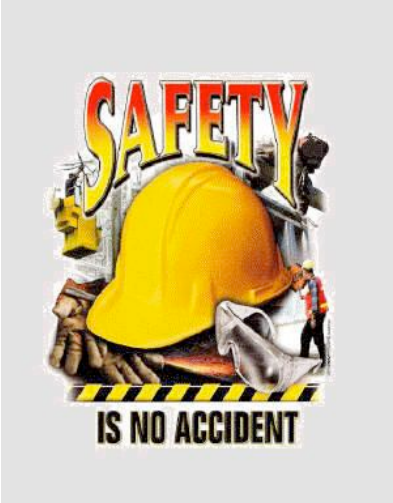
ثانويـة التكنولوجيـا التطبيقيـة
Applied Technology High School

Electrical Workshop

Module 1: **Safety**



PREPARED BY

Academic Services Unit

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Module 1: Safety

Module Objectives

Upon successful completion of this module, students should be able to:

1. Outline safety rules that apply to conditions at homes, labs and workshops, and jobs.
2. Identify electrical hazards and learn how to avoid them.
3. Explain the factors that determine the severity of an electric shock.
4. Learn how to respond to emergency situations in case of electrical hazards.

Module Contents:

1.1 Introduction to Electrical Safety

Electricity is a useful and powerful tool in our daily life. Everything around us works with electricity such as lamps, TVs, computers, mobile phones and DVD players. Today, electricity has become such an essential part of our life that it is difficult to imagine life without it. Figure 1.1 shows examples of equipment that work on electricity, which demonstrate the importance of electricity in our daily life.

Figure 1.1: Importance of electricity in our daily lives.

However, electricity is very dangerous. It can cause shock, burn or kill you. Electricity can also damage sensitive devices. Figure 1.2 gives examples of the dangers of electricity. This module covers the basic safety rules and practices that apply at home, outdoor, labs and workshops.

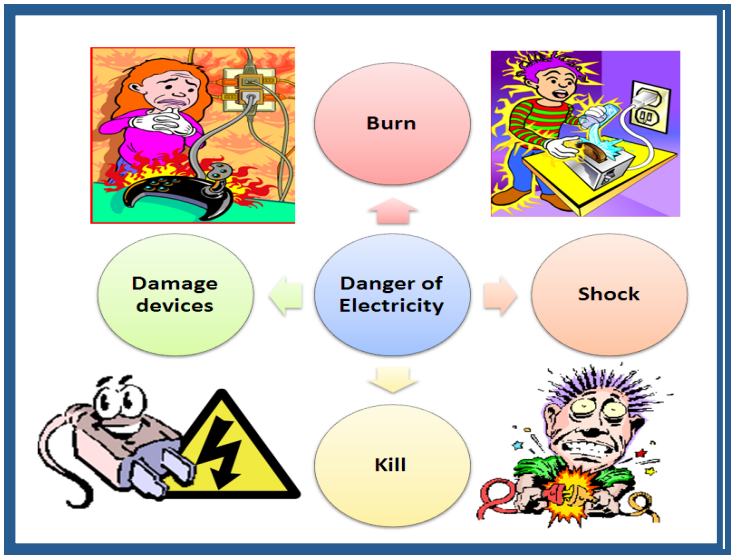
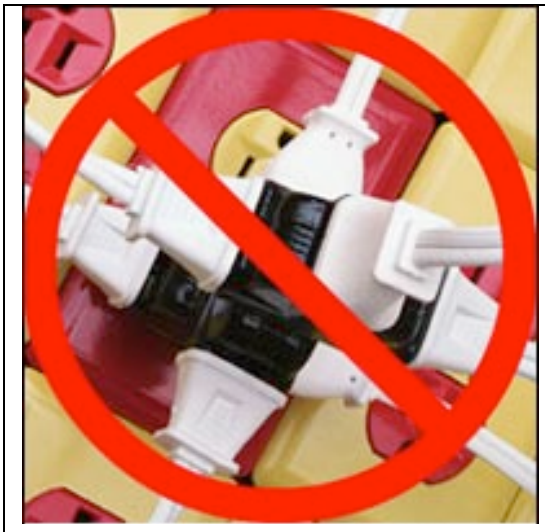


Figure 1.1 Dangers of electricity

1.2 Home Safety

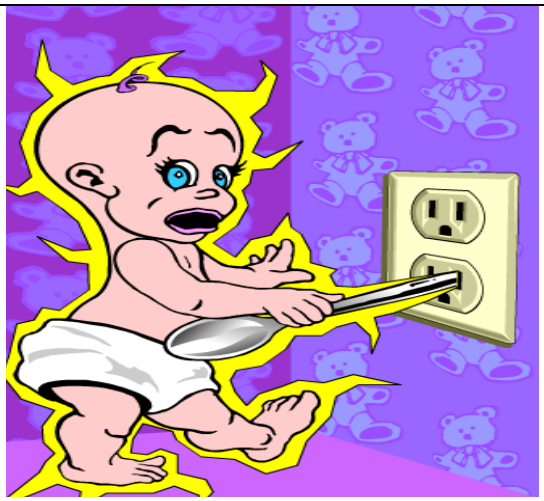
To protect your home from electrical risks and hazards, you need to follow some home safety tips that are illustrated below:



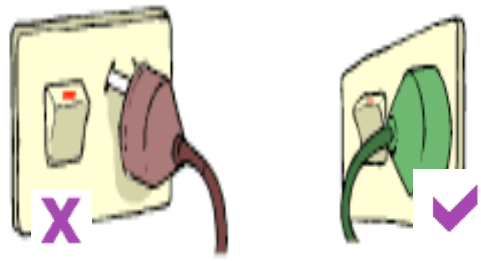
DON'T overload plugs as this can cause electrical fire.

Never use an electrical appliance in a wet area. This can cause an electric shock.

DON'T pull on the cable to remove a plug from the socket. This can damage the insulation and cause an electric shock or an electrical fire.

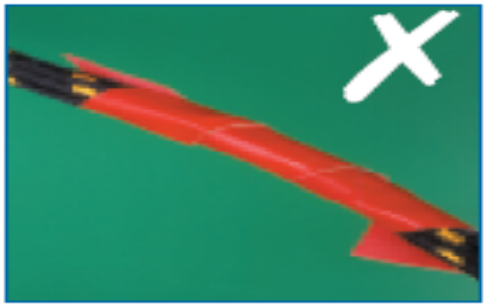


Never allow children to play with outlets. Inserting conductors in an electrical outlet is dangerous and can cause shock, which can kill a person.

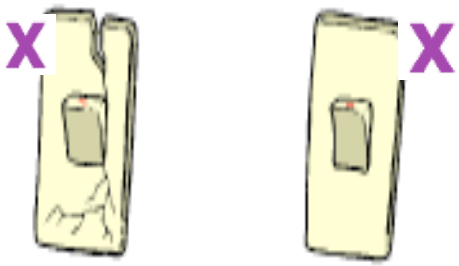


Plugs **should be** pushed carefully all the way into the power points.

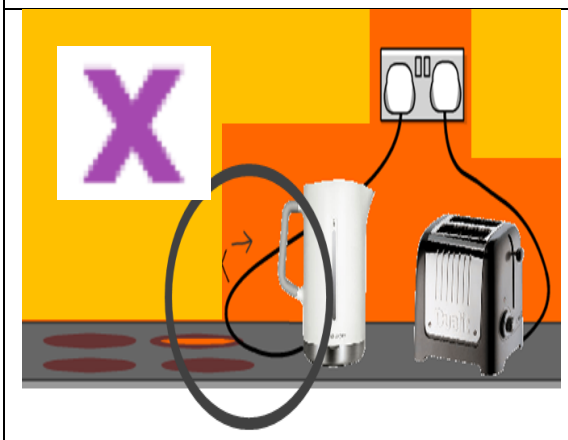
Replace the socket outlet if the plug is loose in the socket or if it shows signs of damage.



DON'T make joints in a cable; replace it with one of adequate length.



Switches and power points **should not** be cracked, broken or loose.



DON'T let leads from electrical equipment, such as toasters or kettles, trail across your cooker tops.

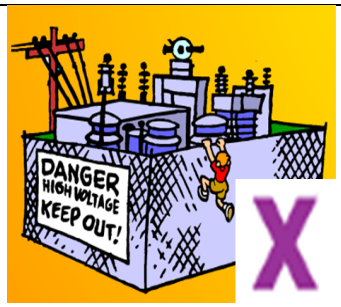
Always use plug protectors to stop small children from pushing things such as keys and pins into the power outlet.

1.3 Outdoor Safety

There are many outdoor electricity sources that can cause electricity hazards such as high voltage power lines, electricity substations and transformer boxes. To avoid accidents and protect yourself from electrical injuries, follow the next tips:

<table>
<tr><th colspan="2">WHILE WORKING</th></tr>
<tr><td> 
Never bring ladders, long-handled tools or other items within 10 feet of an overhead power line.</td><td> 
Never touch the underground power lines.</td></tr>
<tr><th colspan="2">While Playing</th></tr>
<tr><td> 

Never play with transformers because they carry high voltages that can be deadly.</td><td> 
Never fly kites or model airplanes near electric power lines.</td></tr>
</table>

WHILE PLAYING – cont.		
		
DON'T play near live power lines. If you see a downed power line, stay as far away as possible and keep others away.	**DON'T** play near electricity substations. They contain powerful electrical equipment that is dangerous.	**DON'T** climb trees that are near power lines. This can seriously injure you.

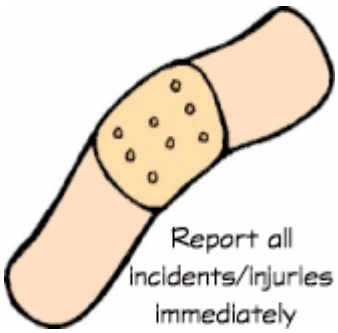
1.4 Labs & Workshops Safety

Before you can use equipment and machines or attempt practical work in a workshop or a lab, you must understand basic safety rules. These rules will help keeping you and others safe in the workshop. Following safety rules will also prevent you and others from accidents, injuries as well as death. To avoid accidents and injuries in the workshops and labs, follow the next safety rules and practices:

Before conducting workshop tasks, be familiar with the location of:		
		
Fire extinguishers	Fire alarm pull stations	First aid kits

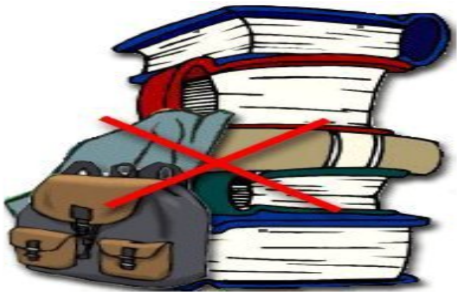
 Emergency telephone numbers.	 Emergency exits.	 Emergency stop button.

 Smoking, eating or drinking are **not permitted** in labs and workshops	 Keep the workshop clean and tidy at all times
 Keep the workshop floor dry	 Keep your tools and work area organized

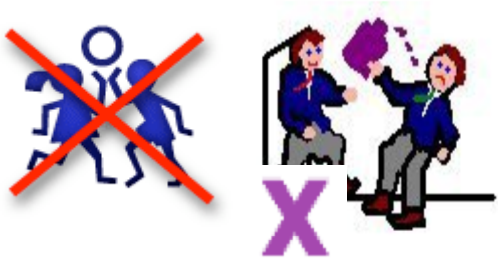


Report accidents such as spells, burns, cuts or injuries to the teacher immediately

Wear safety shoes while working in a workshop. Sandals or slippers **are not allowed** in workshops



Keep your lab bench organized and free of bags and books



Don't joke or play with your friends inside the lab

Listen Carefully to all instructions and lab procedures from your teacher. Ask questions if you aren't sure.

Always use the appropriate personal protective devices and check that they are clean and in good condition.

1.5 Safety and Accident Prevention Signs

We have seen a number of safety signs that read, **"Warning", "Caution", or "Danger"**. **Figure 1. 2** show some common safety and accident prevention signs and their meanings.

 **Respiratory Protection**	 **Eye Protection**	 **Footwear protection**	 **Hearing Protection**
 **No Smoking**	 **Hand Protection**	 **Hard Hat Protection**	 **Highly Flammable**
 **High Voltage Hazard**	 **Biological Hazard**	 **No Walking**	 **Poisonous Hazard**

Figure 1. 2: common safety and accident prevention signs

1.6 Introduction to Electricity

Have you ever thought how electricity comes to your house? Electricity is generated from different sources such as power stations, wind turbines, water power, solar power and battery power. **Figure 1. 3** shows the sources of electricity. **Figure 1. 4** shows how electricity reaches your home.

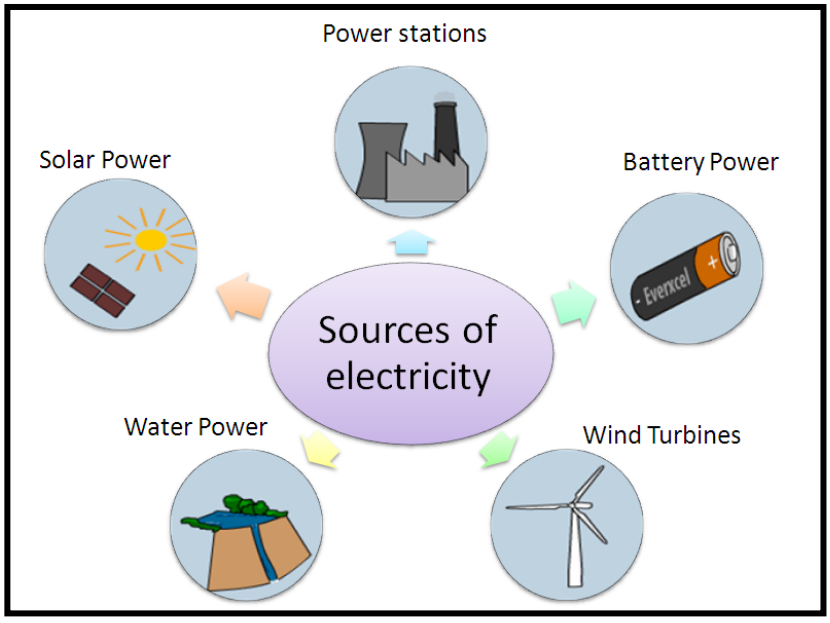


Figure 1. 3: sources of electricity

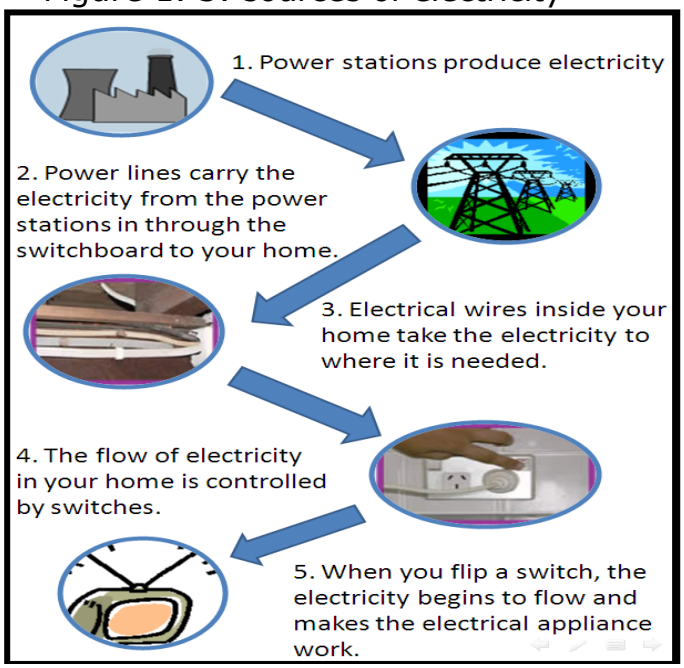
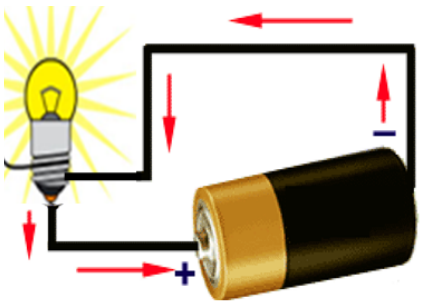
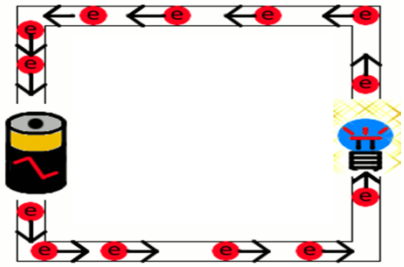


Figure 1. 4: How electricity comes to your homes

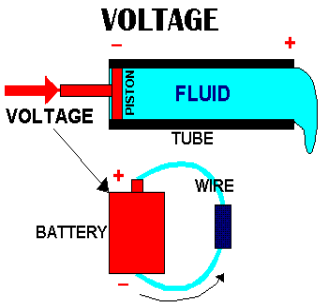
Basic Electrical Terms:



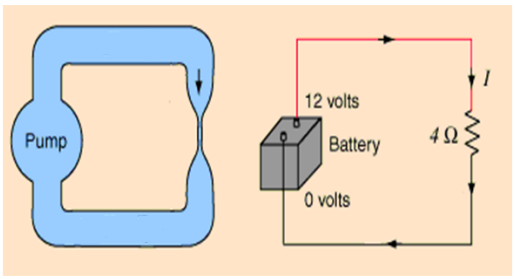
Circuit: Complete path of the current. It consists of electricity source, a conductor, and the output device or load (such as a lamp, or a heater).



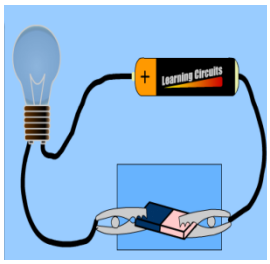
Current (I): Flow of electrons. It is measured in amperes (A) by an Ammeter .

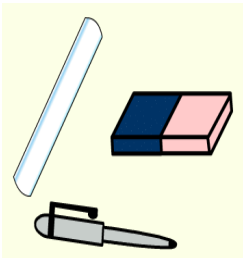


Voltage (V) : is the pressure that causes the flow of electric current in a circuit. It is measured in volts (V) by a Voltmeter.

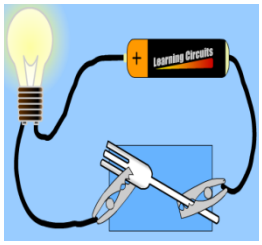


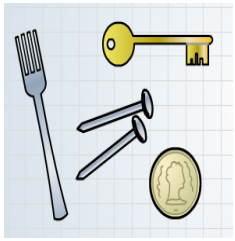
Resistance (R): Restriction to current flow. It is measured in units called ohm (Ω) by an Ohmmeter.



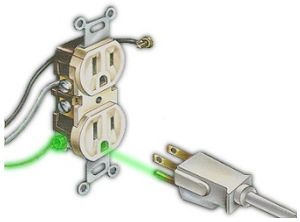


Insulators: Materials that **do not** allow electric current to flow such as; wood, plastic , rubber and paper.





Conductors: Materials that allow electric current to flow easily such as; metals and water.



Grounding: A conductive connection from all equipment to the earth which acts as a protective measure. It is a safety measure to help prevent people from accidentally coming in contact with electrical hazards. For example, by connecting the metal frame of the refrigerator to the ground, if the chassis becomes charged for any reason, the unwanted electricity will travel down the wire and out safely into the earth; and in the process, trip the circuit-breaker stopping the flow of electricity.

1.7 Electric Shock

- An electrical shock is received when electrical current passes through the body.
- You will get an electrical shock if part of your body completes an electrical circuit by:
  1. Touching a live wire and the electrical ground as shown in **Figure 1. 5**.
  2. Touching a live wire and another wire at a different voltage.

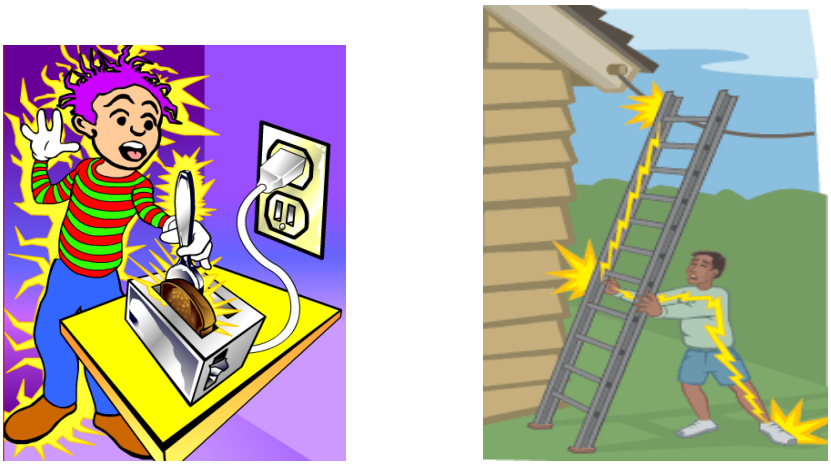


Figure 1. 5: how can you get an electric shock?

- Severity of the shock depends on (see **Figure 1. 6**) :
  - Path of current through the body
  - Amount of current flowing through the body (amps)
  - Duration of the current flow through the body

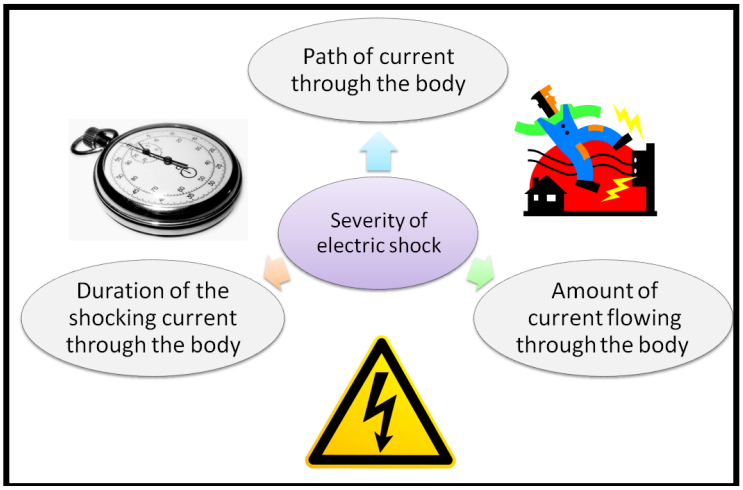
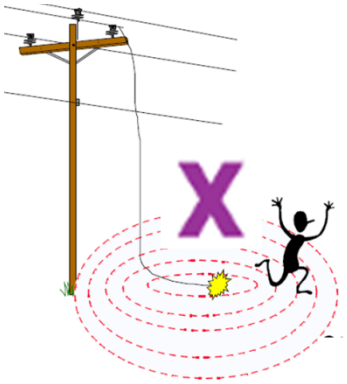
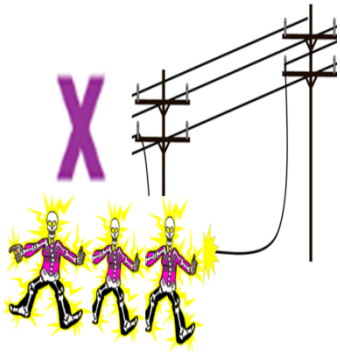
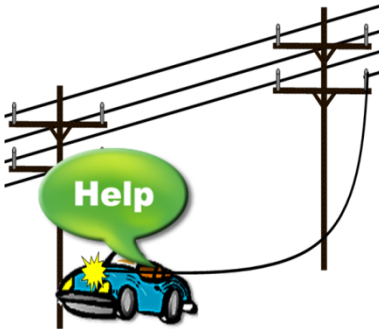
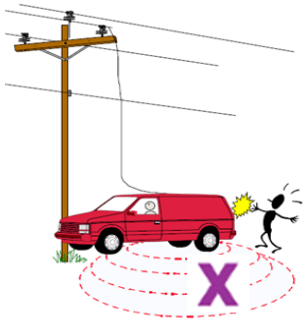
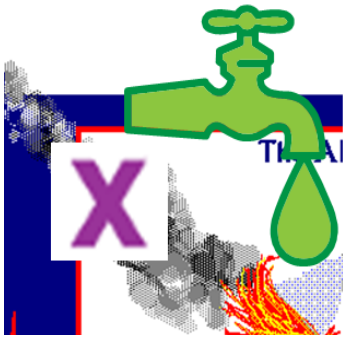


Figure 1. 6: factors that determine the severity of electric shock

1.8 How to Act in Emergency Situations

Downed Wire		
 Stay away from all downed wires - even if there are no sparks.	 Get help right away.	 **Do not touch** anything, or anyone, that is touching a downed wire

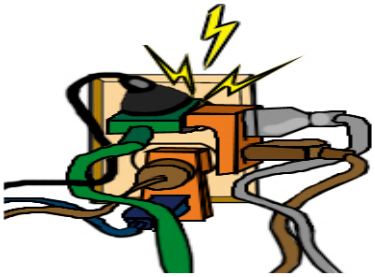
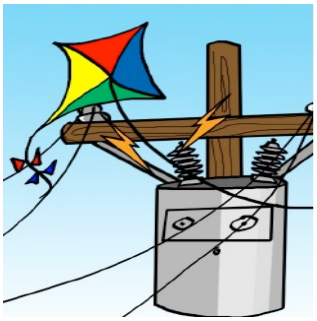
Downed Wire Touching a Vehicle		
 If you are inside a vehicle, wait inside for help.	 If you must get out, jump without touching the ground and the vehicle at the same time.	 If you are a witness, stay clear and call for help.

Electrical Fire		
		
Get help right away.	Unplug the faulty appliance to turn off the power, **if possible**.	**Never** throw water on an electrical fire

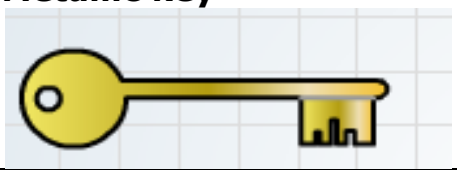
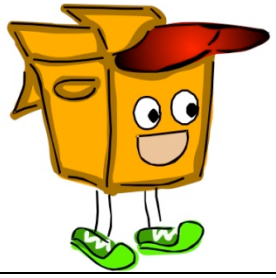
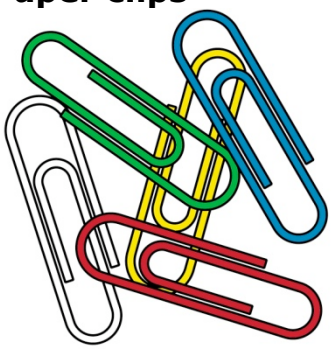
Electrical Shock		
		
Never touch a person who is being shocked.	Unplug the faulty appliance or turn off the power, **if possible.**	Call for help immediately

1.9 Class & Lab Activities

Activity 1: Indicate the safe and unsafe behavior in the following pictures. Give Reasons

Behavior	Safe	Not safe
		
		
		
		

Activity 2: Sort the following items into conductors and insulators

	Conductor	Insulator
Metallic key 		
Cartoon box 		
Plastic ruler 		
Water 		
Paper clips 		

Activity 3: Fill in the following table:

Term	Symbol	Unit	Measuring Device
Resistance	**R**		
Voltage		**volts (V)**	
Current			**Ammeter**

Activity 4: Complete following sentences:

- The severity of the electric shock depends on:
  1. _____
  2. _____
  3. _____

- List three tips for workshop and lab safety:
  1. _____
  2. _____
  3. _____

- What should you do if you see a downed wire?
  1. _____
  2. _____
  3. _____

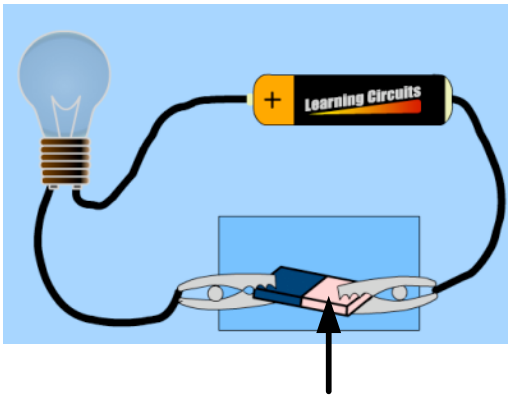
Activity 5: Identify and name the following safety equipment:

		
_____	_____	_____

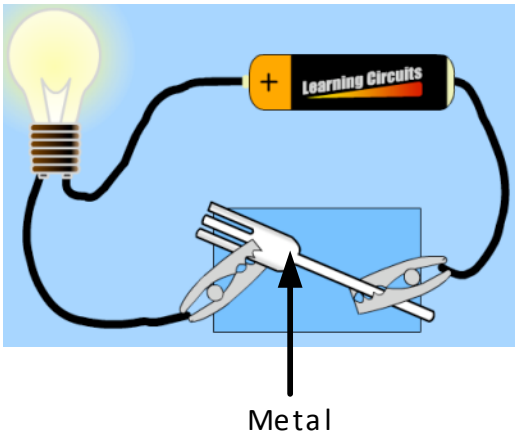
Activity 6: Write the name of each of signs shown below.

			
_____	_____	_____	_____
			
_____	_____	_____	_____
			
_____	_____	_____	_____

Activity 7: Differentiate between the circuits shown in the figures below by answering the following questions:



Circuit 1



Circuit 2

a) The lamp in circuit 1 is off. Give reason

_____

_____

b) The lamp in circuit 2 is on. Give reason

_____

_____