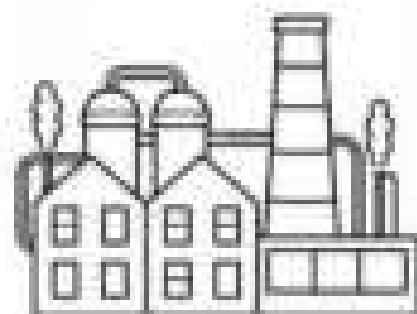
Electricity in Ontario

Powering Up Ontario

Have you ever wondered how your lights turn on or how your devices charge? Let's explore how electricity is generated in Ontario!

Non-renewable Resources:

In Ontario, some electricity is generated using natural gas, especially when people need extra electricity during busy times. Natural gas is burned to produce heat, which creates steam that spins a large machine called a turbine which generates electricity. It is important to remember that natural gas is a non-renewable resource, meaning it cannot be replaced once it is used up. Ontario does not use coal-fired power plants to generate electricity.



Renewable Resources:

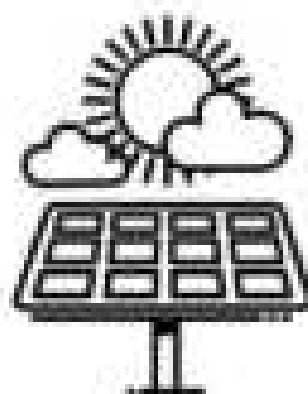
Ontario produces much of its electricity from renewable resources, especially hydroelectric power. Water flowing over a dam, like those at Niagara Falls, turns turbines to generate electricity. Ontario also uses wind turbines and solar panels to produce clean electricity. These resources can be replaced naturally and help reduce greenhouse gas emissions.

Other Sources:

A large share of Ontario's electricity comes from nuclear power. Nuclear power plants use energy from uranium to produce heat that creates steam, which turns turbines and generate electricity. Nuclear power does not release greenhouse gases while producing electricity, but it is not considered a renewable energy source.

It is important to use electricity wisely. By conserving electricity and supporting cleaner energy sources, Ontarians can help protect the environment for future generations.

In conclusion, Ontario generates electricity from a mix of nuclear, hydroelectric, wind, solar, and natural gas. Using a variety of energy sources helps provide reliable electricity while working toward a cleaner future.



Questions

Answer the questions below using evidence from the text.

1) How does a hydroelectric station generate electricity?

2) Why is it important to use more renewable resources like wind and solar for electricity generation?

True or False

Is the statement true?

1) Ontario generates much of its electricity from coal-fired power plants.	True	False
2) Ontario still uses coal-fired power plants to generate electricity.	True	False
3) Wind and solar energy are renewable energy sources.	True	False
4) Nuclear power is one of Ontario's major sources of electricity.	True	False
5) Natural gas can be reused indefinitely.	True	False

Questioning

Write 3 questions you have about the reading.

1)	
2)	
3)	

Moving Electricity in Ontario

How Electricity Travels from Power Plants to Our Homes and Businesses

Imagine electricity as a team of runners in a relay race, making its way from power plants to your house or business!

Start of the Race: The Power Plants

The race begins at Ontario's power plants. Many hydroelectric stations, including those at Niagara Falls, use flowing water to spin turbines and generate electricity. Ontario also produces electricity using nuclear power plants, wind turbines, solar panels, and natural gas power plants.

Passing the Baton: Boosters

Once electricity is generated, it requires a boost for its long journey. This boost is provided by transformers, which increase the voltage of electricity, allowing it to travel long distances without losing too much energy.

The Long Journey: Transmission Lines

The boosted electricity travels through high-voltage transmission lines. These lines are like long highways that carry electricity across the province. Metal towers support the wires as they transport electricity from power plants to substations.

Getting Closer: Substations

Before reaching your home, the electricity needs a second boost. This happens at substations, where transformers reduce the voltage to a safer level for neighbourhoods. Substations are usually fenced areas with electrical equipment.

Final Stretch: Distribution Lines

Now ready for the last part of its journey, the electricity travels through distribution lines on smaller poles along streets. These lines carry electricity safely to homes, schools, businesses, and community buildings.

Finish Line: Your Home

At last, the electricity reaches your home or business. It passes through an electricity meter, which measures how much electricity is used before powering lights, appliances, computers, televisions, and many other devices.

In Ontario, electricity is delivered through a reliable network that connects hydroelectric stations, nuclear plants, wind farms, solar panels, and natural gas plants. This system helps provide safe, dependable electricity to millions of people across the province.



Questions

Answer the questions below using evidence from the text.

1) What role do transformers play in the transmission of electricity?

2) Describe the journey of electricity from a power plant to a house or a business.

True or False

Is the statement true?

1) Transformers are used to decrease the voltage of electricity.	True	False
2) Transmission lines carry low-voltage electricity.	True	False
3) Transformers at substations increase the voltage of electricity.	True	False
4) Substations are usually located in fenced-off areas.		False
5) Distribution lines are the small poles seen along the streets.		False

Diagram

Draw a diagram of electricity travelling from a power plant to a city.

Measuring Electricity In Our Homes

Measuring Electricity in our Homes

We measure the amount of electricity we have used in our homes by kilowatt hours. A kilowatt-hour (symbol: kWh) is a unit for measuring energy over a period of one hour. It is how many hours one kilowatt has been used in a house. One kWh is the electricity needed to burn ten 100-watt light bulbs for one hour. An LED 40 inch TV would use approximately 100 watts per hour. This would mean it would take 10 hours for it to reach one kilowatt-hour.

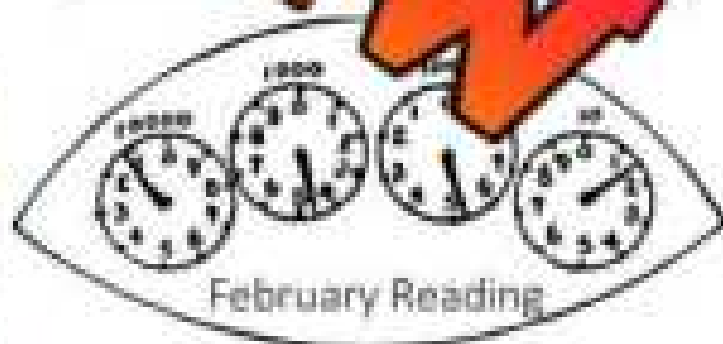
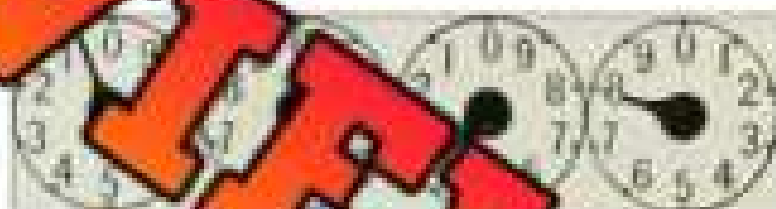


Reading a Four Dial Metre

Many metres use 4 or 5 dials to provide the number of hours a house has used. Other metres use the one above. To read the dials, you start from left to right. Every dial is read counter-clockwise. If the pointer is between two numbers, read the number that is just past it. If the pointer is between 9 and 0, always read 9.

Read the Metre

Write the reading on the line



January Reading: 12380 kWh

February Reading: _____

How many hours were used in January?

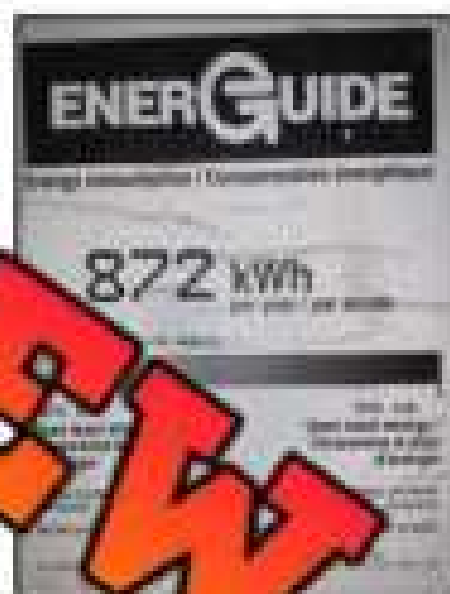
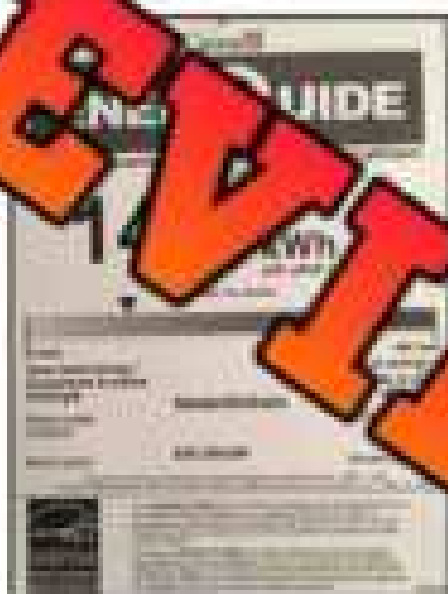
Reading Efficiency Labels

Household Appliances

Some appliances in our homes are energy hogs. They require a lot of electricity to operate. Older appliances were made with poor technology that need a lot of energy to run. Replacing old refrigerators or furnaces with newer high efficiency appliances can save a lot of money on energy bills in the long run.

In Canada, the government requires companies to put an energy efficiency label on appliances that displays how much electricity the appliance uses. The label is called the **EnerGuide**. It shows how many kilowatt-hours an appliance will use for a year. The **EnerGuide** also shows how efficient the appliance is compared with other similar appliances.

Read the **EnerGuide** label to learn everything you learned about the appliance from the label.



Evaluating Appliances at Home

Check some of the large appliances you have at home. See if you can find their EnerGuide sticker to determine if the appliance is energy efficient or not.

Results

Fill in the table to learn more about your appliances at home.

Appliance #1

1) What type of appliance is it? (washer, dryer, etc.)

2) How many kWh does the appliance use?

3) Is this appliance energy efficient or not? Explain.

4) If possible, research newer appliances to learn more about how much electricity they use. Write down the information you find below.

Appliance #2

1) What type of appliance is it? (washer, dryer, etc.)

2) How many kWh does the appliance use?

3) Is this appliance energy efficient or not? Explain.

4) If possible, research newer appliances to learn more about how much electricity they use. Write down the information you find below.

Results

Fill in the table to learn more about your appliances at home.

Appliance #3

1) What type of appliance is it? (washer, dryer, etc.)

2) How many kWh does the appliance use?

3) Is this appliance energy efficient or not? Explain.

4) If possible, research newer appliances to learn more about how much electricity they use. Write down the information you find below.

Appliance

1) What type of appliance is it? (washer, dryer, etc.)

2) How many kWh does the appliance use?

3) Is this appliance energy efficient or not? Explain.

4) If possible, research newer appliances to learn more about how much electricity they use. Write down the information you find below.

Electricity and Coding

Electricity and Coding

The field of science and technology has grown massively since the invention of electricity. Electricity has been used to provide energy in the form of light, heating, cooling, and to power our appliances as well as gadgets.

Coding has also changed the field of science and technology. Coding is used to tell an electronic what to do. Therefore, electronics and coding now work hand in hand. Just about every electronic you can think of uses coding to allow it to work.

For example, your washing machine runs on electricity. It also uses code to allow the user to choose what they want the washing machine to do. The code might look something like this:



Multiple Choice

Circle the correct answer.

1) Coding was invented before/after electricity?	Before	After
2) Coding is used to tell computers	to do	The time
3) Appliances use _____ to give the user options.	coding	light
4) Electricity is used to provide energy in the form of	Light	lights
5) Which uses electricity?	Television	Carpets

Question

How does electricity and coding work together to make many things we use today?

What is Binary Code?

What is Binary Code?

Binary code is a coding system using the numbers 0 and 1 to represent everything a computer needs to know. The 0s and 1s are called bits.

For example,

- The on button is represented by 1 while the off switch is represented by 0
- Letters are represented by 0s and 1s. A = 01000001 or 1, B = 01000010 or 10
- Numbers are also represented by 0s and 1s. The number 1 = 1, 2 = 10, 3 = 11, 4 = 100

Why Do Computers Use Binary?

Computers are able to make sense of complicated data. The binary counting system is the simplest and most available because it uses only two numbers. Computers can process the binary code to allow them to understand what we are sending to it.

Binary Code Alphabet

Below you can see the binary code for each letter and number in our alphabet. Binary is read from right to left. You will notice that uppercase and lowercase have their own binary code because they are different to the computer. The circles also represent binary. The black circles represent 1s while the white circles represent 0s.

01000001	A	0●00000●	01000001	A	0●00000●	00110000	0	00●●0000
01000010	B	0●00000●	01100000	a	0●●●0000	00110001	1	00●●000●
01000011	C	0●00000●	01100001	b	0●●●000●	00110010	2	00●●000●
01000100	D	0●00000●	01100010	c	0●●●000●	00110011	3	00●●000●
01000101	E	0●00000●	01100011	d	0●●●000●	00110100	4	00●●000●
01000110	F	0●00000●	01100100	e	0●●●000●	00110101	5	00●●000●
01000111	G	0●00000●	01100101	f	0●●●000●	00110110	6	00●●000●
01001000	H	0●00000●	01100110	g	0●●●000●	00110111	7	00●●000●
01001001	I	0●00000●	01100111	h	0●●●000●	00111000	8	00●●000●
01001010	J	0●00000●	01101000	i	0●●●000●	00111001	9	00●●000●
01001011	K	0●00000●	01101001	j	0●●●000●	00111010	10	00●●000●
01001100	L	0●00000●	01101010	k	0●●●000●	00111011	11	00●●000●
01001101	M	0●00000●	01101011	l	0●●●000●	00111100	12	00●●000●
01001110	N	0●00000●	01101100	m	0●●●000●	00111101	13	00●●000●
01001111	O	0●00000●	01101101	n	0●●●000●	00111110	14	00●●000●
01010000	P	0●00000●	01101110	o	0●●●000●	00111111	15	00●●000●
01010001	Q	0●00000●	01110000	p	0●●●000●	00111000	16	00●●000●
01010010	R	0●00000●	01110001	q	0●●●000●	00111001	17	00●●000●
01010011	S	0●00000●	01110010	r	0●●●000●	00111011	18	00●●000●
01010100	T	0●00000●	01110011	s	0●●●000●	00111100	19	00●●000●
01010101	U	0●00000●	01110100	t	0●●●000●	00111101	20	00●●000●
01010110	V	0●00000●	01110101	u	0●●●000●	00111110	21	00●●000●
01010111	W	0●00000●	01110110	v	0●●●000●	00111111	22	00●●000●
01011000	X	0●00000●	01110111	w	0●●●000●	00111000	23	00●●000●
01011001	Y	0●00000●	01111000	x	0●●●000●	00111001	24	00●●000●
01011010	Z	0●00000●	01111001	y	0●●●000●	00111010	25	00●●000●
			01111010	z	0●●●000●			



Writing Binary

When these letters are typed, what does the computer see?

Input	Binary Code Version
Example Sam	01010011 01100001 01101101
Your name (Choose a first name)	
Canada	
I am 11	

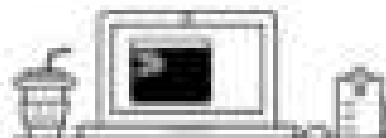
Reading BinaryRead the binary code and decide what it says.
Hint - it is all lowercase

Binary Code Version	Input
01100011 01101111 01100100 01100101	
01101101 01100001 01110100 01101000	
01110011 01100011 01101001 01100101 01101110 01100011 01100101	
01100110 01110101 01101110	

What is Binary Code?

Writing Binary

Shade in the 1s and leave the 0s white.



Input	Binary Code Version		
Example Sam			
cod			
binary			
ba			

Reading Binary

Read the binary code and determine what letter was told.
Hint - it is all lowercase

Binary Code Version		

Writing Code – TV Remote

How Does a TV Remote Work?

The battery inside the remote gives it electricity. The remote has an LED light that sends binary code to the TV. The TV has been programmed to understand the binary code it is being sent.



For example,

Remote Code	
if on button is pressed	
then send 01101110 to the television	

TV Code	
if on button is pressed	
then close the television	

Binary

When the remote sends a binary code to the TV?



Remote Code	
if volume up button is pressed	
then send to the television	



Remote Code	
if channel down button is pressed	
then send to the television	



Remote Code	
if off button is pressed	
then send to the television	



Name: _____

Date: _____

Unit Test – Electricity

Multiple Choice

/10

1) Electricity is the flow of... a) Protons b) Electrons c) Molecules d) Neutrons	2) A circuit needs to be _____ to produce electricity. a) Open b) Closed c) Conductive d) All of the above
3) When two objects are the same, they _____ a) Attract b) Destroy c) Connect to d) Repel	4) An example of a turbine is... a) A rocket b) A windmill c) A solar panel d) All of the above
5) Which of the following is a conductor? a) Glass b) Wood c) Gold d) Oil	6) Which of the following is a not renewable source of energy? a) Solar b) Wind c) Coal d) Hydro
7) True or False: A resistor is used in a circuit to create more voltage. a) True b) False	8) Which type of circuit is a battery operated hand saw? a) Open Circuit b) Closed Circuit c) Parallel Circuit d) Series Circuit
9) In Canada, which source of energy is used the most to generate electricity? a) Solar b) Wind c) Nuclear d) Hydro	10) Which device converts mechanical energy into electricity? a) Static Electricity b) Generator c) Circuit d) Motor

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

/3

Term	Definition (what does it mean)
Turbine	
Series Circuit	
Parallel Circuit	

Short Answer Questions (2 marks each)

1) What is static electricity? How does it work?

2) Why are parallel circuits used more in houses? Explain how outlets and light switches.

3) What is the difference between an insulator and a conductor?

1) How is electricity generated? Describe the renewable and non-renewable ways electricity is generated. Discuss how these forms of energy are transformed into electricity.

2) How has electricity changed our lives? Are there any drawbacks to using electricity? Discuss what life would be like without electricity and what you can do to use less electricity.



Workbook Preview



The Universe

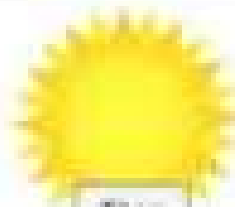
What is the Universe?

The **universe** is everything we can touch, feel, sense, measure, and detect. This means it is everything that is living, planets, galaxies, dust clouds, light, and even time.

Before the universe was created, time, space, and matter did not exist.



Planet



Star

What is a galaxy?

A **galaxy** is a massive collection of gas, dust, and billions of stars and their solar systems that are all held together by gravity.



Natural Satellite

Preview of 75 pages from this product that contains 145 pages total.

The Universe - An Unimaginably Large Entity

This picture was taken by the Hubble Space Telescope. It shows thousands of galaxies as each of the tiny dots are galaxies.

Each galaxy has upwards of 400 billion solar systems.

Our solar system has 8 planets and one Sun, which means our Milky Way Galaxy could have upwards of 3.2 trillion planets and 400 billion Suns.

It is also estimated that there are approximately 2 trillion galaxies that we can see from our planet. That's a lot of stars, solar systems and planets!

The universe is home to many celestial bodies. A **celestial body** is an object in space. Celestial bodies include stars, planets, natural satellites (moons), comets, asteroids, galaxies, and meteors or meteorites.



Meteor

Name: _____

7

Scientific Concepts
K-1

The Universe

Questions

Answer the questions below using evidence from the text

1) What is the difference between a solar system and a galaxy?

2) How can you explain using the terms: galaxies, stars, and solar systems.

Visualizing

Draw what you were picturing while reading. Explain the picture

True or False

Is the statement true or false?

1. Galaxies are larger than the Universe	True	False
2. A galaxy can have upwards of 400 billion solar systems	True	False
3. A solar system has 100 billion planets in it	True	False
4. The universe has around 2 trillion galaxies	True	False
5. There could be 3.2 trillion planets in our galaxy	True	False

Solar Systems - Size, Structure, Age

What is a Solar System?

Our solar system is the collection of eight planets and their moons in orbit around the Sun. It also includes the smaller bodies in the form of asteroids, comets, and meteoroids.

Age of Solar System

Our solar system is about 4.6 billion years old. It is believed that 4.6 billion years ago, gravity pulled a

cloud of dust and gas together. In the center, the massive concentration of dust and gas created a molecular cloud, which eventually formed the Sun. With the birth of the Sun, the planets began to form 100 million years around it.



Size and Structure of the Solar System

The image above shows the size and structure of our solar system. As you can see, the size of the Earth is small compared to the size of Jupiter, Saturn and Uranus.

The furthest object that we can see in our solar system is Sedna, which is 143.73 billion km away from the Sun. This means the diameter of the solar system is 287.46 billion km.

There are eight planets in our solar system and one sun that each planet orbits around. An **orbit** is a regular, repeating path that one object takes around another. Therefore, all the planets orbit the Sun, as they all travel in a circle around the Sun. Since planets are further away from the Sun, it takes them longer. In fact, it takes Neptune 165 years to orbit the Sun once! Earth orbits the Sun every 365 days. Earth is the 3rd planet from the Sun, or some refer to it as the 3rd rock from the Sun.

Name: _____

9

Science/Computer
2021

Solar System - Size, Structure, Age

Questions

Answer the questions below using evidence from the text

1) What is our solar system? When was it formed?

2) What is our solar system? Did anything surprise you about the size of the planets?

Questioning

Write 3 questions you have after the reading

1)

2)

3)

True or False

Is the statement true or false?

1) The Sun orbits around the planets

True

False

2) All the planets orbit the Sun every 365 days

True

False

3) The Sun is the largest object in our solar system

True

False

4) The Earth orbits the Sun every 365 days

True

False

5) Our solar system was formed 4.6 billion years ago

True

False

Name: _____

10

Geography/Science
K-1

Diagram of our Solar System

Diagram of our Solar System

Label the solar system using the word bank

Word Bank

Mercury

Uranus

Earth

Jupiter

Saturn

Neptune

Mars

Venus

Sun

PREVIEW

What are Moons?

What are Moons?

Moons are natural objects that orbit planets. Scientists call moons "natural satellites" because a satellite also orbits a planet. Most people think satellites are just machines we send in to space to orbit a planet, but satellites can be natural too.

Planets and asteroids orbit the Sun, but moons orbit planets. Moons come in different shapes and sizes and are made of rock. Most moons are airless, but some have atmospheres and even oceans. We know a lot more about the moon because in 1969, American astronauts landed on the moon and took rock samples back to Earth to study them.

Moons and Planets

The Earth has one moon. There are 214 moons in our solar system. Most of the moons orbit around Jupiter and Saturn. Smaller planets usually have less moons. Mars has two moons and Mercury don't have any. Although scientists aren't 100 percent sure, they believe Jupiter has 79 moons.

It was discovered in 2019, that Saturn has more moons than scientists didn't know about. This gives Saturn a total of 82 moons. Saturn's moon Titan is larger than the planet Mercury! Check out the size comparison in the photo below. Titan is larger than Mercury, but Titan is larger than our moon.

The Earth's moon can be seen by us each evening on a clear night, but it's really far away! It is 384,399 kilometres from the Earth! It took the American astronauts 3 days travelling at an average speed of 3,280 kph.

How was Earth's Moon Formed?

There are many theories that try to explain how the moon was formed. No one knows for sure! The most accepted theory is that the moon formed when the Earth and another small planet collided. The debris from the collision began to orbit the Earth. Over time, the debris collected to form a moon.



Questions - What are Moons?

Questions

Answer the questions below using evidence from the text

1) What are moons? Do all planets have moons?

2) How do moons form?

Summarize

What is the main idea and supporting details

True or False

Circle whether the statement is true or false

1. Moons are natural satellites because they orbit planets	True	False
2. Moons orbit around the Sun, not around planets	True	False
3. Scientists know exactly how many moons there are in our solar system	True	False
4. Most moons have atmospheres (air) and oceans	True	False
5. Moons are made of rock materials	True	False

Asteroids and the Asteroid Belt

What is an Asteroid?

An **asteroid** is a chunk of rock and metal in outer space that is in orbit around the Sun. Asteroids are not round, but instead are shaped like potatoes. They vary in size from less than a meter in diameter to hundreds of kilometers across.

Types of Asteroids

There are three types of asteroids that are categorized based on which elements make up the asteroid. The three types of asteroids are carbon, stony, and metallic.

1. **Carbon Asteroids** - These asteroids are made from rocks that are rich in carbon. These asteroids are very dark in color and make up about 5% of all asteroids in the solar system.
2. **Stony Asteroids** - These asteroids are made up of rock and some metal.
3. **Metallic Asteroids** - These asteroids are made up of mostly iron and nickel but often have small amounts of stone mixed in.

Asteroid Belt

There are hundreds of thousands of asteroids that form a scattered ring of asteroids that orbit the sun. These asteroids form what scientists call the asteroid belt. The asteroid belt

is located between the planets Mars and Jupiter. The Kuiper Belt is located in the outer part of the solar system. It is much thicker, but is also made up of rock and metal chunks that were left over after the planets formed.

Sometimes asteroids are forced out of the asteroid belt by gravity and sent towards the outer solar system. Luckily, not many get too close to Earth!

Largest Asteroids

The largest asteroids are so large, they are considered dwarf planets or minor planets. The four largest asteroids are Ceres, Vesta, Pallas, and Hygiea.



Asteroids and the Asteroid Belt

Questions

Answer the questions below using evidence from the text

1) What is an asteroid? What types of asteroids are there?

2) What is an asteroid belt?

Visualizing

Draw what you will picture when you are reading. Explain the picture

True or False

Circle whether the statement is true or false

1. An asteroid is always made from rock and stone	True	False
2. Some asteroids are so large, they are considered minor/dwarf planets	True	False
3. The asteroid belt is between Earth and Mars	True	False
4. Some asteroids are smaller than a meter in diameter	True	False
5. An asteroid will never escape the asteroid belt	True	False

Meteors, Meteorites, and Comets

What is a Meteor?

A **meteor** is an asteroid or other object that burns or vaporizes when it enters the Earth's atmosphere. Sometimes asteroids will be on a trajectory to collide with the Earth. This is not dangerous because our atmosphere vaporizes and burns the object so that nothing gets to the ground. The process happens so fast that we see a "shooting star" in the sky.

Very rarely, a small piece of the asteroid will survive the trip through the atmosphere and land on the Earth's surface. These pieces are known as **meteorites**. A **meteoroid** is a meteor that hasn't entered the earth's atmosphere. It is very much like an asteroid, but much smaller.

A meteor enters the Earth's upper atmosphere at speeds up to 200,000 km/h! Meteors can be seen at any time, but it is best to look for them during meteor showers. These occur around the same dates each year, when the Earth passes through a stream of dust left behind a passing comet.

What is a Comet?

A **comet** is a celestial body that orbits the Sun. They are found at the edge of our solar system, beyond the orbit of Pluto. We can only see them when they get close enough to the Sun because they display a visible coma made of gas and dust. Comets are made of dust, ice, and small rocky particles.

Halley's comet is the most well known comet because it can be seen by the naked eye every 75 to 76 years. It was last seen on Earth in 1986 and will be visible in 2061 again when it appears in the inner solar system. The comet is named after English astronomer Edmond Halley, who examined reports of a comet approaching Earth in 1531, 1607, and 1682. He figured out that these three comets were actually the same comet returning over and over again. He predicted that the comet would come again in 1758.

Even though he wasn't alive to see the comet's return, he was correct in his prediction. The comet was eventually named after him. He is credited with discovering that comets can orbit the Sun, which means they become visible to us at predictable times.

Meteoroid, Meteor and Meteorite



Meteors, Meteorites, and Comets

Questions

Answer the questions below using evidence from the text

1) What is the difference between a meteor and a meteorite?

2) What is Halley's comet the most well known?

Questioning

Write 3 questions about the reading

1)

2)

3)

True or False

Is the statement true or false?

1. A meteorite is a shooting star – an asteroid burned up completely	True	False
2. A meteor is a piece of meteorite that lands on the Earth's surface	True	False
3. A comet orbits the sun on the outer edge of the solar system	True	False
4. Halley's comet can be seen every 70 years	True	False
5. A comet is most visible when it is near the sun	True	False

Identifying Celestial Bodies

Which Type?

Which celestial body does the description represent?

Word Bank

Meteor

Meteorite

Meteoroid

Planets

Asteroid

Comet

Star

Natural Satellite

Solar System

Galaxy

1) _____ side of the Earth's atmosphere. Is often
seen as a bright streak that breaks off

2) Collection of _____ celestial bodies that orbit a
star because of their strong _____

3) Small rock that _____ in the _____

4) Smaller than planets, _____ the _____ planets. These
orbit around the Sun.

5) Huge celestial bodies made up of _____ these
own heat and light and often have planets or _____

6) Small rock that lands on the Earth's surface

7) Collection of solar systems, including billions of _____

8) Celestial bodies that orbit planets

9) Made of ice, rock, and dust, these orbit the sun. We can see a
tail on them when they get close to the Sun.

10) Examples - Jupiter, Mars, Saturn

11) Examples - Titan, Triton, Phobos, Europa, Mimas, Io

12) Examples - Milky Way, Andromeda, Cygnus A, Virgo A

13) Examples - Sirius, Polaris, Rigel, Vega, Pleiades, Antares

14) Examples - Ceres, Eros, Hathor, Hermes, Icarus

15) Examples - Halley, Chron, Encke, Arend-Roland, Hale-Bopp

Gravity

What is 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. All massive objects (planets and stars) have a gravitational pull that pull matter towards their centre.

but the pull is much stronger on the Sun. The Sun has a much stronger gravitational pull than the Earth because the Sun is much larger than the planet/star, the more mass an object has, the stronger gravitational pull it has. We don't feel the Sun's gravitational pull as much as Earth's because we are so far away from the Sun. The Sun's gravitational pull is important however, because it is what keeps the planets in our solar system in orbit around the Sun. Without the Sun's gravity, the planets, moons or asteroids would fly away from the Sun and there would be no orbiting.



Sir Isaac Newton

In 1666, Newton observed an apple falling from a tree. He realised that the force that made the apple fall downward instead of simply floating away. He realised that the Earth must attract the apple, which is why it falls straight downward. He called this force of attraction between the Earth and Matter – gravity.

Why is Gravity Important

Without gravity, we wouldn't be able to stay on the Earth's surface. We would float away along with all of our stuff. Gravity is also the force that keeps the Earth orbiting around the Sun.

Mass vs Weight

Our weight is based on gravity. **Weight** is the measurement of the force of gravity pulling on an object. This means our weight is how much gravity is pulling us towards the Earth's surface. 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 gravitational pull is stronger or weaker. However, our mass is the same on all planets because our bodies have the same amount of matter.

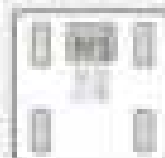
Mass vs Weight

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 gravitational pull is stronger or weaker. For example, our weight on the moon would be about 1/6 of our weight on earth because the moon is much smaller and has 1/6 times less of a gravitational pull. Our mass is the same everywhere, including on the moon because all objects have the same amount of matter.



Math Time

To find the weight on earth, multiply the weight on the moon by 6 to find the weight on the moon. To find the weight on the moon, divide the weight on earth by 6 to find the weight on the moon.

Weight on the Moon	Weight on Earth
15 kg	
50 kg	
110 kg	



Questions

Use information from the text to support your answers.

1) What is the difference between mass and weight?

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

Emitting or Reflecting Light?

Emitting Light vs Reflecting Light

Light sources that create light for us to see are **light emitters**. Emitting light means they create light. Our solar system emits a lot of light for us on Earth.

On the other hand, some things look like they emit light, but really they just reflect light from a light source. **Reflecting light** means the object doesn't create their own light, they just bounce light off of them.

Examples of Light Emitters

The stars in our solar system are light emitters because they are sources of light. They all create light instead of just reflecting light. The Sun is actually a star, and it is a pretty average sized star. There are about 200 billion stars in our galaxy.

The Sun emits so much light for us that it creates daylight for us. That is because the Sun is closer to us than any other star. Those other stars are also producing similar amounts of light, but they are much, much further away from the Earth.

Stars are balls of burning gases, mostly hydrogen and helium. They emit light because their gravity causes its gases to fuse together, which releases energy in the form of light and heat and it makes them very hot and bright.

Examples of Light Reflectors

The moon, other planets and their moons, asteroids, and comets are all examples of light reflectors. The moon is a light reflector that reflects the light from the Sun. That is why you can stare directly at the moon, but not at the Sun. Staring at the Sun can cause blindness because it is such a powerful light emitter, but the moon won't cause you any damage because it is not creating any light and it reflects a much lower amount of light energy.

When we see other celestial bodies in outer space, we can only see them because they reflect light from the stars, mainly the Sun. These stars illuminate the other comets, planets, asteroids, and moons in our solar system. The moon's composition is mostly oxygen, silicon, magnesium, iron, calcium, and aluminum. Together, these materials reflect only 3 to 12 percent of the sunlight that falls on it. This means the moon isn't a great light reflector.



Questions - Emitting or Reflecting Light

Questions

Answer the questions below using evidence from the text

1) What is the difference between a light emitter and a light reflector?

2) Why does the sun illuminate other celestial objects? Which celestial bodies reflect the sun's light?

Questioning

Write 3 questions you have after the reading

1)

2)

3)

True or False

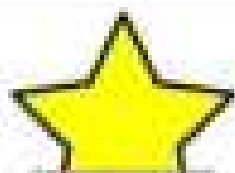
Is the statement true or false?

1. A light emitter is a light source that creates light	True	False
2. A light emitter only reflects light and does not create it	True	False
3. Stars, and the sun (also a star) are light emitters	True	False
4. The moon is a light emitter because it is bright	True	False
5. The moon is a good light reflector that reflects 100 percent of sunlight	True	False

Emitting or Reflecting Light?

Which Type?

Is the picture an example of a light emitter or light reflector?



Star

Emitter

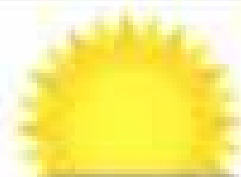
Reflector



Saturn

Emitter

Reflector



Sun

Emitter

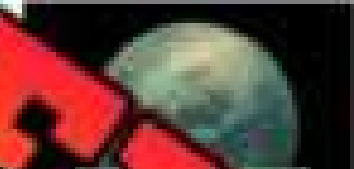
Reflector



Earth

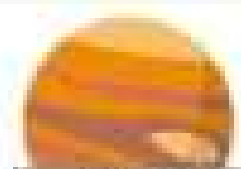
Emitter

Reflector



Emitter

Reflector



Jupiter

Emitter

Reflector



Earth's Moon

Emitter

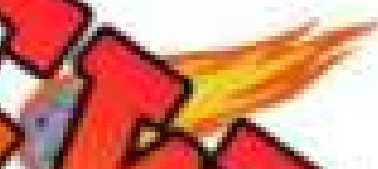
Reflector



Mars

Emitter

Reflector



Emitter

Reflector

Explain

Which celestial bodies reflect light and which emit light

Emit Light	Reflect Light

Constellations

What are Constellations?

A **constellation** is a group of visible stars that we can see from Earth. A constellation forms a pattern that often takes the shape of an animal, mythological creature, a man, a woman, or an inanimate object like a compass, microscope, or crown.

Research

Learn more about the major constellations. Draw a picture and write down any interesting information you learned about the constellation.

Constellation	Drawing	Information
The Big Dipper		
The Little Dipper		
Orion		
Taurus		
Gemini		

Conception of the Earth

Conception of the Earth

Throughout the history of mankind, scientists and people alike have argued over how the Earth came about. Many theories have come and gone, such as the Flat Earth theory, Earth-centred theory and the Sun-Centred theory. These theories will continue to be argued about as new scientific evidence comes out through space travel and other breakthroughs.

Flat Earth

The Flat Earth theory holds that the surface of the Earth is flat. This theory has been around for thousands of years ago, in the year 276 BC, Eratosthenes proved that the Earth was flat is because it appeared that the sun went around the planet's surface and it looks like the horizon line always points that way.



Flat Earth Map

Flat Earth supporters believe the edge of the world is an "Ice Wall" that prevents people from falling off the surface of the Earth. This theory has been scientifically debunked. Satellite photos have shown that the Earth is a sphere.

Earth-Centred Theory

After the Flat Earth model was debunked, Plato coined the term geocentric, which just means Earth Centred model. In this theory, Plato believed that the Earth was the centre of the universe. He believed that the stars, the sun, the moon, and other planets all moved around the Earth.

Sun-Centred Theory

Nicolaus Copernicus was the astronomer who put forth the theory that the Sun is at rest near the centre of our solar system. In 1543, he detailed his theory that all planets, including the Earth, rotate around the Sun. It took more than 100 years for his theory to be accepted and it is still the accepted theory of today.



Earth-centred model (left)

Sun-centred model (right)

Conception of the Earth

Questions

Answer the questions below using evidence from the text

1) What is the flat earth theory? Why was it debunked?

2) What is the difference between the Earth-Centred and Sun-Centred theories?

3) Is it possible for a new theory to debunk the Sun-Centred theory? Explain.

Making Connections

What does the reading tell you about your life?

True or False

Is the statement true or false?

1. Nicolaus Copernicus came up with the flat-earth theory	True	False
2. Flat Earth supporters are worried people will fall off the side of the earth	True	False
3. The Geocentric Model means the earth is at the centre of the universe	True	False
4. The most accepted theory is the Sun-Centred theory	True	False
5. The Sun-Centred theory means the sun and moon rotate around the earth	True	False

Day and Night

What Causes Days and Nights?

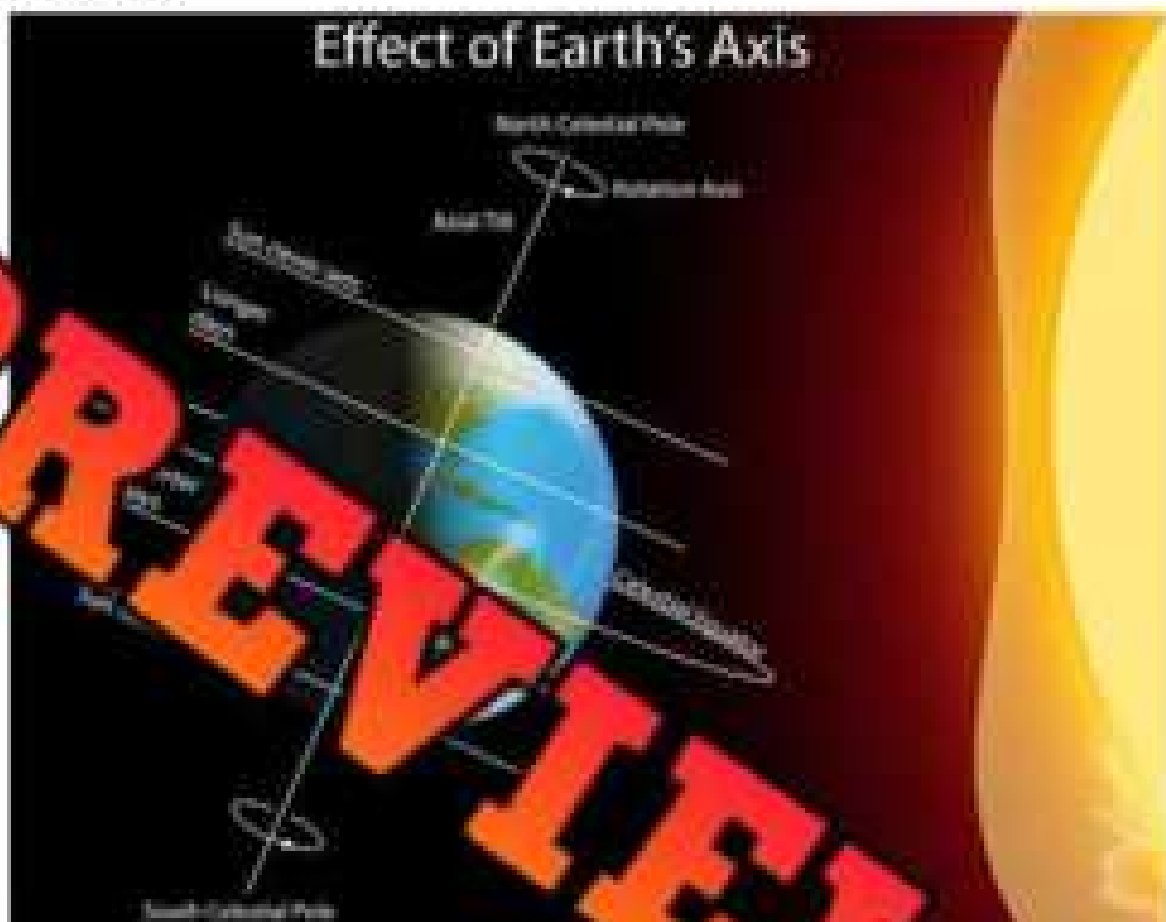
Have you ever wondered why we have days and nights? Why we get more sun during parts of the day versus during the night? It all comes down to the Earth's positioning to the sun.

The Earth spins on an axis very quickly.

Scientists have figured out that the Earth moves at a speed of 1,000 miles per hour in a full rotation every 23 hours and 56 minutes. As the Earth rotates on its axis, the side of the Earth facing the sun experiences daylight. Approximately 12 hours later, that same side of the Earth is facing away from the sun, which means it will be dark. That is why we have different time-zones because it is light in China while it is dark in Canada. In fact, in Hong Kong, it is 12 hours ahead of Toronto, or the Eastern Time Zone (Ontario).

Did you know?

Every location on Earth experiences a different amount of sunlight. Places near the equator receive approximately 12 hours of sunlight each day throughout the year, however, places near the poles can experience 24 hours of sunlight or 24 hours of darkness depending on the season. Could you imagine having a season where it never gets dark?



Day and Night

Questions

Answer the questions below using evidence from the text

1) What do you notice about the Earth's axis?

2) Why do we have days and nights? Explain.

True or False

Is the statement true or false?

1. We have days and nights due to the Earth's position relative to the sun.	True	False
2. The Earth spins 1500km/h	True	False
3. The Earth does one full rotation roughly every 24 hours	True	False
4. When a location on Earth is facing the sun, it is day time	True	False
5. Some places on Earth don't receive any daylight for months	True	False

Visualizing

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

Seasons - Earth's Orbit

EARTH'S SEASONS in the Northern Hemisphere

What Are Seasons?

We have 4 seasons that we divide our year into: summer, fall, winter, and spring. Each season is 3 months long with summer being the warmest and winter being the coldest.

Why Do We Have Seasons?

Seasons happen due to the Earth's positioning with the Sun. As the Earth orbits the Sun, the days and nights due to the Earth's rotation change. It is not the distance of the Earth from the Sun, but the angle of the Earth around the Sun.

The Earth orbits the Sun, or the Sun orbits the Earth, once a year, or every 365 days. As the Earth orbits the Sun, one side of the Earth receives more direct sunlight.



The Earth's Tilt

The Earth is tilted on its axis at 23.5 degrees in relation to the Sun. This means that as it orbits the sun, for half of the year the northern or southern hemisphere is pointed towards the sun. When the southern hemisphere is pointed towards the sun, the northern hemisphere is colder and experiences winter.

The opposite is true when the northern hemisphere is pointed towards the sun. That is also why the regions closer to the equator are always warm because they are always angled towards the sun and the angle does not change much from season to season.

As you can see from the diagram, we don't experience winter because we are further away. Even though the Earth's orbit is not a perfect circle, we experience seasons because of the Earth's tilt. On December 22, the northern part of the Earth is pointed slightly more away from the Sun than the southern hemisphere. On the contrary, in the summer, the northern hemisphere is pointed more at the sun than the southern hemisphere.

Seasons - Earth's Orbit

Questions

Answer the questions below using evidence from the text

1) Why do we experience seasons? Explain.

2) How does the Earth move in relation to the Sun. It moves in two ways, explain them both.

Making Connections

What does the revolution of the Earth mean for you in your life?

True or False

Circle whether the statement is true or false

1) It takes the Earth 24 hours to orbit around the Sun	True	False
2) It takes roughly 365 days for the Earth to orbit around the Sun	True	False
3) During the winter season, the Earth is tilted away from the Sun	True	False
4) During the summer season, the Earth is much closer in its orbit to the Sun	True	False
5) The Earth is tilted on its axis at 23.5 degrees	True	False

Phases of the Moon

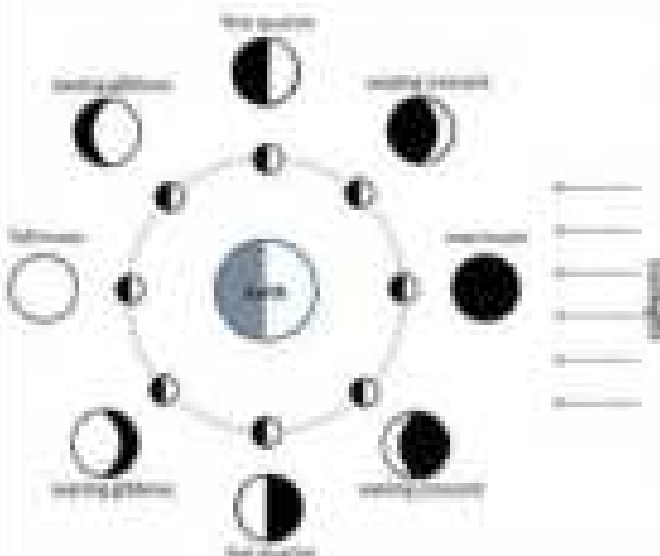
What are the Phases of the Moon?

Have you ever noticed that the shape of the moon changes? Some nights the moon is a full circle, while other nights it is a small sliver. Astronomers have figured out that we have 8 main phases of the moon, meaning we have 8 different shapes of the moon that we can see on a clear



Why does the Moon change shape?

The Moon is shaped like a sphere, and it orbits around the Earth. The Earth's moon takes about 4 weeks to finish one orbit around the Earth. Orbit means to travel in a repeated path around the Earth. Since the orbit is repeated over and over, we can predict what phase of moon we will see in the future.



The moon will go through all 8 phases in the 4-week orbit. This is called the **lunar cycle**. We see a different shape because the Sun lights up different parts of the moon as it orbits around the Earth. A new moon can't be seen, while a full moon is completely visible on Earth.

The Sun always lights up half of the moon, but what we see depends on where the Moon is in its orbit around the Earth.

Phases of the Moon

Diagram

Draw each of the phases of the moon

Waxing Crescent	Waxing Gibbous	Full Moon	Waning Gibbous	Last Quarter	Waning Crescent	New Moon	

Questions

Answer the questions below using evidence from the text

1) Why do we have different phases of the moon?

2) What is the lunar cycle? If we see a full moon, how long until the next full moon?

True or False

Circle whether the statement is true or false

1. There are 9 phases of the moon	True	False
2. The lunar cycle is 28 days long	True	False
3. The Earth orbits around the moon	True	False
4. The sun always lights up half of the moon	True	False
5. We cannot see a new moon	True	False

Lunar Eclipse vs Solar Eclipse

What is an Eclipse?

An **eclipse** is when one celestial body (planet, sun, moon) moves into the shadow of another. This happens when the celestial body is blocked by another celestial body. The term is commonly used to describe a solar eclipse or a lunar eclipse.

We have to remember that the Sun is very far away from us and the Moon. This means that the Moon orbits our planet, it sometimes gets right between the Sun and the Earth. The Earth gets in between the Sun and the Moon.

Lunar Eclipse

A **lunar eclipse** occurs when the Earth is between the Sun and the Moon. This means the Earth is blocking the Sun from the Moon as the Earth is blocking it. This casts a shadow on the Moon.

During a total lunar eclipse, you'll see the Earth's shadow moving across the moon's face. Once it totally covers the moon, the moon will appear red, rusty orange or copper-coloured.

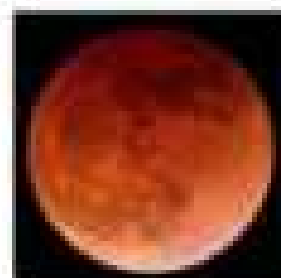
A **partial lunar eclipse** happens when the three bodies do not form a straight line. When this happens, only part of the moon is behind the Earth.

Solar Eclipse

A **solar eclipse** occurs when the Moon passes between the Earth and the Sun.

During a solar eclipse, the light from the Sun cannot reach the Earth. During a total solar eclipse, the Moon blocks out the Sun completely. A partial eclipse is when the Moon blocks out a portion of the Sun.

An **annular eclipse** happens when the Moon is at its furthest point in orbit and does not cover the Sun completely. We see a thin ring of light emerging from outside the rim of the moon.



Full or Total
Lunar Eclipse



Lunar Eclipse vs Solar Eclipse

Questions

Answer the questions below using evidence from the text

1) Why do eclipses happen?

2) What is the difference between a solar eclipse and a lunar eclipse?

Diagram

Draw a diagram of a lunar eclipse and a solar eclipse. Label the Sun, Moon, and Earth

Lunar Eclipse

Solar Eclipse

True or False

Circle whether the statement is true or false

1. A lunar eclipse is when the Moon blocks the Sun's light to the Earth	True	False
2. A solar eclipse is when the Earth blocks the Sun's light to the Moon	True	False
3. An partial eclipse happens when the Sun's light is completely blocked	True	False
4. An annular eclipse happens when we see a thin ring of light	True	False
5. A total eclipse is when the Moon/Earth blocks the Sun completely	True	False

Types of Eclipses

Questions

Which type of eclipse is the picture showing?

Word Bank

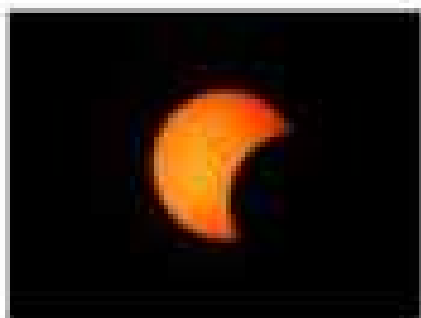
Annular Solar Eclipse

Partial Solar Eclipse

Total Solar Eclipse

Total Lunar Eclipse

Partial Lunar Eclipse



Lunar and Solar Eclipses

Research

Fill in the table below about each of the different eclipses

Eclipse	What is it?	Draw - What does the Moon look like?	Timing - When was the last eclipse?
Partial Lunar Eclipse			
Total Lunar Eclipse (Blood Moon)			
Partial Solar Eclipse			
Total Solar Eclipse			
Annular Solar Eclipse			

PREVIEW

Ocean Tides

What are Ocean Tides?

An **ocean tide** is the rise and fall of the ocean water level. When the sea level rises to its highest point, it is called high tide. When it falls to its lowest point, we call it low tide. The rise and fall of tides is known as the tidal cycle.

Tide cycles are different depending on where you are. If there is one high tide and one low tide in one day, it is called a **diurnal tide cycle**.

If there is one high tide and one low tide in one day, it is called a **diurnal tide cycle**. If there are two high tides and two low tides each day, it is called a **semi-diurnal tide cycle**. All other ocean tides are called **mixed tides**.

Tides and the Moon

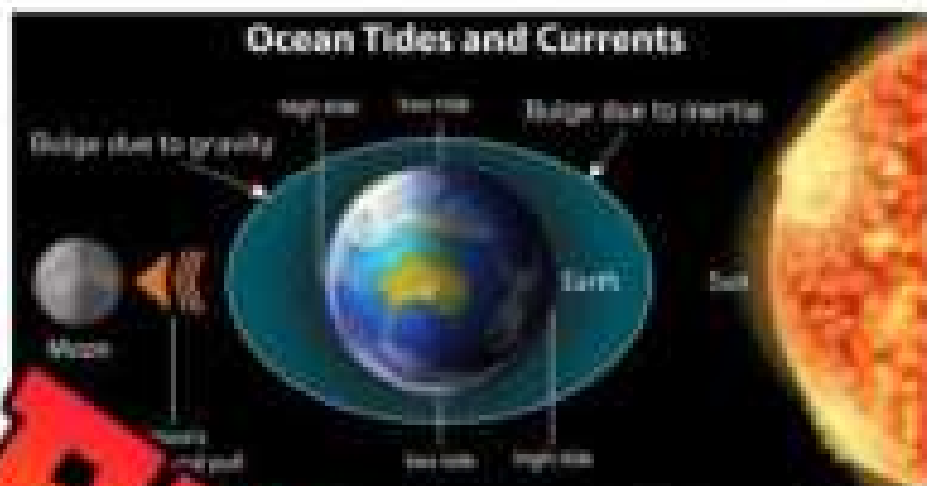
The Moon affects the tides because of gravity. Gravity pulls things towards the center of the Earth.

The Moon has gravity of its own, which pulls the ocean water towards it. Gravity on the Moon is weaker than on Earth's so we don't notice it. The pull of the Moon on the oceans is noticeable.

The oceans are pulled towards the Moon by its gravity slightly, causing waves or tides. The high tide happens on the side of the Earth that is closest to the moon. The opposite side of the Earth also produces a high tide because the Earth compensates for this pulling by bulging out on both sides of the Earth towards and away from the moon.

Solar Tide

The Sun also affects the Earth's ocean tides. However, the Sun has about half the gravitational pull than the Moon because it is so far away. Scientists group the two gravitational forces together and usually only refer to them as lunar tides.



Name: _____

43

Guided Reading Comprehension
K-2

Ocean Tides

Questions

Answer the questions below using evidence from the text

1) What is an ocean tide? What causes them?

2) What is the difference between a lunar and solar tide? Which is stronger?

Visualizing

Draw what you were picturing while reading. Explain the picture

True or False

Circle whether the statement is true or false

1. An ocean tide is the rise and fall of the ocean	True	False
2. A diurnal tide is when there are two high tides and two low tides	True	False
3. The Moon has a stronger gravitational pull than the Earth	True	False
4. Low tide is when the water is at it's lowest point	True	False
5. The Moon causes the ocean tides	True	False

Celestial Objects in the Night Sky

What is a Celestial Object?

A **celestial object** is a natural object which is located outside of the Earth's atmosphere. The Moon, the Sun, an asteroid, planet or star are all examples of celestial objects.

We can see the same celestial objects in our night sky, between sunset and sunrise. If the sky is clear with no clouds, many celestial objects can be seen with an unaided eye, binoculars or telescope. Sometimes, we can only see certain celestial objects during certain times of the year. This is because we are orbiting the Sun and other planets are also orbiting the Sun. Travelling at different speeds, but these speeds, orbits, and rotations are predictable. This gives scientists the ability to understand when certain celestial objects will be visible.

List of Celestial Objects

- **The Moon** – Can be observed almost every night if the sky is clear.
- **Jupiter** – Jupiter is the largest planet in our solar system. It is very bright and exciting to observe. It is best observed just hours before sunrise because the visibility of it lessens when the sky gets brighter.
- **The 5 Visible Planets** – the five planets that are closest to Earth can be easily seen in the night sky with the naked eye. These planets from closest to the Sun are – Mercury, Venus, (Earth), Mars, Jupiter, Saturn. With a telescope, you can see dynamic features like Jupiter's cloud belts, Saturn's rings and Mars' ice caps.
- **The Big Dipper** – The best known constellation – collection of stars that consists of seven stars.



Celestial Objects in the Night Sky

Questions

Answer the questions below using evidence from the text

1) Why are some celestial bodies only visible during certain times of the year?

2) When should we look to see Jupiter?

Making Connections

Have you seen a celestial body? Explain.

True or False

Is the statement true or false?

1. The Earth is a celestial body	True	False
2. The Big Dipper is a collection of 7 stars	True	False
3. Uranus is part of the 5 visible planets	True	False
4. Jupiter can be seen with the naked eye	True	False
5. We see stars and planets randomly on random days throughout the year	True	False

Canada and Space Exploration

Canada and Space

Canada's contribution to space exploration

Technologies	What Are They?
Hubb Space Telescope	

9 Canadians have flown into space. Research the names of 9 Canadian astronauts and their names below.

1.	6.
2.	7.
3.	8.
4.	9.
5.	

Space - Extreme Environment

Space is one of the most extreme environments imaginable. The spaceships are subjected to extremes temperatures, both hot and cold, and the threat of radiation damage. Each spacecraft that is launched into space deals with many dangerous situations throughout its journey.

1. When the spacecraft is launched, the rocket that sends the spacecraft into orbit will shake and vibrate. It is extremely loud inside the spaceship. The engineers who build the spacecraft must test whether it will hold up under these conditions. To test it, they simulate the rocket launch in a laboratory.
2. Temperature in space can be extremely cold – hundreds of degrees below freezing to many millions of degrees below zero – especially when the spacecraft goes closer to the Sun.
3. The radiation (heat) from the Sun can cause the electronic technology on the spacecraft to malfunction if the spacecraft is not insulated properly.
4. While in outer space, there is no air and no gravity. The space suits astronauts wear protect them from the vacuum of space and the low pressure in space. If they took off their suit, the low pressure would cause their blood to start to bubble, removing oxygen from the blood and starving the brain of oxygen.
5. Sickness is an issue for people in space. Humans are built to live under conditions with gravity. The feeling of weightlessness due the zero gravity causes symptoms of nausea, vomiting, dizziness, headaches and tiredness.
6. With no gravity, showers do not work. Instead, astronauts will take a sponge bath.
7. Astronauts need to exercise in space because without gravity, they do not exercise their muscles. They secure their bodies and lift using bands that create tension. Regular weights wouldn't work as weight is the force of gravity!



Space - Extreme Environment

Questions

Answer the questions below using evidence from the text

1) Why is living in space an extreme environment?

2) What might be the hardest part of being in space?

Visualizing

Draw what you were picturing while reading. Explain the picture

True or False

Is the statement true or false?

1. Extreme temperatures go from 0 to hundreds of degrees above 0	True	False
2. Living in space can lead to nausea, headaches, tiredness, and vomiting	True	False
3. Astronauts must wear a space suit to maintain an ideal pressure	True	False
4. Astronauts take showers to keep clean in space	True	False
5. Muscle loss is common for astronauts in space	True	False

Surviving in Space

Human Needs in Space

Humans have basic needs in order to survive on Earth and in space. Having these needs met in space is challenging. Astronauts must have oxygen, food, water, and rest. On Earth, it is pretty simple to meet these needs. In space, it becomes much more complicated.



Oxygen

The gas in space is not good for human life. Worse yet, is the fact that most of space contains no gas at all. Scientists call space a vacuum. Spacecrafts need to supply astronauts with oxygen. When an astronaut leaves the spacecraft, their spacesuit provides them with the oxygen they need.

Food

When humans first travelled to space, they brought the dried food on their missions. Astronauts would add water to the food. They also moved their menu for astronauts, allowing them to bring lots of different foods, such as, soups, crackers, and fruits. Foods low in salt are important for astronauts because eating salty foods can bring on bone loss, which is a problem in space.

Astronaut Strawberries

Rest

Even on the most important space missions, the astronauts still need to rest their bodies. Sleeping on a spacecraft is a little more challenging because there is no sunset in space. Most astronauts wear blindfolds to block the sun. Another issue is the lack of gravity. Astronauts sleep in special sleeping bags that are strapped down to the floor.



Surviving in Space

Questions

Answer the questions below using evidence from the text

1) How do astronauts survive without oxygen in space?

2) What do astronauts eat in space? What did they use to eat?

Questioning

Write 3 questions you have after the reading

1)

2)

3)

True or False

Is the statement true or false?

1. Gravity allows astronauts to sleep in beds	True	False
2. Astronauts can eat whatever they'd like now in space	True	False
3. Most of outer space has no gas - it is considered a vacuum	True	False
4. Astronauts do not need to rest as much as we do	True	False
5. We have the same needs on Earth as we do in space	True	False

Benefits of Space Exploration - Satellites

Satellites

A **satellite** is a small object that orbits around the Earth.

The first satellites were designed to study the space environment and test whether a satellite or spacecraft could survive in Earth's orbit. Since then, there are

6,542 artificial satellites currently orbiting the Earth.

Below is a list of ways you have used satellites lately.

- 1) **Eating Food** - The food you ate used ingredients harvested by farmers. Farmers use satellites to help them water their wheat fields.
- 2) **Watching TV** - People all over the world have satellite TV. The shows you watch are transmitted from a satellite dish on our house and into our TV.
- 3) **Making a Phone Call** - When you have a problem - call the park ranger with your satellite phone. It will never have a problem.
- 4) **Posting a Story on Social Media** - Social media is becoming more popular, especially in rural areas. It can provide high-speed internet anywhere in the world.
- 5) **Paying for a Hot Chocolate** - When you use your credit card, a link is made between the business and your bank to use the money you have in your bank account.
- 6) **Deciding What to Wear** - Weather apps use satellites to collect data on temperatures, precipitation, cloud movement, and wind direction.
- 7) **Tracking a Flight** - If you're picking up a friend from the airport, you can track their flight because of satellites. Airplanes send a signal to satellites while in flight.
- 8) **Crossing a Bridge** - Driving across town to grab a bite to eat? When you cross a bridge, feel confident because satellites are monitoring ground movement, as well as bridge and road stability.
- 9) **Breathing Fresh Air** - The Canadian satellite SCISAT gathers information about 40 different atmospheric gases. They research the quality of the air.
- 10) **Finding Directions** - GPS uses satellites to pinpoint your location. Since they know where you are, they can direct you to your destination.



Benefits of Space Exploration - Satellites

Questions

Answer the questions below using evidence from the text

1) Why are satellites important to our everyday lives?

2) What technology do you miss the most if we didn't have satellites in space?

Making Connections

How have you used satellites lately?

Word Scramble

Unscramble the words below using the word bank

Satellite	Orbit	Transmit	Research	Signal	Artificial
-----------	-------	----------	----------	--------	------------

TTINRMAS		ISELTTEAL	
AISGLN		ARLCITIFA	
ITROB		HCSREARE	

Space - Understanding Climate Change

Space Developments - Understanding Climate Change

Scientists are using space to learn more about our Earth. By using satellites that orbit space, researchers can receive images that tell us more about how our planet is changing. In addition, new technologies are able to detect areas of high greenhouse gases. Together, these technologies can help us reduce global warming and climate change.

Satellite Images

Satellites have the ability to take pictures of the earth from our vantage point in space. This provides scientists with useful information about crop development, drought, and other environmental changes.



Satellite images can provide information about how our planet is changing. Time-lapse photos from space show that forests are rising, glaciers are melting, and soils are drying as deserts are growing.



Slowing Climate Change

New technologies launched into space are also being used to slow climate change. For example, the positioning, navigation, and timing (PNT) technology is being positioned in space above areas of high emissions. This technology is usually positioned over transportation routes, like highways. It tracks the amount of emissions being released.

As law-makers make changes related to vehicles, the PNT technology can track their effects on emissions. Banning gas-powered vehicles and rewarding people to drive electric vehicles are two laws that will affect emissions. The law-makers have also made changes like adding carpool lanes and work-from-home laws. The PNT technology will tell law-makers if their new laws are working to slow down greenhouse gas emissions.

Space - Understanding Climate Change

Questions

Answer the questions below using evidence from the text

1) What is satellite imaging? How is it helping us understand the effects of climate change?

2) What is being tracked by the PNT technology? How will this help slow down climate change?

Summarize

What is the main idea of the text? List supporting details.

True or False

Circle whether the statement is true or false

1) Satellite imaging is showing that sea levels are getting lower	True	False
2) Satellite imaging is show that glaciers are melting	True	False
3) Law-makers will use the information from PNT to make new laws	True	False
4) Studying satellite images tells us how our planet is changing	True	False
5) Our planet is not changing very much, so we don't need to make changes	True	False

Technology Needed for Space Exploration

Technologies Needed for Space Exploration

There are 5 technologies that are needed to explore space: (1) spacecraft, (2) super-high-speed optical communication, (3) telescopes, (4) spectroscopes, and (5) life-support systems.



Spacecraft

A spacecraft is a vehicle used for travelling in space. A rocket is used to launch a spacecraft into space. Once the spacecraft has left Earth's atmosphere, the rocket is lost in the process. The spacecraft must provide the astronauts with everything they need to survive in space (oxygen, water).

Super-High-Speed

The astronauts in space must be able to communicate with the team on Earth who help support the mission. Communication from a spacecraft takes a long time, as the distance is much farther than say sending a message from New York to Canada. As of now, it takes 90 minutes to send a photo from Mars to Earth.

Telescopes

Telescopes allow scientists on Earth to study distant objects in the Universe by detecting the heat or radio waves they emit. Knowing what is in our Universe allows us to plan for space exploration.

Spectroscopes

Spectroscopy provides information about molecules, atmospheric conditions, and composition that gives scientists a better understanding of the solar system. This information gives astronauts more understanding of what they may encounter in space.

Life-Support Systems

The spacecraft provides life-supporting needs like air, water, air temperature, waste disposal, and pressure regulation. Without these life-supporting systems on the spacecraft, no astronaut could survive.

Mars Rover

Why Explore Mars

Mars is the fourth planet from the Sun. Even though Venus is closer to Earth than Mars is, it is a lot more difficult to visit than Mars. Since Venus is closer to the Sun, its surface temperature is hot! In fact, it is 426 degrees Celsius! That and its carbon-dioxide-rich atmosphere that is 90 times denser than Earth's, make it very difficult to explore.

Mars is the planet that is most similar to Earth. It is the most likely planet to have life other than Earth. Here are some of the similarities and differences below.

	Earth	Mars
Distance From Sun	149.6 million km	228 million km
Length of Day	24 hours 37 minutes	24 hours 37 minutes
Force of Gravity	9.8 m/s ² (stronger)	0.375 times weaker than Earth
Moons	One Moon	Two Moons
Average Temperature	13 Degrees Celsius	-42 Degrees Celsius
Size - Diameter	12,756 km	6,791 km
Water	71% of Earth covered in water	100 times drier than the driest parts of Earth

Mars Rovers

Over the last 25 years, NASA has sent 5 rovers to Mars to learn more about the planet. The first rover weighed only 23 pounds and could travel at only 0.03 kph. In 2021, the Perseverance Rover landed on Mars. It weighs 2,260 pounds and can travel 0.12 kph (4 times faster). The

Perseverance Rover even has a helicopter named Ingenuity. Together, they are looking for signs of past or present life in hopes to see if humans could one day explore Mars.

Rovers provide information to scientists on Earth. They can tell us what different parts of the planet are made of, what gases make up the atmosphere, and provide pictures of landforms on Mars. The information above has been collected by rovers on Mars.



Name: _____

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Guided Reading Connection
SS.122.2.2.1

Mars Rover

Questions

Answer the questions below using evidence from the text

1) Which planet would be easier to live on - Mars or Venus? Explain.

2) Do you think we could eventually live on Mars? Explain what we would need in order to live there.

Visualizing

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

True or False

Is the statement true or false?

1) Mars is bigger than Earth	True	False
2) Mars has a lot of water, so maybe human life could survive there	True	False
3) It is warmer on Earth than on Mars	True	False
4) Mars is the closest planet to Earth	True	False
5) The Perseverance Rover is looking for life on Mars	True	False

Rovers on Mars

Learn more about the Mars rovers by researching them online. Try searching, 'the Mars rovers' to find information about each rover that has explored Mars.

Research

Learn more about the rovers that have landed on Mars.

1) a) What was the first rover to land on Mars?	
b) What was the weight of the rover?	
c) What was the top speed of the rover?	
d) When did it land on Mars?	
e) What was the speciality of the rover?	
2) a) What were the second and third rovers to land on Mars?	
b) What was the weight of the rovers?	
c) What was the top speed of the rovers?	
d) When did they land on Mars?	
e) What was the speciality of the rovers?	

Rovers on Mars

Research

Learn more about the rovers that have landed on Mars

3) a) What was the fourth rover to land on Mars?

b) What was the weight of the rover?

c) What was the top speed of the rover?

d) When did it land?

e) What was the speciality of the rover?

4) a) What was the fifth rover to land on Mars?

b) What was the weight of the rover?

c) What was the top speed of the rover?

d) When did it land on Mars?

e) What was the speciality of the rover?

Controversy of Space Travel

Controversy of Space Travel

Human spaceflight has been debated for its positives and negative outcomes for many years. NASA retired its Space Shuttle program in 2011 because it was too expensive to maintain and did not deliver the major leap forward in scientific research. Read below to learn about the positives and negatives to space travel.

Positives

There is a lot of evidence that space exploration has improved our knowledge in a number of different fields.



- Understanding our planet better
- Performing riskier medical procedures from medical technologies that were inspired by Canadian robotics in the 1960s
- Cell phone capabilities – to have cell phones would be impossible without satellites
- Satellites give us information on weather, climate, and climate change
- Information about our solar system, galaxy, and universe
- Development of technologies such as orange drink and pacemakers

Negatives

The main concerns of space exploration is the risk and the cost.

- In the USA alone, over 20 astronauts have lost their lives while working in space
- Astronauts that make it home alive were exposed to strong radiation as a result of being so close to the sun. This might affect their health later in life.
- The past few space shuttle missions did not provide scientists with new information. So what is the point?
- Space pollution – debris from spacecrafts continue to orbit the Earth
- The COST! The Apollo space program cost the US government \$25.4 billion in the 1960's. With inflation, that cost would be about \$152 billion of today's dollars. This tax money could have been spent on improving our schools or hospitals.

Controversy of Space Travel

Questions

Answer the questions below using evidence from the text

1) What are some of the drawbacks to space travel?

2) Why should we continue to pay for space exploration? Explain.

Questioning

Write 3 questions you have about reading

1)

2)

3)

True or False

Is the statement true or false?

1) No one has lost their life in space	True	False
2) Space travel can be dangerous	True	False
3) Space travel costs a lot of money, billions of dollars	True	False
4) We have benefitted from technologies made for space travel	True	False
5) Satellites give us information about climate, weather, and climate change	True	False



SYSTEM INVESTIGATION AND COMMUNICATION PREVIEW

Spa





Grade 6 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	84 - 85, 91, 94
A1.2	use a scientific experimentation process and associated skills to conduct investigations	70 - 75
A1.3	use a engineering design process and associated skills to design and build devices, models, structures, and/or systems	76 - 85
A1.4	follow safety procedures during science investigations, including wearing appropriate safety clothing and safely using tools, instruments and materials	70 - 85
A1.5	communicate their findings using science and technology vocabulary and formats that are appropriate to the audiences and purposes	70 - 85
A2.1	write and execute code in investigation, including modelling concepts, with a focus on obtaining data in different ways for a variety of purposes	86 - 92
A2.2	identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	86 - 92
A3.1	describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems	86 - 87, 89, 91, 93, 95
A3.2	investigate how science and technology can be used with other subject areas to address real-world problems	86 - 87, 89 - 91, 93 - 95
A3.3	analyse contributions to science and technology from various communities	86 - 87, 89 - 90

Gravity - Science Experiment

Information

What is this experiment about?

What affects the forces of gravity? If we drop two objects that weigh the same but are different in shape, which will fall first? What if the objects weigh different amounts but have the same shape?

Research Question

Out of the 5 items we chose, which item will fall the fastest (have the strongest gravitation)? Which will fall the slowest?

Hypothesis: _____

Materials

1. 5 different objects – choose items that have no air resistance (no feathers)
2. Stopwatch
3. High point to stand on

Procedure

1. Move to the high point where you will drop your object
2. Have a friend ready with a stopwatch
3. The stopwatch operator says go when they are ready, and the person up high drops the object
4. When the object hits the floor, the stopwatch operator clicks stop
5. Do this for all 5 objects and record your times in the chart below

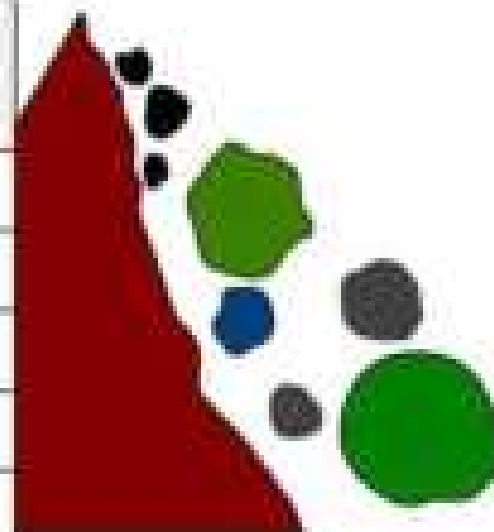
Object	Time

Gravity - Science Experiment

Rank

Rank the objects in order of how fast they fell

Rank 1 - Fastest 5 - Slowest	Object
4	
5	

**Result**

Answer the questions from the experiment

1) Was your hypothesis correct? Why or why not?

2) What did you notice about the results? Does the weight of an object affect the gravitational pull on the object? Does the shape of the object affect the results?

3) Why do you think you saw these results?

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: $20 + 300 + 5 = 325$ grams.



Materials What you need for the experiment

- Spring scale - to measure the weight of objects in Newtons or grams
- Balance scale - to find the mass of objects in grams
- 6 objects that you can weigh on both scales (check both)
- Optional - Buckets - to use if you will put your objects in

Procedure How you will perform the experiment

- 1) Weigh each object using the spring scale and then the balance scale.
- 2) When weighing using the spring scale, if you use a bucket, you will need to subtract the weight of the bucket.
- 3) Convert the units from the spring scale into grams or kilograms.

Observations Fill in the table below with your observations.

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

Name: _____

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Calculate Questions
ALL ALL ALL

Mass vs Weight - Experiment

Results:

Answer the questions below



1) What force is acting on the spring scale?

2) How does a 3-beam balance scale work? How does it tell us the mass of an object?

3) What is the relationship between mass and the weight of an object?

4) Were the mass and weight of the objects the same? Explain.

5) If you weighed the same objects on the moon, how much would each weigh? Remember, our weight on the moon is six times less.

Experiment - Rotating Earth

Research Question

Why do we have day and night?

Why do we have a day with light and a night with no light?



Materials

What do we need for our experiment?

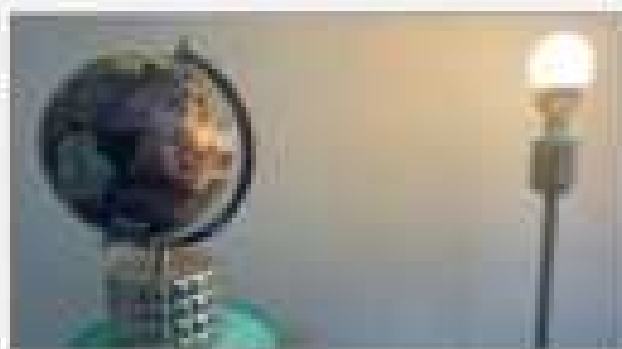
- 1) Globe
- 2) Lamp or light
- 3) Dark room



Method

How do we complete our experiment?

- 1) Take the lamp shade off the lamp
- 2) Put the globe about 20 centimetres away from the light
- 3) Point the globe so that Canada is being lit up. Notice that the world are dark while Canada is light.
- 4) Spin the globe slowly. Notice if some parts are now a bit lit up and some places are now in the dark.
- 5) Keep spinning the globe until Canada is now in the dark. Which countries are now lit up?
- 6) Now switch the position of the lamp and the globe. Notice when you repeat the steps above that Canada is either further or closer to the Sun. This creates our seasons.



Experiment - Rotating Earth

Observations

Answer the questions below



1) When it is light in Canada, which countries are in the dark?

1)

2)

3)

4)

5)

2) When Canada is positioned so that it points toward the Sun, which season is it?

Summer

Winter

Fall

Spring

3) When Canada is positioned so that it points farthest from the Sun, which season is it?

Summer

Winter

Fall

4) Why do we have seasons? Describe the relative locations of the Sun and the Earth during each season.

Summer

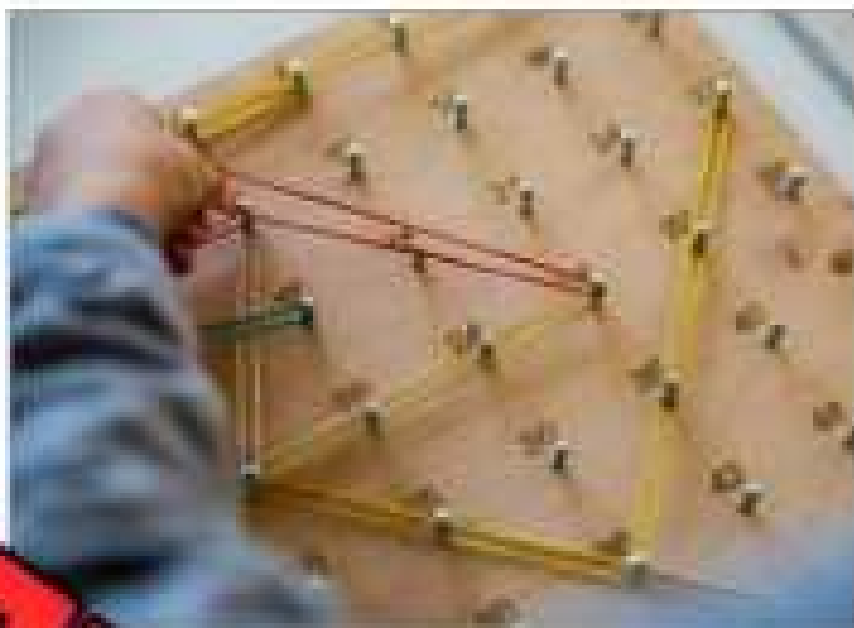
Fall

Winter

Spring

Experiment - Geoboard Constellations

Use a geoboard to represent 4 constellations. You can research your own, or choose from the options provided. Once you created your geoboard constellation, draw it using dot paper.



Materials

needed

- Paper with dot paper
- Geoboard
- Elastics
- Constellations

Procedure

How you perform the experiment

- 1) Research or choose 4 constellations from the options provided to you
- 2) One at a time, represent a constellation using elastics on the geoboards. You likely won't be able to represent it perfectly, but do your best!
- 3) Draw each constellation on the dot paper before moving on to the next constellation

Orion Constellation

Hercules Constellation

Experiment - Geoboard Constellations

Examples

Below are some examples of constellations you can use

Draco Constellation

Constellation

Serpens Constellation

Grus Constellation

Triangulum Constellation

Sagittarius Constellation

Perseus Constellation

Pegasus Constellation

Orion Constellation

Name: _____

79

Constellation Worksheets
AT ALL LEVELS

Experiment - Geoboard Constellations

Draw

Draw each constellation you decide to represent on your geoboard

Constellation Name	Drawing	How Many Stars

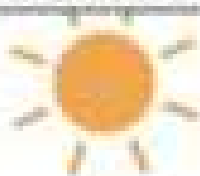
Constellation Name	Drawing	Many Stars

Experiment - Making a Sundial

Research Question

Can we tell time without a watch?

A sundial can be used to tell the time using shadows. Where the shadow points is the time.



Materials

What do we need for our experiment?

- 1) Plate
- 2) Marker
- 3) Pencil
- 4) Playdough or clay

Method

How do we do the experiment?

Create Your Paper Plate Sundial

- 1) Write the numbers on the plate, just like a clock. Your sundial will look just like a clock.
- 2) Stick a pencil through the middle of the paper plate with the clay to make it stand up.

Using Your Sundial

- 1) First thing in the morning, find a sunny area where there won't be any shade (away from trees)
- 2) Put the plate down and check the time. When it is a round number (ex. 9:00am), turn the plate so that the shadow points to the current time
- 3) Check back in an hour to see if the sundial is working.
- 4) When the shadow is between numbers, the time is between those numbers. For example, if it is between 1 and 2, it could be 1:30. If the shadow is closer to the 2, it could be 1:45.

Experiment - Making a Sundial

Observations

Check your sundial throughout the day



Where is the Shadow Pointing (Between the _____ and the _____)	Time Estimate (Guess the Time)	Clock Time (Check afterwards)

Results

Answer the questions

1) How accurate is your sundial?

2) Can you use the sundial to determine the time to the nearest minute or second? Explain

3) How do sundials work? Does the Earth move in a predictable pattern around the Sun?

Experiment - Moon Phases

Recreate the moon phases using Oreo cookies. Follow the instructions below to complete the activity.

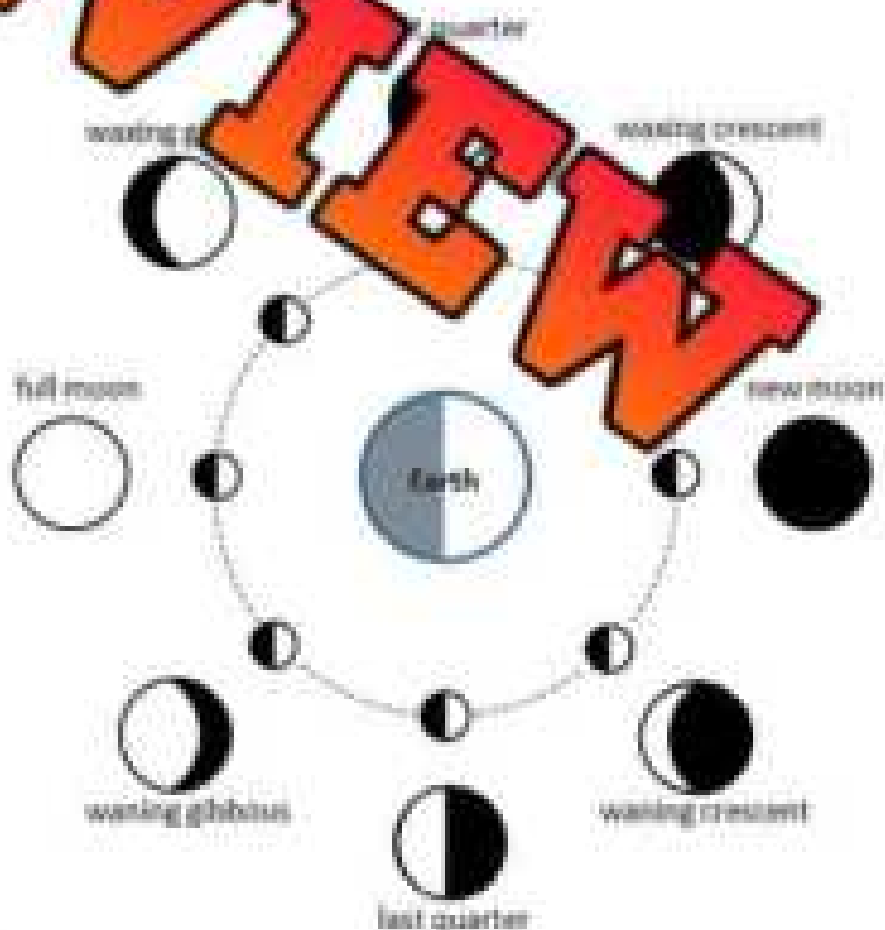
Materials: What you need

- 8 Oreos
- Popsicle sticks
- A popsicle stick for scraping the icing off the cookies



Procedure: How to complete the activity

- 1) Separate the cookie so that the icing is on one side of the cookie and not the other. Twisting the cookie a bit works to achieve this.
- 2) Use the popsicle stick to create each phase of the moon
- 3) Glue the phase of the moon onto the paper plate. Make sure to put them in order
- 4) Label the moon phases with their official name



Experiment - Moon Phases

Results

Answer the questions below

1) Does the Moon emit light or reflect light?

2) Does the Moon move around the Earth or does the Earth move around the Moon?

3) What are the phases of the moon?

4) Why are the phases of the moon the way they are? How do astronomers know what moon phase we will have a month from now?

5) Go online and search "Moon Phase Calculator". Write down the moon phase we will have on your next birthday. Then find out the moon on your 30th birthday and your 60th birthday?

Date	Name of Moon	
Next Birthday		
30th Birthday		
60th Birthday		

Solar System Assignment

Assignment

What are we learning more about?

Our solar system is a fascinating collection of planets, moons, asteroids, comets, meteoroids, and our star – the Sun. The components of our solar system are in certain positions that scientists have figured out using high-powered telescopes, satellites, and space probes.

You will be asked to represent the 8 planets in our solar system. You should try to be as accurate as possible in their position relative to each other. The main goal is to have the Earth closest to the Sun because it supports life. The third planet from the Sun.

In addition, the size of the planets should be considered and created to scale. Our sun's diameter is about 11 times larger than Earth's and Jupiter's diameter is about 11 times wider than Jupiter's.

When you are finished, you can present your solar system to the class. Your class could do a science fair where you show your solar system.



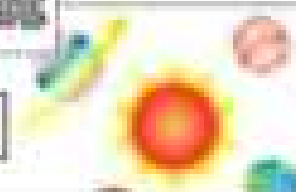
Ideas

Check out some ideas for models below. Search for more ideas:

- A fruit inspired solar system on a paper plate
- Brownie solar system
- Play dough solar system
- Styrofoam solar system
- Button solar system
- Yarn wrapped solar system
- Plastic lid solar system
- Solar system mobile
- Coat hanger solar system



Solar System Assignment

**Planning**

Explain the model you chose

1) Describe the model you will make.

2) Write the planets in order from smallest to largest.

3) Write the planets in order from smallest to largest below.

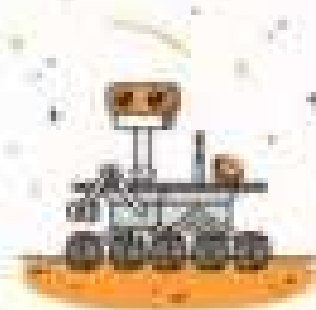
4) Write the planets in order from closest to the Sun to furthest.

5) How will you make sure the planets will be the right size and in the right order from the Sun?

Coding - Driving the Mars Rover

About the Perseverance Rover

On July 30th, 2020, the Perseverance rover launched and began its voyage to Mars. Fast forward to February 18th, 2021, and the car-sized Perseverance rover landed inside the Red Planet's Jezero Crater. The goal of the rover is to search for signs of ancient Mars life and collect samples for its return to Earth.



Driving the Rover

Here on Earth, it is 10:00 am in California, but on Mars it is 4:00 pm. A robot named Victoria begins her 10-hour shift to drive the Mars rover. She has been on Mars since 2008. She lives in two different worlds, spending time on Mars as well as on Earth.

Verma worked on the software program used by Perseverance. The new rover is able to move around Mars, sending constant direction from the team on Earth. Perseverance can even move rocks on its own.

Commanding the Rover

To get the rover to follow instructions, the robot needs a driver to follow. They beam the codes up to Mars through the Deep Space Network, which is NASA's interplanetary communications network. The network uses radio frequencies that travel through large antenna systems.

With the distance between Mars and Earth being so large, it takes about 20 minutes for the commands to reach the rover. This makes it challenging to tell the rover what to do. The driver on Earth will command the rover to move up to 100 metres. After 20 minutes, they can see if the rover is approaching a cliff or other dangerous obstacle.

The driver can also command the rover to perform science experiments on Mars or investigate targets that were previously discovered.

if rover sees an interesting rock

then define its location as

move to

then of

Coding - Driving the Mars Rover

True or False

Circle whether the statement is true or false

1) Commands are sent immediately from Earth to the rover on Mars	True	False
2) The driver has to wait 20 minutes for the rover to execute a command	True	False
3) There are cliffs on Mars that could be dangerous if the rover went over	True	False
4) The rover can do many things on Mars without the driver's commands	True	False
5) It is <u>hotter</u> on Mars than on Earth	True	False

Questions 6-8: Answer the questions below using evidence from the text.

1) How does the driver communicate with the rover on Mars?

2) Does the Perseverance rover use code? Explain.

Directions

Read the program and follow the instructions to draw the output.

if  is clicked

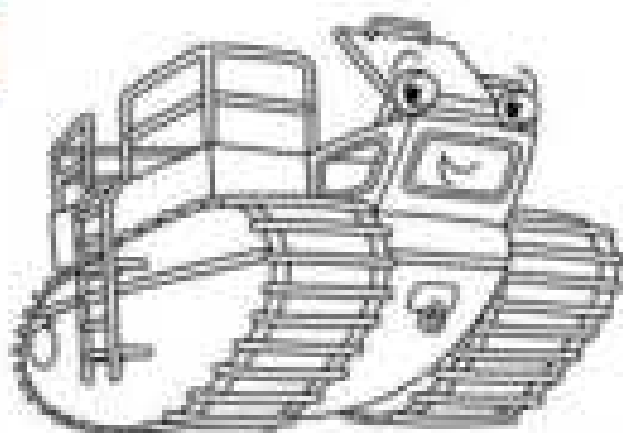
colour the tracks

colour the body

colour the ladder and rails

colour the hatch

colour the windows



If Then Conditional Statements - Activity**Directions**

Follow the if/then statements to move the rover to the rocks

1)	if our solar system is bigger than the universe	then	Move down 3 spots
2)	if the Earth is closer to the Sun than Mars	then	Move right 5 spots
3)	if the Sun is a star	then	Move down 4 spot
4)	if a planet is made of ice, rock, and dust	then	Move left 3 spots
5)	if a planet is the closest planet	then	Move down 3 spots
6)	if water is closer to the Sun	then	Move down 4 spots
7)	if we were on the Moon on Earth	then	Move left 2 spots
8)	if we have the same amount of air on Earth	then	Move left 2 spots
9)	if the moon emits light	then	Move up 3 spots
10)	if the Sun emits light	then	Move right 4 spots

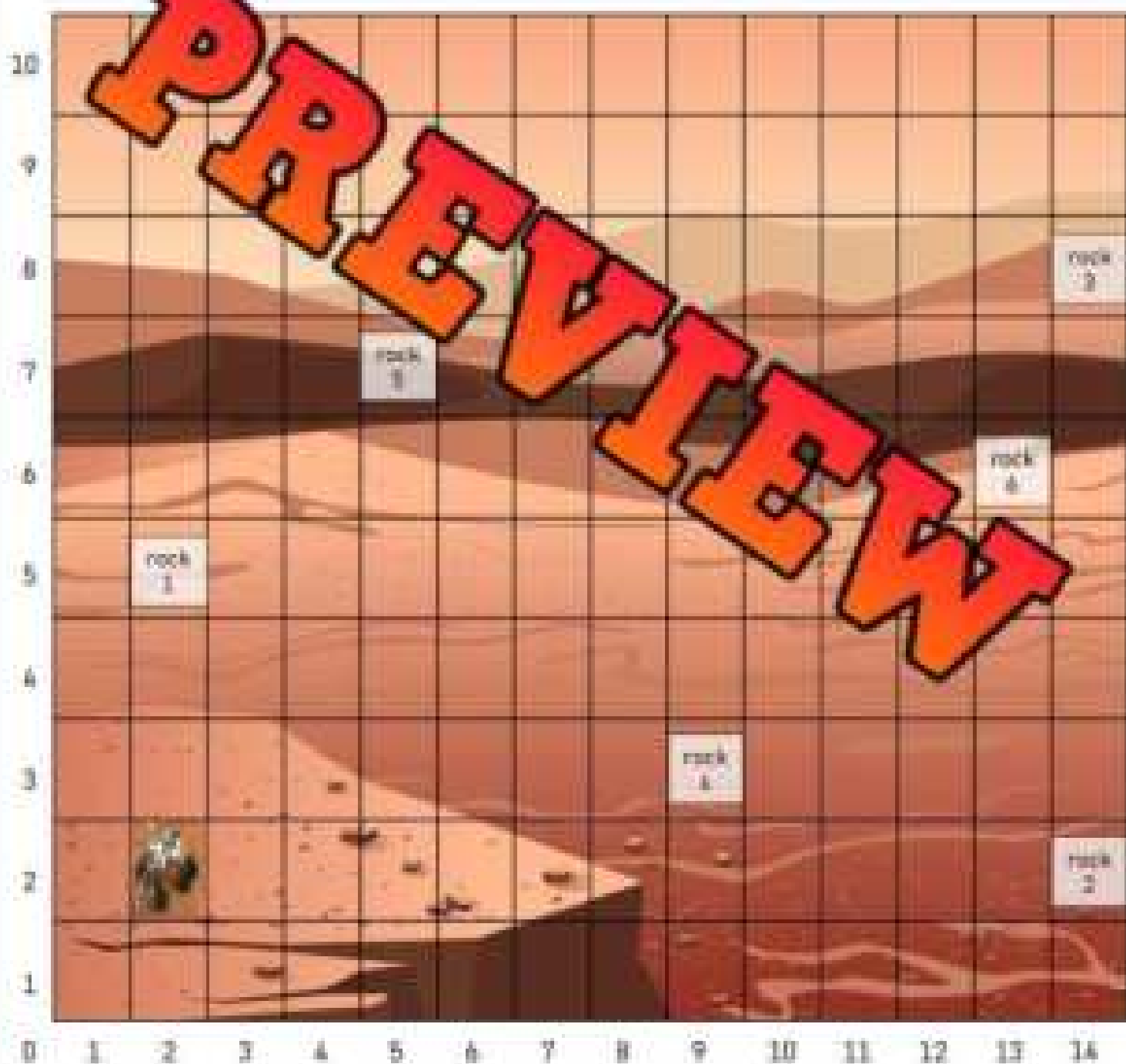


Coding - Driving the Mars Rover

The map below shows the Jezero Crater on Mars. There is a cliff in the front that the rover should not travel over, or it could break. The rover has found interesting rocks and defined those areas as rock1, rock2, rock3, rock4, rock5, and rock6.

Mapping

Use this map to write the code on the next page



Coding - Driving the Mars Rover

Coding

Write code that moves the rover to all 6 interesting rocks. Have the rover take pictures at each location.

Example

- move to (3, 5)
- take 5 pictures of rock 1
- move to (5, 5)
- take 3 pictures of rock 2

Code

PREVIEW

Question

What would happen if the rover stopped working because of a crash?
How bad would that be?

STEAM Assignment - Designing a Rover

Create your own rover that can explore a new planet. Consider the following questions.

What tools does your rover need?

- camera, hatch to collect samples, propeller to fly, etc.

What is your rover capable of doing?

- Can it fly?
- Can it move quickly?
- Can it see in dark?
- Does it have vision allowing it to see living things?

What will your rover be designed to do?

- Will it check for alien life or plants?
- Will it check for places humans could live in?



Questions

Answer the questions about your rover below.

1) What is the name of your rover?

2) What tools will your rover have?

3) What is your rover capable of doing?

4) What will your rover be designed to do?

STEM Assignment - Coding My Rover

Write simple If/Then statements so that the driver of the rover can send instructions for the rover to follow. For example, to work a flashlight on the rover, the code could look like this.

If the flashlight button is pressed

THEN turn on the flashlight



IF/THEN Write a code for each tool that your rover has so that you can control the tools

IF

THEN

IF

THEN

IF

THEN

IF

THEN

IF

THEN

IF

THEN

IF

THEN

PREVIEW

STE Assignment - Rover Exploration

Which planet will your rover explore? Choose a planet and learn more about the size of the planet as well as the conditions the rover will need to navigate through.

Questions

Answer the questions about the planet your rover will explore

1) Which planet will your rover explore?

2) What is your rover looking for on this planet?

3) How big is the planet? How does it compare to the size of the Earth?

4) Will your rover be able to explore much of this planet? How fast about how fast the rover can move and how it moves in your answer.

5) What are the conditions on this planet? Is it hot or cold? Is there water? Does it have mountains or volcanoes? Can your rover survive these conditions?