



Lesson Plan: Electromagnetism

Grade Level: 6

Subject: Physical Science

Duration: 45–60

NGSS MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Learning Objectives

By the end of this lesson, students will be able to:

- **Explain** the relationship between electricity and magnetism and how electric current produces a magnetic field.
- **Describe** how electromagnets work and identify their practical applications in everyday



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energy. Generators produce electricity by moving a conductor through a magnetic field.

- **Magnetic Field:** An invisible region in the space around a magnet where a magnetic force can be detected. Magnetic field lines show the direction and strength of the force.
- **Induction:** The production of electrical current in a conductor by moving it through a magnetic field or by changing the magnetic field around it. This process converts mechanical energy to electrical energy.
- **Transformer:** A device used to increase or decrease voltage in an electrical circuit. Step-up transformers increase voltage, while step-down transformers decrease voltage.



- **Direct Current (DC):** A type of electrical current in which electric charges flow in only one direction through a circuit, such as the current from a battery.

Materials Needed: (all links are included in this PDF)

- Printed copies of the Study Guide (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-electromagnetism-1.pdf>)
- Activity Lesson handouts (<https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-electromagnetism-1-3.pdf>)
- Vocabulary matching worksheet (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-electromagnetism-1-1.pdf>)
- Assessment worksheet (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-electromagnetism-1-0.pdf>)



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(<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-electromagnetism-1.pdf>)

- Introduce the concept that electricity and magnetism are related forces that can be converted into one another.

Step 2: Direct Instruction (15 minutes)

- Use the Study Guide to explain electromagnetism: how electric current flowing through a wire creates a magnetic field around it. (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-electromagnetism-1.pdf>)



- Demonstrate building a simple electromagnet: wrap insulated copper wire around an iron nail 20-30 times, connect the wire ends to a battery, and show how the nail can now pick up paper clips.
- Explain the difference between electric motors (electrical to mechanical energy) and generators (mechanical to electrical energy) using diagrams from the Activity Lesson. (<https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-electromagnetism-1-3.pdf>)
- Discuss transformers and their role in managing voltage for safe electricity delivery to homes. (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-electromagnetism-1.pdf>)

Step 3: Guided Practice (15 minutes)

- Distribute the Activity Lesson handout and work through the circuit diagrams as a class, identifying series and parallel circuits. (<https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-electromagnetism-1-3.pdf>)



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Step 5: Assessment (10 minutes)

- Administer the assessment worksheet with multiple-choice questions covering electromagnetism concepts, motors, generators, and transformers. (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-electromagnetism-1-0.pdf>)
- Ask students to classify everyday devices as using electric motors, generators, or electromagnets: refrigerator (motor), wind turbine (generator), doorbell (electromagnet), electric saw (motor).



- Review answers as a class and clarify any misconceptions about energy conversion and electromagnetic applications.

Differentiation Strategies

For advanced learners:

- Challenge advanced learners to research and present on how MRI machines or maglev trains use electromagnetism, connecting the lesson concepts to cutting-edge technology.
- Have students design an experiment to test variables that affect electromagnet strength, such as number of coils, current strength, or core material.

For learners needing support:

- Provide pre-labeled diagrams of electromagnets, motors, and generators with color-coded parts to help students visualize component relationships.



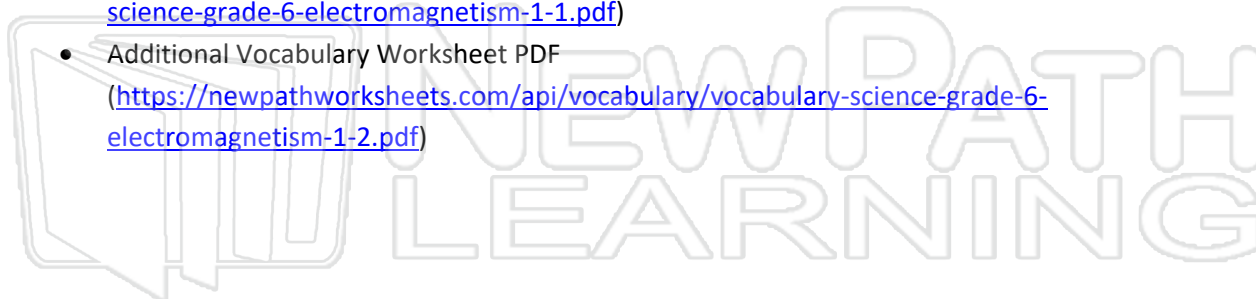
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- NewPathWorksheets: Electromagnetism (<https://newpathworksheets.com/science/grade-6/electromagnetism-1>)
- Study Guide PDF (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-electromagnetism-1.pdf>)
- Activity Lesson PDF (<https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-electromagnetism-1-3.pdf>)
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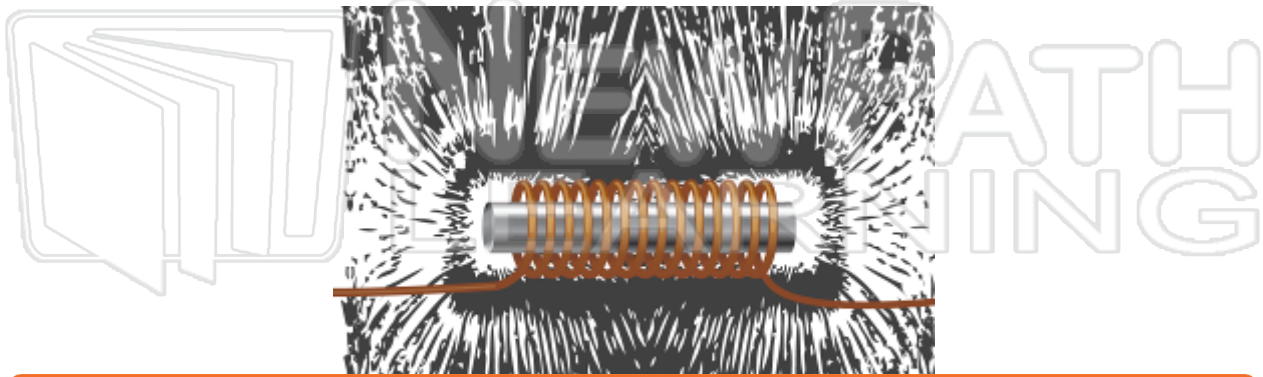
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ELECTROMAGNETISM

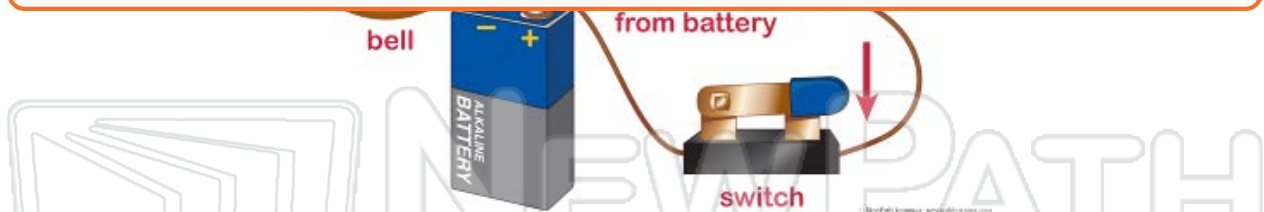
Overview

The production of a magnetic field around an electrical current is called **electromagnetism**. This is shown in the diagram below.



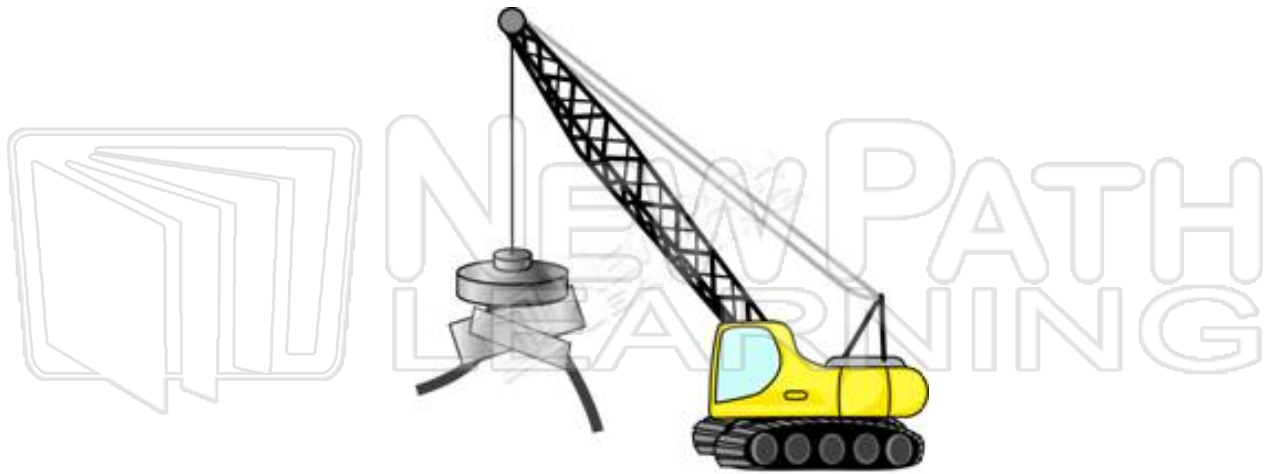
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The magnetic field produced here when the circuit is closed is a combination of the magnetic force from the electrical current and the metal bar. Opening the circuit reduces the strength of the magnetic field and stops the clapper from striking the bell.

In junkyards, large electromagnets held by cranes are used to lift heavy loads of metal. When current is flowing the metal is lifted and when current stops flowing, the metal drops off the magnet.



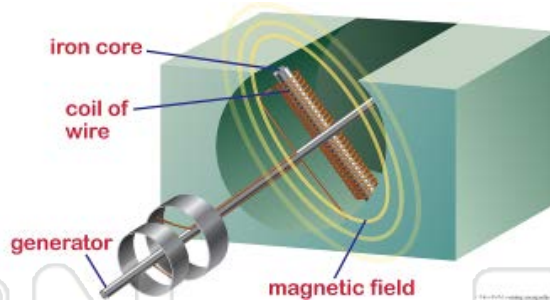
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How does an electric motor work?

Induction

A **generator** works in an opposite manner from a motor. By moving a conductor through a magnetic field, induced electricity is produced by **induction**. In this activity, mechanical energy is converted to electrical energy. In the diagram below, we see induction occurring in two different ways:



Generators produce almost all of our electricity. By burning coal, oil or natural gas, large amounts of water are converted to steam which provides the mechanical energy needed to turn the generators. In some cases, falling water alone is enough to do this job.

LESSON CHECKPOINT:

How does a generator work?



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without transformers, getting electricity from power plants to our homes would be impossible. Coming out of large generators, voltages first have to be increased to be carried over long distances. When it nears our homes, these high voltages have to be reduced to safely enter and then work our appliances.

LESSON CHECKPOINT:

What are the two types of transformers and what does each type do?

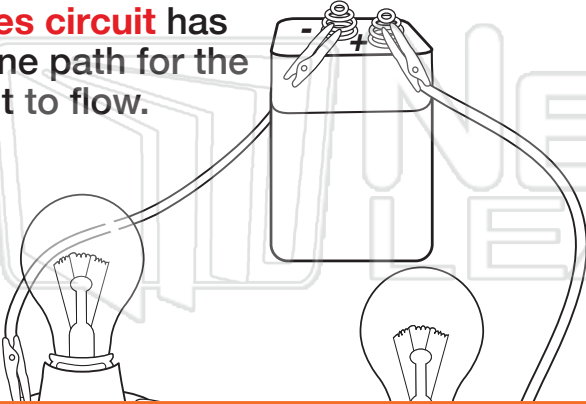


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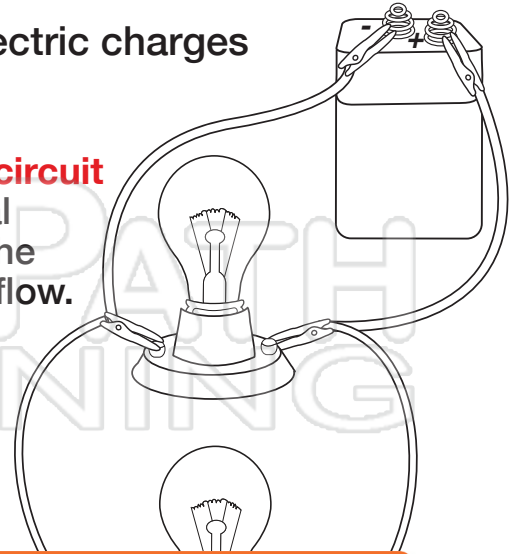
Electricity

Electric current is the continuous movement of electric charges through a conductive material.

A **series circuit** has only one path for the current to flow.



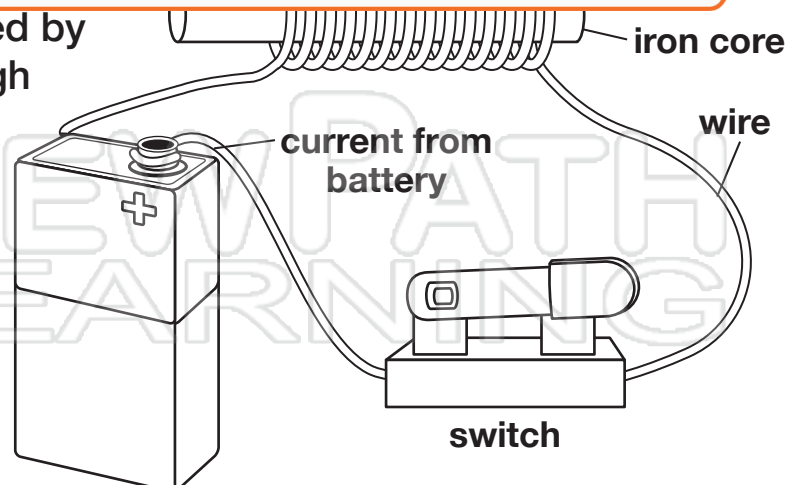
A **parallel circuit** has several paths for the current to flow.



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An **electromagnet** is in which a magnetic field is created by running an **electric current** through a coiled wire. They are used in electric motors, computers and power generators, among other devices.

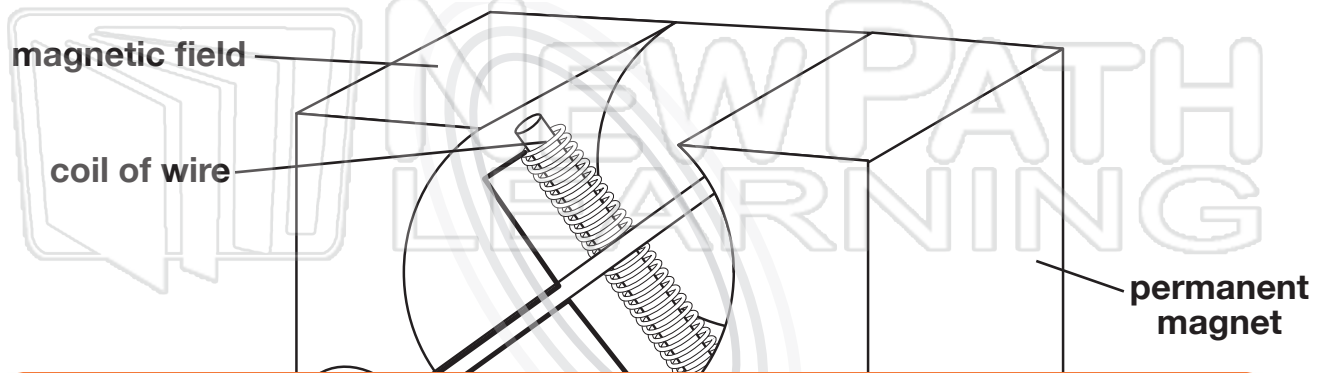




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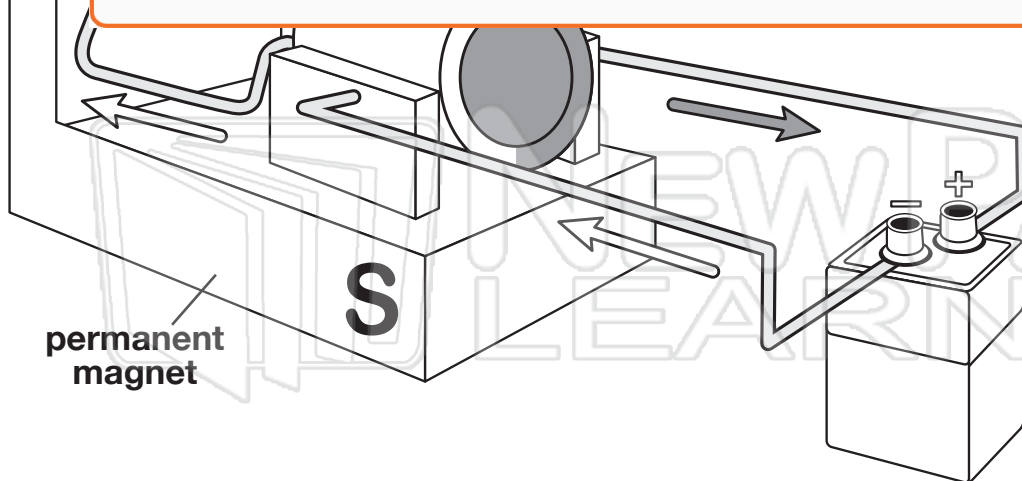
Generators produce almost all of our electricity. By burning coal, oil or natural gas, large amounts of water are converted to **steam** which provides the **mechanical energy** needed to **turn** the generators.

Electromagnets inside generators change magnetism to electrical energy.



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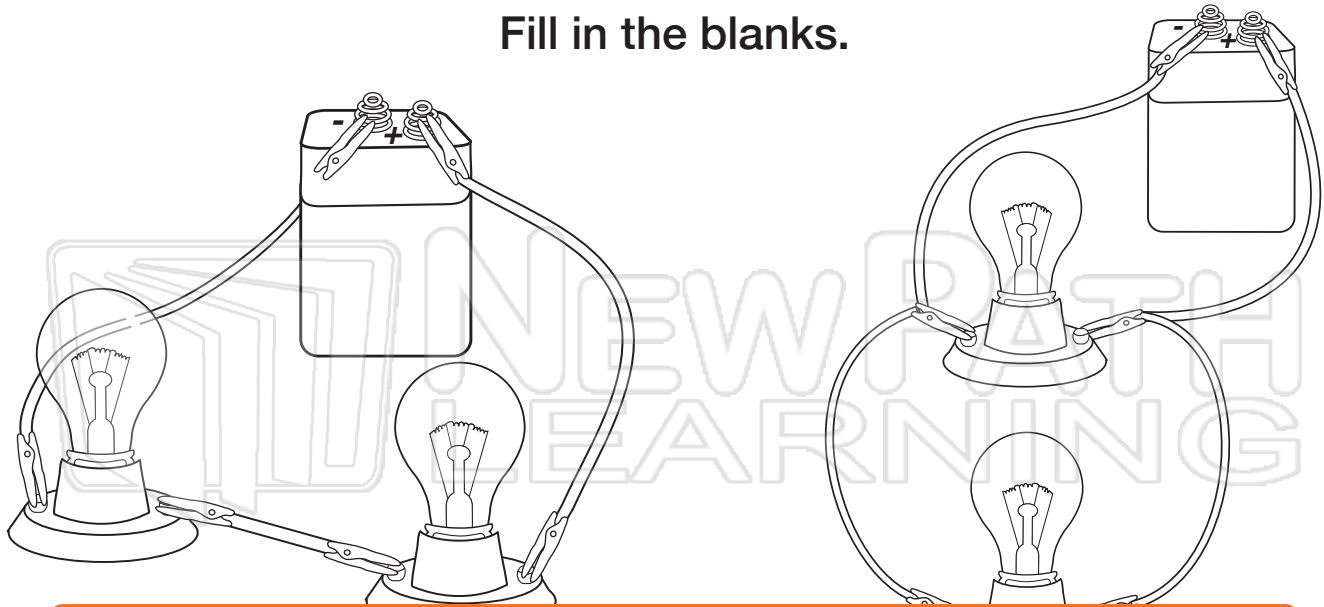


Electromagnetism

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Fill in the blanks.



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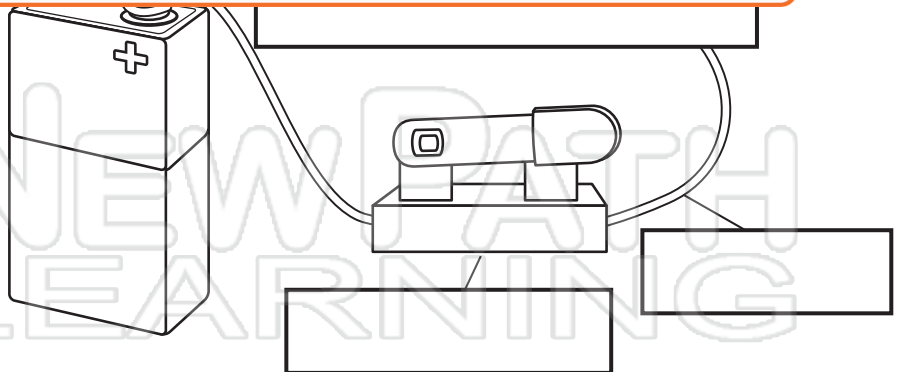
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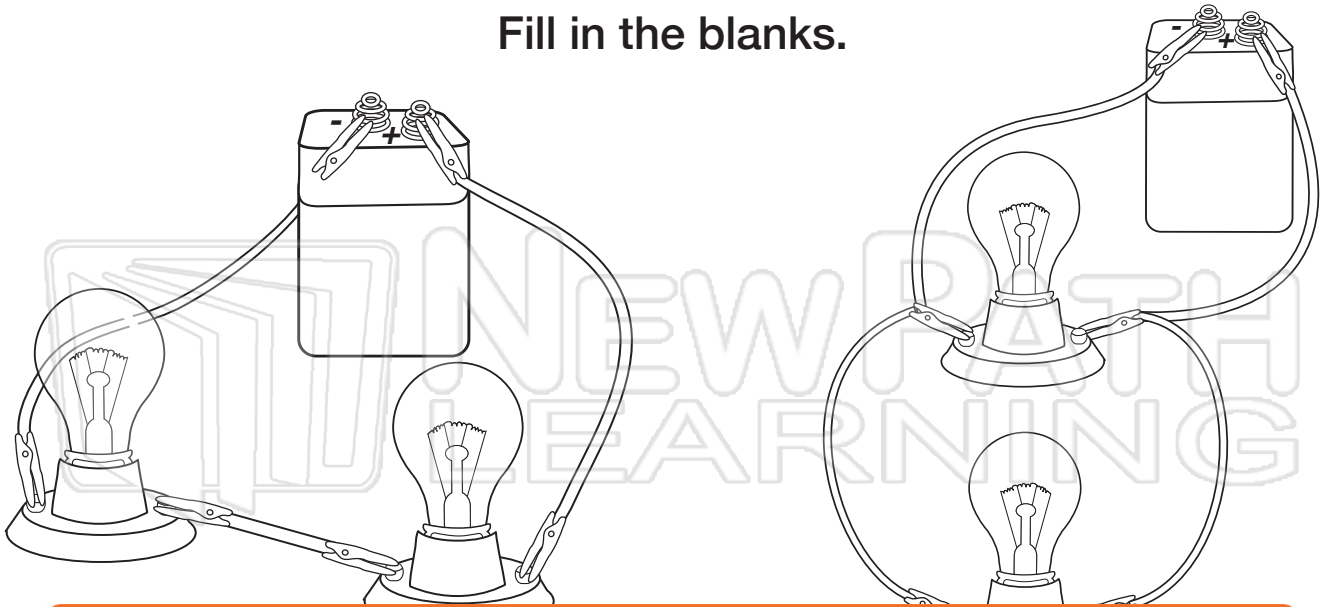
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Answer Key - Sample

Fill in the blanks.



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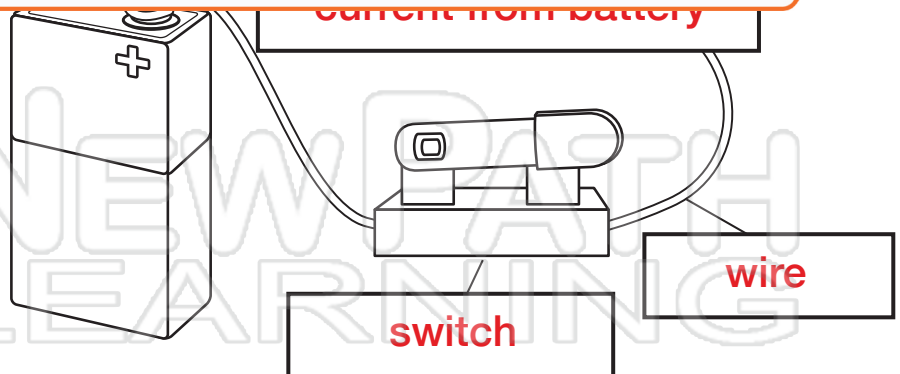
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e

through a coiled wire. They
are used in electric motors,
computers and power
generators, among other
devices.

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Name _____ Class _____ Date _____

1

What can be created by an **electric current** running through a **wire**?

- A** a magnetic field
- B** insulator
- C** compass
- D** iron filings

2

The relationship of **magnetism** to **electricity** is referred to as _____.

- A** generation
- B** transformation
- C** electromagnetism
- D** magnetic force

**3**

The picture below is of a **wind turbine**. What would this turbine be **used** for?

- A** convert chemical energy to mechanical energy
- B** convert mechanical energy to chemical energy
- C** convert mechanical energy to electrical energy

**4**

The word **solenoid** is another name for _____.

- A** an electromagnet
- B** a motor
- C** a generator
- D** a simple machine

5

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7

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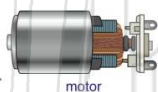
- B** mechanical to electrical to mechanical
- C** mechanical to chemical to electrical
- D** chemical to electrical to mechanical

- C** keep the magnet from freezing up
- D** increase the electrical energy

**9**

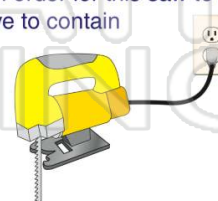
In a working **electric motor**, _____.

- A** a solenoid converts AC to DC electric power
- B** only permanent magnets are used
- C** the polarity of the electromagnet is reversed
- D** the polarity of the permanent magnet is reversed

**10**

In the diagram below, a man is using an **electrical saw**. In order for this saw to work, it would have to contain a(n) _____.

- A** turbine
- B** generator
- C** engine
- D** motor





Name _____ Class _____ Date _____

- 1 What can be created by an **electric current** running through a **wire**?

A a magnetic field
B insulator
C compass
D iron filings

(A)

- 2 The relationship of **magnetism** to **electricity** is referred to as _____.

A generation
B transformation
C electromagnetism
D magnetic force

(C)



- 3 The picture below is of a **wind turbine**. What would this turbine be **used** for?

A convert chemical energy to mechanical energy
B convert mechanical energy to chemical energy
C convert mechanical energy to electrical energy

(C)



- 4 The word **solenoid** is another name for _____.

A an electromagnet
B a motor
C a generator
D a simple machine

(A)

5



(B)

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(A)

B mechanical to electrical to mechanical
C mechanical to chemical to electrical
D chemical to electrical to mechanical

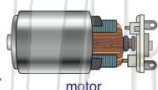
C keep the magnet from freezing up
D increase the electrical energy



- 9 In a working **electric motor**, _____.

A a solenoid converts AC to DC electric power
B only permanent magnets are used
C the polarity of the electromagnet is reversed
D the polarity of the permanent magnet is reversed

(C)



- 10 In the diagram below, a man is using an **electrical saw**. In order for this saw to work, it would have to contain a(n) _____.

A turbine
B generator
C engine
D motor

(D)





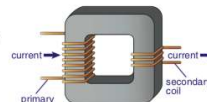
Name _____ Class _____ Date _____

1 What is the relationship of a **motor** to a **generator**?

- A they do the same thing
- B they make electricity
- C they are opposites
- D one can replace the other

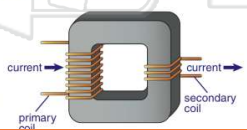
2 What **evidence** is there in this diagram that this is a **step-down transformer**?

- A more wire loops where current goes in
- B current goes in on the left and out on the right
- C more wire loops where current goes out
- D the magnet is bigger on one side



3 The device pictured below is a type of **transformer** used to _____.

- A increase current
- B decrease voltage



4 In the diagram below, **falling water** is being used to produce **electricity**. How is this achieved?

- A falling water runs a motor
- B falling water



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- C a conductor moves through a magnetic field
- D all of the above



- C The bell has to have a small motor in it.
- D The bell has to have a step-up transformer in it.

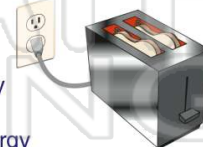
9 The **rate** at which electrical energy is transformed to **another form** of energy is called _____.

- A current
- B generation
- C power
- D ohms



10 An electric toaster **requires power** to convert _____.

- A heat energy to mechanical energy
- B electrical energy to mechanical energy
- C electrical energy to thermal energy
- D heat energy to thermal energy





Name _____ Class _____ Date _____

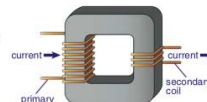
1 What is the relationship of a **motor** to a **generator**?

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- D one can replace the other

(C)

2 What **evidence** is there in this diagram that this is a **step-down transformer**?

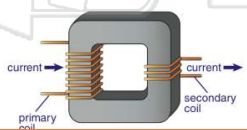
- A more wire loops where current goes in
- B current goes in on the left and out on the right
- C more wire loops where current goes out
- D the magnet is bigger on one side



(A)

3 The device pictured below is a type of **transformer** used to _____.

- A increase current
- B decrease voltage



(B)

4 In the diagram below, **falling water** is being used to produce **electricity**. How is this achieved?

- A falling water runs a motor
- B falling water



(C)

5



(A)

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(A)

- C a conductor moves through a magnetic field
- D all of the above



- C The bell has to have a small motor in it.
- D The bell has to have a step-up transformer in it.

9

The **rate** at which electrical energy is transformed to **another form** of energy is called _____.

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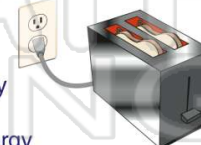


(C)

10

An electric toaster **requires power** to convert _____.

- A heat energy to mechanical energy
- B electrical energy to mechanical energy
- C electrical energy to thermal energy
- D heat energy to thermal energy



(C)



Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Direct current (DC)

Alternating current (AC)

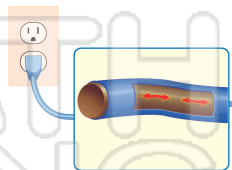
Electromagnetism

Step down transformer

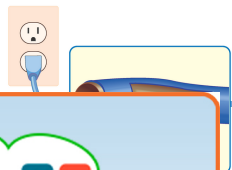
Generator

Electric motor

1. - a type of electrical current in which the electrical charges in a circuit flow back and forth



2. - a type of electrical current in which charges flow only in one direction in a circuit



3. energy

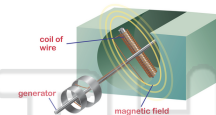


4. current

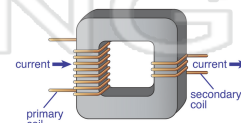
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5. - a device that uses magnets and wires to turn mechanical energy into electrical energy by using the wind, falling water, and even steam



6. - a device used to decrease the amount of voltage put into it





Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Direct current (DC)

Alternating current (AC)

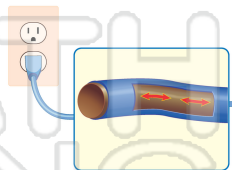
Electromagnetism

Step down transformer

Generator

Electric motor

1. alternating current (AC) - a type of electrical current in which the electrical charges in a circuit flow back and forth



2. direct current (DC) - a type of electrical current in which charges flow only in one direction in a circuit



3. electromechanics

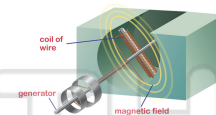


4. electromagnetism

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5. generator - a device that uses magnets and wires to turn mechanical energy into electrical energy by using the wind, falling water, and even steam



6. step down transformer - a device used to decrease the amount of voltage put into it

