

Science Nine

Module Four: Electrical Principles and Technologies

Name:

Date Received:

Date In:

Grade:



Electrical Principles and Technologies

Unit D

| | | |
|----------------|---|--|
| Topic 1 | Electric Charges <ul style="list-style-type: none"> ▪ Producing Charges ▪ Making Sense of Electrical Charges ▪ Conductors, Insulators, and In-Between | <ul style="list-style-type: none"> ▪ Neutralizing Unbalanced Charges ▪ Preventing Electrostatic Buildup |
| Topic 2 | Electricity Within a Circuit <ul style="list-style-type: none"> ▪ Circuit Elements and Diagrams ▪ Basic Circuit Symbols ▪ Measuring Current | <ul style="list-style-type: none"> ▪ Measuring Voltage ▪ Rivers of Electricity |
| Topic 3 | Resisting the Movement of Charge <ul style="list-style-type: none"> ▪ Calculating Resistance ▪ Model problem ▪ Resistors | <ul style="list-style-type: none"> ▪ Variable Resistors ▪ Types of Circuits ▪ House Wiring |
| Topic 4 | The Energy Connection <ul style="list-style-type: none"> ▪ Electricity and Heat ▪ Electricity to Motion ▪ Motion to Electricity | <ul style="list-style-type: none"> ▪ Electricity to Light ▪ Light to Electricity |
| Topic 5 | Portable Power <ul style="list-style-type: none"> ▪ Electrochemical Cells ▪ Fuel Cells ▪ Types of 'dry' cells | |
| Topic 6 | Generators and Motors <ul style="list-style-type: none"> ▪ Electricity to Magnetism ▪ Electromagnets ▪ Magnetism to Electricity ▪ What's in a Generator? ▪ DC Generators | <ul style="list-style-type: none"> ▪ Electric Motors: Electric to Mechanical Energy ▪ DC Motors ▪ AC Motors |
| Topic 7 | Electricity in the Home <ul style="list-style-type: none"> ▪ Transmission of Electricity through the Power Grid ▪ From the Grid into Your Home ▪ Home Wiring ▪ Digital Devices ▪ Measuring Electric Power ▪ Model Problem ▪ Paying For Electric Energy ▪ Model Problem | <ul style="list-style-type: none"> ▪ Power Rating ▪ Electric Devices and Efficiency ▪ Incandescent Bulbs ▪ Halogen Bulbs ▪ Fluorescent Tubes ▪ Model Problem ▪ Home Electric Safety ▪ Electric Safety Outdoors |
| Topic 8 | Electricity Production and the Environment <ul style="list-style-type: none"> ▪ Electric Energy from Burning Fuels ▪ Fossil Fuels Affect Land and Air ▪ Electric Energy from Flowing Rivers ▪ Energy from Atomic Reactions ▪ Heating the Environment ▪ Electrical Technology and Society | <ul style="list-style-type: none"> ▪ Cogeneration ▪ Reducing the Energy Wasted by Devices ▪ Alternative Energy Sources ▪ Electrical Energy Sources and Alternatives |

Topic 1 (pgs. 266-271)

Explain how an object becomes 'charged'.

What is the difference is between a 'positive charge' and a 'negative charge'?

Describe and illustrate the 'Laws of Electric Charge'.

Explain the difference between **conductors**, **semi-conductors** and **super conductors**. How are they different from insulators?

How can you prevent an electric discharge from doing harm to people or expensive electrical equipment?

Topic 1 - Electric Charges






1. These forces are responsible for lightning, nature's most spectacular show of electricity ...
 - A. magnetic forces
 - B. electric forces
 - C. attractive forces
 - D. repelling forces
2. Some particles in an atom are charged. Those that are **charged negatively** are called ...
 - A. neutrons
 - B. electrons
 - C. nucleus
 - D. protons
3. When **charged objects** are brought close to uncharged objects, this occurs ...
 - A. separation
 - B. attraction
 - C. neutralization
 - D. atomization
4. The **laws of electric charges** include all of the following, EXCEPT...
 - A. opposite charges attract each other
 - B. charged objects attract neutral objects
 - C. similar (like) charges repel each other
 - D. opposite charges repel each other
5. A **Van de Graaff generator** uses this to build up a static charge on its surface ...
 - A. friction
 - B. heat
 - C. moisture
 - D. light
6. Electric charge can be detected using an electroscope. A pocket-sized version, used to measure exposure to atomic radiation is called a ...
 - A. occilascope
 - B. dosimeter
 - C. radioscope
 - D. atom-radiator
7. Materials can be conductors, semiconductors, superconductors, or insulators. Which of the following materials would make a good insulator?
 - A. aluminum
 - B. human body
 - C. silicon
 - D. porcelain
8. One disadvantage of superconductors has been their need to be subjected to extremely ...
 - A. low temperatures
 - B. high temperatures
 - C. high voltage lines
 - D. small spaces
9. The purpose of a 'static strap' worn by electronic technicians, when working with electronic components, is to make sure the static charge on the technician's hand or body is ...
 - A. reinforced
 - B. neutralized
 - C. dissipated
 - D. discharged
10. Non-conductors, or insulators, must be neutralized with this ...
 - A. discharge
 - B. radiation
 - C. ionization
 - D. recharger

Topic 2 (pgs. 272-278)

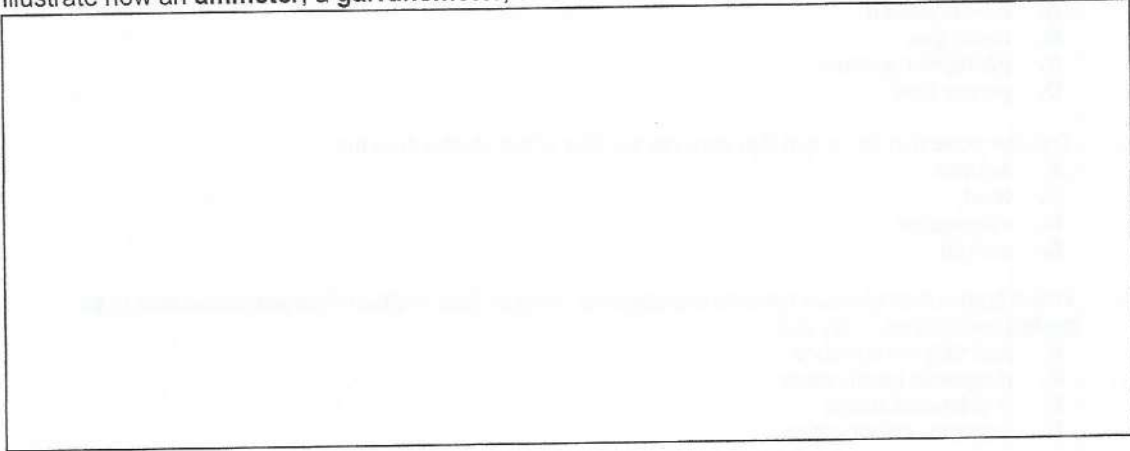
List and give examples of the four basic elements or types of components in a simple circuit.

| <i>Component</i> | <i>Description</i> | <i>Examples</i> |
|------------------|--------------------|-----------------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Identify or illustrate the electrical circuit component or symbol in the table.

| | | | |
|---|------|--|-------------------|
| | wire | | resistor |
| | cell |  | |
|  | | | variable resistor |
| | lamp |  | |
|  | |  | |

Illustrate how an **ammeter**, a **galvanometer**, and a **voltmeter** are included in a schematic drawing.



What do each of these electrical devices measure?



Ammeter _____ Voltmeter _____ Galvanometer _____

All forms of energy are measured in **joules (J)**. When describing the electrical energy in a circuit, different units are used. What units are used in each case?

Current _____ Voltage _____

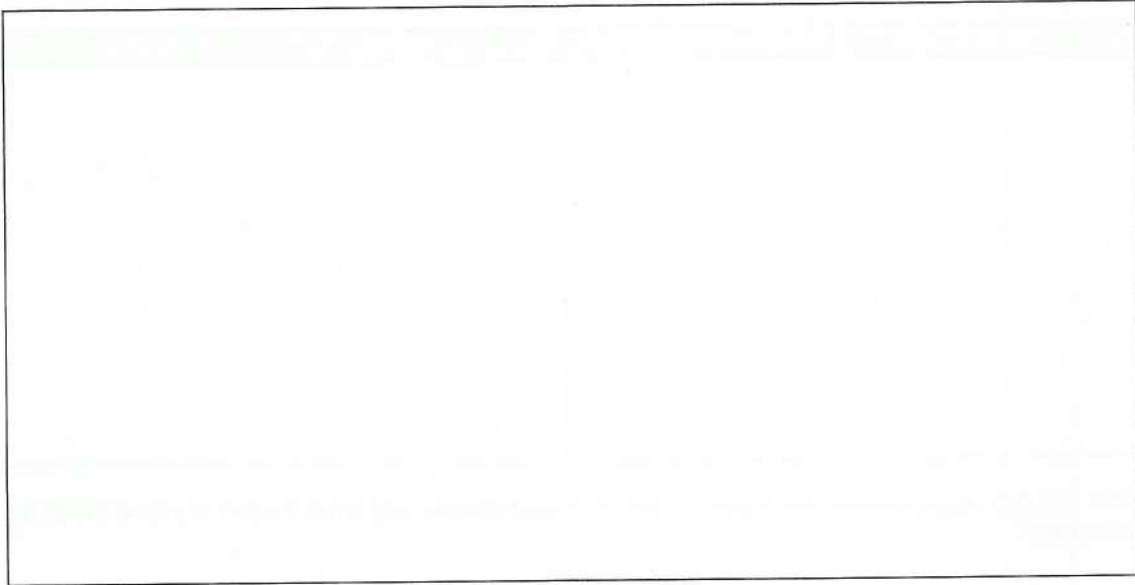
Describe and Illustrate the difference between **Current**, and **Voltage** using a **MODEL**

Topic 2 - Electricity Within A Circuit

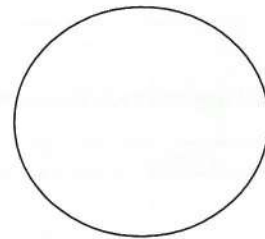
1. A circuit needs 4 components in order to operate effectively. The **conductor** in a neon light is the ...
 - A. on-off switch
 - B. neon gas
 - C. phosphor powder
 - D. power box
2. The component in the circuit that controls the flow of the electricity is the ...
 - A. source
 - B. load
 - C. conductor
 - D. switch
3. These types of conductors have no resistance to electron flow and therefore are considered to be perfect conductors. They are ...
 - A. metallic conductors
 - B. magnetic conductors
 - C. superconductors
 - D. superior conductors
4. Current is the rate of flow of charged electrons in a conductor, and is measured in ...
 - A. amperes
 - B. volts
 - C. ohms
 - D. milli-volts
5. The potential difference across two points is usually referred to as ...
 - A. micrometer
 - B. voltage
 - C. resistance
 - D. voltmeter
6. A waterfall can be used to model current, voltage and resistance. If a waterfall is wide and free flowing, it models high ...
 - A. voltage
 - B. current
 - C. amperage
 - D. resistance
7. What symbol does this  represent in an electrical circuit diagram?
 - A. lamp
 - B. switch
 - C. battery
 - D. resistor
8. In order to have a battery as a source of electrical current, you need ...
 - A. a switch
 - B. 2 loads
 - C. 2 cells
 - D. a conductor
9. The electrical component represented by this symbol  is...
 - A. volts
 - B. voltmeter
 - C. variable resistor
 - D. volta resistance
10. Comparing an electric current to a water system helps us model electrical principles. The water flows through the pipes in the system and is controlled by valves, which represent ...
 - A. loads
 - B. resistance
 - C. switches
 - D. conductors

Topic 3 (pgs. 279-291)

Resistance is the property of a substance that hinders the movement (motion) of electric charge and converts electrical energy into other forms of energy. Use a diagram to illustrate what you understand about this statement.



According to Georg Simon Ohm, what is the relationship between current, voltage and resistance, and how can it be calculated?



In what applications are variable resistors used?

Illustrate a **series circuit** and a **parallel circuit** using the following:

Power source – 4 cells

Loads – 3 resistors (eg. buzzer, 2 lamps)

As many switches as you think you need

| Series | Parallel |
|--------|----------|
| | |


What is a potential problem with a parallel circuit in your house, and what is used to prevent it from happening?

What are the factors and that affect resistance of wire, and how does each factor affect resistance?

| <i>Factor</i> | <i>Effect</i> |
|---------------|---------------|
| | |
| | |
| | |
| | |

Topic 3 - Resisting the Movement of Charge

1. Resistance can be measured directly with a/an ...
 - A. ammeter
 - B. millimeter
 - C. ohmmeter
 - D. galvanometer
2. *Resistance* is a measure of how difficult it is for the electrons to flow through a conductor. The standard unit for resistance is *ohm*. The symbol for the ohm is ...
 - A. Σ
 - B. Ω
 - C. β
 - D. Φ
3. A certain condition needs to be met in order to prove the mathematical link between voltage, current and resistance as represented by Ohm's Law. The condition is that ...
 - A. resistance must be created
 - B. calculations must be precise
 - C. temperature must be constant
 - D. measurement must be accurate
4. A variable resistor is a control device that allows you to change the resistance in a circuit. It is also called a ...
 - A. rheohm
 - B. rheostat
 - C. thermostat
 - D. thermocouple
5. Using Ohm's Law calculate how much current is created when **210 V** creates a current through a **150 ohm** resistor. Use this shortcut formula to solve the problem



 - A. 0.5 A
 - B. 2 A
 - C. 4.5 A
 - D. 1.4 A
6. Solutions can also be resistors. The more charged particles in a solution, the
 - A. more molecules it has
 - B. more resistance it has
 - C. less resistance it has
 - D. fewer molecules it has
7. Different resistors are used for different applications, especially in electronics. The major application for resistors is to control ...
 - A. current or voltage
 - B. heat and temperature
 - C. direction and intensity
 - D. strength and distance
8. To alter electron flow gradually, like in a surge-protection device, a variable resistor is used. A variable of this type is also called a ...
 - A. rheostats
 - B. thermistor
 - C. varistors
 - D. transistor
9. An electrical circuit that provides only one path for the current to flow is called a ...
 - A. series circuit
 - B. single circuit
 - C. parallel circuit
 - D. multiple circuit
10. 4 factors affect the resistance of wire. The gauge of the wire (AWG #) represents the ...
 - A. length
 - B. temperature
 - C. material
 - D. cross-section area

Topic 4 (pgs. 293-299)

What is **energy**?

Complete the table that shows **energy conversions** related to electricity

| Device | Type of Energy Used | Type of energy converted to |
|-----------------------|---------------------|-----------------------------|
| thermopile | | |
| piezoelectric crystal | | |
| piezoelectric crystal | | |
| LED | | |
| photovoltaic cell | | |
| electroplaques | | |

Describe how a **thermocouple** is made, what energy transformation occurs when it is used and how it works.

What is the '**piezoelectric effect**'?

What process/device enables a **solar cell** to transform the Sun's energy into useable electricity?

Topic 4 - The Energy Connection

1. Electrical energy can be produced from other forms of energy, or it can be converted into other kinds of energy. The conversion in a battery is
 - A. chemical energy into mechanical energy
 - B. mechanical energy into electrical energy
 - C. chemical energy into electrical energy
 - D. solar energy into electrical energy
2. A device which converts thermal energy into electrical energy is a ...
 - A. rheostat
 - B. thermocouple
 - C. photovoltaic cell
 - D. piezoelectric crystals
3. The basic principle of the thermocouple was discovered by Thomas Johann Seebeck in 1821, and in his honor was named the 'Seebeck ...'
 - A. Principle
 - B. Effect
 - C. Law
 - D. Action
4. A *thermo-electric generator* is a device based on a thermocouple that converts heat directly into electricity without moving parts. Several thermocouples connected in a series is called a ...
 - A. thermadore
 - B. thermostat
 - C. thermopile.
 - D. thermal farm
5. A device which converts sound energy (vibrations) into electrical energy is a ...
 - A. thermostat
 - B. rheostat
 - C. photoelectric cell
 - D. piezoelectric crystals
6. When a crystal or Rochelle salt is compressed or pulled, a potential difference is built up on the opposite sides of the crystal. Conductors then take this through a circuit to produce electric energy (a spark). A barbeque 'spark' lighter uses the ...
 - A. piezoelectric effect in reverse
 - B. photovoltaic cells
 - C. thermo-nuclear fission
 - D. light-emitting diodes
7. Solid-state components, when connected to a semiconductor chip in the right direction, will produce light and last for many years. These light emitting devices are called ...
 - A. LED's
 - B. CCD's
 - C. EEG's
 - D. CFC's
8. The International Space Station uses this type of energy to generate electricity on the station ...
 - A. chemical
 - B. solar
 - C. wind
 - D. tidal
9. Certain animals, namely, the electric eel, can produce electric shock, to kill or stun prey. They have a special organ that contains specialized muscle cells called ...
 - A. epidermals
 - B. electroplaques
 - C. electrostatic
 - D. electrolysis

Topic 5 (pgs. 300-307)

What did Luigi Galvani discover and what importance did it have for the science of physics?

What are 'voltaic piles'?

Illustrate the difference between a **Wet Cell** and a **Dry Cell**.

| Wet Cell | Dry Cell |
|----------|----------|
| | |

Explain the difference between a **primary cell** and a **secondary cell**. Give two examples of each and what devices would use them.

Topic 5 - Portable Power

1. A source of electricity consisting of a number of alternating disks of two different metals separated by acid-moistened pads, forming primary cells connected in series are called ...
 - A. Galvanic cells
 - B. Voltaic piles
 - C. Cadmium cells
 - D. Alkaline piles
2. Luigi Galvani noticed when two different metals, connected together, touched a frog's nerve at the same time, the frog's muscle would contract. He called this ...
 - A. muscle fibre
 - B. kermit power
 - C. animal electricity
 - D. electrochemical cell
3. The fluid or chemical paste that conducts free electrons in an electrochemical cell is called an ...
 - A. electrode
 - B. electrolyte
 - C. electroplate
 - D. electroplaque
4. The different metals in an electrochemical cell, one which releases electrons, and one which attracts electrons are called ...
 - A. electrodes
 - B. electrolytes
 - C. electroplates
 - D. electroplaques
5. After the reactants are used up the electrochemical reactions will not continue in this type of cell ...
 - A. conducting cell
 - B. secondary cell
 - C. primary cell
 - D. battery cell
6. Zinc and copper react differently in an electrolyte. The electrolyte eats away the zinc electrode, leaving behind electrons that give it this kind of charge.
 - A. static
 - B. neutral
 - C. positive
 - D. negative
7. The **electrolyte paste**, which enables a dry cell to conduct electricity, does so because, it contains ...
 - A. an insulator
 - B. static electrical charges
 - C. chemicals that form ions
 - D. metal plates that release electrons
8. A single 6V battery is made up of ...
 - A. 1 very strong cell that is 6 volts
 - B. 2 cells – 3 volts each
 - C. 3 cells – 2 volts each
 - D. 4 cells – 1.5 volts each
9. Rechargeable cells use an external electrical source to which can be recharged because the ...
 - A. wet cells are drying out
 - B. electrodes can be reversed
 - C. electrolyte is being replaced
 - D. chemical reactions can be reversed
10. All of the following are secondary cells, EXCEPT ...
 - A. lead acid
 - B. zinc-carbon
 - C. nickel-cadmium
 - D. nickel-metal hydride

Topic 6 (pgs. 309-317)

Describe how a device, such as a **generator**, converts mechanical energy into electrical energy.

How is an **electromagnet** constructed?

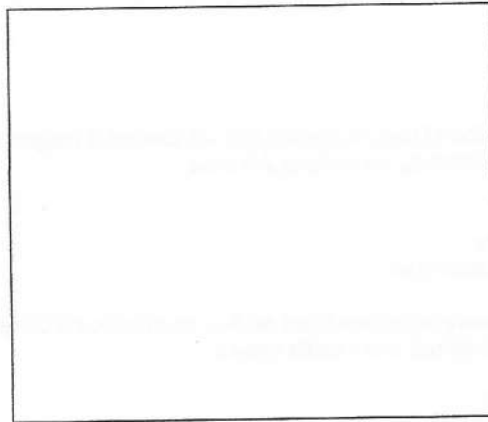
Explain the difference between **AC** and **DC current**.

Illustrate a **DC Generator** and a **DC Motor**

| DC Generator | DC Motor |
|--------------|----------|
| | |

How does an **AC Motor** differ from a DC Motor?

Illustrate a **Simple Motor** you can make with common household materials.



Describe the **step-by-step procedure** and what you observed when it worked, or didn't work (the **troubleshooting techniques** you used).

| Procedure Order | Description of what to do | What worked or didn't and what you did about it |
|-----------------|---------------------------|---|
| Step 1 | | |
| Step 2 | | |
| Step 3 | | |
| Step 4 | | |
| Step 5 | | |
| Step 6 | | |
| Step 7 | | |
| Step 8 | | |
| Step 9 | | |
| Step 10 | | |

Topic 6 - Generators and Motors

1. Any system or device that has moving parts is associated with this type of energy ...
 - A. electrical
 - B. chemical
 - C. gravitational
 - D. mechanical

2. Hans Christian Oersted found that an electric current created a magnetic field. When electrical energy passes over a compass, the compass needle ...
 - A. spins
 - B. is deflected
 - C. rotates clockwise
 - D. rotates counterclockwise

3. The amount of needle movement depended on how much electric current was flowing in the wire. When the current was reversed, the needle moved ...
 - A. slower at first
 - B. faster than usual
 - C. In the opposite direction
 - D. back and forth

4. A device that converts mechanical energy (energy of motion – windmills, turbines, nuclear power, falling water, or tides) into electrical energy is called an.
 - A. electric turbine
 - B. electric generator
 - C. electrical supply
 - D. electrical device

5. These reverse the direction of flow in the electromagnetic coil of a motor...
 - A. power source and armature
 - B. armature and bushes
 - C. commutator and brushes
 - D. commutator and armature

6. The strength of an electromagnet is affected by all of the following, **Except** ...
 - A. type of wire
 - B. number of coils
 - C. strength of current
 - D. type and size of core

7. Mr. Jones was trying to make an electromagnetic coil to demonstrate the power it has. His coil worked, but not very well. The most likely reason was because the ...
 - A. coil was made of copper wire
 - B. battery was brand new
 - C. metal core was too thin
 - D. battery was dead

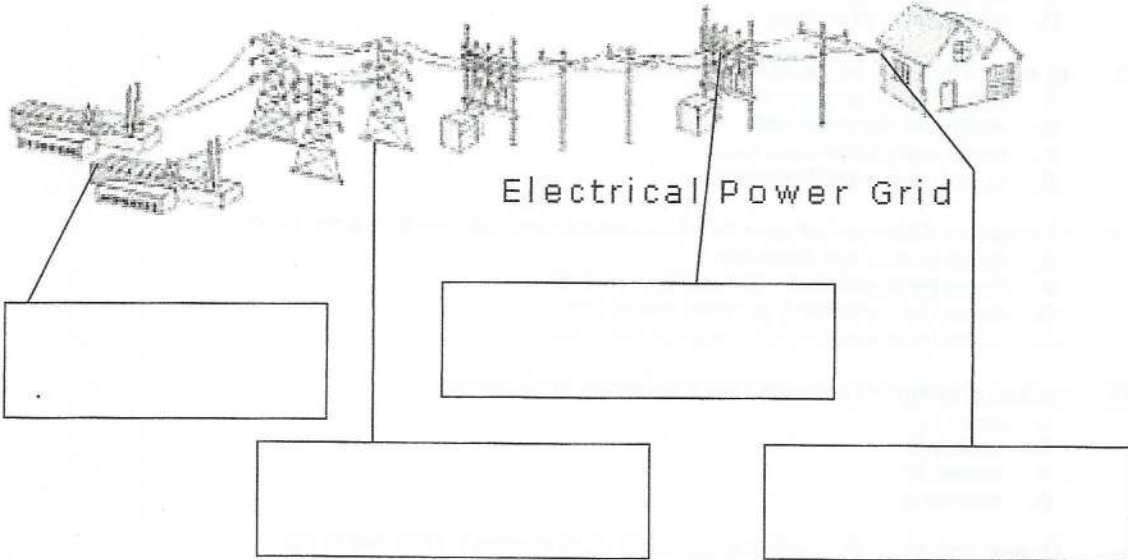
8. Electric effects can be created using a magnet. In 1831 Michael Faraday (and Joseph Henry) discovered ...
 - A. electrolysis
 - B. electric charges
 - C. electromagnetic radiation
 - D. electromagnetic induction

9. A generator has a coil of wire rotating inside a stationary field magnet. The central axle has a loop of wire attached to two slip rings. The current is switched as the loops move up and down alternatively through the magnetic field. The slip rings conduct the current to the circuit through the brushes (the brush and ring assembly allows the whole loop to spin freely). The electricity produced by this type of generator is called ...
 - A. direct current
 - B. alternating current
 - C. semi-conducting current
 - D. static electrical current

10. A DC generator is much the same as a DC motor, and is often called a dynamo. The DC generator's pulsating electricity is produced ...
- A. **back and forth**
 - B. in one direction
 - C. across the circuit
 - D. in reversed directions
11. All electric motors operate on this principle – opposite poles ...
- A. attract and like poles repel.
 - B. **repel and like poles attract**
 - C. move away from each other
 - D. spin in opposite directions
12. The primary difference between direct and alternating current is that direct current ...
- A. flows in only one direction
 - B. **flows back and forth 10 times per second**
 - C. flows back and forth 30 times per second
 - D. flows back and forth 60 times per second
13. Instead of producing electricity, like a generator does, a motor ...
- A. uses it
 - B. **makes it**
 - C. moves it
 - D. rotates it
14. Michael Faraday's discovery of electromagnetic induction in 1831, led to this ...
- A. battery
 - B. **transformer**
 - C. generator
 - D. split ring comutator
15. AC motors have a rotating core, or rotor, surrounded by a stationary component called a ...
- A. stapor
 - B. stator
 - C. regulator
 - D. activator

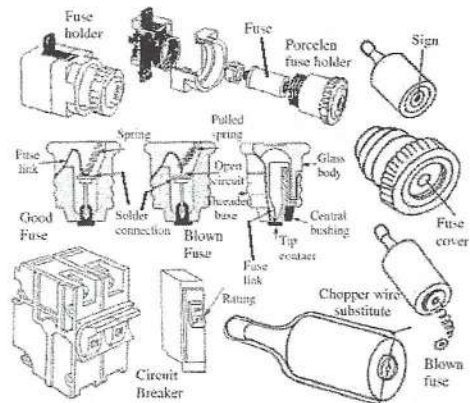
Topic 7 (pgs. 318-331)

Illustrate and label, with explanations, how power is transmitted from the generating power station to your home.



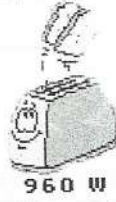
Describe what a **service panel** in your house is and what function it serves.

Explain the different between a **fuse** and a **circuit breaker**.



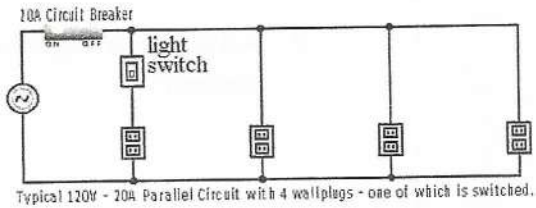
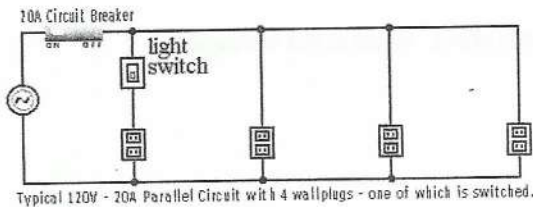
Add these appliances to each house circuit as directed and calculate what the current is. If the circuit is overloaded – color the circuit breaker RED

Electrical Appliances w/ Power Rating



Situation 1 – Mom is making toast for breakfast and sandy is drying her hair

Situation 2 – Dad is ironing his shirt, while he turns on the lamp to see better and mom is drying her hair

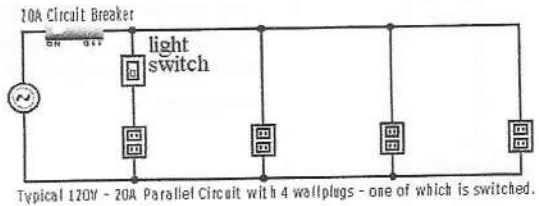
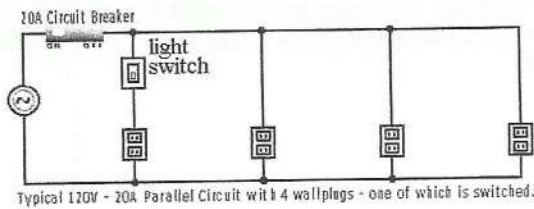


Total Current Situation 1

Total Current Situation 2

Situation 3 – The toaster is plugged in, the iron is warming up and Mom has just turned on the lamp in the bedroom

Situation 4 – Mom is ironing her shirt, Sam has turned the lamp off, Dad is making toast and Sandy is re-drying her hair with her own hairdryer



Total Current Situation 3

Total Current Situation 4

What are **transistors** used as and in what devices are they commonly found?

Complete the **Power Problems** (Show your work)

Formula

Problems

1. What is the Power (watts and kilowatts) of a hair dryer that requires 8 A of **current** on a 240 V circuit?

Solution:

2. A 850 W oven requires a 7A current. What is the **voltage**?

Solution:

3. A flashlight uses 2 1.5 V D-cells to light a bulb that can work on a current up to 0.5A. What is the maximum **Power** of the bulb?

Solution:

Complete the **Electrical Costs Problems** (Show your work)

Formula:
Cost = usage X time

Problems:

1. You go around your house and find out there are 35 lights (60W each) in your house. If they all are on for about 5 hours every day. What does it cost your parents for 1 year?

Solution:

Direct Energy

Charges

\$ 0.11 per kWh
for energy usage

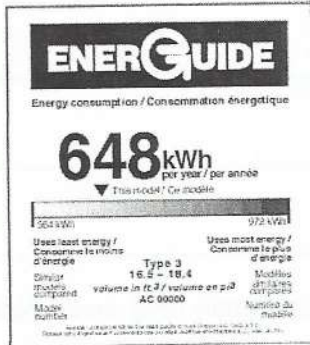
2. Your stereo is on 4 hours every day. It operates on 120V, using 4A of current. How much does it cost your parents for 1 year?

Solution:

Explain what this illustration means, and how does it help the consumer?

ENERGUIDE Label

Explanation






How is the **efficiency** of a light bulb determined mathematically?

Formula

Explanation:

What are the advantages and disadvantages of different light bulbs?

| Type | Advantages | Disadvantages |
|---|------------|---------------|
| Incandescent  | | |
| Halogen  | | |
| Fluorescent  | | |

Calculate the efficiency of an 800W kettle that takes 6 min to boil water. To heat the water to boiling point, it takes 200,000 J of energy. What is the **efficiency** of the kettle?

Show your work

Explanation of how efficient the kettle is:

Identify the safety measure **not** being followed in each illustration, and identify what should be done to make it safer.

Illustration

What's Unsafe?

What should be done to make it safer?

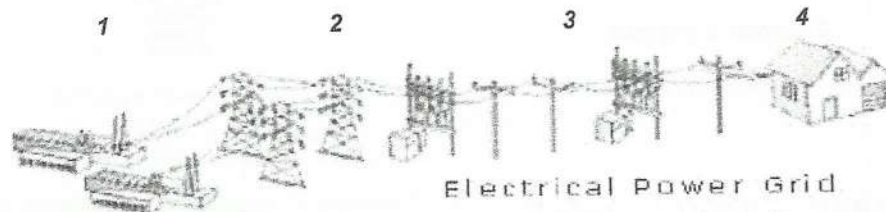






What are four simple rules to follow, to protect yourself against **fatal electrical shock**, from electrical hazards outdoors?

Topic 7 - Electricity in the Home

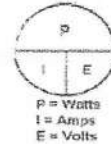


1. Use the illustration provided to identify where you would likely find the highest voltage ...
- 1
 - 2
 - 3
 - 4
2. It is necessary for Urban power companies to reduce voltage to communities. They are able to do this with a step-down transformer. This type of transformer reduces voltage because...
- it is coiled with more wires
 - it is coiled in reverse directions
 - the secondary coil is larger than the primary coil
 - the primary coil is larger than the secondary coil
3. A power use meter is connected from the power lines to the outside of your home. It is then routed to a central service panel that is full of ...
- transistors
 - transformers
 - conductors
 - circuit breakers
4. The lower part of the service panel contains many fuses that are used to regulate ...
- branch circuits
 - circuit breakers
 - breaker panels
 - power switches
5. After major electrical work is done in a home, an electrical inspector is called in to determine if the electrical work has been completed to the standards outlined in the ...
- city bylaws
 - CSA labels
 - electrical code
 - EnerGuide labels
6. Technology has revolutionized the way we do things. The device able to convert information into numbers is the computer. These numbers, which are ones and zeros, are called ...
- binary
 - bits
 - bytes
 - data
7. Microcircuits are circuits that are miniaturized to fit into a small space and perform many functions. Transistors in these modern digital circuits act as ...
- fuses
 - loads
 - valves
 - switches
8. A 15A current passes through an indoor heater when it is plugged into your home outlet (110V). What is the formula to determine the power of the heater?
- $P = I / V$
 - $P = V / I$
 - $P = I \times V$
 - $P = E \times t$

(P) Power in watts

(I) current in amperes

(V) voltage in volts



POWER = CURRENT \times VOLTAGE

CURRENT = $\frac{\text{POWER}}{\text{VOLTAGE}}$

VOLTAGE = $\frac{\text{POWER}}{\text{CURRENT}}$

$E = P \times t$ $P = E / t$ $t = E / P$

Efficiency (%) = $\frac{\text{useful energy output (J)}}{\text{total input energy (J)}} \times 100\%$

9. A ghetto blaster has a power rating of 28 watts. If it was on each day (all day) during an average month (30 days) and the cost of electricity, in Alberta, is \$0.11 per kilowatt hour. What is the cost of operating the ghetto blaster for one month?
- \$ 2.22
 - \$ 22.18
 - \$ 221.78
 - \$ 2217.60
10. The efficiency of a device is the ratio of the useful energy that comes out of a device to the total energy that goes in. A light bulb gives off 5J of useful light energy for every 100J of electrical energy used to make it work. What is the efficiency of the light bulb?
- 105 %
 - 95 %
 - 20 %
 - 5 %
11. "The problem with this computer game", said Matt, "is that the power bar keeps popping its circuit. I think that I need a better power bar, so I can play my game without interruption."
- Don't use electricity near water
 - Improper or unsafe equipment
 - Keep a safe distance high voltage
 - Don't use more electricity than recommended
12. Which of the following is the lowest amount of current that can be fatal...
- 0.001A
 - 0.01V
 - 0.1A
 - 1.0A
13. James Moore was inspecting the wiring in a new house and found that the green wire had not been connected properly in the electrical panel. The wiring did not pass safety inspection because the ...
- panel had a short circuit
 - electrical outlets were not grounded
 - electrical circuits were overloaded
 - green wire was the hot wire
14. A power line has snapped in an ice storm. One end landed on a car, with the driver still inside. The driver will not be electrocuted as long as he ...
- keeps calm and moves slowly out of the car
 - makes sure he doesn't touch the wire as he gets out
 - stays inside the car until help arrives
 - doesn't step in any water as he gets out
15. The dangers of electrical shock can vary depending on the situation. Which of the following would likely be the most dangerous (getting a nasty shock!) ...
- Touching an electrified fence on a hot summer day while wearing running shoes.
 - Touching an electrified fence when you are barefoot in a rainstorm
 - Climbing a metal fence on a hot summer day while wearing running shoes.
 - Climbing a metal fence when you are barefoot in a rainstorm.

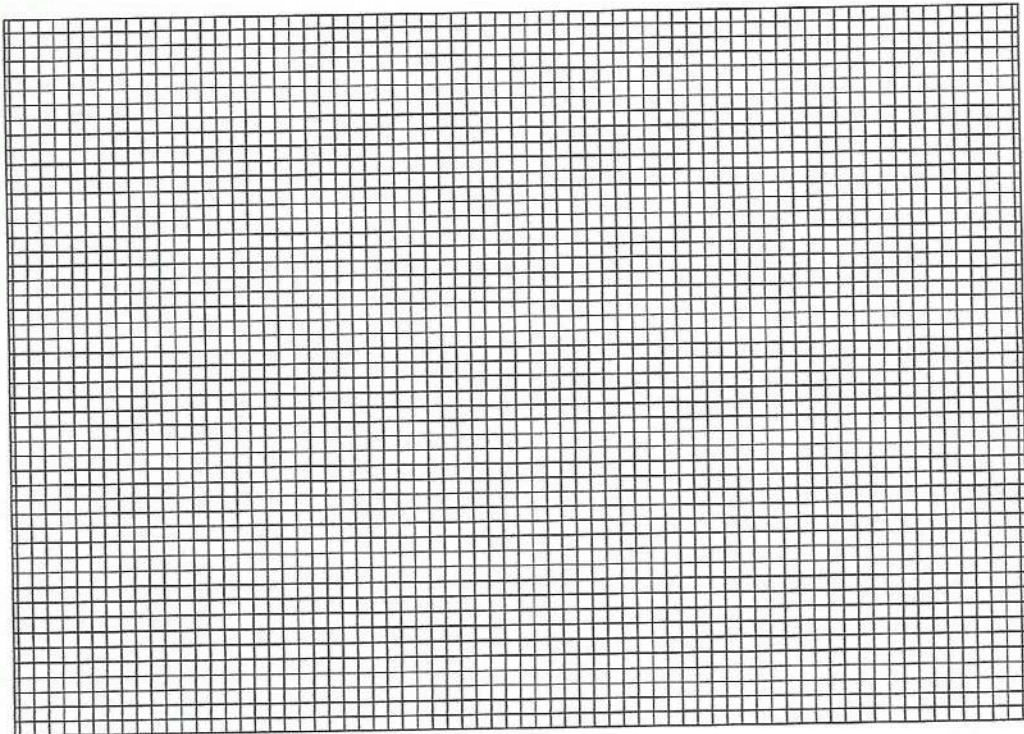
Topic 8 (pgs. 332-342)

Describe the process of electrical generation from the **burning of coal**.

Using the Map and Graphic information on p. 333 in your Science Focus 9 Textbook to create a graph of those regions that produce in excess of 1000GW•h shown using the following different colored bars on the graph:

- █ Total electricity production (red)
- █ Electricity from thermo-electric sources (green)
- █ Electricity from hydro-electric sources (blue)
- █ Electricity from nuclear sources (yellow)

Title _____



What consequences – affecting Land and Air - result from the use of Fossil Fuels to generate electricity?

How can **gravity** produce electricity? (Think about flowing water)

How is electricity generated in **Nuclear Reactors**?

Topic 8 - Electricity Production and the Environment

1. 65% of electrical energy around the world is generated by the burning of ...
 - A. wood
 - B. hydrogen
 - C. fossil fuels
 - D. dead plants
2. Many of the usable fuel resources we have, that are nonrenewable, are being used up. One of the following is a renewable resource.
 - A. coal
 - B. wood
 - C. natural gas
 - D. methane gas
3. To generate electrical energy, coal is used to produce steam that drives this ...
 - A. transformer
 - B. condenser
 - C. generator
 - D. turbine
4. Alberta uses a large amount of coal to generate electricity because it can be mined very easily. Strip mining has this negative impact ...
 - A. the original natural environment cannot be fully restored
 - B. all species of animals lose their habitat permanently
 - C. soil contamination occurs and cannot be reversed
 - D. dangerous chemicals can leach into the water table
5. Manufacturing and industrial plants install antipollution systems to remove harmful emissions, such as sulfur dioxide. These systems are called ...
 - A. reactors
 - B. bleachers
 - C. scrubbers
 - D. precipitators
6. By-products, from the generation of electrical energy, can be harmful to living organisms and to the environment. One such by-product reacts with water to produce ACID RAIN. The chemical that does this is ...
 - A. sulfur dioxide
 - B. nitrogen oxide
 - C. carbon dioxide
 - D. sulfuric oxide
7. Water can also be used to generate electrical energy. The energy conversion is ...
 - A. mechanical to gravitational to electrical
 - B. electrical to mechanical to gravitational
 - C. gravitational to electrical to mechanical
 - D. gravitational to mechanical to electrical
8. The narrow pathway in the dam which directs water to the turbines is called the ...
 - A. channel
 - B. spillway
 - C. penstock
 - D. generator
9. The Sun joins atoms together to make larger atoms, releasing a lot of energy in the process, whereas, a nuclear reactor, which splits atoms, also releases a lot of energy and is called nuclear ...
 - A. fusion
 - B. fission
 - C. uranium
 - D. plutonium

10. When industries cool down their machinery, warm wastewater can cause harm to aquatic ecosystems when it is returned to the water system. This is called ...
 - A. radioactive waste
 - B. thermal generation
 - C. thermal pollution
 - D. industrial waste
11. A system that can produce two different types of energy for industrial, or commercial use is called ...
 - A. regeneration
 - B. cogeneration
 - C. electrolysis
 - D. bigeneration
12. The thermal energy used to generate electricity from beneath the earth's surface is called ...
 - A. tidal
 - B. geological
 - C. chemical
 - D. geothermal
13. The International Space Station uses this type of energy to generate electricity for use on the station ...
 - A. tidal
 - B. wind
 - C. solar
 - D. chemical
14. A single windmill produces a small amount of electricity, but many connected together can generate a large amount of electricity. Many windmills connected together are called wind ...
 - A. farms
 - B. arrays
 - C. groups
 - D. clusters
15. A fuel cell uses this to generate electricity ...
 - A. oxygen
 - B. hydrogen
 - C. nitrogen
 - D. carbon dioxide

Unit D: Electrical Principles and Technologies

Outcome #1- Understand the use of devices that convert different forms of energy into electricity and electrical energy into other forms of electricity.

| Essential Outcomes (Ideas I must understand) | My Understanding |
|---|------------------|
| <ul style="list-style-type: none"> Identify, describe and understand examples of mechanical, chemical, thermal, and electrical energy. | 1 2 3 4 |
| <ul style="list-style-type: none"> Experiment with and describe evidence of energy transfer. | 1 2 3 4 |
| <ul style="list-style-type: none"> Experiment with and evaluate the use of different chemicals, concentration of chemicals and designs for electric cells and batteries. | 1 2 3 4 |
| <ul style="list-style-type: none"> Change the design of an electrical device and observe and evaluate the result. | 1 2 3 4 |
| Important Outcomes (Ideas that are important to know and be able to do) | My Understanding |
| <ul style="list-style-type: none"> Construct, use and evaluate devices that convert mechanical energy into electrical energy and vice versa. | 1 2 3 4 |

Outcome #2- Describe technologies for transfer and control of electrical energy.

| Essential Outcomes (Ideas I must understand) | My Understanding |
|--|------------------|
| <ul style="list-style-type: none"> Understand the dangers of electrical devices by referring to the voltage and current rating of devices and identify safe and unsafe electrical activities. | 1 2 3 4 |
| <ul style="list-style-type: none"> Compare static and current electricity and identify examples of each. | 1 2 3 4 |
| <ul style="list-style-type: none"> Identify materials that are electrical conductors and insulators and compare the resistance of different materials to electric flow. | 1 2 3 4 |
| <ul style="list-style-type: none"> Describe, using a model, the nature of electric current and explain the relationship between current, voltage, and resistance. | 1 2 3 4 |
| <ul style="list-style-type: none"> Measure voltages and currents in circuits and calculate resistance using Ohm's law. | 1 2 3 4 |
| Important Outcomes (Ideas that are important to know and be able to do) | My Understanding |
| <ul style="list-style-type: none"> Use switches and resistors to control the flow of electricity and predict the effect of these in other devices. | 1 2 3 4 |
| <ul style="list-style-type: none"> Develop test and troubleshoot circuit designs | 1 2 3 4 |
| <ul style="list-style-type: none"> Draw circuit diagrams to show the flow of electricity through them | 1 2 3 4 |
| <ul style="list-style-type: none"> Identify similarities and differences between microelectronic circuits and circuits in a house. | 1 2 3 4 |

Outcome #3- Identify and estimate energy inputs and outputs for sample devices and systems, and explain the efficiency of energy conversions.

| Essential Outcomes (Ideas I must understand) | My Understanding |
|---|------------------|
| <ul style="list-style-type: none"> Identify the input and output energy in a device or system. | 1 2 3 4 |
| <ul style="list-style-type: none"> Using appropriate units to describe the energy transformed by an electrical device. | 1 2 3 4 |
| <ul style="list-style-type: none"> Use the concepts of conservation of energy and efficiency to describe energy devices. | 1 2 3 4 |
| <ul style="list-style-type: none"> Compare the energy input and output as well as calculate efficiency. | 1 2 3 4 |
| Important Outcomes (Ideas that are important to know and be able to do) | My Understanding |
| <ul style="list-style-type: none"> Describe ways to reduce the waste of energy in common household devices. | 1 2 3 4 |

Outcome # 4- Analyze the impact of electricity on our society and our environment.

| Essential Outcomes (Ideas I must understand) | My Understanding |
|--|------------------|
| <ul style="list-style-type: none"> Identify the by-products of electrical generation and their impacts on the environment. | 1 2 3 4 |
| Important Outcomes (Ideas that are important to know and be able to do) | My Understanding |
| <ul style="list-style-type: none"> Identify alternative sources of electrical energy including: oil, gas, coal, biomass, wind, waves, and batteries. Tell the good and bad points for each energy source. | 1 2 3 4 |
| <ul style="list-style-type: none"> Identify uses of electrical technologies, and give the benefits and impacts for the electrical technologies. | 1 2 3 4 |
| <ul style="list-style-type: none"> Identify concerns regarding conservation of energy and how we can make our resources last longer. | 1 2 3 4 |