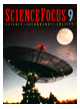


Electrical Principles and Technologies

Unit D

Topic 1 **Electric Charges**

- Producing Charges
- Making Sense of Electrical Charges
- Conductors, Insulators, and In-Between
- Neutralizing Unbalanced Charges
- Preventing Electrostatic Buildup

Topic 2 **Electricity Within a Circuit**

- Circuit Elements and Diagrams
- Basic Circuit Symbols
- Measuring Current
- Measuring Voltage
- Rivers of Electricity

Topic 3 **Resisting the Movement of Charge**

- Calculating Resistance
- Model problem
- Resistors
- Variable Resistors
- Types of Circuits
- House Wiring

Topic 4 **The Energy Connection**

- Electricity and Heat
- Electricity to Motion
- Motion to Electricity
- Electricity to Light
- Light to Electricity

Topic 5 **Portable Power**

- Electrochemical Cells
- Fuel Cells
- Types of ‘dry’ cells

Topic 6 **Generators and Motors**

- Electricity to Magnetism
- Electromagnets
- Magnetism to Electricity
- What’s in a Generator?
- DC Generators
- Electric Motors: Electric to Mechanical Energy
- DC Motors
- AC Motors

Topic 7 **Electricity in the Home**

- 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
- 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**

- 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
- 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?

_____

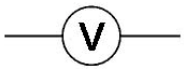
_____

Topic 2 (pgs. 272-278)

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

Component	*Description*	*Examples*

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 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.

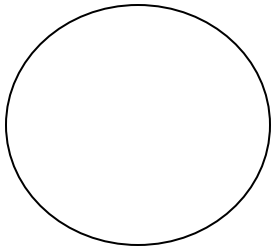
According to Georg Simon Ohm, what is the relationship between current, voltage and resistance, and how can it be calculated?

_____

_____

_____

_____



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?

Factor	*Effect*

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 5 (pgs. 300-307)

What did Luigi Galvini 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 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?

_____

_____

_____

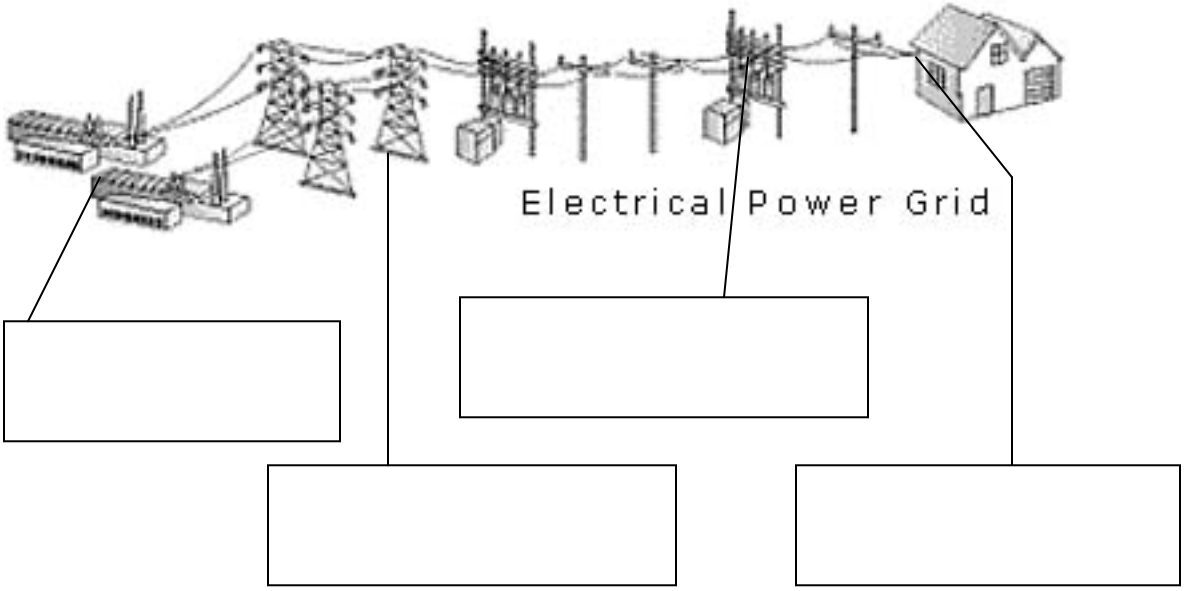
Illustrate a **Simple Motor** you can make with common household materials.

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 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**.

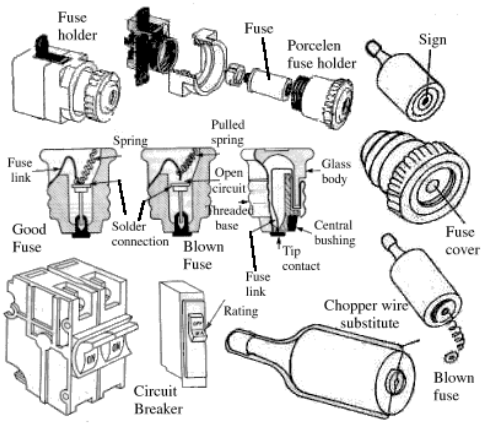
_____

_____

_____

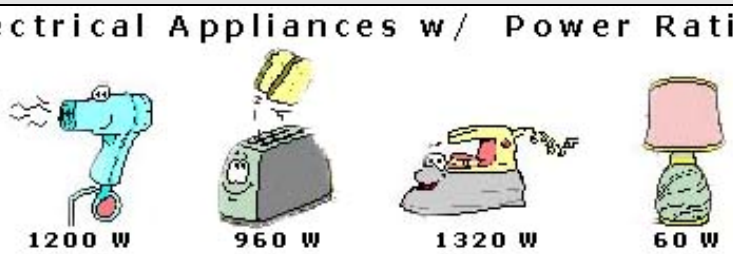
_____

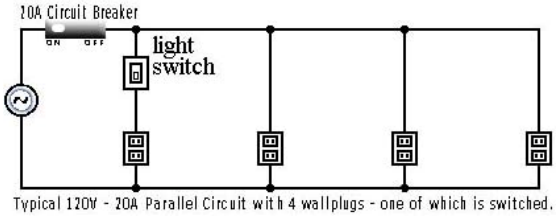
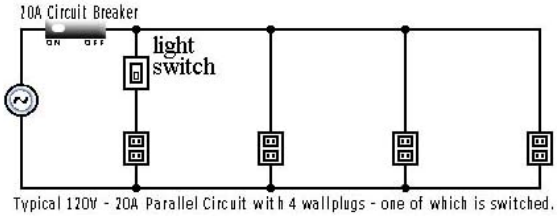
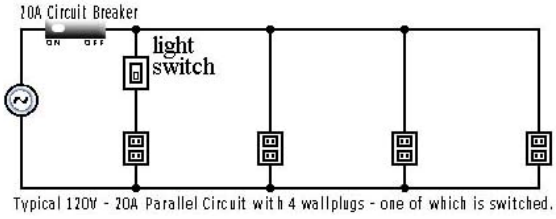
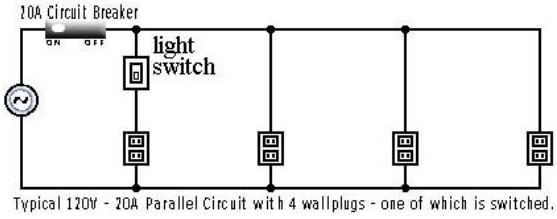
_____



_____

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



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

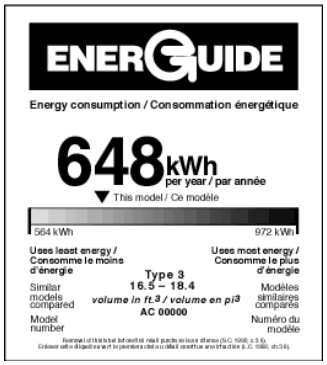
for energy usage

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

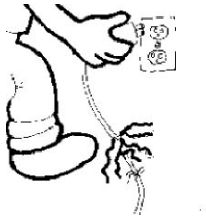
Explanation of how efficient the kettle is:

_____

_____

_____

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 8 (pgs. 332-342)

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

_____

_____

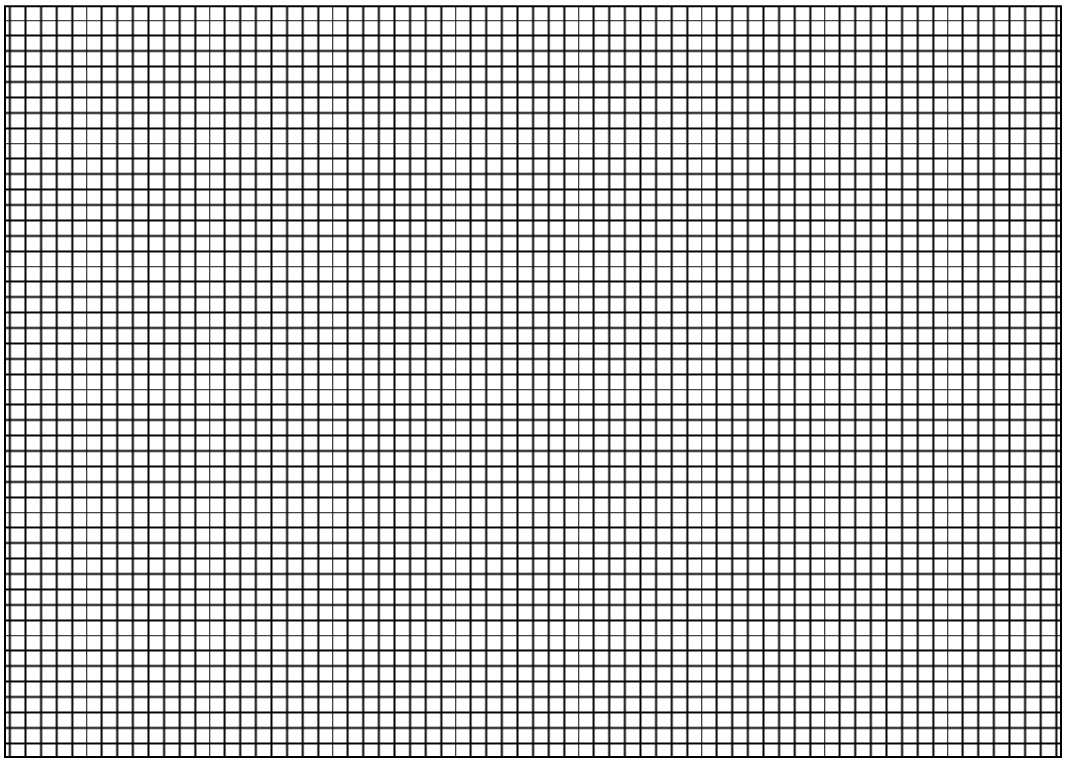
_____

_____

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**?

_____

_____

_____

What is **thermal pollution**?

_____

_____

What is **cogeneration**?

_____

_____

_____

Complete the table

Alternative Energy Source	Advantages	Disadvantages
Wind		
Solar		
Tides		
Geothermal		