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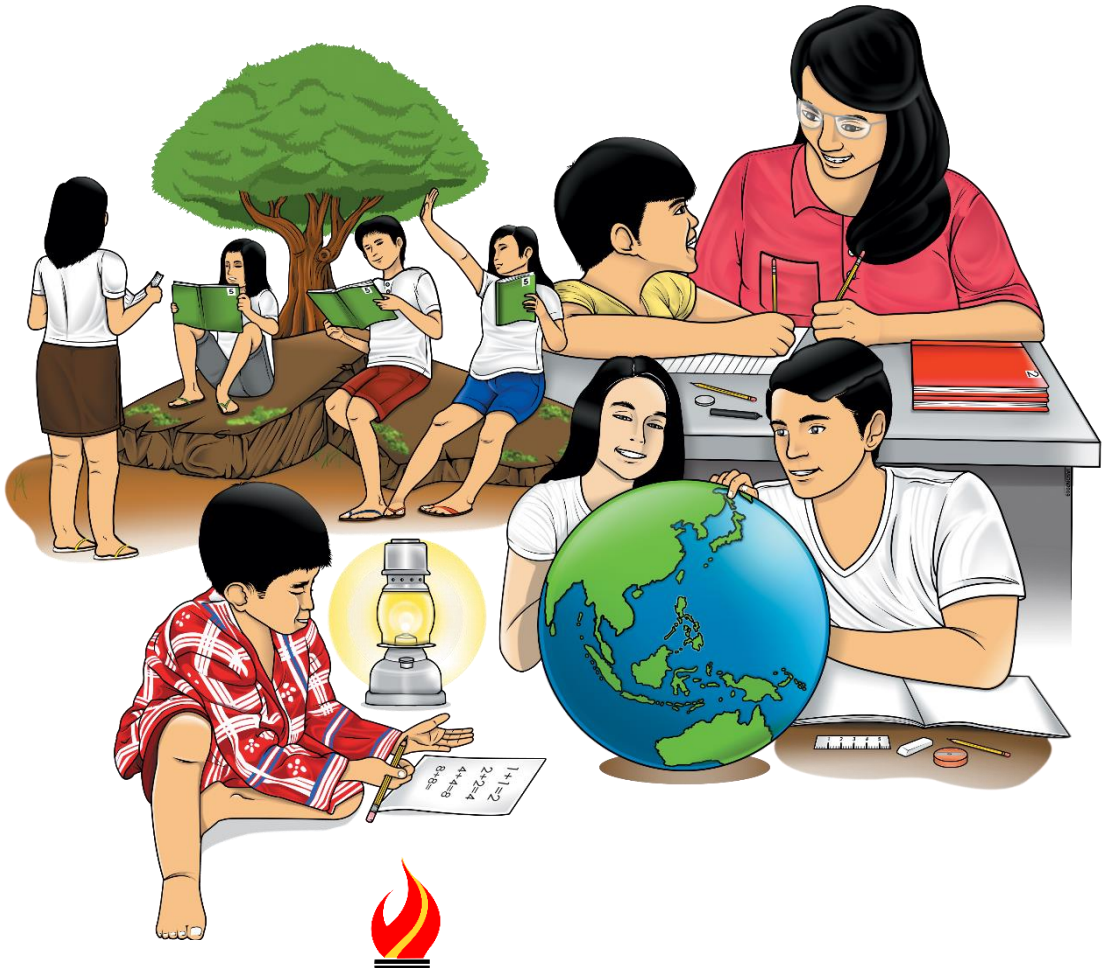
Science

Quarter 2 – Module 5: Simple Electric Motor and Generator



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Science

Quarter 2 – Module 5:
Simple Electric Motor and Generator

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

The SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pretest is provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the posttest to self-check your learning. Answer Key is provided for each activity and test. We trust that you will be honest in using them.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

During summer afternoons, what do you usually look for? You look for the switch of a fan as you need to cool down. The moment you switch on the fan, it starts rotating. Have you ever wondered why the fan is rotating? You may say that it has a motor inside that makes it rotate. But what is going on inside the motor that makes the fan rotate that way? In this module, we'll try to answer all these questions regarding how motor works and how it is made.

After going through this module, you are expected to attain the following objective:

Learning Competency

- Explain the operation of a simple electric motor and generator. **(S10FE-IIj-54)**

This module can somehow assist you in your quest for knowledge. Consider the following tips for better understanding.

1. Try to answer the pretest questions. After doing it, you may check your answers using the key answer provided at the end of the module. This will help you discover your potential and understand your strengths and weaknesses as an individual.

2. This module contains several lessons on the Operation of Simple Electric Motors and Generators. Read thoroughly and understand the nature of the Transformation of Energy between Electric Motor and Generator and identify some uses of both Electric Motor and Generators.

3. Worthwhile and fun-filled activities requiring readily available materials are provided to better enhance your learning comprehension. The activities will help you grasp the concepts used in the lessons. If you hardly do the activities by yourself, feel free to seek assistance from your Science teacher and consult any books in Physics for supplements.

4. After finishing all the lessons, you are now equipped with knowledge which you may use to solve problems related to the topic and ready to answer the questions in the posttest. It would be really fruitful if you will get higher scores than in the pretest.

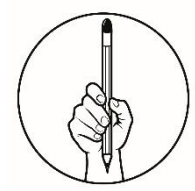
Pre – Requisite Skills

This learning material will provide you a chance to apply your background knowledge on the following topics:

- Simple Electric Motors and Generators;
- Uses of Simple Electric Motors and Generators; and
- Transformation of Energy between Electric Motor and Generator.

Keeping Time

You should be able to finish this in five (5) hours. You may prefer to allot an hour per day for this module. If that is the case, you will need 5 days to finish studying this topic.



What I Know

DIRECTIONS: Read each question carefully. Choose the letter of the correct answer. Use a separate sheet of paper for your answer.

1. Which of the following principles explains how an electric motors works?
   A. magnetic force
   B. magnetism
   C. electrolysis
   D. electromagnetism

2. Which is NOT a distinguishing feature of an electric generator?
   A. Electric generator converts mechanical energy into electrical.
   B. Electric generator converts electrical energy into mechanical energy.
   C. It generates electricity.
   D. It is based on the principle of electromagnetic induction.

3. What do we call a device that converts electricity into mechanical movement?
   A. electric charge
   B. electric motor
   C. electric current
   D. electric generator

4. What do you call a device that converts mechanical movement into electricity?
   A. electric field
   B. electric motor
   C. electric generator
   D. electric plasma

5. Which of the following situations illustrate how a simple electric motor works?
   A. The energy stored in the car's batteries is converted into the rotation of the wheels.
   B. Electrical energy turned into rotation of the blades in the food processor and cut up food.
   C. Both A and B
   D. None of these

6. Which of the following is a device that converts electrical energy into mechanical energy?
   A. vacuum cleaner
   B. bicycle
   C. weighing scale
   D. all of the above

7. What two forces are required for generators and electric motors to work?
   A. magnetic and thermal
   B. magnetic and radiant
   C. electric and thermal
   D. electric and magnetic

8. What would happen to the coiled wire in an electric motor model if there is a repulsion and attraction of the magnetic poles?
   A. The coil fluctuates and converts electrical energy into chemical energy.
   B. The coil stops and changes mechanical energy into electrical energy.
   C. The coil rotates and changes electrical energy into mechanical energy. D. The coil remains stable.

9. What do you call a huge wheel that rotates when pushed by water, wind, or steam (associated with generators)?
   A. Turbine B. Magnet C. Motor D. Pipe

10. What do you call a devise that produces an electric current when a coil of wire is wrapped around an iron core and rotated near a magnet?
   A. magnet B. car C. generator D. motor

11. He was credited for his discovery of electromagnetic induction.
   A. Thomas Edison C. Nikola Tesla
   B. Benjamin Franklin D. Michael Faraday

12. Which of the following is the function of commutator in generator?
   A. Provide magnetic fields where the coil spins
   B. Supplies energy to the generator.
   C. Works like a rectifier that changes AC voltage to DC voltage within the armature winding.
   D. Decrease the loss of energy caused by Eddy Current.

13. What are the three basic parts of an electric motor?
   A. commutator, stator, and rotor
   B. armature, brushes, and battery
   C. commutator, armature, and brushes
   D. battery, armature, and DC power supply

14. Which of these kitchen appliances does not have an electric motor?
   A. water filter C. food processor
   B. refrigerator D. all of the above

15. Which of the following is the correct description of the operation of an electric motor?
   A. Electric motor uses electricity.
   B. The operation is based on the principle of electromagnetism.
   C. The motor converts electric energy into mechanical energy.
   D. All of the above

How did you find the pretest? What was your score? If you got 15 items correctly, you may skip the module. But if you scored 14 and below, you must proceed with the module.

Lesson 1 Simple Electric Motor and Generator

What's In

Directions: Do you still remember your lessons in Grade 9 about energy transformation? You need to recall these energy sources and how they transform energy to other forms of energy. This topic is very much related and helpful for you to easily understand the topics on the generation and transformation of energy between electric motor and generator. Below are examples of the sources of energy paired with words having jumbled letters as clue for identifying them. Rearrange the letters to form a word(s) that will best describe the pictures of the different sources of energy. Use a separate sheet of paper for your answer.

Bangui Windmill, Ilocos Norte by obra19 from https://commons.wikimedia.org/wiki/File:BANGUI_WINDMILL,ILOCOS_NORTE_2.jpg

1. BOI FEUL _____

2. IWDN _____

Palinpinon Geothermal power plant in Sitio Nasulo, Brgy. Puhagan, Valencia, Negros Oriental, Philippines by Mike Gonzalez (The Coffee) from https://commons.wikimedia.org/wiki/File:Puhagan_geothermal_plant.jpg

3. RTEAW _____

4. HETA _____

Illustration of Sun on pickpik.com from https://www.pickpik.com/solar-flare-sun-eruption-energy-fireball-orange-110243

Solar panels installed at the Asian Development Bank headquarters in Mandaluyong City, Metro Manila, Philippines from https://www.flickr.com/photos/asiandevelopmentbank/29832018263

5. SOLRA _____

Are your answers correct? How many words have you identified? Refer to the back page for better understanding on how these sources of energy transformed energy to other forms.

What's New

"Electric Motor"

What you need:

- Clean sheet of paper and ballpen

What you have to do:

1. Below are objects normally found at home. List down which has an electric motor. Use a separate sheet of paper for your answer.

 WALL CLOCK	 STAND FAN	 FLAT IRON
 VASE	 MOTORCYCLE	 WATER DISPENSER
 PROJECTOR	 LAPTOP	 GARBAGE BIN
 ADJUSTABLE WRENCH	 OVEN TOASTER	 HELMET

Directions: On a separate sheet, answer the following questions based onthe activity on page 6.

1. What are those materials with electric motors?

_____

2. What are those materials which do not have electric motors?

_____

3. Describe the materials with electric motors.

_____

4. Describe the materials without electric motors.

_____

5. What do you think is the role of the electric motor in the materials/appliances?

_____

What is It

Have fun in learning Simple Electric Motor and Generator...

You have probably experienced when at one moment you're watching your favorite program on TV and on the next minute you're groping in the dark because of power interruption. At such time, you may have wished you had a candle or a flashlight so that you could see in the dark. How can you make a steady flow of electricity?

What is a generator?

- A generator converts Mechanical Energy to Electrical Energy.
- It produces an electric current when a coil of wire is wrapped around an iron core and rotated near a magnet.

How does a generator work?

- An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output.

Principle of Electromagnetic Induction in Generator

- Modern generators can be attributed to Michael Faraday's principle of **ELECTROMAGNETIC INDUCTION.** Faraday discovered that when a conductor moves in a magnetic field, electrical charges could be created and directed to create a flow of current.

Photograph of Michael Faraday by John Watkins on commons.wikimedia.org from **https://tinyurl.com/MFaraday**

- At its most basic, an electrical generator is nothing more than an electromagnet – moving wire near a magnet to direct the flow of electricity. It's similar to how a pump pushes water through a pipe.

- It is important to understand that a generator does not actually "create" electrical energy. Instead, it uses the mechanical energy supplied to it to force the movement of electric charges present in the wire of its windings through an external electric circuit.

- This flow of electric charges constitutes the output electric current supplied by the generator. This mechanism can be understood by considering the generator to be similar to a water pump, which causes the flow of water but does not actually create the water flowing through it.

How water, wind, and steam make electricity through generator?

1. Water – Hydropower plants capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of the falling water into mechanical energy. Then a generator converts the mechanical energy from the turbine into electrical energy.

2. Wind - The wind turns the blades of the windmill, known as the turbine, which, in turn, spins the shaft that turns the coil inside the magnet, known as the generator, and it produces the electricity.

3. Fossil Fuel/Steam/Heat - Oil is burned to heat water which makes steam. Steam moves the turbine blades that turn a shaft inside the generator. The shaft spins the coil of wire inside a magnet in the generator that produces a current of electricity.

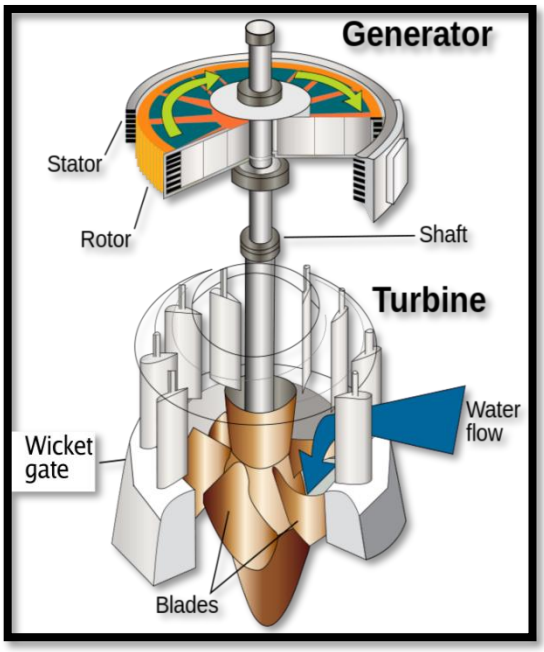
What are the main components of a DC generator?

A DC generator is an electrical machine which converts mechanical energy into **direct current electricity**.

1. Stator - The main function of the stator is to provide magnetic fields where the coil spins. A stator includes two magnets with opposite polarity facing each other. These magnets are located to fit in the region of the rotor.

2. Rotor - A rotor in a DC machine includes slotted iron laminations with slots that are stacked to shape a cylindrical armature core. The function of the lamination is to decrease the loss caused due to "Eddy Current".

3. Commutator - A commutator works like a rectifier that changes AC voltage to DC voltage within the armature winding. It is designed with a copper segment, and each copper segment is protected from each other with the help of mica sheets. It is located on the **shaft** of the machine.



Hydraulic turbine and electrical generator, cutaway view on commons.wikemedia.org from https://commons.wikimedia.org/wiki/File:Water_turbine_(en_2).svg

4. Brushes – The Brushes are in constant contact with the commutator and are attached to the wires leading from the generator. The commutator spins while the brushes remain stationary, transferring current from the commutator.

5. Shaft – The shaft transfers mechanical energy to the generator and turns the coil through the magnetic field. The shaft may be turned by a turbine that operates with water, steam or air, or by other means.

Difference between the AC Generator and the DC Generator

- AC generator produces AC electrical power whereas DC generator produces DC electrical power
- In DC generator the current flows in one direction whereas in the AC generators current reverses periodically.
- In DC generator split rings are used they wear out quickly in AC generator slip rings are used, so they have high efficiency.
- AC generators are used for small domestic applications whereas DC generators used to power large motors.

What are the top Uses of Generator?

- Back -Up power for your house
- Stand-by power for businesses
- Temporary power in a construction site
- Permanent power to a farm
- Helping main source of electricity to supply the total power required
- Pop concerts, events, and exhibitions
- Caravans/Camping in remote locations Outdoor catering facilities

What is an electric motor?

Figure 1: "Electric Motor" illustrated by Richard C. Paragas

ELECTRIC MOTOR

- Anything that changes electricity into motion, meaning electrical energy into mechanical energy is called an electric motor.

Basic Principles

- Danish physicist **HANS CHRISTIAN ØRSTED** began a new scientific era when he discovered that electricity and magnetism are linked. He showed by experiment that an electric current flowing through a wire could move a nearby magnet.

H.C. Ørsted by Christoffer Wilhelm Eckersberg on commons.wikimedia.org from https://tinyurl.com/HCOrsted

- The discovery of **ELECTROMAGNETISM** set the stage for the eventual development of our modern technology-based world.

How do Electric Motors work?

- Motors work through the principles of **ELECTROMAGNETISM**. If you run electricity through a wire, it creates a magnetic field. If you coil the wire around a rod and run electricity through the wire, it creates a magnetic field around the rod. One end of the rod will have a north magnetic pole and the other will have a south pole. Opposite poles attract one another, like poles repel. When you surround that rod with other magnets, the rod will rotate from the attractive and repulsive forces.

What are the parts of an electric motor?

Electric motor designs can vary quite a lot, though in general they have three main parts: a rotor, a stator and a commutator. These three parts use the attractive and repulsive forces of electromagnetism, causing the motor to spin continually as long as it receives a steady flow of electric current.

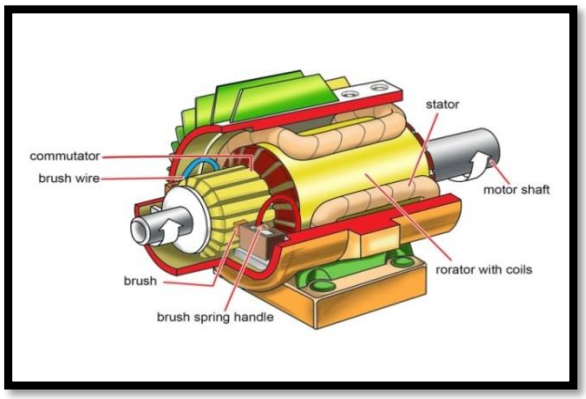


Figure 2: "Parts of the Electric Motor" illustrated by Richard C. Paragas

A. THE STATOR

Every electric motor has two essential parts; one stationary, and one that rotates. The stationary part is the stator. Though configurations vary, the stator is most often a permanent magnet or row of magnets lining the edge of the motor casing, which is usually a round plastic drum.

B. THE ROTOR

Inserted into the stator is the rotor, usually consisting of copper wire wound into a coil around an axle. When electric current flows through the coil, the resulting magnetic field pushes against the field created by the stator, and makes the axle spin

C. THE COMMUTATOR

1. BASICS – An electric motor has another important component, the commutator, which sits at one end of the coil. It is a metal ring divided into two halves. It reverses the electrical current in the coil each time the coil rotates half a turn. The commutator periodically reverses the current between the rotor and the external circuit, or the battery. This ensures that the ends of coils do not move in opposite directions, and ensures that the axle spins in one direction.

2. **MAGNETIC POLES – BRUSHES AND TERMINALS**. At one end of the motor are the brushes and the terminals. They are at the opposite end from where the rotor exits the motor casing. The brushes send electrical current to the commutator and are typically made of graphite. The terminals are the locations where the battery attaches to the motor and sends the currents to spin the rotor.

Difference between the AC Motor and the DC Motor

- In the AC Motor, the source of power is AC mains supply whereas in DC motor power is obtained from batteries.
- In AC motors no commutators and brushes are used whereas in DC motors these play an important part in their operation.
- In AC motors the armature is stationary and the magnetic field rotates whereas in DC motors it is vice versa.
- AC motors are suitable for large industrial applications whereas DC motors are suitable for domestic applications.

APPLICATIONS OF ELECTRIC MOTOR

Electric motors are extremely important in modern-day life. They are used in food processors, vacuum cleaners, dishwashers, computer printers, fax machines, video recorders, machine tools, printing presses, automobiles, subway systems, sewage treatment plants, and water pumping stations, to mention only a few applications.

Figure 3: Example of the applications of Electric motor in automobile and food processor/blender.

Comparison of Motor and Generator

A motor and generator perform opposite functions, but their fundamental structure is the same. Their structure is a "**coil mounted on an axle within a magnetic field"**. An electric motor is used to produce rotational motion from electrical supply. In a motor, an electric current is passed through the coil. The coil then creates a magnetic field that interacts with the already existing magnetic field. This interaction forces the coil to rotate.

For a motor, the input energy is electrical energy and the useful output energy is mechanical energy.

The generator is used to produce an electric current from rotational motion (on large scale power stations a "**turbine"** is used to provide this rotation). In a generator, the rotation causes the coil to rotate inside the magnetic field. This induces an alternating current in the coil.

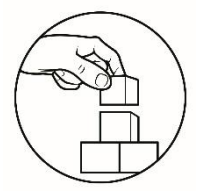
For generator the input energy is mechanical energy and the useful output energy is electrical energy.

In power stations, it is usually the magnet which is attached to the axel and rotates with the coils surrounding the magnet. However, the end result is the same.

The motor and the generator are almost similar from the construction point of view, as both have stator and rotor.

The differences between Motor and Generator are as follows:

- The motor converts electric energy into mechanical energy, whereas, generator does the opposite.
- Electricity is used in the motor, but the generator produces the electricity.
- An example of motor is an electric car or bike where electric current is supplied to the machine or device and it gets converted to mechanical motion and, as a result, the car or bike moves. The example of generator is that in power stations, the turbine is used as a device which converts mechanical energy from the force of water falling from the dam to generate electric energy.



What's More

Activity 1: "Electric Generator"

What you need:
(Materials locally available at home or nearby)

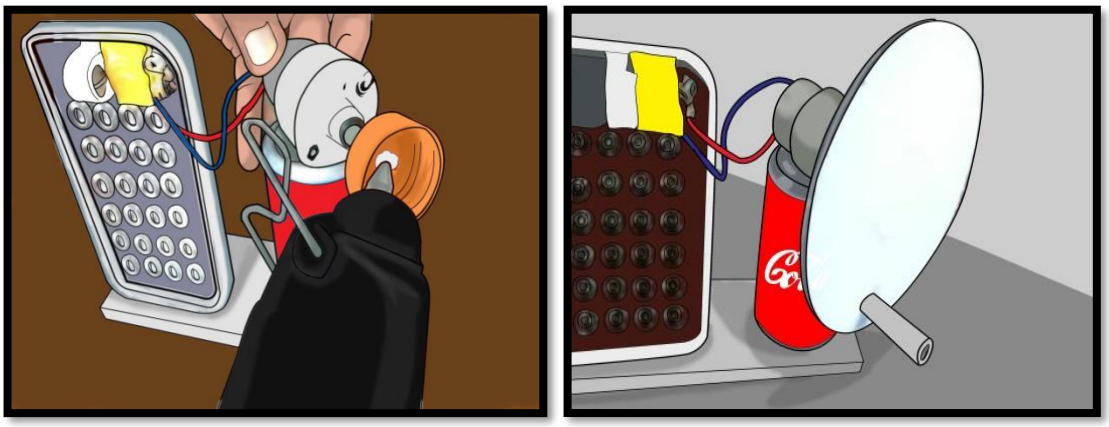
small plastic board	tin can/soda can	led lights
plastic bottle cap	motor from a broken toy	old CD
glue		

What you have to do:
A. For the base
- Use a small piece of plastic board, one side is attached with a double-sided sticky tape.
- All other parts will be held to the exposed side of the double-sided sticky tape (use hot glue for extra strength).

B. Motor Holder
- Use soda can (one side of the can is placed on sticky layer of the tape. To increase the strength, use hot glue).

C. Light Source
- Use LED panel, having 24 LED lights from a broken lamp.
- LED panel is glued vertically.
- Connections are made from motor to LED panel
- The end of motor shaft should be attached with a plastic bottle cap and hot glued.

D. For the Fly wheel
- Use old CDs, glued together.
- Glue the other side of the cap to this flywheel
- Make a handle for rotating the flywheel.
- Rotate the CD using handle provided until the LED glows.
- If the connection between motor and panel does not work properly then try rotating counter clockwise.



Your output from this activity will be rated by your teacher according to the following criteria:

Completeness of the Parts (Simple Generator)	-	5 points
Functionality	-	5 points
Neatness of work/Durability	-	5 points
Total	-	15 points

Assessment 1

Directions: Choose the best answer from the choices in the parenthesis. Write your answer on a separate sheet of paper.

1. A generator is a machine which converts Mechanical Energy into (Chemical, Electrical).
2. Generator (uses, produces) electricity, hence, the glowing of the LED lights when rotation takes place.
3. The generator is used to produce an electric current from (rotational, diagonal) motion of the CD with handle.
4. Generator works on (Michael Faraday's, Christian Oersted's) Electromagnetic induction.
5. On a large scale power station like the hydroelectric power plant (San Roque Dam) a (propeller, turbine) is used to provide the rotation.

Activity 2: "Simple Electric Motor"

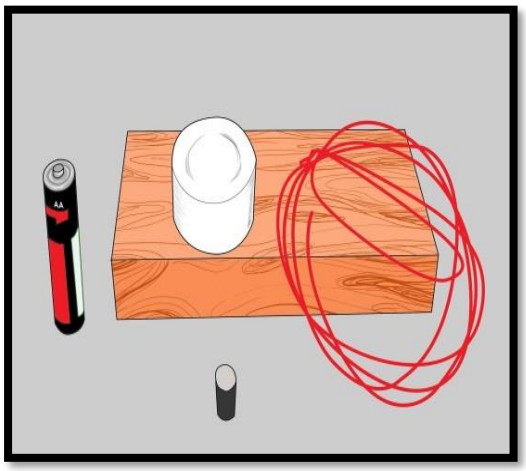
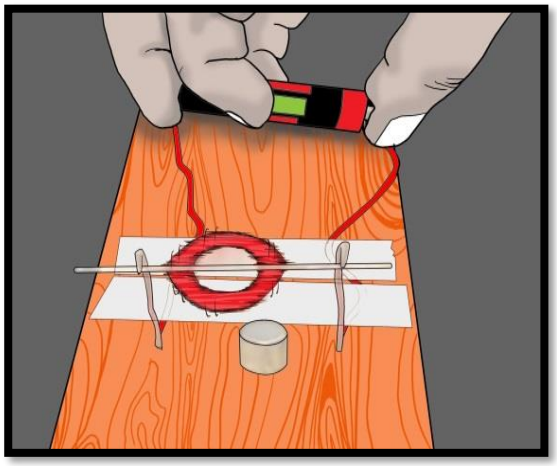
What you need:
(Materials locally available at home or nearby)

AA Battery	small magnet	scotch tape
a block of wood	wire	

What you have to do:

1. Coil the wire around an AA battery at least 10 times.
2. Remove the coil from the battery and wrap the ends of the coil 2 times.
3. Remove the insulation and be careful not to damage the wire.

4. Cut two pieces of wire about 8 inches.
5. Remove the insulation of each end of the wire.
6. Bend each wire and form an S shape.
7. Attach the wire to the wooden block using tape.
8. Each wire bends about 90°.
9. Make sure that the coil is at the center and is balanced.
10. Put the magnet under the coil and connect the battery.

Your output from this activity will be rated by your teacher according to the following criteria:

Completeness of the Parts (Simple Electric Motor)	-	5 points
Functionality	-	5 points
Neatness of work/Durability	-	5 points
Total	-	15 points

Assessment 2

Directions: Choose the best answer from the choices in the parenthesis. Write your answer on a separate sheet of paper.

1. An electric motor is a machine which converts Electrical Energy into (Mechanical, Potential) energy.

2. The (battery, wire) supplies the electric current into the coil and it gets converted into motion.

3. (Christian Oersted, Michael Faraday) discovered that a magnetic field was produced by a flow of electric current.

4. When battery is connected, the coil creates a magnetic field that interacts with the already existing magnetic field brought about by the (battery, magnet).

5. The interaction of magnetic fields from the battery and magnet forces the coil to (stop, rotate).

Activity 3: "Comparison of Electric Motor and Generator"

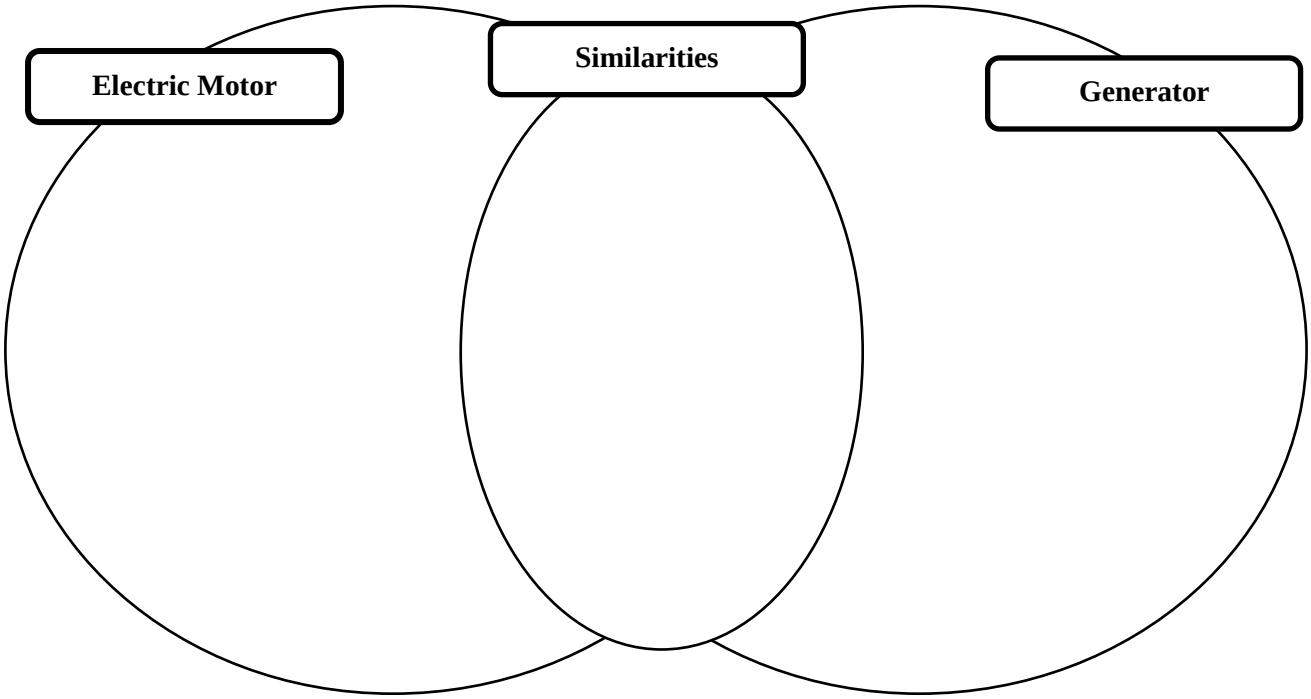
What you need:

Piece of paper and ballpen

What you have to do:

Compare and contrast the Electric Motor and Generator using the Venn diagram.

Choose the answers from the box below.



1. have stator and rotor	6. converts mechanical energy into electrical energy
2. power turbine	7. coil mounted on axle within a magnetic field
3. electricity is used	8. converts electrical energy into mechanical energy
4. produces electricity	9. input is electrical
5. electric car or bike	10. input is mechanical

***Note:** The Venn diagram must be photocopied or be copied on a separate sheet of paper.

Assessment 3

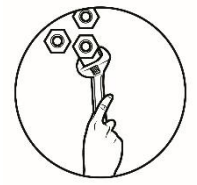
Directions: Choose the best answer from the choices in the parenthesis. Write your answer on a separate sheet of paper.

1. Electricity is produced in the (motor, generator).
2. Electric bike, where electric current is supplied to the machine as a result of a movement, is an example of (motor, generator)
3. The generator transforms mechanical into (radiant, electrical) energy, whereas electric motor does the opposite.
4. Both motor and generator have stator and (commutator, winding poles).
5. The motor converts electrical energy into (mechanical, chemical) energy, whereas generator does the opposite.

What I Have Learned

Excellent job! You are almost done with the module. Let's summarize what you have learned from the lesson and activities by answering the following questions. Write your answer on a separate sheet of paper.

1. What are the similarities and differences between electric motor and generator?
   _____
2. How does electric motor and generator work?
   _____



What I Can Do

What you need:

crayons/oil pastel/pencil short coupon bond ruler pencil/pen

What you have to do:

- Using your creativity and artistic ability, draw how a simple motor and generator operates/works.

Your output in the poster making will be rated by your teacher using the following criteria:

Relevance to the Topic	5 points
Creativity	5 points
Neatness	5 points
Color Harmony/Organization	5 points
Total	20 points

Assessment

Directions: Read each question carefully. Choose the letter of the correct answer. Use a separate sheet of paper for your answer.

1. What do you call an energy converting system that transforms electrical energy into mechanical movement?
   A. Electric motor
   B. Electric field
   C. Electric generator
   D. Electric plasma

2. Which of the situation below shows how a basic electric motor works?
   A. The energy contained in the batteries of the vehicle is transformed into wheel rotation.
   B. Electrical energy converted into blade rotation in the food processor and cut down food.
   C. Both A and B
   D. None of these

3. Which is the correct sequence in the operation of generator in the production of electricity in Hydroelectric Power Plant?
   I. A turbine converts the kinetic energy of the falling water into mechanical energy.
   II. Hydropower plants capture the energy of falling water to generate electricity.
   III. Once an electrical current has been established, it is directed through copper wires to power machines and devices.
   IV. The generator converts the mechanical energy from the turbine into electrical energy.
   A. I, IV, II, III
   B. II, I, IV, III
   C. IV, I, III, II
   D. III, II, IV, I

4. He was credited for discovering that electric currents create magnetic fields, which was the first connection found between electricity and magnetism.
   A. James Maxwell
   B. Hans Christian Ørsted
   C. Michael Faraday
   D. Alessandro Volta

5. What will happen to the coiled wire in a model of an electric motor if the magnetic poles are repulsed and attracted?

   A. The coil remains stable.

B. The coil fluctuates and converts electrical energy into chemical energy.
C. The coil stops and changes mechanical energy into electrical energy.
D. The coil rotates and changes electrical energy into mechanical energy.

6. What are the three basic parts of an electric generator?
A. commutator, stator, and motor shaft
B. armature, brushes, and battery
C. stator, rotor, and commutator
D. battery, armature, and DC power supply

7. Which of these is the commutator function in the generator?
A. Acts as a rectifier that converts AC voltage to DC voltage within the winding of the armature.
B. Diminish the energy loss caused by Eddy Current.
C. Offer magnetic fields where the coil is rotating.
D. Provides electricity to the generator.

8. What do you name a mechanism that generates electrical current when a wire coil is wrapped around an iron core and rotated close to a magnet?
A. car B. magnet C. motor D. generator

9. Which is NOT a distinctive attribute of an electrical generator?
A. Electric generator turns mechanical energy into electric energy.
B. Electric generator turns electric power into mechanical energy.
C. It provides electricity.
D. It is based upon the electromagnetic induction theory.

10. What do you name a huge wheel (associated with generators) that rotates when driven by water, wind, or steam?
A. Motor B. Pipe C. Turbine D. Magnet

11. Which of the following is a device that converts electrical energy into mechanical energy?
A. electric bicycle
B. microwave oven
C. rice cooker
D. all of the above

12. Which of the following is the right explanation of the electrical motor operation?
A. Electric motor uses electricity.
B. The operation is based on the principle of electromagnetism.
C. The motor converts electric energy into mechanical energy
D. All of the above

13. What do you call a device that transforms mechanical energy into electrical energy?
A. electric charge
B. electric motor
C. electric generator
D. electric current

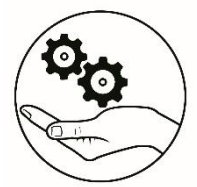
14. Which is the correct sequence in the operation of simple motor?
I. Magnets placed near one another either attract or repel.
II. The attraction and repulsion causes the wire to jump.
III. Electric current starts to creep along wire; it creates a magnetic field all around it.
IV. Electrical energy converted to mechanical energy.

V. Temporary magnetic field interacts with the permanent magnet

A. V, IV, II, II, I
B. III, V, I, II, IV
C. V, III, I, IV, III
D. III, II, IV, I, V

15. Which two forces are required to operate with generators and electric motors?
    A. electric and magnetic
    B. electric and thermal
    C. magnetic and radiant
    D. magnetic and thermal

I know that you've worked hard. You have accomplished a lot. I hope that you have understood and appreciated the concept on the Operation of the Simple Electric Motor and Generator. Keep it up! See you in the next Module.



Additional Activities

A. "Motors Everywhere"

DIRECTIONS: Look around your house and you will find that it is filled with electric motors. Here's an interesting experiment for you to try: Walk through your house and count all the motors you find in the kitchen, bathroom, bedroom, living room and finally the garage.

Question: In walking through your house, how many devices with electric motors have you counted in different areas of your house?

_____

***Note:** Use a separate sheet for your answer.

B. How Does a Generator Work? (YouTube Video)
***Note:** This is an optional activity.

Wait there's more! You might want to view a YouTube video entitled: "How does a generator work? Here's the link of the video:
https://tinyurl.com/OperationOfGenerator

C. Electrical Motor and Generator Comparison

Compose a poem/song that explains the operation of simple electric motor and generator.
***Note:** Use a separate sheet for your composition.

Your output in the poem/song will be rated by your teacher using the following criteria:

Relevance to the Topic	5 points
Creativity/Style and Originality	5 points
Total	10 points

Answer Key

What I Know

1. D
2. B
3. B
4. C
5. C
6. A
7. D
8. C
9. A
10. C
11. D
12. C
13. A
14. A
15. D

What's In

1. BioFuel
2. Wind
3. Water
4. Heat
5. Solar

What's New

With Electric Motor
1. WATER DISPENSER
2. MOTORCYCLE
3. OVEN TOASTER
4. FLAT IRON
5. WALL CLOCK
6. STAND FAN
7. PROJECTOR
8. LAPTOP

Without Electric Motor
1. Vase
2. Garbage Bin
3. Helmet
4. Adjustable Wrench

Questions:

1. WATER DISPENSER, MOTORCYCLE, OVEN TOASTER, FLAT IRON, WALL CLOCK, STAND FAN, PROJECTOR, and LAPTOP.

2. VASE, GARBAGE BIN, HELMET, and ADJUSTABLE WRENCH

3. Materials with electric motor need electricity to function

4. Materials without electric motor don't need electricity to function.

5. Electric motor converts electrical energy into mechanical energy.

What's More

Assessment 1
1. Electrical
2. Produces
3. Rotational
4. Michael Faraday
5. Turbine

Assessment 2
1. Mechanical
2. Battery
3. Christian Oersted
4. Magnet
5. Rotate

Activity 3 (Venn Diagram)
1. Similarity
2. Generator
3. Electric Motor
4. Generator
5. Electric Motor
6. Generator
7. Similarity
8. Electric Motor
9. Electric Motor
10. Generator

Assessment 3
1. Generator
2. Motor
3. Electrical
4. Commutator
5. Mechanical

Assessment
1. A
2. C
3. B
4. B
5. D
6. C
7. A
8. D
9. B
10. C
11. D
12. D
13. C
14. B
15. A

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