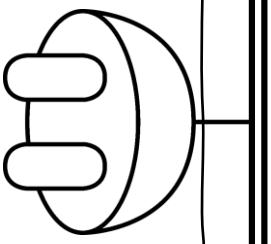
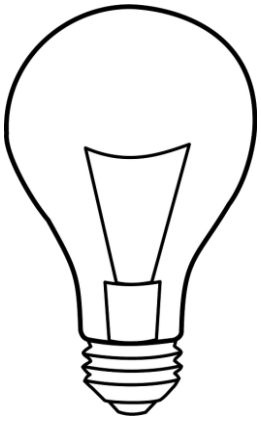
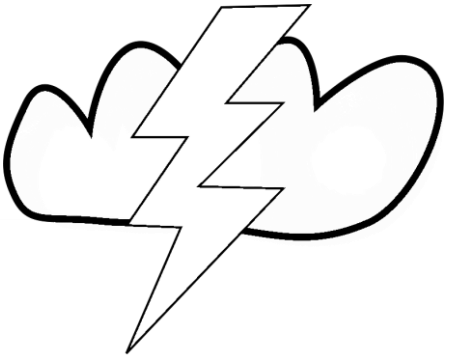
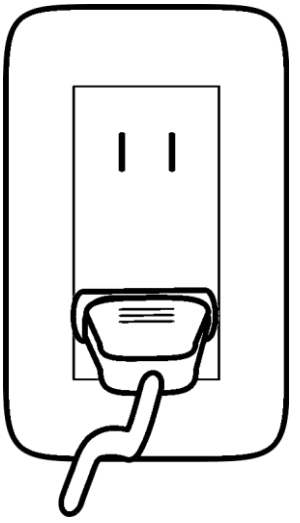
NAME: _____

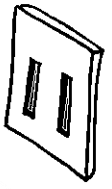
Electricity & ELECTROMAGNETISM

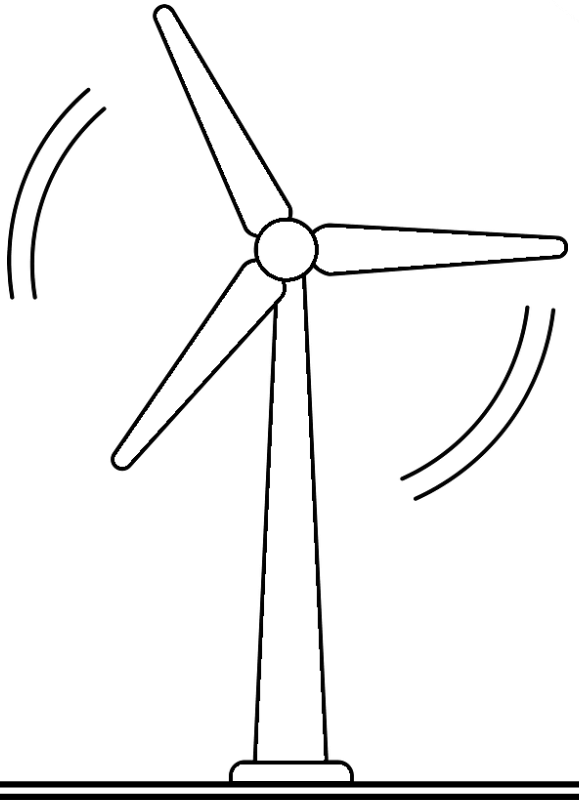


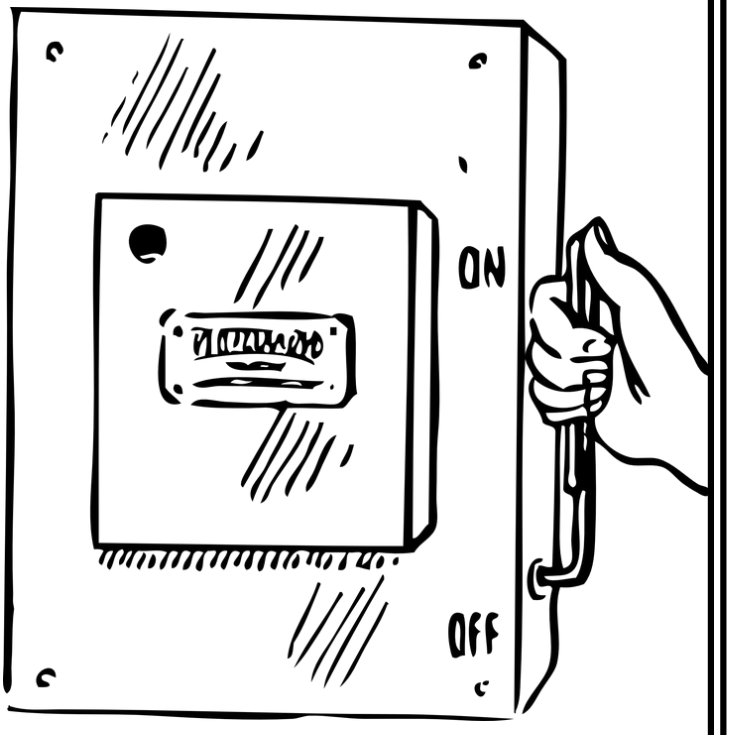












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Key Terms

Define Research the meaning of each of the key terms

Electricity	
Static Electricity	
Transforming Energy	
Insulator	
Conductor	
Turbine	
Parallel Circuit	
Series Circuit	

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Curriculum Connection
C.1

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 food, batteries, and gasoline. Chemical energy can produce thermal energy as well. Wood contains chemical energy that is stored in the wood. When the wood is burned, the chemical energy that was stored in the wood transforms into thermal energy and heat.

Electrical Energy
Electrical energy provides energy for machines to work. When we plug in our favourite electronic, the outlet we plug in to provides electrical energy. Electrical energy comes from other sources of energy like the burning of fuels or the energy from natural resources like hydro dams or solar power. Electrical energy often transforms into thermal energy. Think about how a TV 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 two things, one of them hotter than the other. Heat is the flow of thermal energy. Thermal energy actually creates wind as the movement of heat from warmer areas to cooler areas causes wind. This energy can be harnessed by wind turbines. The sun's thermal energy produces these 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.

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Curriculum Connection
C.1

Forms 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 have about the reading

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

Curriculum Connection
C.1

Law of Conservation of Energy

Energy on the Move

In 1907, Albert Einstein created the first law of energy – that it cannot be created nor destroyed, but only transformed. Since energy is either potential or kinetic, it is always there and cannot be created or destroyed. It can only change from one type of energy to another. This concept is called the **law of conservation of energy** because it explains how energy is always conserved and never lost.

An example of this is when gas is burned in a car. The chemical energy in the gas is not gone, it is just transformed to heat energy through the exhaust pipe. When we are cold, we can move around to burn the chemical energy in the food we eat. That energy doesn't disappear as it results in heat energy being released.

Law of Conservation of Energy – More Examples

- A ball at the top of a hill has potential energy because of its position. When it begins to move, the potential energy is gone, but now it has kinetic energy because it is moving. The energy transformed from potential to kinetic.
- When we turn on a lightbulb, electrical energy from the wire connected to it is transformed to light energy and heat energy.
- Wood has potential energy in it. When we burn the wood, the potential energy is transformed into heat and light energy. The potential energy in the wood is not gone, it has just been transformed into heat and light.

- When a musician strikes a drum, the drum stick provides mechanical energy into the drum. The energy is not gone, it is transformed into sound energy.
- When you rub your hands together, you are using mechanical energy. The energy does not disappear, it transforms into thermal energy, making our hands feel warm!

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Curriculum Connection
C.1

Law of Conservation of Energy

Questions

Use information from the text to support your answer

1) What does Einstein mean by energy cannot be created nor destroyed?

_____

_____

_____

2) Where does the electrical energy go when you turn on a lightbulb?

_____

_____

_____

Transforming Energy

Describe how energy is transforming in the picture below

_____

_____

_____

_____

_____

_____

Multiple Choice

Circle the correct answer

1) Who thought of the first law of energy?	Einstein	Edison
2) Food energy is often transformed into _____ energy	Light	Mechanical
3) Wood's chemical energy is transformed into light and _____	Heat	Electrical
4) When a drummer strikes a drum, they are using _____ energy	Sound	Mechanical
5) Energy cannot be created nor...	Destroyed	Transformed

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 cities. When we plug a cord into an outlet, we are connecting to the wires that carry electricity from the power plants. The power plants charge us money for using their energy. They can track how much energy we are tapping in to.

Power Plants

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

Nuclear power is one form of power plant that contains machines called nuclear reactors. Heat is produced by these reactors when atoms are split apart. The heat is then used to boil water and create steam. The steam turns turbines to generate electricity.

Fossil fuels are another form of power plant that burns the material to 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.

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Curriculum Connection
C.1

Electricity - Questions

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. What is a power plant? What types of power are used?

_____

_____

_____

Summarize

Write the important details from the reading passage

_____

_____

_____

_____

_____

Matching

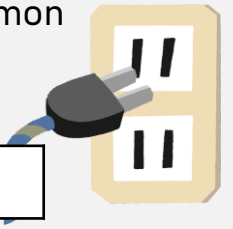
Draw a line from the term to the description

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.

Curriculum Connection
C.1

Using Electricity

Electricity is energy used to power anything we plug into the wall. Common household things we use electricity for are:



TV	Video Games	Computer	Toaster	Fridge

Brainstorm Draw or write things that need electricity to work

Electricity

Name: _____ 14

Curriculum Connection
C.1

Electrical Devices We Use

What is an Electrical Device
An **electrical device** is something that is powered by electricity. Anything that you need a battery for, or that you plug into a wall, is considered an electrical device. Now think for a moment, how many different electrical devices do you use in a day or a week. Write them down in the categories below.

Electrical Devices at Home

Write down which devices you use at home

1.	5.
2.	6.
3.	7.
4.	8.

Electrical Devices at School

Write down which devices you use at school

1.	5.
2.	6.
3.	7.
4.	8.

Electrical Devices In the Community

Write down which devices you use in the community

1.	5.
2.	6.
3.	7.
4.	8.

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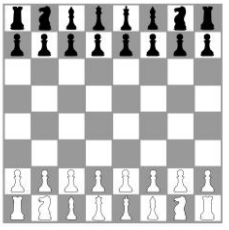
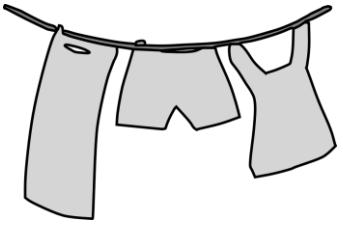
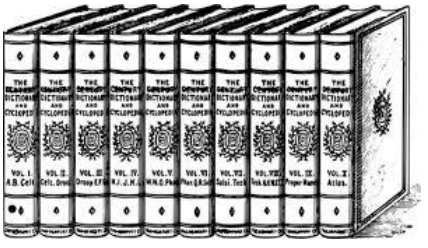
Curriculum Connection
C.1

Impact of Electricity on our Lives

How Has Electricity Changes our Lives?
Electricity is the greatest invention in history because it changed the world. Lighting, refrigeration, and air conditioning are the three things that most people in developed countries rely on each and everyday. However, electricity has had impacts to almost everything we do throughout our daily lives. Look at the pictures below and write what the equivalent would be before or after electricity.

Before Electricity	After Electricity
	
	
	
	
	

Questions

1. How have you used electricity today?

_____

_____

_____

_____

_____

2. What do you think would be the most difficult challenges in life without electricity?

_____

_____

_____

_____

_____

_____

3. What are some challenges to life with electricity?

_____

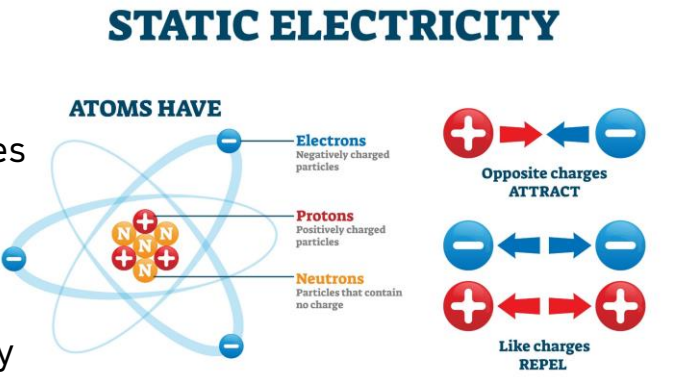
_____

_____

Curriculum Connection
C.1

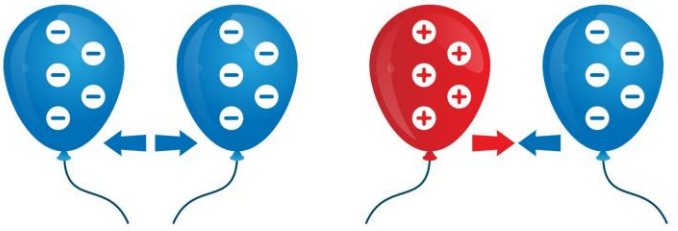
Electrostatic Force

Electrostatic Force



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

When two particles are the same, they repel (push away) each other. If they are opposite, they attract (pull towards) each other.



Most objects are neutral, meaning 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 other objects. When objects move due to their charge, it is called an **electrostatic force**.

The Cat

This poor cat has styrofoam stuck to it. 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.

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Curriculum Connection
C.1

Electrostatic Force

Questions

Answer the questions below using evidence from the text

1) What does electrostatic force mean?

_____

_____

_____

2) What is happening 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

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

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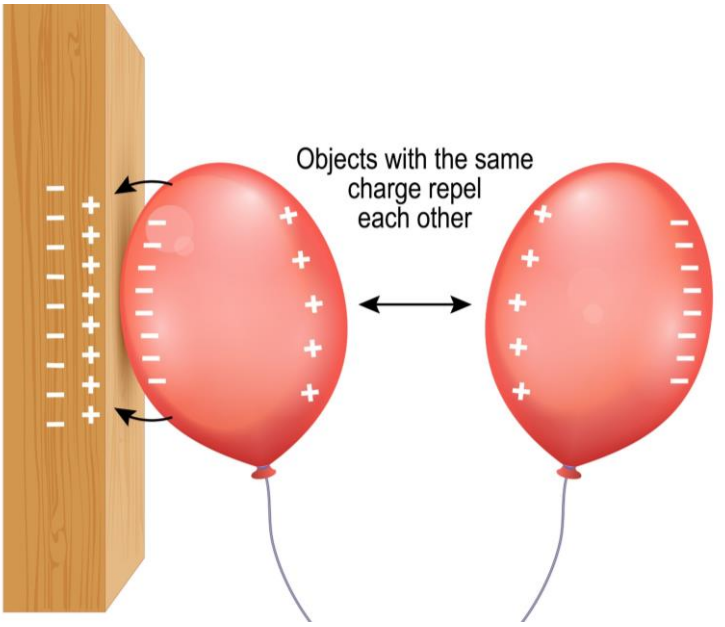
Curriculum Connection
C.1

Static Electricity

Static Electricity

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



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

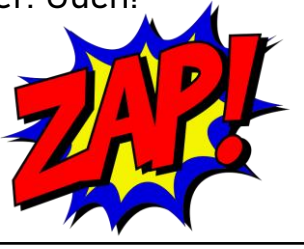
You can't see the extra negative charges but try bringing that balloon near a wall. The extra negative charges in the balloon will become attracted to the positive charges in the wall and they will stick together.

Zap – Static Electricity

When you shake hands with a friend, 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!

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.



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Curriculum Connection
C.1

Static Electricity

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 were picturing while 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

Name: _____ 20

Curriculum Connection
C.1

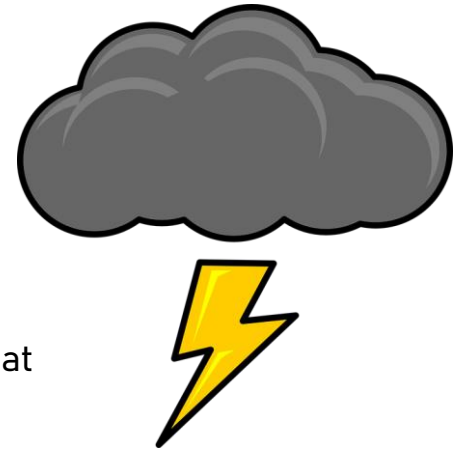
Dangers of Static Electricity

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 also be a problem when our clothes cling to each other or to our hair. Often, clothing has more static after they've been in a tumble dryer.

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



Dangers of Static Electricity

The most dangerous example of static electricity comes in the form of lightning. **Lightning** is caused when static electricity builds up in clouds and causes a huge spark that forms between the ground and the clouds. The result is a lightning strike that is really just the flow of charges through the atmosphere.

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!

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Curriculum Connection
C.1

Dangers of Static Electricity

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 were picturing while you were reading. Explain the picture

_____

_____

_____

_____

_____

Word Scramble

Unscramble the words below using the word bank

STATIC	DANGER	SAFE	LIGHTNING	CLING	CLOTHING

GLIINTGHN		EGDRAN	
TASCTI		HGTNOCIL	
LNCIG		EFSA	

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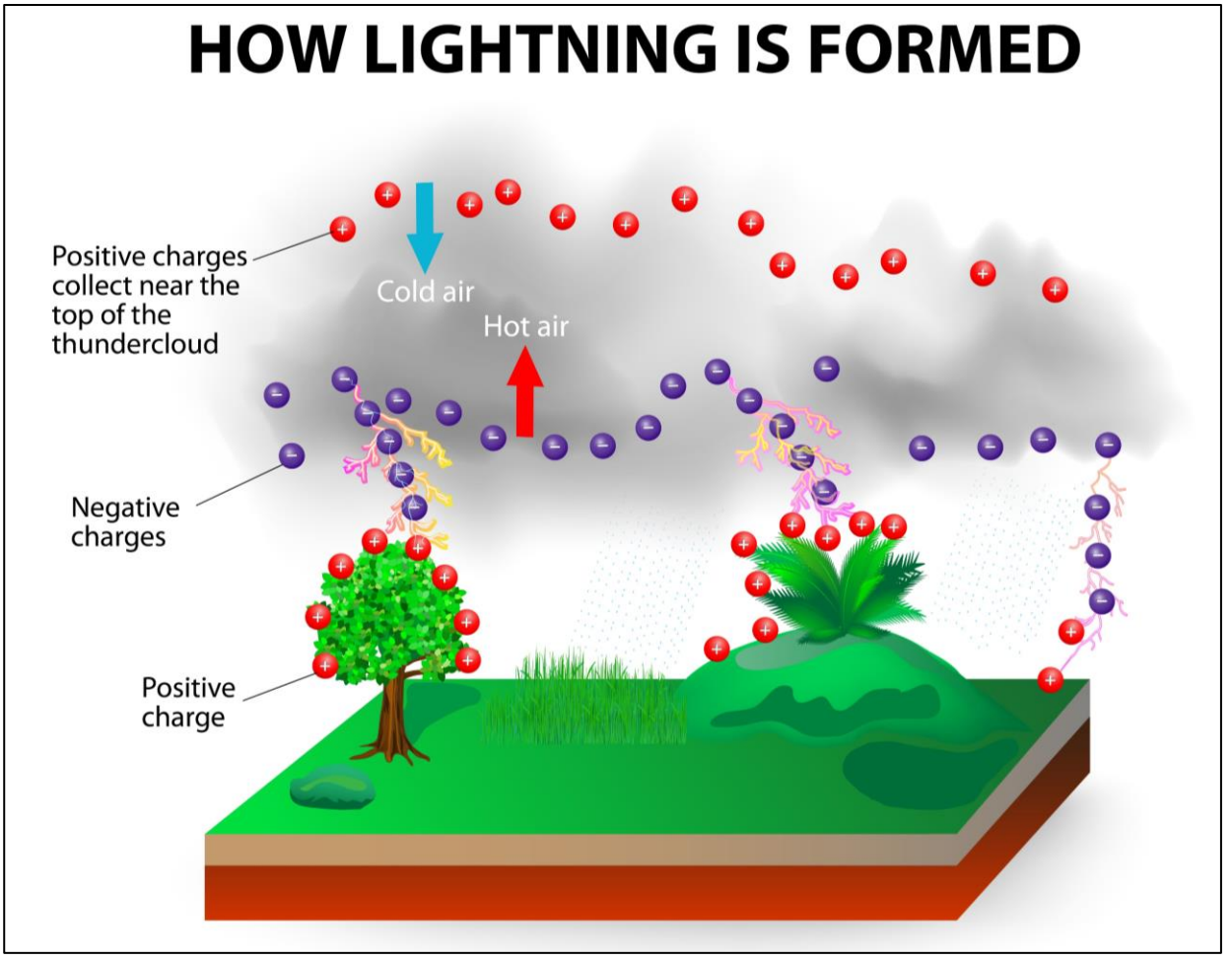
Curriculum Connection
C.1

Lightning - Electrostatic Force



How Lightning Is Formed

Lightning is an electrostatic current that travels from one electrically charged object to another. When a thundercloud forms, raindrops bump into each other causing a static electric charge.

In the diagram, you can see the thundercloud is becoming negatively charged at the bottom. When this happens, the positively charged objects on the earth's surface will become attracted to the negatively charged thundercloud. Once the charge is strong enough, their attraction will cause lightning, which is an electrical current between the two objects that are oppositely charged.

The diagram shows the thundercloud making lightning strikes with a tree, shrub, and the ground because they are positively charged.

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Curriculum Connection
C.1

Lightning - Static Electricity Force

Questions

Answer the questions below using evidence from the text

1) What is lightning?

_____

_____

2) How does lightning form?

_____

_____

_____

_____

Visualizing

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

_____

_____

_____

_____

_____

True or False

Is the statement true or false?

1) Lightning forms because of magnetic forces	True	False
2) Lightning forms when thunderclouds change their charge	True	False
3) Opposite charges attract which makes electrostatic currents	True	False
4) Lightning is an electrostatic current	True	False
5) Lightning happens when objects have the same charge	True	False

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Curriculum Connection
C.1

Static Electricity Activities

Magic Spoon | What are we learning more about?

Materials

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

Procedure

1) Put the salt and pepper on the black piece of paper
2) Rub the spoon on a dish cloth for about 10 seconds
3) Hold the round part of the spoon up to the salt and pepper mixture
4) Watch for the particles to jump from the paper up to the spoon

Observations | What did you notice?

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

_____

_____

2) Did more of the salt or pepper cling to the spoon? Why might that be the case?

_____

_____

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

_____

_____

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

_____

_____

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Curriculum Connection
C.1

Static Electricity Activities

Bending Water

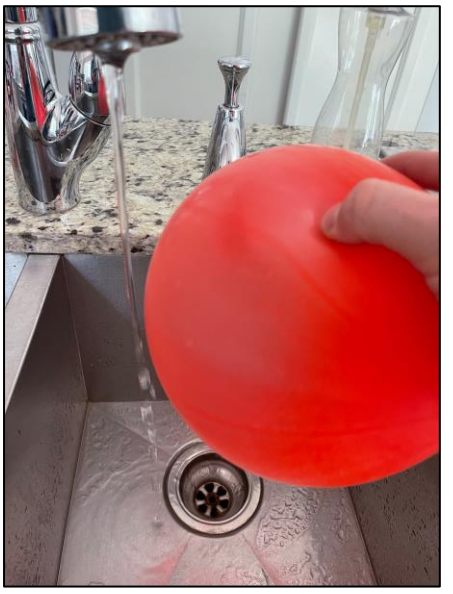
What are we learning more about?

Materials

- ✓ 1 balloon
- ✓ Sink with faucet

Procedure

1) Rub your hair with the balloon
2) Run a small stream of water. The smaller the better, but it needs to be a full stream, not just drips.
3) Hold the balloon near the stream but not touching it.
4) Watch the stream of water bend



Observations

What did you notice?

1) What happened when the balloon went 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?

_____

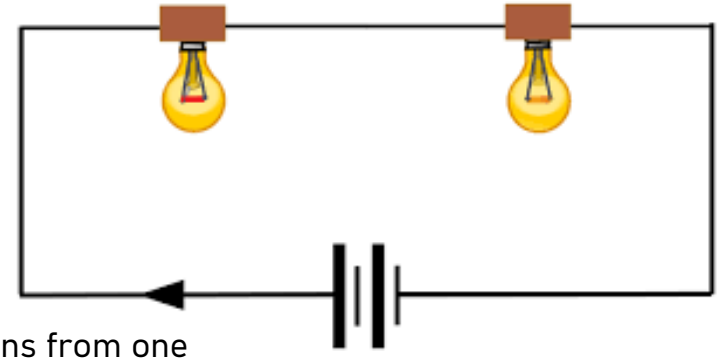
_____

Curriculum Connection
C.1

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 (the middle) and the electrons spin fast around the outside of the atom.

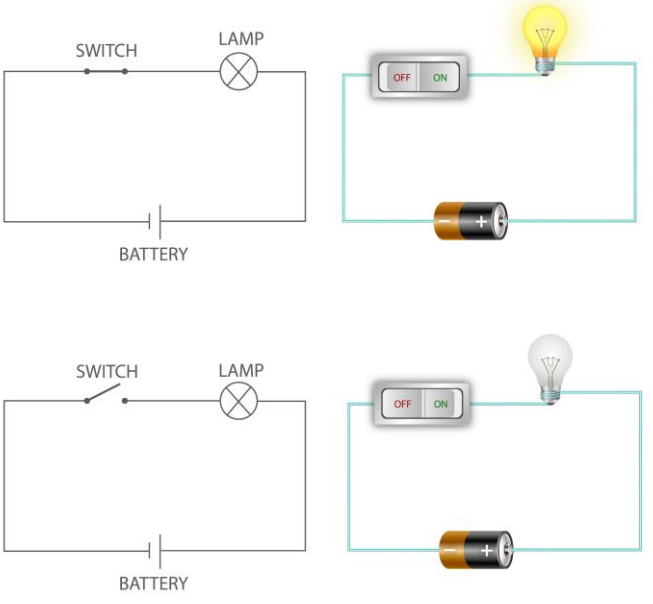


What is Electricity?

All matter is made of atoms and all materials are matter. In a conductive material, electrons will move from atom to atom. **Electricity** is the flow of these 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 making 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.

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Curriculum Connection
C.1

How Electricity Works

Questions

Answer the questions below using evidence from the text

1) What do atoms have to do with electricity?

_____

_____

_____

2) How does an electrical circuit work?

_____

_____

_____

True or False

Is the statement true or false?

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 off	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

_____

_____

_____

_____

_____

Name: _____ 28

Curriculum Connection
C.1

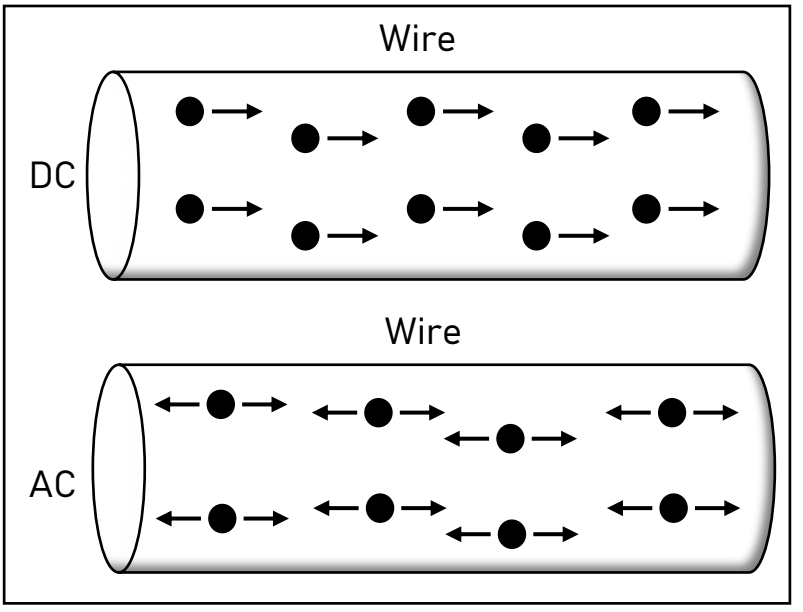
Current Electricity vs Static Electricity

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 produce direct current. Therefore, devices that use batteries use direct current electricity. With direct current electricity, the flow of electrons moves in just 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 to our buildings and houses. 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 positively or negatively 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.

Name: _____ 29

Curriculum Connection
C.1

Current Electricity vs Static Electricity

Define

What do the terms below mean?

Direct Current	
Alternating Current	
Current Electricity	
Static 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	

Curriculum Connection
C.1

Dangers of Current Electricity

Why is Current Electricity Dangerous?

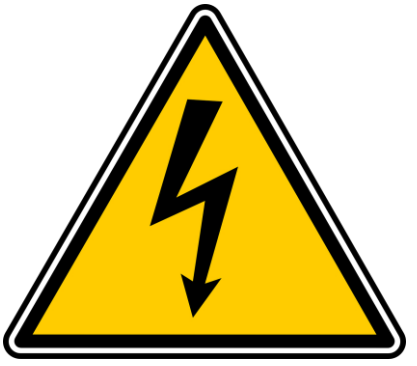
The human body is a good conductor of electricity. This means that the flow of current electricity will flow easily through our bodies. The main reason for this is because our bodies are 70 percent water, and water is a conductor of electricity.

Electricity

What Can Happen

If you are not careful using electricity, you could expose yourself to its flow of electrons and be badly hurt. The following problems could happen:

- Muscles tighten up, making it almost impossible to pull away from the circuit
- Lungs constrict, making it difficult to breathe
- Heartbeat is interrupted and your blood vessels tighten
- 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

Name: _____ 31

Curriculum Connection
C.1

Dangers of Current Electricity

Questions

Answer the questions below using evidence from the text

1) Why is current electricity dangerous?

_____

_____

_____

2) How can you stay safe from electricity?

_____

_____

_____

True or False

Is the statement true or false?

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	True	False
5. You can use all the plugs on an extension cord or power bar safely	True	False

Making Connections

What does the reading remind you of in your life?

_____

_____

_____

_____

_____

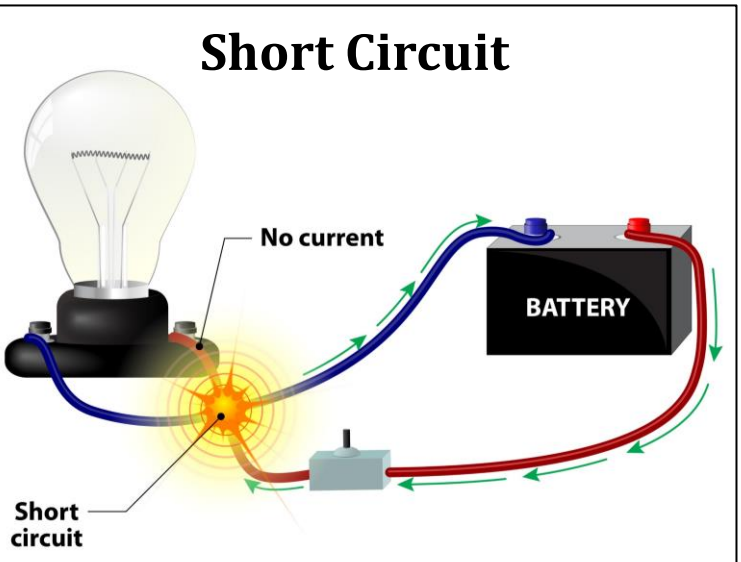
Name: _____ 32

Curriculum Connection
C.1

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. When the load receives some of the voltage, there is a power drop because the load uses some of the electricity to produce heat and light. When this happens, the voltage that ends up on the other side of the cell is reduced.



In a **short circuit**, the load is not used, which means there is no power drop. This can happen if a wire to the load is loose or if the circuit is improperly wired. When the same voltage from the cell flows back to the other end 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 supplying the wire with an electrical current. The green arrows show the current travelling around the circuit. The problem is that this circuit has crossed wires, so the current is not travelling to the light bulb. Since the same voltage is returning back to the battery, the circuit will heat up and could start a fire.

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.

Name: _____ 33

Curriculum Connection
C.1

Dangers of Short Circuits

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 or false?

1) A short circuit happens when the circuit is designed incorrectly	True	False
2) A short circuit can happen when wires get crossed	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 with no load	True	False
5) Short circuits are not dangerous	True	False

Summarize

Summarize the main idea and supporting details of the reading

_____

_____

_____

_____

_____

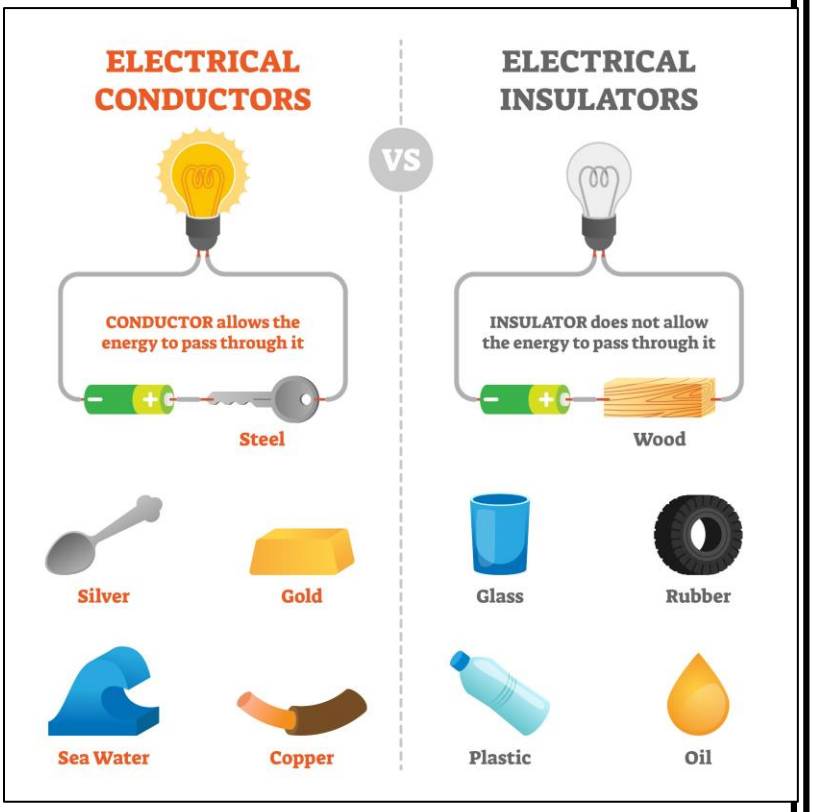
Name: _____ 34

Curriculum Connection
C.1

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. People that work with electricity need to use insulators to keep them safe. When they handle potentially live wires, they use an insulating material like rubber gloves. Plastic and wood are also good insulators.



Insulator or Conductor?

Write insulator or conductor beside the 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	

Name: _____ 35

Curriculum Connection
C.1

Insulator or Conductor - Lab Experiment

Create a circuit and test the following materials to see if they are insulators or conductors. If the circuit lights up the bulb or spins the fan, it is a conductor, if not, it is an insulator. Make sure to make an estimate first.

Material	Estimate (insulator or conductor)	Insulator or Conductor
Pencil		
Coin		
Paper		
Cardboard		
Paperclip		
Eraser		
Popsicle Stick		
Rubber Band		
Brad Nail		

Questions

Answer the questions below using evidence from the text

1) What is the difference between a conductor and an insulator?

_____

_____

_____

2) From the experiment you just did, what types of materials are the best conductors?

_____

_____

_____

Curriculum Connection
C.1

Resistors

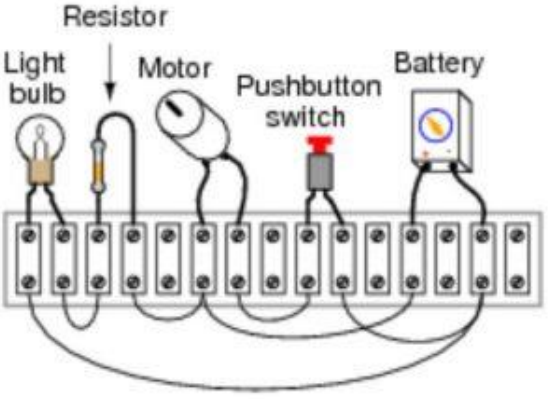
What is a Resistor?

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.

Resistance

All materials will allow electricity to flow if the voltage is strong enough. Even air, which is normally an insulator, suddenly becomes a conductor if a big enough voltage passes through it. This is what happens when lightning strikes through the air. Materials can be described based on how resistant they are to letting voltage through.

A resistor works the same way. It is a material that lets some electricity through. A good conductor would make a poor resistor, as it would let too much voltage through. A strong insulator would also be a bad resistor as it would likely 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 coloured 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.

Name: _____ 37

Curriculum Connection
C.1

Resistors

Questions

Answer the questions below using evidence from the text

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

_____

_____

_____

2) How does a 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 pass 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 passes through	True	False

Draw

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

Curriculum Connection
C.1

Series vs Parallel Circuit

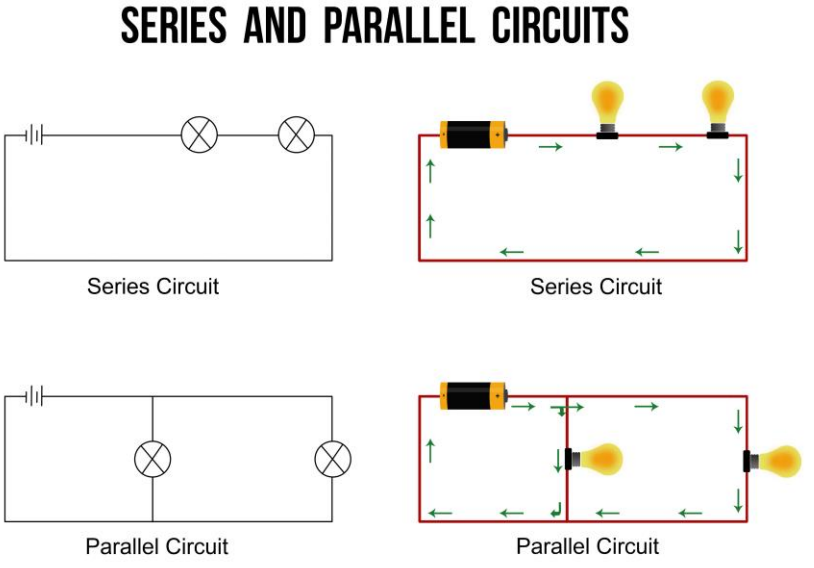
Series and Parallel Circuits

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 the most 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 a conducting material to the lightbulbs and then back to the battery. The flow continues in this manner 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.



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.

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Curriculum Connection
C.1

Series vs Parallel Circuit

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

Is the statement true or false?

1) In a series circuit, only one component can be used in the circuit	True	False
2) In a parallel circuit, if one component breaks, the others will not work	True	False
3) In a series circuit, if one component breaks, the others will not work	True	False
4) The electricity in a parallel circuit gets split between each part 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**

Name: _____ 40

Curriculum Connection
C.1

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?

_____

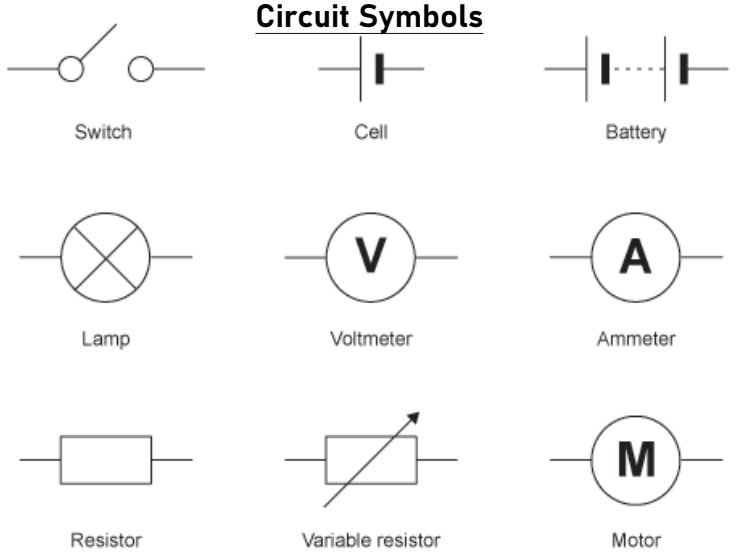
Name: _____ 41

Curriculum Connection
C.1

Drawing Circuit Diagrams

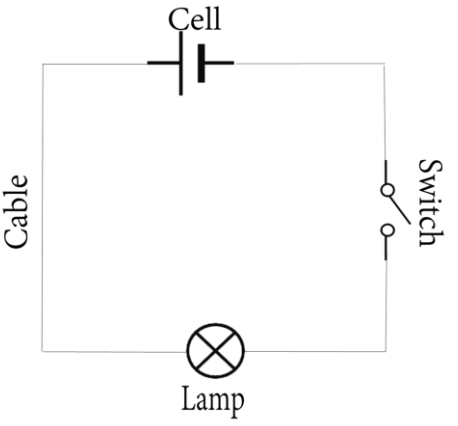
When an electrician is planning the circuits they will use, they often draw them out beforehand. Check out the symbols they use to draw their circuit diagrams.

Circuit Symbols



Example

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



Draw

Draw the following circuits. Be creative.

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).

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Curriculum Connection
C.1

Drawing Circuit Diagrams

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).	
Series	**Parallel**

2) Circuit with one switch, 2 batteries, 3 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**

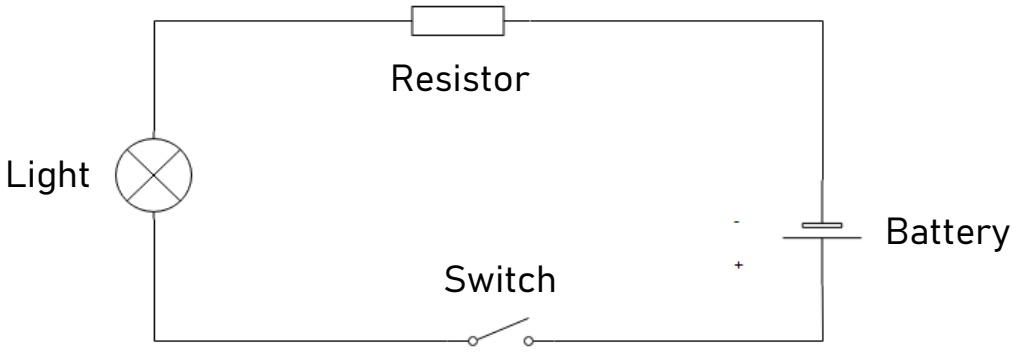
Name: _____ 43

Curriculum Connection
C.1

Interpreting Circuit Diagrams

Interpret Answer the questions below

1)



1. a) What is happening in this circuit?

_____

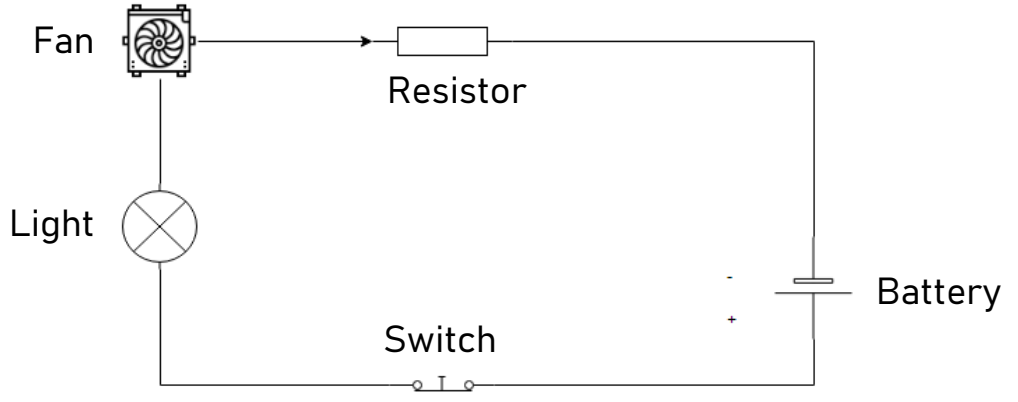
_____

b) Will this circuit light the bulb?

_____

_____

2)



2. a) What is happening in this circuit?

_____

_____

b) Is this a series or parallel circuit? _____

c) Will the light and fan work? Explain.

_____

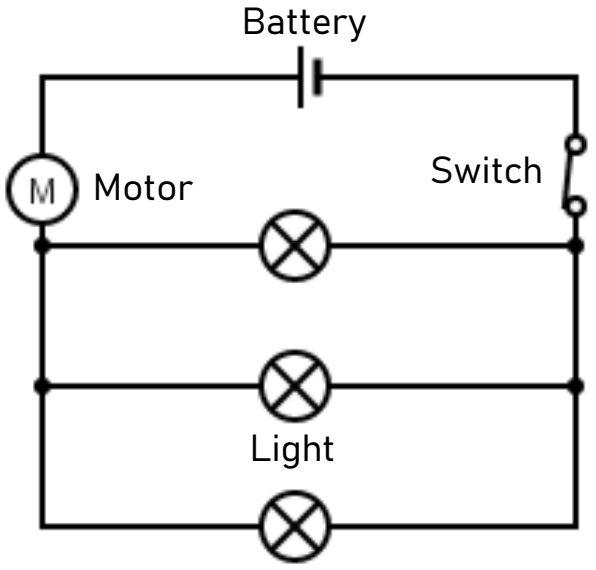
Name: _____ 44

Curriculum Connection
C.1

Interpreting Circuit Diagrams

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.

_____

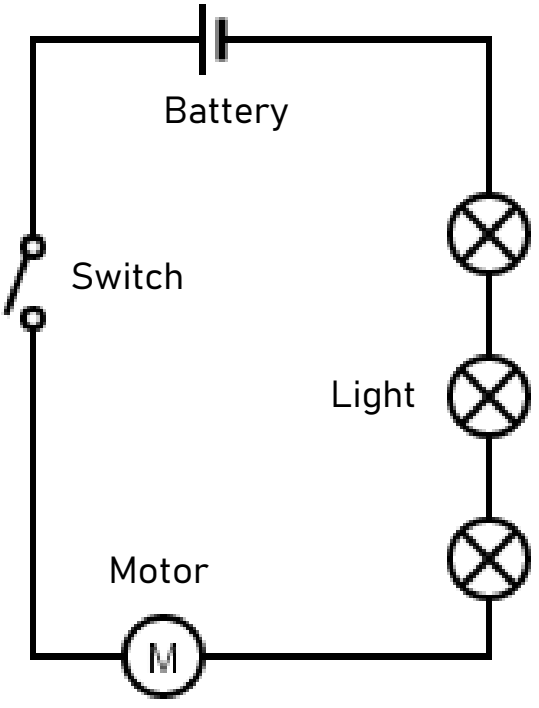
_____

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

_____

_____

4)



4. a) What is happening in this circuit?

_____

_____

b) Is this a series or parallel circuit?

_____

c) Will the motor and lights work? Explain.

_____

_____

_____

d) How could you get this circuit to work?

_____

_____

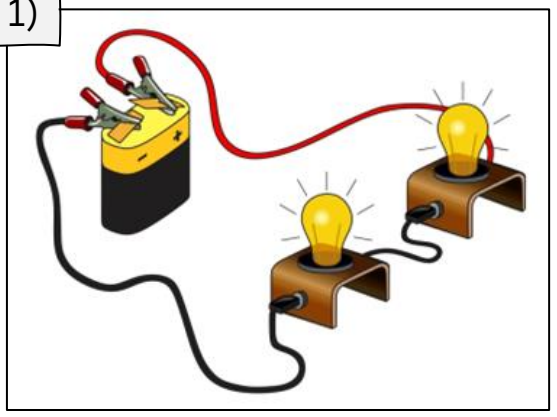
Name: _____ 45

Curriculum Connection
C.1

Drawing Circuit Diagrams

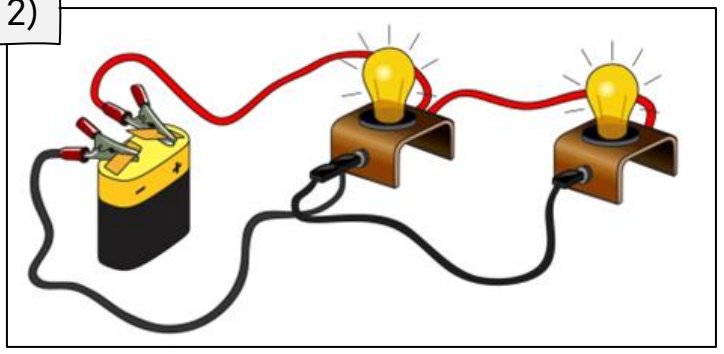
Draw Draw a circuit diagram that represents the picture

1)



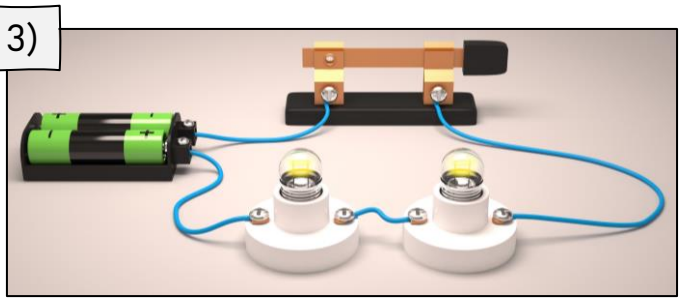
Circuit Diagram

2)



Circuit Diagram

3)



Circuit Diagram

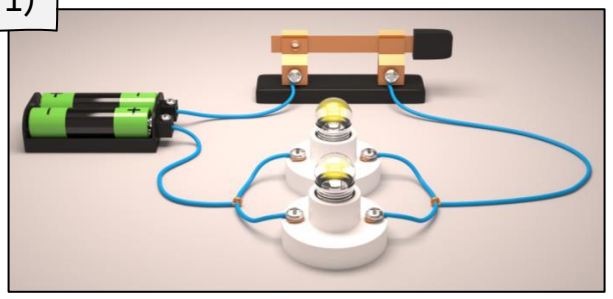
Name: _____ 46

Curriculum Connection
C.1

Drawing Circuit Diagrams

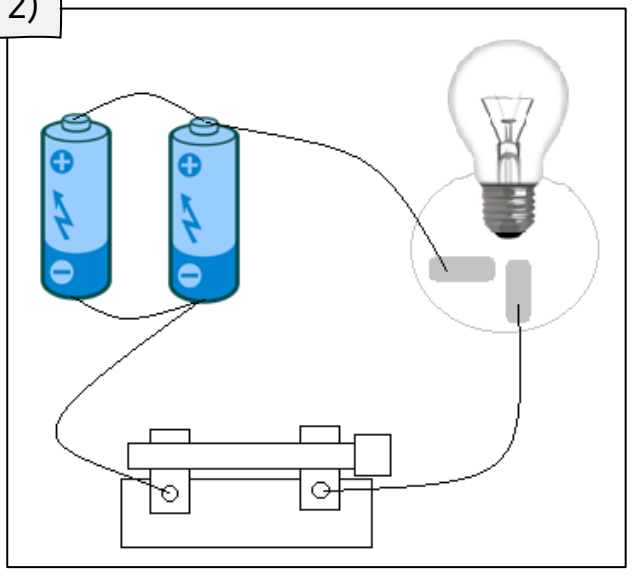
Draw Draw a circuit diagram that represents the picture

1)



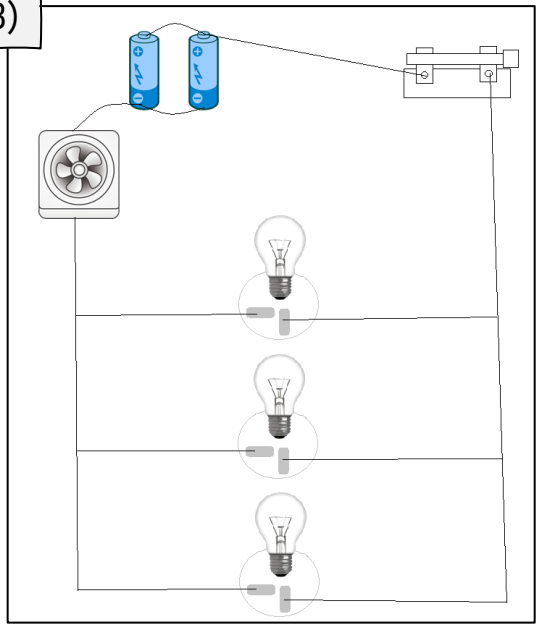
Circuit Diagram

2)



Circuit Diagram

3)



Circuit Diagram

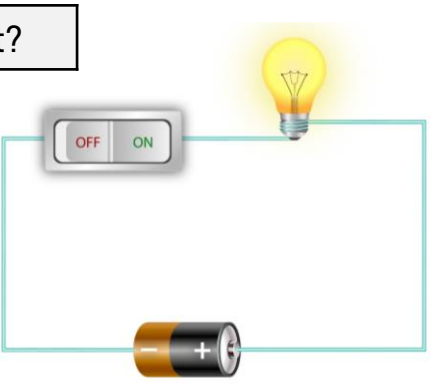
Name: _____ 47

Curriculum Connection
C.1

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) Wires
4) Switch

Method
How do we complete the experiment?

1) Use a wire to connect the light bulb to 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 should 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!

Name: _____ 48

Curriculum Connection
C.1

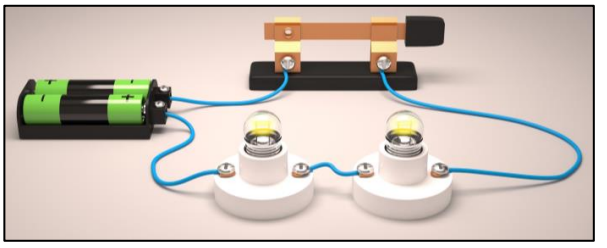
Experiment - Series Circuit

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) Multiple light bulbs and/or fans
3) Wires
4) Switch



Method — How do we complete the experiment?

1) Connect the components of the electrical circuit 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? Explain.

_____

_____

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

Name: _____ 49

Curriculum Connection
C.1

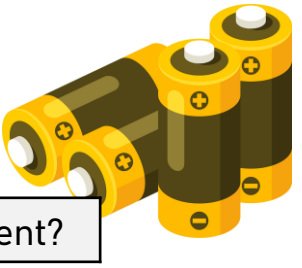
Experiment - Testing Battery Power

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) Batteries
2) Multiple light bulbs and or fans
3) Wires



Method
How do we complete the experiment?

1) Connect the battery to a light bulb and write down how bright the bulb is
2) Connect the battery to two light bulbs and write down how bright the bulbs are
3) Connect the battery to three light bulbs and write down how bright the bulbs are
4) Now add multiple batteries to the circuit that has multiple 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?

_____

_____

Name: _____ 50

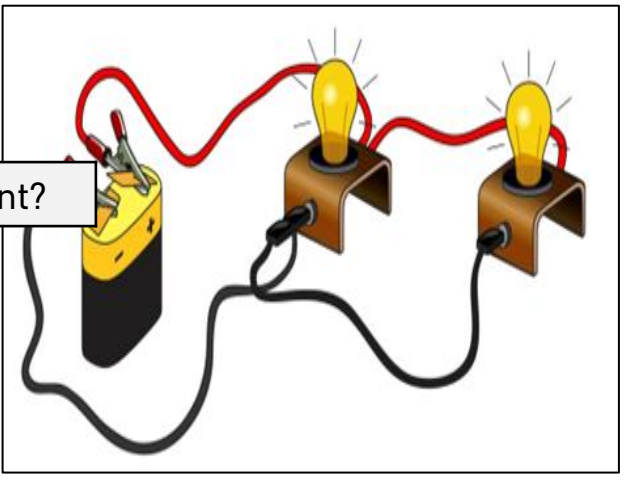
Curriculum Connection
C.1

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 light bulbs
3) Wires
4) Clips

Method

How do we complete the experiment?

1) Create a parallel circuit that lights up both lightbulbs
2) Disconnect one wire that leads to one of the lightbulbs. 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!

Name: _____ 51

Curriculum Connection
C.1

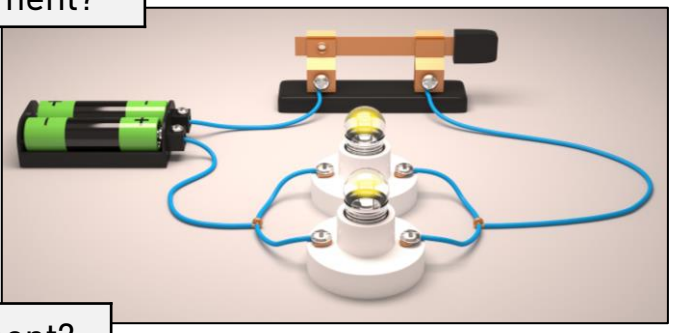
Experiment - Parallel Circuit

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) Batteries
2) Multiple light bulbs and/or fans
3) Wires
4) Switch



Method
How do we complete the experiment?

1) Connect the components of the electrical circuit 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? Explain.

_____

_____

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

Curriculum Connection
C.1

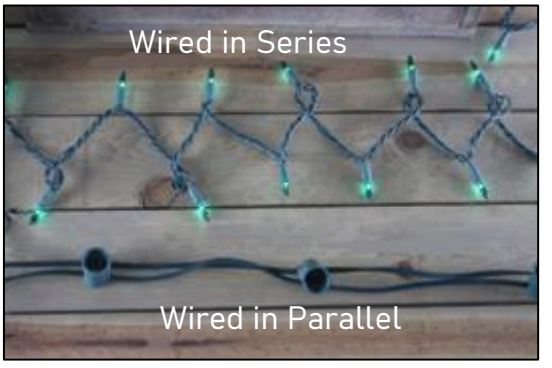
Uses of Parallel and Series Circuits

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 battery cells that are wired in series. If the tool needed 48 volts, it would use 12 cells that each provide 4 volts.

In some instances, it is helpful to use a series circuit for additional safety. For example, an electronic lawn mower will often have a handle that acts as a switch to the electrical circuit. But, when you hold down the handle, the lawn mower won't start. This is because there is another switch that starts the mower. You will need to push both switches at the same time (often you hold the handle and push the other button switch). If you release the handle, the circuit is opened, and the mower will turn off.



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, it 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.

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Curriculum Connection
C.1

Uses of Parallel and Series Circuits

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 electronics	True	False
2) Series circuits are used in simple electrical devices	True	False
3) Houses will use parallel circuits to provide electricity to outlets and 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?

_____

_____

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Name: _____ 54

Curriculum Connection
C.1

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.

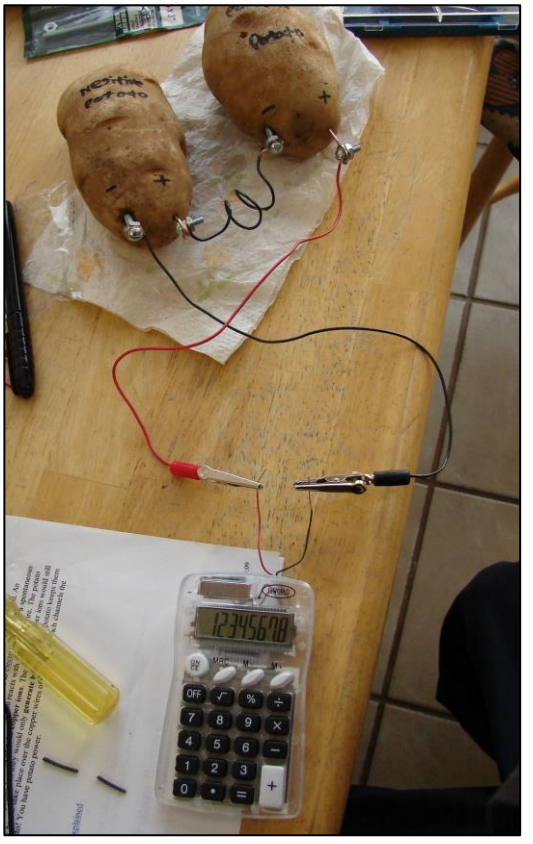
Today, you will research an idea online that showcases something interesting about electricity. It could be what materials conduct electricity. It could also be objects that produce electricity.

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 possibility are endless! Have fun and find an interesting experiment



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Curriculum Connection
C.1

Experiment - Electricity Assignment

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 need?

4) What will your classmates learn from your experiment?

_____

_____

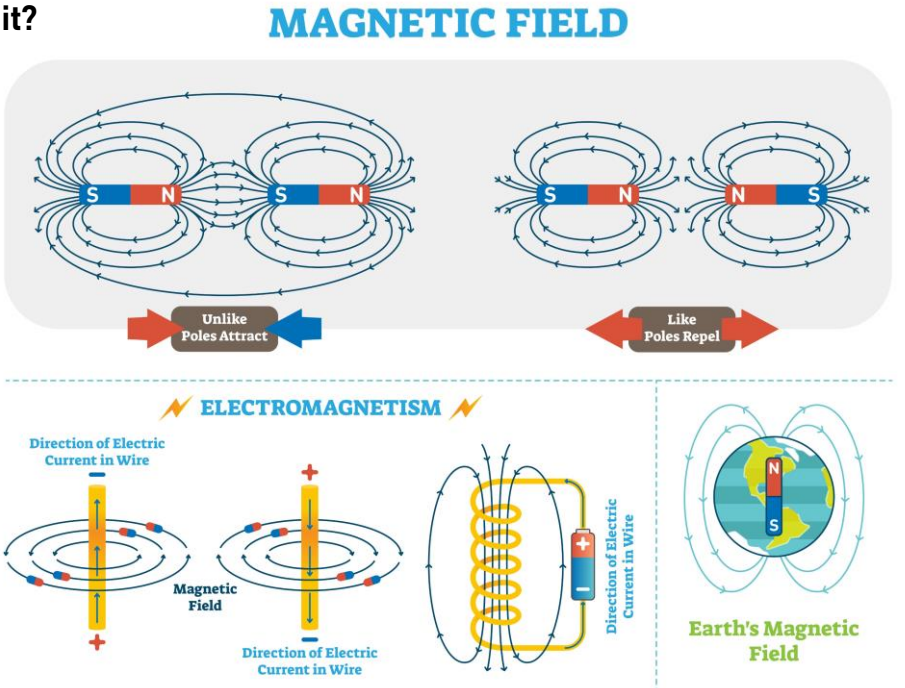
_____

_____

_____

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, just like gravity. The **electromagnetic force** causes oppositely charged electrons to attract each other.

This is why when you put batteries in an electronic device, they need to be put in correctly or else the electrons will not be aligned properly to be attracted to each other. This would stop the circuit because the 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 that is able to move magnetic materials closer or further away. This magnetic field is 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.

Name: _____ 57

Curriculum Connection
C.2

Electromagnetic Force

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 things move?

_____

_____

_____

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

Transforming Electricity

Transforming Energy – Forms of Energy

Remember, energy is never created, nor destroyed. This means it can only be transformed into other forms of energy. When a wind turbine spins, it transforms mechanical energy into electrical energy.

Transforming Electricity

Electricity has been one of the most influential inventions in human history. It has given us the ability to create an easily transportable form of energy that can be transformed into any other form of energy. We are constantly transforming electricity into light from our light bulbs, heat from our electric baseboards, sound from our speakers, and mechanical energy from our electric vehicles.

Electricity Transforming Into Heat

An electric heater is an electrical device that converts electricity into heat. When an electrical current travels through a wire, the wire now has extra energy added to it. The extra energy causes the atoms in the wire to vibrate faster. This vibration creates heat.

An electric heater will have many wires that allow a strong electrical current to travel through it to heat it up. When the heater is turned off, the wires won't be hot as there are no electrons travelling through it.

Electricity Transforming Into Sound

Sound comes from vibrations. In order to create vibrations, mechanical energy is needed. Therefore, electricity is used to create movement within a speaker. The movement creates vibrations that we hear in the form of music.

As electricity travels through the wires in a speaker, it travels to a motor that has an electromagnet inside. The electromagnet uses magnetism to vibrate a diaphragm based on the electrical signals it is being sent. The diaphragm creates sound waves that travel out of the speaker and into our ears so we can hear.

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Curriculum Connection
C.2

Transforming Electricity

Questions

Answer the questions below using evidence from the text

1) What forms of energy can electricity be transformed into?

_____

_____

_____

2) How does electricity transform into heat for an electric space heater?

_____

_____

_____

_____

True or False

Is the statement true or false?

1) Electricity can be transformed into heat, sound, and mechanical energy	True	False
2) Electricity can be created using wires and a battery	True	False
3) Other forms of energy can be transformed into electricity	True	False
4) The flow of electrons through a wire creates heat	True	False
5) The use of a electromagnet in a speaker creates mechanical energy	True	False

Questioning

Write 3 questions you have about the reading

1)	
2)	
3)	

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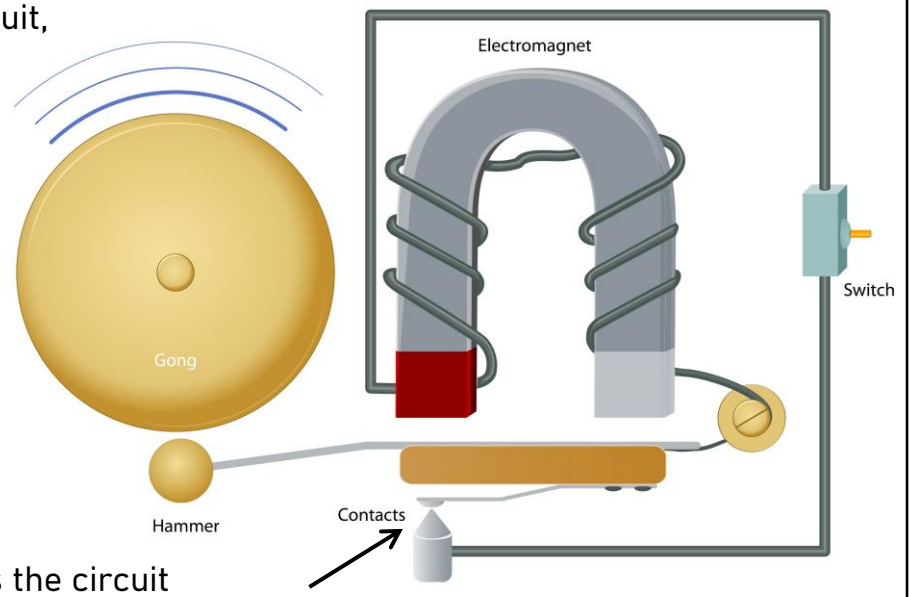
Curriculum Connection
C.2

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. The electric bell has the following components:

- An **electromagnet** that creates a magnetic force
- A **hammer** that strikes a gong
- A **gong** that creates a loud sound when struck
- A **switch** that opens and closes the circuit



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
2) The circuit is closed, meaning electricity flows through the circuit
3) The electromagnet now creates a magnetic field and it pulls the metal 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

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Curriculum Connection
C.2

Transforming Electricity - Electric Bell

Question

How does an electric bell work?

True or False

Is the statement true or false?

1) An electromagnet is used as a force that moves magnetic materials	True	False
2) Electricity uses electromagnets to create movement	True	False
3) Electricity is transformed into mechanical energy using an electromagnet	True	False
4) When the circuit is open, the electromagnet becomes magnetic	True	False
5) When the circuit is closed, the electromagnet loses its force	True	False

Diagram

Draw a diagram of an electric bell. Label the diagram

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Curriculum Connection
C.2

Electromagnetic Lab Experiment

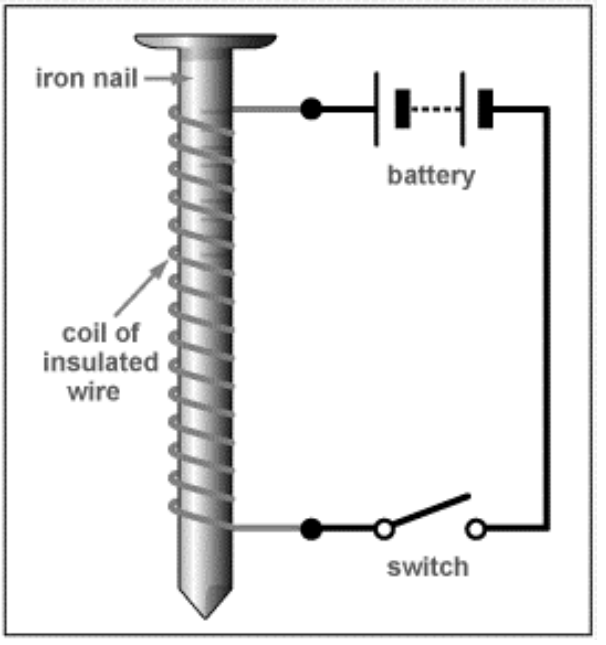
Information — What is this lab about?

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

Materials — What you need for the lab

1. A large iron nail (10cm long)
2. Approximately 1 metre of copper wire
3. A fresh D size battery
4. Paper clips or other metal objects
5. 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.

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Curriculum Connection
C.2

Electromagnetic Lab Experiment

Hypothesis

Explain what the following terms mean

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 paper clip now have a magnetic field?

_____

_____

_____

2) What happened when you disconnected the wires? Was the nail still magnetic? Explain.

_____

_____

_____

Diagram

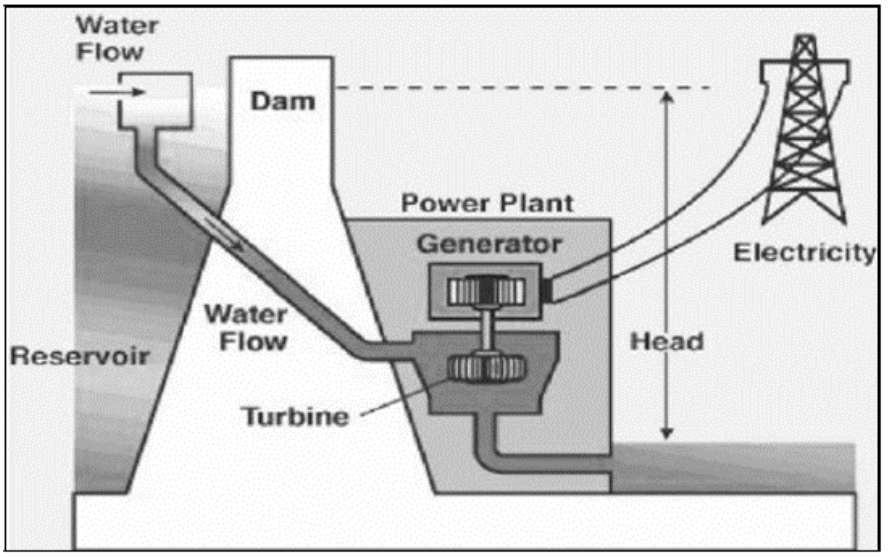
Draw a diagram of your electromagnet. Label the parts

Curriculum Connection
C.2

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 how much electricity we generate and export to other countries.



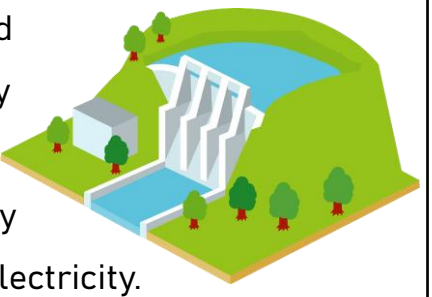
How we Generate Electricity

Electricity is generated when mechanical energy is harnessed and used to rotate a turbine. We can use a variety of mechanical energy sources 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 will spin the turbine that is shaped like a wheel. As the **turbine** spins, it connects to a generator that converts the 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.

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Curriculum Connection
C.2

Generating Electricity

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 generated	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 its bad for the 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

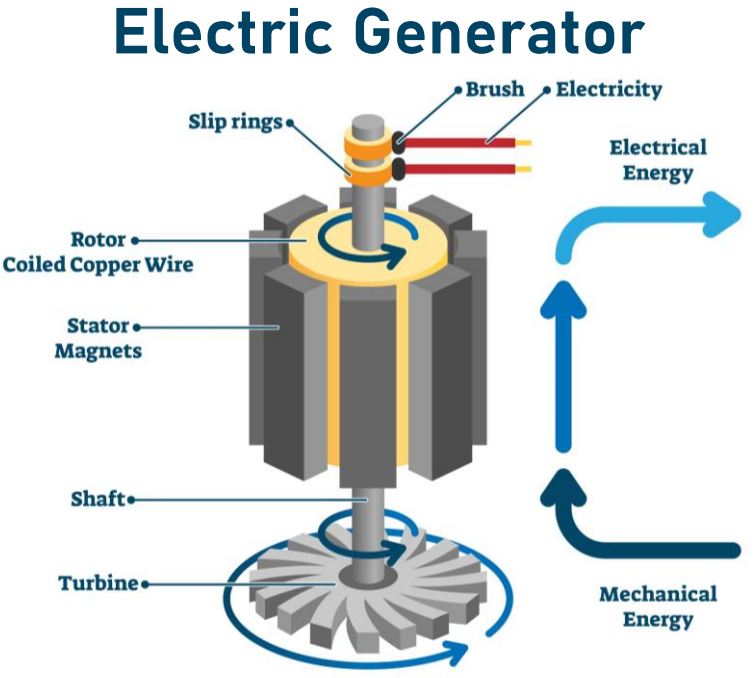
What is a Turbine?

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 Works

A **generator** is a machine that is used to produce electricity. A generator has a turbine that spins from the movement 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 and brushes.

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.

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Curriculum Connection
C.2

Electromagnetism and Turbines

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 the statement true or false?

1) A turbine uses fluids to generate energy (electricity)	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?

_____

_____

_____

_____

_____

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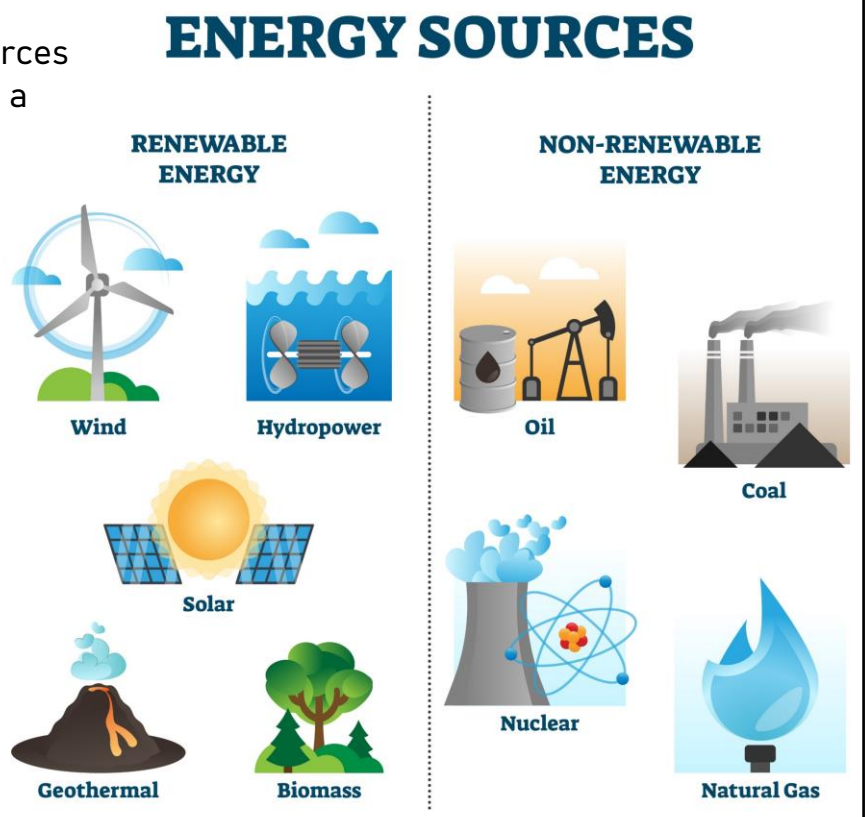
Curriculum Connection
C.1

Renewable vs Non-Renewable Energy

Non-Renewable Resources

Non-renewable resources are resources that will not replenish themselves in a lifetime. Once we use all of a non-renewable resource, it could take billions of years to form again.

Nuclear power uses uranium that is a non-renewable resource. **Fossil Fuels** like coal, oil and natural gas are non-renewable resources that are found by digging deep into the ground. Once these materials are all used up, they can not be used again. These resources are easy to use and provide an efficient form of energy, however they are dangerous to our environment.



Using these non-renewable resources involves heating up the material which produces a by-product that pollutes our environment. Scientists are searching for more effective ways to use renewable resources. These non-renewable energy sources are expected to run out very soon if we do not change the way we live.

Renewable Resources

A **Renewable resource** can be used over and over again without any effect on the environment. The sun produces enough **solar energy** for the entire population of the world. If we could setup enough solar panels to collect the energy, we could solve the non-renewable energy crisis. The problem is that the sun is not always shining where these solar panels are located, which makes it an inefficient means of energy.

Wind energy is also a renewable resource as the wind will always come and go, but that is the problem. The inconsistent flow of the wind makes it another inefficient source of energy.

Water or **hydro energy** uses the flow of water through a dam to generate energy. Water power is efficient but costly to build the dams necessary.

Geothermal energy uses the heat from below the Earth's surface to produce steam that spins turbines and generates power. These setups are efficient but also costly.

The last renewable resource that is commonly used is biomass. **Biomass** energy comes from burning plants, crops, and animal waste to create heat and steam that spins turbines.

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Curriculum Connection
C.1

Renewable vs Non-Renewable Energy

Questions

Answer the questions below using evidence from the text

1) Which type of energy do you think is the best?

_____

_____

_____

2) Why are scientists working to find more efficient sources of renewable energy?

_____

_____

_____

True or False

Is the statement true or false?

1. Coal and natural gas are examples of renewable resources	True	False
2. Biomass is when animal poop is burned to create heat.	True	False
3. Geothermal energy is efficient but costly.	True	False
4. Wind and solar energy are efficient sources of energy.	True	False
5. Non-renewable energy sources create harmful by-products when burned	True	False

Visualizing

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

_____

_____

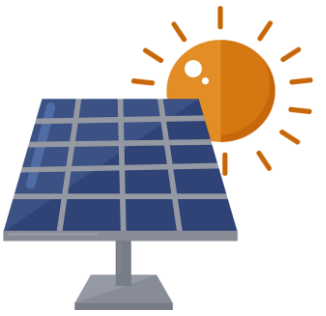
_____

_____

_____

Curriculum Connection
C.1

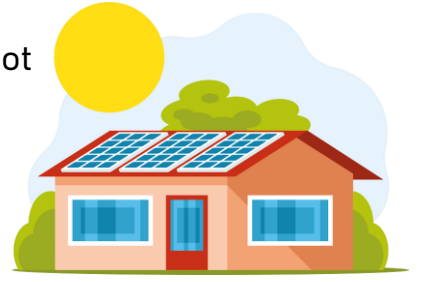
Solar Energy - Generating Electricity



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 for 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 **infinite** resource, meaning the supply is endless.

How Solar Energy Works

Solar energy is harnessed by solar panels that collect and store the sun's energy. The stored energy is potential energy to be used on demand. Solar panels are made of many solar cells that are all connected.

The solar cells have two sides. One side has electrons that are positively charged and the other side has a negative charge. When the sunlight strikes the solar cell, the energy knocks the electrons loose and they begin to flow from one side to the other, creating an electrical circuit. We can plug our electronics into a solar panel so that 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

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Curriculum Connection
C.1

Solar Energy

Questions

Answer the questions below using evidence from the text

1) What is solar energy?

_____

_____

2) How does solar energy work?

_____

_____

_____

Benefits and Drawbacks

Write the benefits and drawbacks of solar energy

Benefits	Drawbacks

Reaction

Do you think we should use more solar energy? Explain.

_____

_____

_____

_____

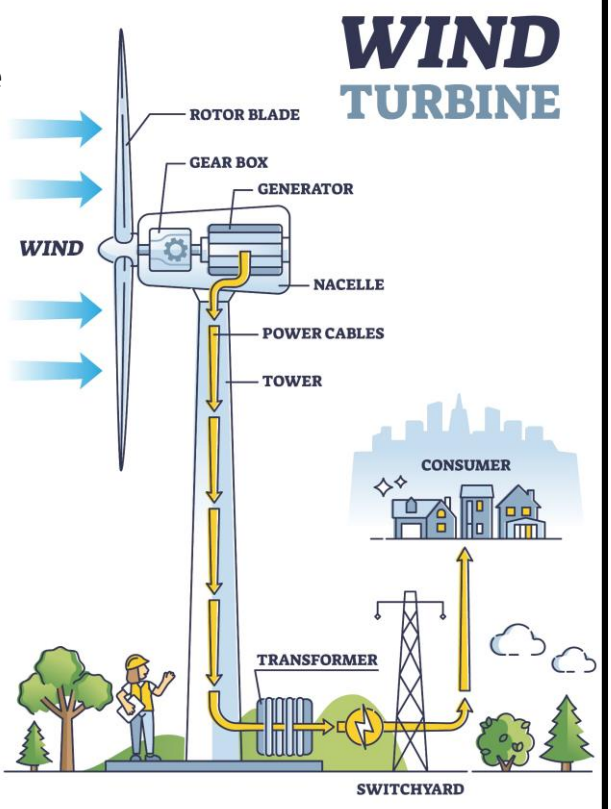
Curriculum Connection
C.1

Wind Energy

What is Wind Energy?

Wind is the movement of air from areas of high-pressure to areas of low pressure. When the gases that make up our air are warmed, they spread out and have higher pressure. When the air is cooled, the pressure is lower as the gas particles get closer together.

Wind energy is the energy we harness from the movement of the wind. Wind energy can fly a kite, move a sailboat and spin a wind turbine. When we use a wind turbine, we can use wind energy to create electricity.



What is a Wind Turbine?

A wind turbine is like a windmill. When the rotor blades are spun by wind energy, they spin a shaft connected to a generator. The generator converts the mechanical energy into electrical energy by forcing the electrons through an electrical circuit. The electricity is sent through a transformer, so it is the proper voltage. It is carried to a switchyard and then to our homes.

Use of Wind Energy in Canada

Wind energy is the second most used renewable energy source in Canada. It creates 3.5% of Canada's electricity. Moving water is number one, with 59% of Canada's electricity generation.

Benefits and Drawbacks of Wind Energy

Benefits	✓ Clean energy that doesn't produce greenhouse gases and won't run out ✓ Free energy once you have setup the wind turbine ✓ Wind turbines don't take up much space on the ground
Drawbacks	✓ Dangerous to birds and bats who can fly into the blades ✓ They are noisy so they are usually built in rural areas ✓ Are expensive to setup ✓ They only work when the wind is blowing. This causes unpredictable amounts of energy. If it isn't windy for a long period of time, the stored wind energy will run out

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Curriculum Connection
C.1

Wind Energy

Questions

Answer the questions below using evidence from the text

1) Why does wind happen?

_____

_____

2) How does wind energy work?

_____

_____

_____

Benefits and Drawbacks

Write the benefits and drawbacks of wind energy

Benefits	
Drawbacks	

Reaction

Do you think we should use more wind energy? Explain.

_____

_____

_____

_____

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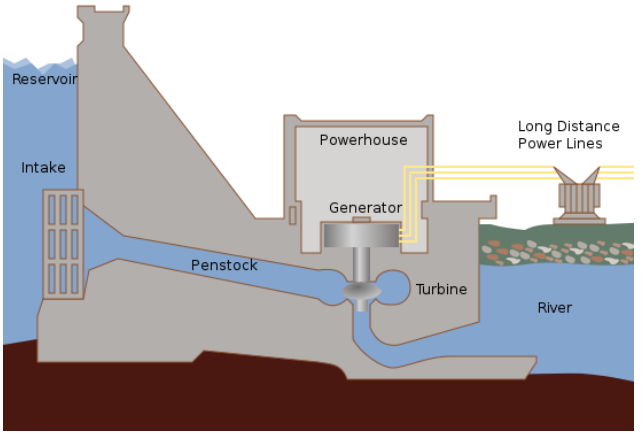
Curriculum Connection
C.1

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 to generate electricity.

Hydro energy is one of the oldest forms of energy. Watermills were first used in the 3rd century by the Greeks. The movement of water would spin a watermill that would spin a pipe. The pipe could be connected to a machine that could do work.

How Hydro Energy Works

A hydroelectric dam is built to block the flow of water. 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 flows consistently, spinning 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

Name: _____ 75

Curriculum Connection
C.1

Hydro Energy

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

Write the benefits and drawbacks of hydro energy

Benefits	
Drawbacks	

Reaction

Do you think we should use more hydro energy? Explain.

_____

_____

_____

_____

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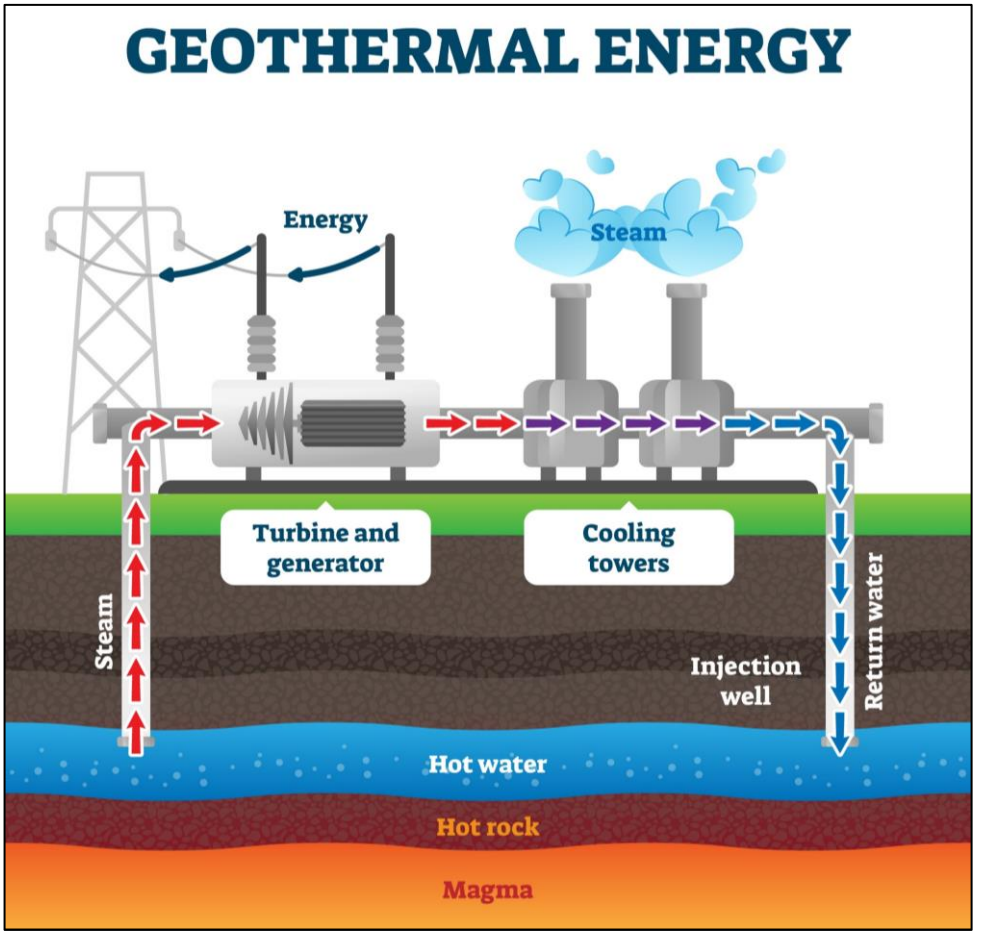
Curriculum Connection
C.1

Geothermal - Generating Electricity



Explain

Answer the questions below

1) Describe how geothermal energy works based on the diagram

_____

_____

_____

_____

2) Do you think geothermal energy is good for the environment? Explain.

_____

_____

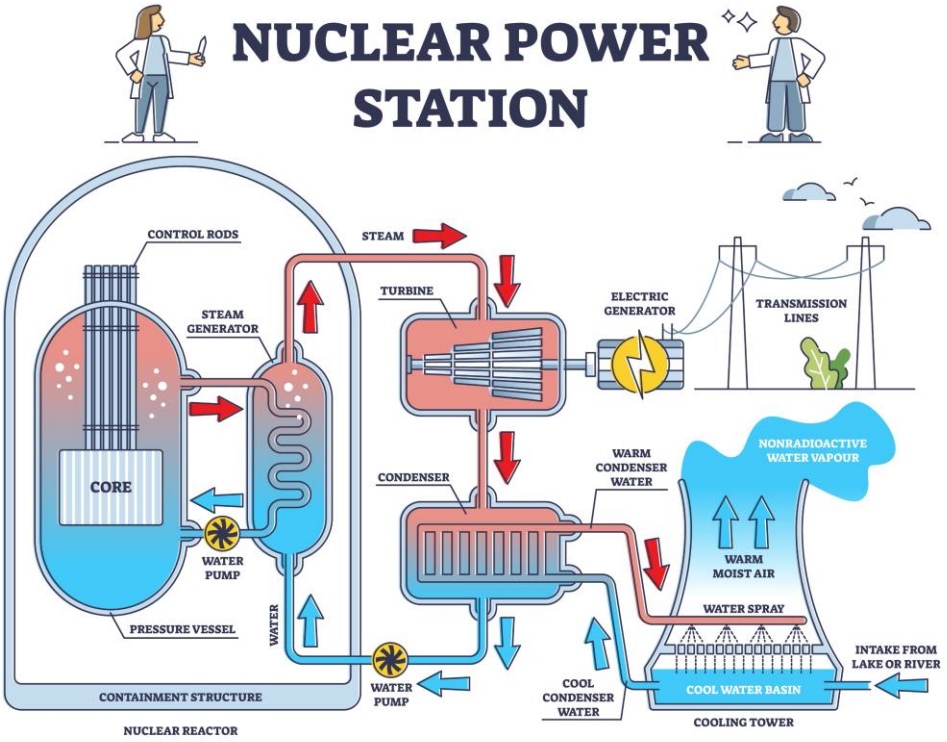
_____

Curriculum Connection
C.1

Nuclear Power

Nuclear Power

Nuclear energy is produced by splitting a uranium atom into two smaller atoms. This process releases heat from the nucleus of the atom that is used to create steam.



When water is boiled inside the nuclear reactor, the steam that is created expands. This creates a lot of pressure as the steam has to go somewhere. It travels up through the pipe creating a massive force that spins the turbine very quickly, creating a lot of mechanical energy and therefore, electricity.

Nuclear Energy in Canada

In Canada there are 19 nuclear reactors. Ontario has 18 and there is 1 in New Brunswick. Nuclear power plants provide 15% of Canada's electricity.

Advantages of Nuclear Energy

- It does not use large amounts of land to generate energy. In fact, it uses 450 times less land than solar energy to generate the same amount of power.
- It is a stable consistent source of energy. It can be produced around the clock while solar and wind only produce energy 10-30 percent of the day depending on weather conditions
- Nuclear energy does not emit greenhouse gases.

Disadvantages of Nuclear Energy

- The risks of an accident at a generating station could cause damage to people and the environment.
- The used uranium is radioactive waste for thousands of years and must be disposed of carefully to avoid contamination.

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Curriculum Connection
C.1

Nuclear Power - Questions

True or False

Circle whether the statement is true or false

1. Nuclear energy is renewable energy	True	False
2. Nuclear energy generates heat by splitting atoms	True	False
3. Nuclear energy generates no greenhouse gases	True	False
4. Fear of nuclear accidents is why people are against using nuclear energy	True	False
5. Nuclear energy is not used much around the world	True	False

Summarize

Summarize the reading by writing the important information

_____

_____

_____

_____

_____

Questions

Use information from the text to support your answer

1) Do you think we should build more nuclear power generating stations in Canada? Why or why not?

_____

_____

_____

2) What are the benefits of nuclear power?

_____

_____

_____

Curriculum Connection
C.1

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 likely felt this reliance to it!

Generating Electricity – Effect on Environment

In Canada, generating electricity produces far less air pollution than other countries, like the United States. In fact, over 80% of the electricity Canadians use comes from sources that produce no air pollution. These sources 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, winds and solar farms, and nuclear power plants all have an effect on the environment.

Hydroelectric Dam	• The dams block the flow of water and then release some water from time to time. This changing environment makes it hard for wildlife living in the water to survive. • The structure itself is massive. It uses a lot of land • Many of the dams are built in the northern parts of Canada, where 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

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Curriculum Connection
C.1

Generating Electricity - Effect on Environment

Explain Write the effects of each energy source in your own words

Hydroelectric Dam	
Wind	
Solar	
Nuclear	

Reaction Which energy source(s) do you think is best for the environment? Explain

_____

_____

_____

_____

_____

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.

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Curriculum Connection
C.1

Nuclear Power Accidents - Questions

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 were picturing while 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

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Curriculum Connection
C.1

Research - The James Bay Hydroelectric Project

The James Bay Hydroelectric project was one of the largest hydroelectric developments in the last 100 years. Learn more about its development and its impact on the people living near it.

Research Answer the questions below

1) What year did they start building the James Bay Hydroelectric facility?
2) How much did the project cost the government?
3) Which First Nations live in the James Bay area?
4) How much money did the government pay the Cree for use of their land?
5) What was the agreement called between the government and the Cree First Nation?

6) What were the environmental effects of building the James Bay Hydroelectric Project?

7) Did the Cree get a good deal by receiving money from the government for their land? Explain your opinion.

Name: _____ 85

Curriculum Connection
C.1

Measuring Electricity In Our Homes

Measuring Electricity in our Homes

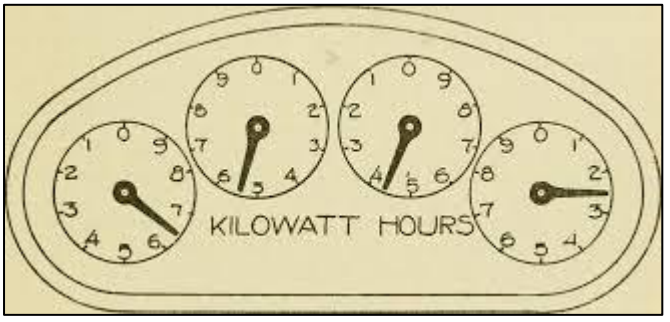
We measure the amount of electricity we have used in our homes by kilowatt hours. A **kilowatt-hour** (symbol: kW·h) is a unit for measuring energy over a period of one hour. It is how many hours one kilowatt has been used in a house. One kW·h is the electricity needed to burn ten 100-watt light bulbs for one hour. An LED 60 inch TV would use approximately 100 watts per hour. This would mean it would take 10 hours for the TV to reach one kilowatt-hour.

Reading a Kilowatt-Hour Metre

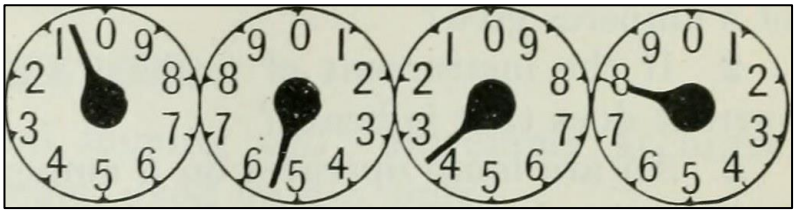
Many kilowatt-hour metres use 4 or 5 dials to provide the number of hours a house has used. Other metres are digital, like the one above. To read the dials, you start from left to right. Every other dial is numbered counter-clockwise. If the pointer is between two numbers, read the number the point has just passed. If the pointer is between 9 and 0, always read 9.

Read the Metre

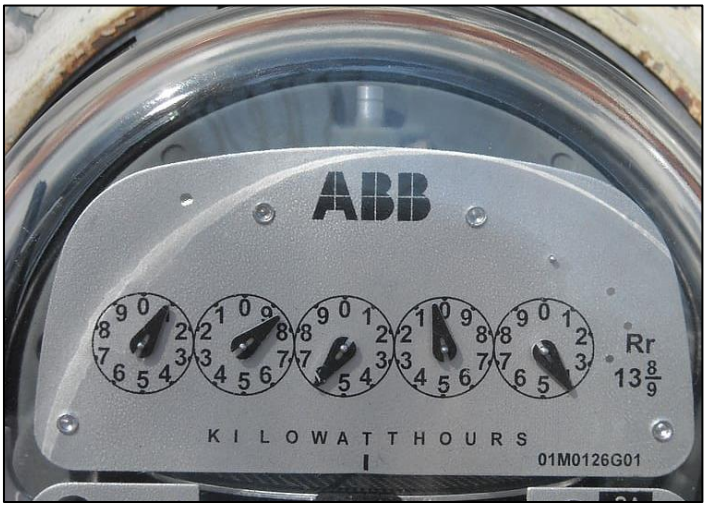
Write the reading below on the line



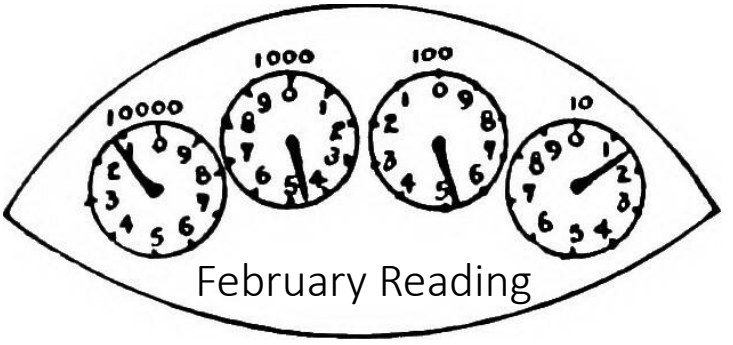
_____



_____



_____



January Reading: 12380 kW·h

February Reading: _____

How many hours were used in January?

_____

Name: _____ 86

Curriculum Connection
C.1

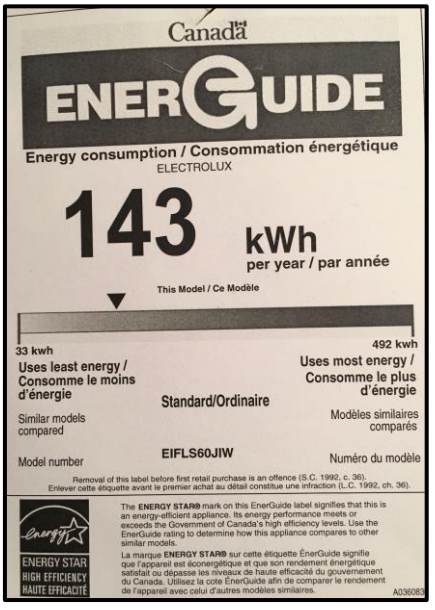
Reading Efficiency Labels

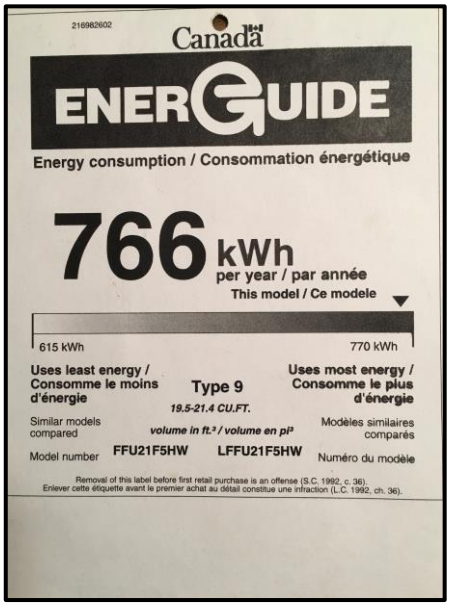
Household appliances
Some appliances in our homes are energy hogs. They require a lot of electricity to operate. Older appliances were made with poor technology that need a lot of energy to run. Replacing old refrigerators or furnaces with newer high efficiency appliances can save a lot of money on energy bills in the long run.

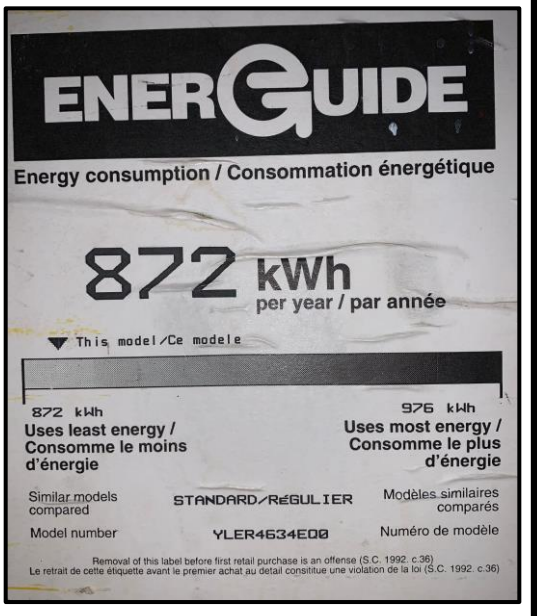
In Canada, the government requires companies to put an energy efficiency label on appliances that displays how much electricity the appliance uses. The label is called the **EnerGuide**. It shows how many kilowatt-hours an appliance will use for a year. The EnerGuide even shows how efficient the appliance is compared with other similar appliances.

Read the EnerGuide

Write down everything you learned about the appliance from the EnerGuide







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Curriculum Connection
C.1

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.	
_____ _____ _____	

Curriculum Connection
C.1

Evaluating Appliances at Home

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 #4	
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.	
_____ _____ _____	

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Curriculum Connection
C.1

How My Family Uses Electricity

Survey How does your family use electricity? Answer yes or no.

1) My family has a car we charge with electricity	☑	☒
2) We have a lot of electronics that use electricity	☑	☒
3) We leave our TV on a lot which wastes electricity	☑	☒
4) We like to leave the lights on in rooms we are not in	☑	☒
5) I use a lot of electronics that I plug into the wall	☑	☒
6) My siblings waste a lot of electricity by leaving them on	☑	☒
7) I always turn off my electronics when I'm not using them	☑	☒
8) We run the dishwasher even if it is not full	☑	☒
9) We don't use a lot of electronics as we play outside more	☑	☒
10) My parents have tools that they plug in using electricity	☑	☒

Write Do you think your family ever wastes electricity? Explain

_____

_____

_____

_____

Name: _____ 90

Curriculum Connection
C.1

Reducing Our Consumption of Electricty

Importance of Reducing our Consumption of Electricity
We've learned about the effects of using too much electricity, but what can we do about it? How can we reduce our consumption at home, at school, and in the community? Think about the ways that you use electricity, and be mindful of alternatives you could choose that require less or no electricity.

At Home

What can you do at home to use less electricity?

1.
2.
3.
4.
5.

At School

What can everyone at your school do to use less electricity?

1.
2.
3.
4.
5.

In the Community

What can you and the people in your city do to use less electricity?

1.
2.
3.
4.
5.

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Curriculum Connection
C.1

If Then Conditional Statements - Activity

Directions Follow the if/then statements to move the electricity to the lightbulb

1)	If lightning is an electrostatic current	then	Move down 3 spots
2)	If a series circuit can work with a dead lightbulb	then	Move right 4 spots
3)	If a parallel circuit can work with a dead lightbulb	then	Move down 2 spot
4)	If a closed circuit turns off a light	then	Move right 3 spots
5)	If a short circuit means wires are crossed	then	Move right 5 spots
6)	If paper is an insulator	then	Move up 3 spots
7)	If a paperclip is a conductor	then	Move right 2 spots
8)	If a resistor increases the electrical current	then	Move left 3 spots
9)	If solar energy cannot generate electricity	then	Move up 4 spots
10)	If electricity generates heat	then	Move down 4 spots

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Curriculum Connection
C.1

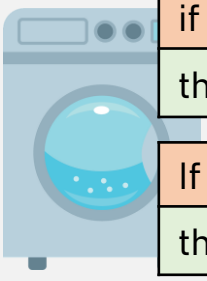
Electricity and Coding

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 program what they want the washing machine to do. The code might look something like this:

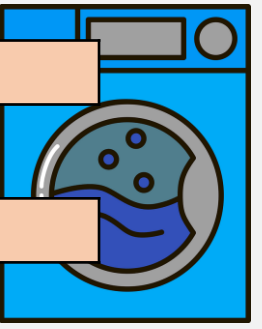


if [gentle wash] is selected

then spin machine at [half] speed, use [cold] water

If [time] is set to [45]

then run washing machine for [45] minutes



Multiple Choice

Circle the correct answer

1) Coding was invented before/after electricity?	Before	After
2) Coding is used to tell computers	What to do	The time
3) Appliances use _____ to give the user options	Electricity	Coding
4) Electricity is used to provide energy in the form of	Light	Thoughts
5) Which uses electricity	Television	Carpets

Question

How does electricity and coding work together to make many things we use today?

_____

_____

_____

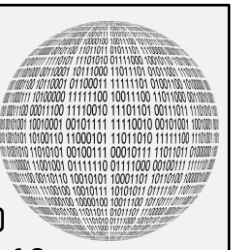
_____

Name: _____ 93

Curriculum Connection
C.1

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 use binary to make sense of complicated data. The binary counting system is the simplest counting method available because it uses only two numbers. Computers can process the 0s and 1s quickly to allow them to understand what we are sending to it.

Binary Code Alphabet

Below you can see the binary number for each letter and number in our alphabet. Binary is read from right to left. You can see that uppercase and lowercase have their own binary code because they are different commands given to the computer. The circles also represent binary. The black circles represent 1s while the white circles represent 0s.

01000001	A	○●○○○○○●	01100001	a	○●●○○○○●	00110000	0	○○●●○○○○
01000010	B	○●○○○○●○	01100010	b	○●●○○○●○	00110001	1	○○●●○○○●
01000011	C	○●○○○○●●	01100011	c	○●●○○○●●	00110010	2	○○●●○○●○
01000100	D	○●○○○●○○	01100100	d	○●●○○●○○	00110011	3	○○●●○○●●
01000101	E	○●○○○●○●	01100101	e	○●●○○●○●	00110100	4	○○●●○●○○
01000110	F	○●○○○●●○	01100110	f	○●●○○●●○	00110101	5	○○●●○●○●
01000111	G	○●○○○●●●	01100111	g	○●●○○●●●	00110110	6	○○●●○●●○
01001000	H	○●○○●○○○	01101000	h	○●●○●○○○	00110111	7	○○●●○●●●
01001001	I	○●○○●○○●	01101001	i	○●●○●○○●	00111000	8	○○●●●○○○
01001010	J	○●○○●○●○	01101010	j	○●●○●○●○	00111001	9	○○●●●○○●
01001011	K	○●○○●○●●	01101011	k	○●●○●○●●			
01001100	L	○●○○●●○○	01101100	l	○●●○●●○○			
01001101	M	○●○○●●○●	01101101	m	○●●○●●○●			
01001110	N	○●○○●●●○	01101110	n	○●●○●●●○			
01001111	O	○●○○●●●●	01101111	o	○●●○●●●●			
01010000	P	○●○●○○○○	01110000	p	○●●●○○○○			
01010001	Q	○●○●○○○●	01110001	q	○●●●○○○●			
01010010	R	○●○●○○●○	01110010	r	○●●●○○●○			
01010011	S	○●○●○○●●	01110011	s	○●●●○○●●			
01010100	T	○●○●○●○○	01110100	t	○●●●○●○○			
01010101	U	○●○●○●○●	01110101	u	○●●●○●○●			
01010110	V	○●○●○●●○	01110110	v	○●●●○●●○			
01010111	W	○●○●○●●●	01110111	w	○●●●○●●●			
01011000	X	○●○●●○○○	01111000	x	○●●●●○○○			
01011001	Y	○●○●●○○●	01111001	y	○●●●●○○●			
01011010	Z	○●○●●○●○	01111010	z	○●●●●○●○			

Name: _____ 94

Curriculum Connection
C.1

What is Binary Code?

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 short form)	
Canada	
I am 11	

Reading Binary

Read the binary code and decide what the computer was told
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	

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Curriculum Connection
C.1

What is Binary Code?

Writing Binary

Shade in the 1s and leave the 0s white

Input	Binary Code Version
Example Sam	
code	
binary	
bit	

Reading Binary

Read the binary code and decide what the computer was told
Hint – it is all lowercase

Binary Code Version	Input

Name: _____ 96

Curriculum Connection
C.1

Writing Code - TV Remote

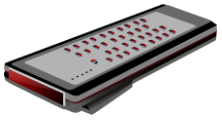
How Does a TV Remote Work?
The battery inside the remote gives it electricity. The remote has an LED light that sends binary code to the TV. The TV has been programmed to understand the binary code it is being sent.

For example

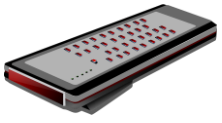
Remote Code
if [on] button is pressed
then send [01101111 01101110] to the television

TV Code
if [on] button is pressed
then [close] the switch

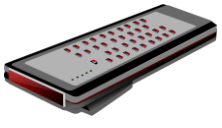
Binary When the remote button is pressed, what binary code is sent to the TV?



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: _____ 97

Electricity Activities

Word Search

Find the word bank words in the puzzle!

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

Word Bank

Electricity
Electromagnetism
Force
Generator
Wind
Turbine
Solar
Current
Magnetism
Wire
Battery
Geothermal
Energy
Electromagnet
Circuit
Parallel
Series

Word Scramble

Unscramble the word bank words from above

NOREREGTA		RELTMEHGAO	
REFCO		AYTERTB	
RIBUTNE		LEIYRCTITCE	
NTMMGIEAS		CMEMNESRGATLITEO	
NWID		IRICTCU	

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 particles are the same, they _____ each other. 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 is a **not** renewable source of energy? a) Solar b) Wind c) Nuclear d) Hydro
7. <u>True or False:</u> A resistor is used in a circuit to create more voltage a) True b) False	8. Which type of circuit is used mostly in battery operated hand-held devices? 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) /6

1. How is electricity generated by geothermal systems?

_____

_____

_____

2. Why are parallel circuits used more in houses? Explain how they are used in outlets and light switches.

_____

_____

_____

3. What is the difference between an insulator and a conductor?

_____

_____

_____

Long Answer (5 marks each) /10

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) What is an electromagnet? How are they used to produce electricity? How are they used in turbines and/or electric bells?