Republic of the Philippines
**DEPARTMENT OF EDUCATION**

# K to 12 Basic Education Curriculum
## Technology and Livelihood Education
## Learning Module

# ELECTRICAL INSTALLATION AND MAINTENANCE

***EXPLORATORY COURSE***

***Grades 7 and Grade 8***

## TABLE OF CONTENTS

# What Is This Module About?

Welcome to the world of ***Electrical Installation and Maintenance!***

This Module is an exploratory course which leads you to ***Electrical Installation and Maintenance*** National Certificate Level II ( NC II)[1]. It covers **5** common competencies that a Grade 7 / Grade 8 Technology and Livelihood Education (TLE) student like you ought to possess, namely:

1) Prepare electrical supplies, materials, and tools;
2) Perform mensuration and calculations;
3) Interpret technical drawings and plans;
4) Maintain tools and equipment; and
5) Practice occupational health and safety

These **5** common competencies are covered separately in 5 Lessons. As shown below, each Lesson is directed to the attainment of one or two learning outcomes:

Lesson 1 – Prepare electrical supplies, materials, and tools
- LO1. Identify electrical supplies, materials, and tools needed in electrical/wiring installation
- LO 2. Request appropriate supplies, materials, and tools for a specific job
- LO 3. Receive and inspect electrical supplies, materials and tools

Lesson 2 – Perform Mensuration and Calculations
- LO 1. Select measuring tools and instruments
- LO 2. Carry out Measurements and Calculations

Lesson 3 – Interpret Technical Drawing and Plans
- LO1. Analyze signs, symbols and data
- LO2. Interpret technical drawings and plans

Lesson 4 – Maintain Tools and Equipment
- LO 1. Check condition of tools and equipment
- LO 2 Perform basic preventive maintenance
- LO 3 Store tools and equipment

[1]***NATIONAL CERTIFICATE (NC) is*** *a certification issued to individuals who achieved all the required units of competency for a national qualification as defined under the Training Regulations. NCs are aligned to specific levels within the PTQF.* ***(TESDA Board Resolution No. 2004-13, Training Regulations Framework)***

***NATIONAL CERTIFICATE LEVEL*** *refers to the four (4) qualification levels defined in the Philippine TVET Qualifications Framework (PTQF) where the worker with:*

*a.* ***NC I*** *performs a routine and predictable tasks; has little judgment; and, works under supervision;*

*b.* ***NC II*** *performs prescribed range of functions involving known routines and procedures; has limited choice and complexity of functions, and has little accountability;*

Lesson 5 – Practice Occupational Health and Safety

LO 1. Identify hazards and risks

LO 2 Evaluate risks and hazards

LO 3 Control hazards and risks

Your success in this exploratory course on ***Electrical Installation and Maintenance*** is shown in your ability to perform the performance standards found in each learning outcome.

# How Do You Use This Module?

This Module has 5 Lessons. Each Lesson has the following parts.

- Learning Outcomes
- Performance Standards
- Materials/Resources
- Definition of Terms
- What Do You Already Know?
- What Do You Need to Know?
- How Much Have You Learned?
- How Do You Apply What You Learned?
- How Well Did You Perform?
- How Do You Extend Your Learning?
- References

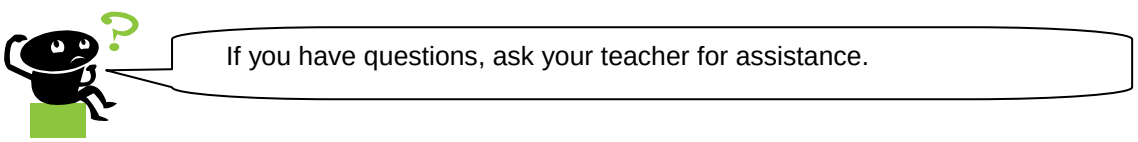
To get the most from this Module, you need to do the following:

1. Begin by reading and understanding the Learning Outcome/s and Performance Standards. These tell you what you should know and be able to do at the end of this Module.
2. Find out what you already know by taking the Pretest then check your answer against the Answer Key. If you get 99 to 100% of the items correctly, you may proceed to the next Lesson. This means that you need not go through the Lesson because you already know what it is about. If you failed to get 99 to 100% correctly, go through the Lesson again and review especially those items which you failed to get.
3. Do the required Learning Activities. They begin with one or more Information Sheets. An Information Sheet contains important notes or basic information that you need to know.

   After reading the Information Sheet, test yourself on how much you learned by means of the Self-check. Refer to the Answer Key for correction. Do not hesitate to go back to the Information Sheet when you do not get all test items correctly. This will ensure your mastery of basic information.
4. Demonstrate what you learned by doing what the Activity / Operation /Job Sheet directs you to do.
5. You must be able to apply what you have learned in another activity or in real life situation.

6. Accomplish the Scoring Rubrics for you to know how well you performed.

Each Lesson also provides you with references and definition of key terms for your guide. They can be of great help. Use them fully.



LESSON 1

# Prepare Electrical Supplies, Materials, and Tools

## LEARNING OUTCOMES:

**At the end of this Lesson, you are expected to do the following:**

**LO 1. identify electrical supplies, materials, and tools;**
**LO 2. request appropriate supplies, materials, and tools for a specific job; and**
**LO 3. receive and inspect electrical supplies, materials and tools.**

# Definition of Terms

**Ampere** - a unit of measure of electric current

**Circuit** - the path of electric current from the source to the components and goes back to the source

**Kilowatt** - a unit of power which is equivalent to 1000w

**Conductor** - a wire or a cord which provides path for current flow

**Resistance** - the quality of electric current measured in ohms that resist the flow of current

**Hot wire** - a wire through which current flows

**Insulator** – material used to cover electric wires which may be made from plastic, rubber, or asbestos.

**Tools** - are implements used to modify raw materials for human use

**Corrugated plastic conduit (CPC)** - commonly known as flexible non-metallic conduit or the *"moldflex"*

**Metallic Conduits-** metal raceways that was classified into four; rigid steel conduit (RSC), intermediate metallic conduit or tubing (IMC or IMT), electrical metallic conduit or tubing (EMC or EMT) and the flexible metallic conduit (FMC)

**Non-metallic conduits**- plastic conduits or raceways designed to be a channel of wire that are classified as; rigid non-metallic conduit or the PVC, the flexible non-metallic or CPC, and the surface plastic molding

**Connectors and Adapters** - accessories that are used to connect from boxes to conduits or raceways to the other boxes in the electrical system

# LEARNING OUTCOME 1

**Prepare electrical supplies, materials, and tools**

## PERFORMANCE STANDARDS

- Tools and materials are identified as per job requirement.
- Tools are classified according to its function as per job requirement.
- Materials are classified according to its uses on a specific project.
- Tools and materials are selected.

## Materials/ Resources

**1.** Utility box
**2.** Connectors
**3.** Male Plug
**4.** Fuse
**5.** Junction Box
**6.** Conduits
**7.** Circuit Breaker
8. Electrical Wires
9. Corrugated Plastic Conduit (CPC)
10. Receptacles
11. Fuse Panel/ Safety switch
12. Square boxes
13. PVC conduit
14. Switches
15. Switch Plates
16. Cut-out boxes

**TOOLS:**

1. Long Nose Pliers
2. Stubby Screw Driver
3. Wire Stripper
4. Portable Electric Drill
5. Philips Screw Driver
6. Combination Pliers
7. Hammer
8. Electrician's Knife
9. Hacksaw
10. Diagonal cutting pliers
11. Half-round file
12. Round file
13. Spirit level

# What Do You Already Know?

**Let us determine how much you already know about preparing electrical supplies, materials and tools. Take this test.**

## Pretest LO 1

**Directions**: Read the statement carefully and identify what is being described or defined. Choose your answer from the words inside the box.

| | | |
|---|---|---|
| Long Nose Pliers | Circuit Breaker | Hammer |
| Electrician's Knife | Utility box | Portable Electric Drill |
| Philips Screw Driver | Connectors | Wire Stripper |
| Male Plug | Fuse Combination Pliers | Junction Box |
| Stubby Screw Driver | Conduits | |

_____1. This is used for griping, holding, cutting electrical wires and cables and even small nails. Usually used by linemen in doing heavy tasks.

_____2. Used for cutting and holding fine wires. This can reach tight space or small opening where other pliers cannot reach and also used in making terminal loops of copper wires.

_____3. This has a cross tip resembling a positive (+) sign. It is used to drive screws with cross slot heads.

_____4. This is tools used in driving or pounding and pulling out nails.

_____5. A tool used for removing insulation of medium sized wires ranging from gauge #10 to gauge #16.

_____6. A small drilling machine with a chuck capacity of ¼" to 3/8". It is used in making holes on metal sheets and concrete walls.

_____7. Comes in either Standard or Philips screw driver with short shank or blade and shorted handle used to turn screws in tight space where standard screw driver cannot be used.

_____8. Used by linemen to remove insulation of wire and cables in low and high voltage transmission lines.

_____9. Is a device inserted to a convenience outlet to conduct electric current. A flat cord is attached to it on one end and the other end is connected to a current consuming instrument or appliance.

_____10. This is a circuit protective device that automatically blows and cut the current when an over load or short circuit happens.

_____11. This is a rectangular shaped metallic or plastic (PVC) material in which flush type convenience outlet and switch are attached.

_____12. Are electrical materials used as the passage of wires for protection and Insulation.

_____13. Are used to attach metallic or non-metallic conduit to the junction or utility boxes.

_____14. This is a protective device used to automatically cut off the current when trouble in the circuit such as short circuit or over load occurs.

_____15. Is an octagonal shaped electrical material where the connections or joints of wires are being done. It is also where the flush type lamp holder is attached.

**Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills**

# What Do You Need To Know?

**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check .**

Information Sheet 1.1

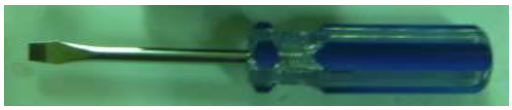
## Electrical Tools and Equipment

Electrical task can be accomplished systematically to save time, effort, and resources. Most of the work cannot be done using bare hands. To do the task, electrical tools or equipment are needed to perform the job. This lesson will discuss the function/use of each tool or equipment used in electrical wiring installations.

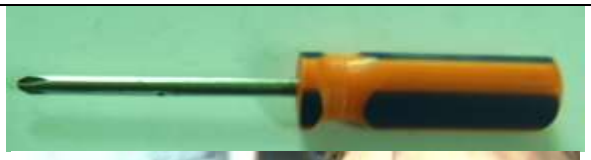
The following are common ***electrical tools and equipment*** needed in the installation of electrical wiring.

I. **SCREW DRIVERS.** These tools are made of steel hardened and tempered at the tip used to loosen or tighten screws with slotted heads. They come in various sizes and shapes.

A. **Standard/Flat Screw Driver.** The blade tip is wedge-shaped and resembles a negative (-) sign. This is used to drive screws with a single slot head.



B. **Philips Screw Driver.** This has a cross tip resembling a positive (+) sign. This is used to drive screws with cross slot heads.



C. **Stubby Screw Driver.** It comes in either Standard or Philips screw driver with short shank or blade and a shorted handle used to turn screws in tight space where standard screw driver cannot be used.

D. **Allen Screw Driver/Wrench.** This could be in the shape of a screw driver or a wrench. Its function is to drive screw with hexagonal slot head.


**II. HAMMERS.** These are tools used in driving or pounding and pulling out nails. They are made of hard steel, wood, plastic or rubber. The following are types of hammer:

**A.** Claw hammer
**B.** Mallet(rubber head)
**C.** Ballpeen hammer

**A**

**B**

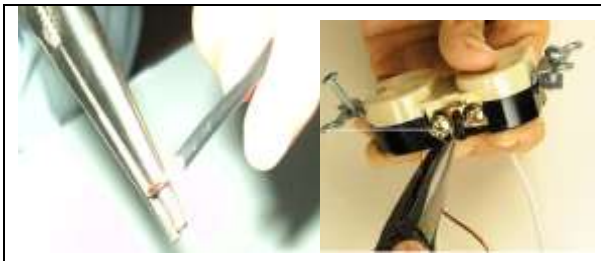
**C**

III. **PLIERS**. These made from metal with insulators in the handle and are used for cutting, twisting, bending, holding, and gripping wires and cables.

**A.** Combination Pliers (Lineman's Pliers). This is used for gripping, holding, and cutting electrical wires and cables and even small nails. They are usually used by linemen in doing heavy tasks.

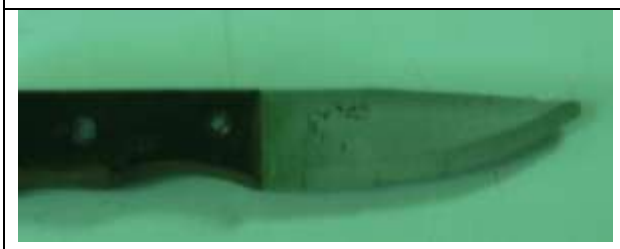
**B.** Side Cutting Pliers. This type of pliers is used for cutting fine, medium and big wires and cables.

**C.** Long Nose Pliers. This is used for cutting and holding fine wires. This can reach tight space or small opening where other pliers cannot reach and also used in making terminal loops of copper wires.



IV. Wire Stripper- A tool used for removing insulation of medium sized wires ranging from gauge #10 to gauge #16.

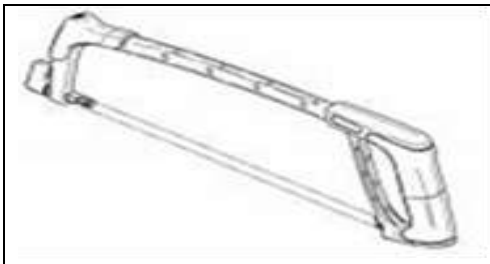
V. Electrician's Knife. This is used by linemen to remove insulation of wire and cables in low and high voltage transmission lines.



VI. Portable Electric drill. A small drilling machine with a chuck capacity of ¼" to 3/8". It is used in making holes on metal sheets and concrete walls.

Portable electric drill

VII. Hacksaw. This tool is used to cut metal conduit and armored cable.



Hacksaw

## Electrical Supplies and Materials

***Electrical materials*** *are* developed and constructed for a special purpose such as to:

1. control the flow of current in an electrical circuit;
2. carry electrical current from the source to the load or current consuming apparatus;
3. hold and secure wires to its fixtures inside and outside houses and buildings; and
4. protect the houses, buildings, appliances' and instruments from any destruction and damage.

The following are the most commonly used ***electrical materials*****.**

| MATERIALS AND DESCRIPTION | PICTURES |
|---|---|
| **Convenience outlet-** a device that acts as a convenient source of electrical energy for current consuming appliances. It is where the male plug of an appliance is inserted and usually fastened on the wall or connected in an extension cord. It maybe single, duplex, triplex or multiplex and could be surface type or flush type. |  Surface type (duplex)  Flush type (duplex) |
| **Male plug-** a device inserted to a convenience outlet to conduct electric current. A flat cord is attached to it on one end and the other end is connected to a current consuming instrument or appliance. |   Male plugs |

| | |
|---|---|
| **Lamp holders-** devices that hold and protect the lamp and are also called as "Lamp Sockets/Receptacles". These come in many designs and sizes. They are classified as flush, hanging (weather proof/chain) and surface types. |   <br>Flush type Hanging (chain)<br>   <br>Surface type Hanging (weather) |
| **Switch -** a device that connects and disconnects the flow of electric current in a circuit. There are many shapes, designs, and types and they are classified as hanging, flush, and surface types. |  <br>Surface type<br>   <br>Flush type Hanging type |
| **Fuse** - a circuit protective device that automatically blows and cut the current when and over load or short circuit happens. |    <br>Knife blade Cartridge Plug type |

| | |
|---|---|
| **Circuit Breaker** - a protective device used to automatically blows and cuts the current when trouble in the circuit such as short circuit or overload occurs. |  <br>Circuit breaker |
| **Junction Box** - an octagonal shaped electrical material where the connections or joints of wires are being done. It is also where the flush type lamp holder is attached. This could be made of metal or plastic (PVC) *Polyvinylchloride.* |  <br>Plastic<br>  <br>Metal |
| **Utility Box** - a rectangular shaped metallic or plastic (PVC) material in which flush type convenience outlet and switch are attached. |   <br>METAL PLASTIC |
| **Flat Cord-** Is a duplex stranded wire used for temporary wiring installation and commonly used in extension cord assembly. It comes in a roll of 150 meters and with sizes of gauge # 18 and gauge # 16 awg (American wire gauge). |   <br>Flat cord |

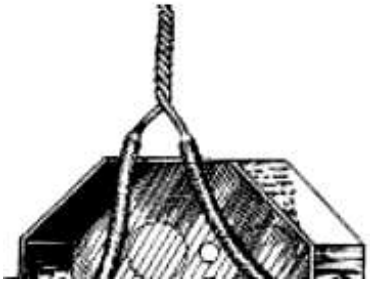
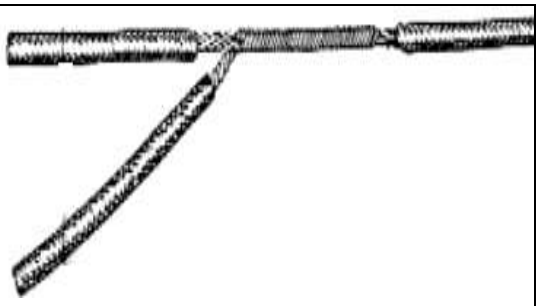
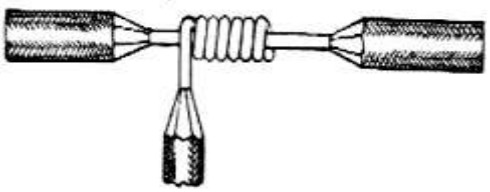
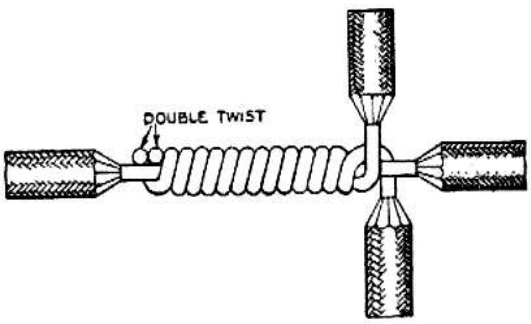
| | |
|---|---|
| **Electrical Wire/Conductor-** electrical material that could be:<br><br>**a**. **Stranded** wire which is made of multiple strands joined together to make a single wire.<br><br>***b***. **Solid** wire is made of a single strand of copper or aluminum wire. These are used in wiring installation inside and outside the buildings. |  <br>a. Stranded wire<br>  <br>**b.** Solid wire |
| **Conduits/Pipes-** electrical materials used as the passage of wires for protection and insulation. These could be rigid metallic, flexible metallic conduit (FMC), rigid non-metallic (PVC), and flexible non-metallic or corrugated plastic conduit (CPC) |  <br>Metallic conduit<br>  <br>Flexible Non-metallic conduit or corrugated plastic conduit (CPC)<br>  <br>Rigid Non-metallic conduit (PVC) |
| **Clamps**- electrical materials used to hold and anchor electrical conduits in its proper position. |   <br>Metal clamp Plastic clamp |
| **Connectors**- used to attach metallic or non-metallic conduit to the junction or utility boxes. |   <br>Metal connector Flexible non metallic connector |

## COMMON WIRE SPLICES AND JOINTS

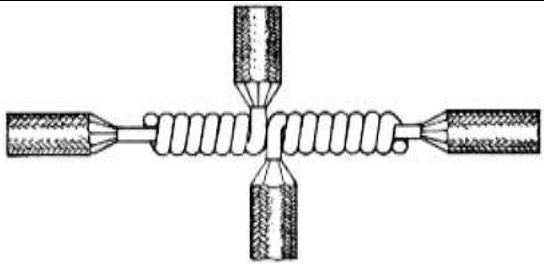
**Introduction**

As a student in Electrical Installation and Maintenance you should acquire the important knowledge and skills in wire splices and joints and should be familiar with the actual application of every splice and joint. This will serve as your tool in performing actual wiring installation. Of course, another factor is the knowledge in interpreting and analyzing the wiring diagram especially if the circuit is complicated.

The following are the Common Electrical Wire Splices and Joints.

<table>
<tr>
<td>  <br>Rat Tail or Pig Tail. This kind of joint is commonly used to join two or more conductors inside the junction box. It is suitable for service where there is no mechanical stress when wires are to be connected in an outlet box, switch, or conduit fitting</td>
<td>  <br>Y-splice. This method of wrapping is generally used on small cables because the strands are flexible and all can be wrapped in one operation.</td>
</tr>
<tr>
<td>  <br>Knotted tap. This is used where the tap wire is under heavy tensile stress.</td>
<td>  <br>Plain tap joint. This is used where the tap wire is under considerable tensile stress circuit.</td>
</tr>
<tr>
<td>  <br>Aerial tap. This is used as a temporary tap</td>
<td> 

<br>Duplex cross joint. This is a two-tap wire turned simultaneously and is used</td>
</tr>
</table>

| | |
|---|---|
| usually done in constructions sites. The easy twist will facilitate tap wire movement | where the two tap wire is under heavy tensile stress. |
|  <br>**Western Union Short-tie Splice.** This is the most widely used splice or joint in interior wiring installation to extend the length of wire from one point to another. |  <br>**Western Union Long Tie**. This is used extensively for outside wiring to extend the length of wire from one end to another. |
|  <br>**Cross joint**. The same application is done as in plain tap and the only difference is that this tap is a combination of two plain taps place side by side with each other. |  <br>**Wrapped Tap or Tee Joint.** This is used on large solid conductors where it is difficult to wrap the heavy tap wire around the main wire. |

## EXTENSION CORD

An ***extension cord*** is a span of flexible electrical power cable with a plug on one end and multiple sockets on the other end. It comes in several varieties to suit the needs of the user. One of the most important considerations is the power handling capacity to make it safe and functional.

Electrical gadgets are product of modern technology to make our life better. The number of electrical gadgets available at home and in offices may exceed the existing convenience outlet installed in every room. The best remedy to address the insufficiency of available outlet is to use an extension cord especially if the electrical gadgets need to operate at the same time.

**REMINDER**

Be careful in buying an extension cord. You have to look for the Department of Trade and Industry (DTI) markings. The Product Standard (PS) or Import Commodity Clearance (ICC) markings on it signify that the product passed the DTI standard for safety and quality.

Sample pictures of extension cords using different materials

# How Much Have You Learned?

Self-Check 1.1

**Direction.** Identify each of the following tools/materials

1.  _____
2.  _____
3.  _____
4.  _____
5.  _____
6.  _____
7.  _____
8.  _____
9.  _____
10.  _____
11.  _____
12.  _____
13.  _____
14.  _____
15.  _____

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity**

Operation Sheet 1.1

## SKINNING OF WIRE USING DIFFERENT TOOLS AND EQUIPMENT

**DIRECTION.** Given are sets of tasks and their corresponding pictures, practice those using appropriate tools and materials. Your performance will be judged using the following criteria:

**PERFORMANCE RUBRICS:**

| CRITERIA | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Accuracy** | | | | |
| **Workmanship** | | | | |
| **Proper handling of tools** | | | | |
| **Speed** | | | | |

**Legend:**

**1- Poor 2- Fair 3- Good 4. Excellent**

| SCALE | DESCRIPTION | POINTS |
|---|---|---|
| **4** | **Excellent** | **93-100** |
| **3** | **Good** | **86-92** |
| **2** | **Fair** | **79-85** |
| **1** | **Poor** | **78 and below** |

- **Accuracy**- the ability to follow the procedures/directions with precision.
- **Workmanship**- the art, skill and finality of work.
- **Proper handling of tools**- the ability to apply proper handling of tools for a given task.
- **Speed**- efficiency of work.

**TOOLS:**

1. Combination Plier
2. Side cutting plier
3. Long nose plier
4. Wire stripper
5. Electrician's knife

**MATERIALS:**

Solid and stranded copper wires of different sizes; #14, #12, #10

| Tasks | Pictures of the Tasks |
|---|---|
| 1. Skin a wire using an electrician's knife, about 1 to 1 ½ inches long. |  |
| 2. Skin a wire using combination and side cutting pliers about 1 ½ inches long. Make sure that there will be no ***knick*** ( deep cut across the wire) on your skinned wires. |  |
| 3. Remove insulators using wire stripper about 1 to 1 ½ inches long |  |

Operation Sheet 1.2A

## A CONNECTING SKINNED WIRES TO WIRING MATERIALS

**OBJECTIVE:** To be able to properly connect skinned wires to bulb receptacles, convenience outlets, switches, or any other wiring materials.

**TOOLS**

1. Combination pliers
2. Side cutting pliers

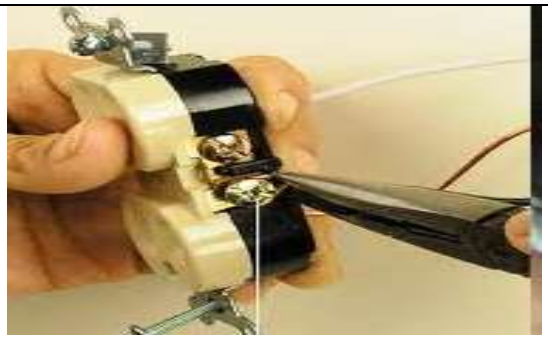
3. Long nose pliers
4. Wire stripper
5. Electrician's knife
6. Phillips screw drivers
7. Flat screw drivers

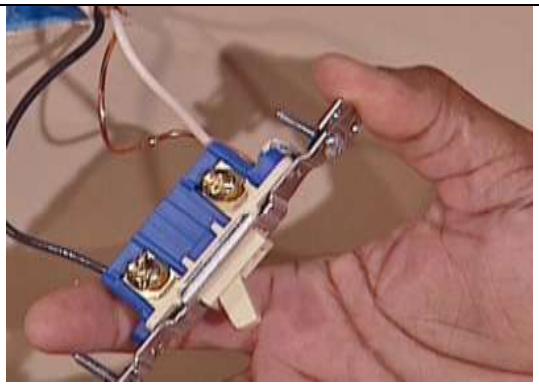
**MATERIALS:**

- Electrical wires used in Activity 1.1

**PROCEDURE:**

Follow procedure on the table below

| | |
|---|---|
| 1. Make terminal loops using long nose pliers from your skinned wires of about 1 to 1 ½ inches long. |  |
| 2. Connect the skinned wire to screw terminals of the bulb receptacle.<br><br>**Be sure that the wire loop is to be connected or attached to the terminal screw in clockwise direction.* |  |
| 3. Insert the loop to the screw and tighten it to the convenience outlet.<br><br>**Be sure that the wire loop is to be connected or attached to the terminal screw in clockwise direction.* |  |

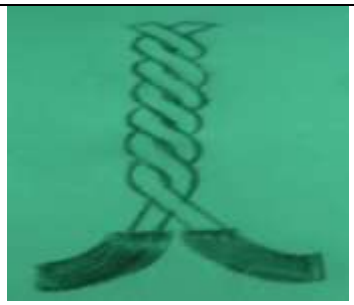
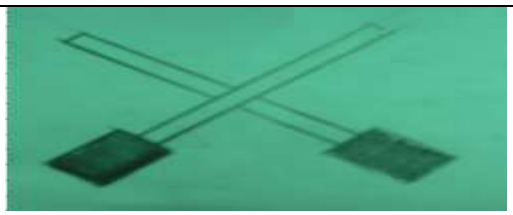
| | |
|---|---|
| 4. Insert the loop to the screw of the switch and tighten it.<br><br>**Be sure that the wire loop is to be connected or attached to the terminal screw in clockwise direction.* |  |
| 5. Insert the loop to the screw of the fuse terminal and tighten it.<br><br>**Be sure that the wire loop is to be connected or attached to the terminal screw in clockwise direction.* |  |

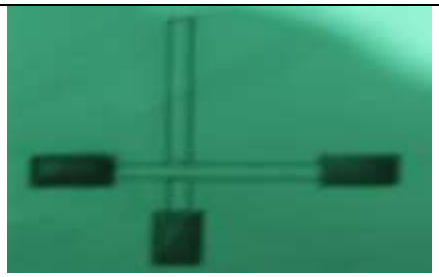
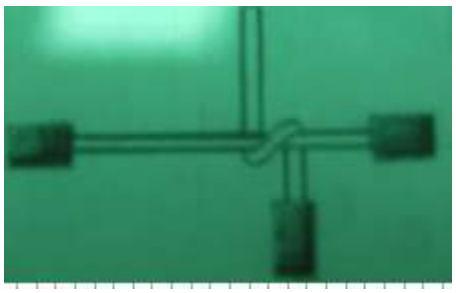
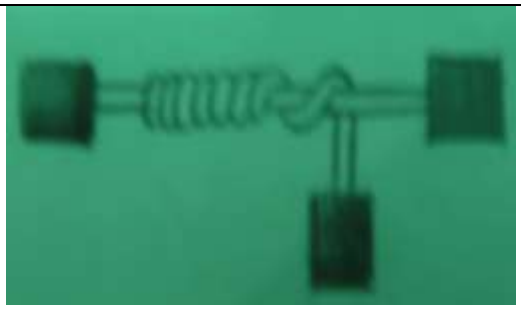
Operation Sheet 1.2B

## SPLICING OF WIRES

**DIRECTIONS:** Below are pictures of ***common wire splices and joints*** used in electrical wiring installations**.** Practice doing the task by following the steps given. Your performance will be judged using the rubric:

| **Steps in splicing a rat tail joint** | |
|---|---|
| **Steps** | **Figures** |
| 1. Strip the wire insulator at the ends of the conductor to be joined at about 50 mm. Clean both wires to be joined. |  |

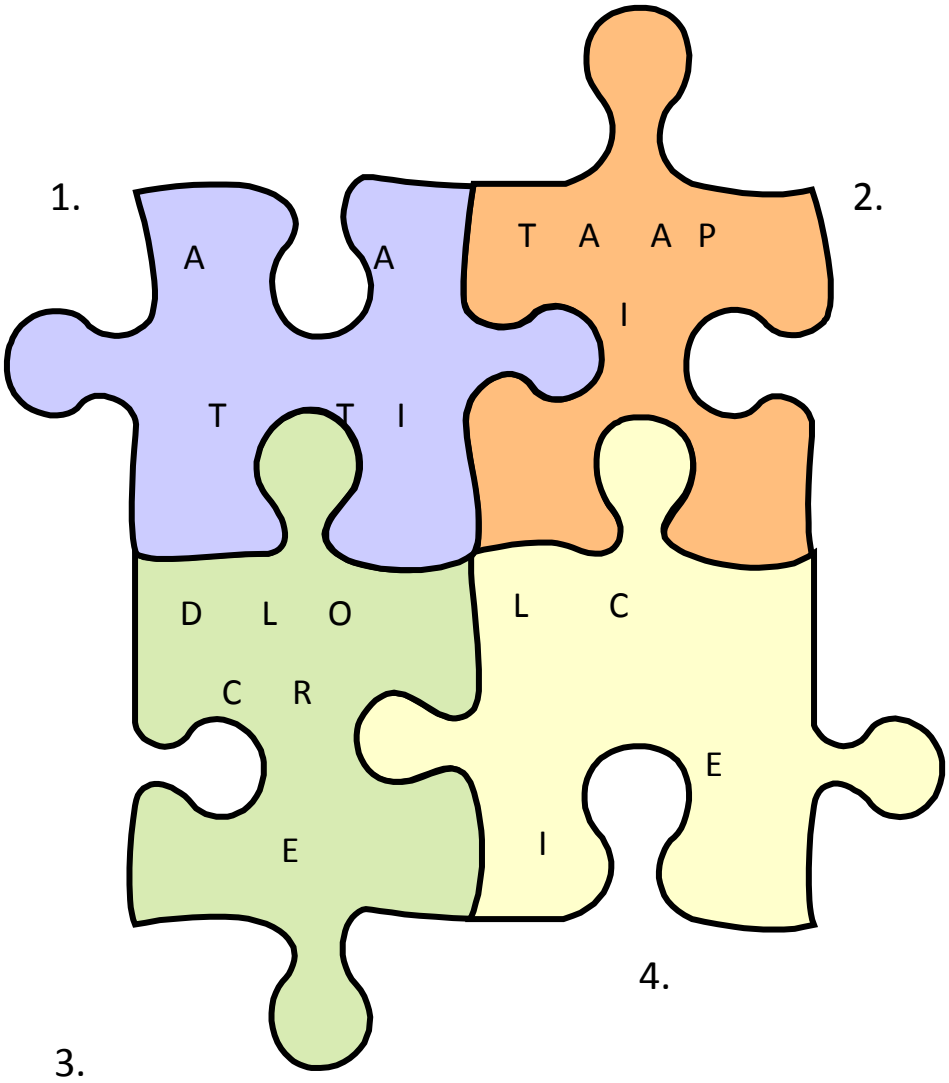
| | |
|---|---|
| 2. Place the two ends of bare wire in crossed position. |  |
| 3. Then, twist the bare conductors about five to seven times. |  |
| **Steps in splicing western union long- tie joint** | |
| **Steps** | **Figures** |
| 1. Strip the wire ends for about 75 mm. |  |
| 2. Place the wires in crossed position about mid halfway from the insulation. |  |
| 3. Make four to six long twists of wires. |  |

| | |
|---|---|
| 4. Wrap each side of the wire for about four to five turns as shown in figure 4. |  |
| **Steps in splicing *aerial tap joint*** | |
| **Steps** | **Figures** |
| • Strip the tap wire end about 75 mm. and the main wire end about 25 mm. |  |
| • Place the wires in crossed position intersecting about 5 mm from the insulation of the tap wire and the main wire. |  |
| • Bend the tap wire over the main wire making a long twist. |  |
| • Turn the tap wire around the main wire making four to five turns. |  |

# How Much Have You Learned?

Self-Check 1.2

**A. Direction:** Inside each piece of puzzle are jumbled letters. Arrange these letters to form the correct word on types of joints and splices/wire connections.




1._____
2._____
3._____
4._____

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Operation Sheet 1.3A

**INTRODUCTION**

Underwriter's knot is one of the skills needed in making an extension cord. It is neither a joint nor a splice but a ***knot*** that is made in an extension cord. Its purpose is to relieve the strain on small wires of the cord and binding screws of convenience outlets and male plug.

For you to make a quality and safe output you have to strictly follow the given procedure in making an underwriter's knot. Below is the procedure.

You will be rated by the use of this performance rubics.

**PERFORMANCE RUBRICS:**

| CRITERIA | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Accuracy** | | | | |
| **Workmanship** | | | | |
| **Proper handling of tools** | | | | |
| **Speed** | | | | |

**Legend:**

**1- poor 2- fair 3- good 4. Excellent**

| SCALE | DESCRIPTION | POINTS |
|---|---|---|
| **4** | **Excellent** | **93-100** |
| **3** | **Good** | **86-92** |
| **2** | **Fair** | **79-85** |
| **1** | **Poor** | **78 and below** |

**Materials:**

- Flat cord no.18 AWG

**Tools:**

- Side cutting
- long nose
- combination pliers
- Wire stripper/electrician's knife

**Procedure and picture:**

| | |
|---|---|
| 1. Split the end of the flat cord about 8 centimeters long. |  |
|  | 1. Bend the left strand of the cord and place it at the back of the main cord following the arrow. |
| 2. Bend the right strand of cord. Place it at the back of left strand and over the main cord. |  |
|  | 3. Insert the right strand cord inside the loop made by left strand cord. |
| 4. Pull both strands of the flat cord to tighten the knot. |  |

Operation Sheet 1.3B

## PROJECT PLAN IN MAKING AN EXTENSION CORD

**INTRODUCTION**

You might be wondering why there are several projects which are not completely done. Well, there are several reasons why this happens. It might be out of budget or not properly planned. So, this Lesson will help you achieve the desired quality project.

A **project plan** is necessary before undertaking any project because it serves as your guide in accomplishing an activity. It will give you an idea what needs to be done, how much to spend and what procedures to undertake.

A well prepared project plan saves time and cost of materials. Below is a sample project plan of an extension cord. This format can also be used in preparing a plan for other projects in the future.

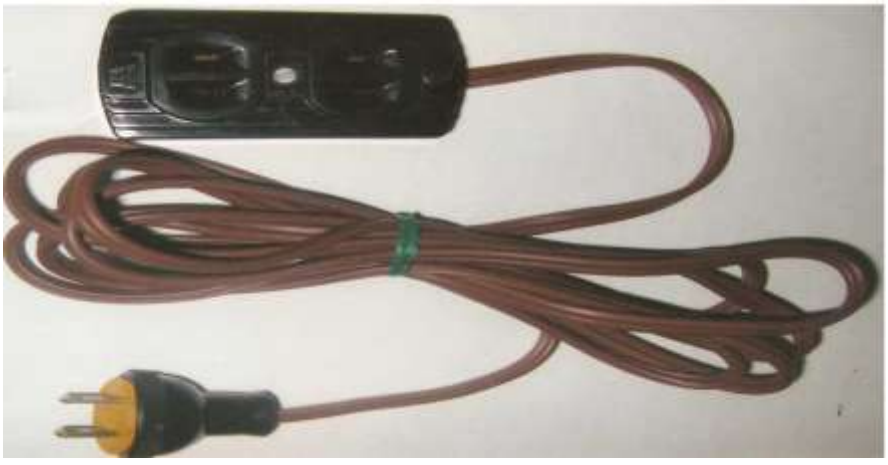
### Project Plan - (Making an extension cord)

Name of Student:_____ Year & Section:_____
**I**. **Name of Project**: Extension Cord Assembly Date Started: _____
Date Finished: _____

**II. Objective:**

a. Demonstrate how to make an extension cord.
b. Observe safety measures while doing the project.

**III. Sketch/Drawing:**



**IV. Materials Needed:**

| Qty. | Unit | Description | Unit Cost | Total Cost |
|---|---|---|---|---|
| 1 | pc. | Convenience Outlet (surface type duplex) | Php 40.00 | Php 40.00 |
| 3 | meters | Flat Cord # 18 AWG | Php 12.00 | Php 36.00 |
| 1 | pc. | Male Plug | Php 15.00 | Php 15.00 |
| 2 | Pcs. | Eyelet Wire Connectors | Php 1.50 | Php 3.00 |
| TOTAL COST OF MATERIALS | | | | Php 94.00 |
| + cost of labor (approximately 20%-30% of cost of materials) | | | | Php 28.00 (30%) |
| **SELLING COST** | | | | **PHP 122.00** |

**Sample Pictures of Materials Needed**

**Flat Cord**

**Male Plug**

**Eyelet wire connectors**

**Convenience Outlet**

**V. Tools and Equipment Needed:**

1. Standard/Flat Screw Driver
2. Philips Screw Driver
3. Long Nose Pliers
4. Side Cutting Pliers
5. Electrician's knife/ Pocket knife
6. Continuity Tester or Multi-tester

**VI. Procedure:**

1. Prepare the plan.
2. Gather all necessary materials, tools and equipment needed.
3. Insert cord into the male plug, split the cord wires about 8 centimeters long.
4. Remove insulation of both wires 1 centimeter long with a pocket knife as if sharpening a pencil. Be careful not to cut any strand.
5. Scrape bare wire with the back of the knife until shiny. Twist the wire stands.
6. Tie the underwriter's knot.

7. Make a loop on terminal wires and connect the wires to the screw of the male plug. The loop should go with the thread clockwise direction.
8. Split the cord wires at the other end about 4 centimeters long, then follow procedure no. 4.
9. Connect the wires to the connectors.
10. Open the convenience outlet then remove the screw.
11. Insert the wire connectors to the screws, tighten it and return the cover.
12. Check the continuity and test the extension cord.

## How Well Did You Perform?

**Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!**

**Criteria for Assessment:**

**PERFORMANCE RUBRICS:**

| CRITERIA | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Accuracy** | | | | |
| **Workmanship** | | | | |
| **Proper handling of tools** | | | | |
| **Speed** | | | | |

**Legend:**

**1- Poor 2- Fair 3- Good 4. Excellent**

| SCALE | DESCRIPTION | POINTS |
|---|---|---|
| **4** | **Excellent** | **93-100** |
| **3** | **Good** | **86-92** |
| **2** | **Fair** | **79-85** |
| **1** | **Poor** | **78 and below** |

- **Accuracy**- the ability to follow the procedures/directions with precision.
- **Workmanship**- the art, skill and finality of work.
- **Proper handling of tools**- the ability to apply proper handling of tools for a given task.
- **Speed**- efficiency of work.

# LEARNING OUTCOME 2

**Request appropriate supplies, materials, and tools for a specific job**

## PERFORMANCE STANDARDS

- Needed materials and tools listed as per job requirement.
- Materials and tools are requested according to the list prepared.
- Requests are done as per company standard operating procedures (SOP)
- Unavailable materials and tools are substituted and provided without sacrificing cost and quality of work.

## Materials/ Resources

1. Inventory form
2. Requisition form
3. Job order form
4. Borrower's form

# What Do You Already Know?

**Let us determine how much you already know about requesting appropriate supplies, materials, and tools for a specific job. Take this test.**

Pretest LO 2

**Direction:** Match the forms in **Column A** with the corresponding descriptions in **Column B**. Write the letter of your answer.

| Column A | Column B |
|---|---|
| 1. A document generated by a user department or storeroom-personnel to notify the purchasing department of items it needs to order, their quantity, and the time frame | _____ a. Inventory of Materials Form |
| 2. The raw materials, work-in-process goods and completely finished goods that are considered to be the portion of a business's assets that are ready or will be ready for sale | _____ b. Requisition Slip Form |
| 3. A form use to request for tools and equipment to be used for a particular job. is a written instruction to perform a work | _____ c. Job Order/ Work Order Form |
| 4. A written instruction to perform a work according to specified requirements, within specified timeframe and cost estimates. | _____d. Borrowers Form |

**Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.**

# What Do You Need To Know?

**Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 2.1

## DIFFERENT TYPES OF FORMS

Correctness of the entry of different forms used in electrical work is necessary in order to acquire right, complete and accurate number of materials and tools needed in a specific electrical job. Here are samples of different forms used in electrical work.

**1. Purchase requisition** is a document generated by a user department or storeroom-personnel to notify the purchasing department items it needs to order, their quantity, and the timeframe. It may also contain the authorization to proceed with the purchase. This is also called ***purchase request*** or ***requisition***.

**REQUISITION SLIP FORM**

**Name:**
**Project:**
**Location:**
**Classification:**
**Purpose:**

| NO. | QUANTITY | UNIT | DESCRIPTION | UNIT COST | TOTAL COST |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

REQUISITIONER TEACHER HEAD PRINCIPAL

2. **Inventory** are raw materials, work-in-process goods and completely finished goods that are considered to be the portion of a business's assets that are ready or will be ready for sale. Inventory represents one of the most important assets that most businesses possess, because the turnover of inventory represents one of the primary sources of revenue generation and subsequent earnings for the company's shareholders/owners.

**INVENTORY OF MATERIALS FORM**

**Name:**

**Section:**

**School:**

**Shop lab.:**

**Purpose:**

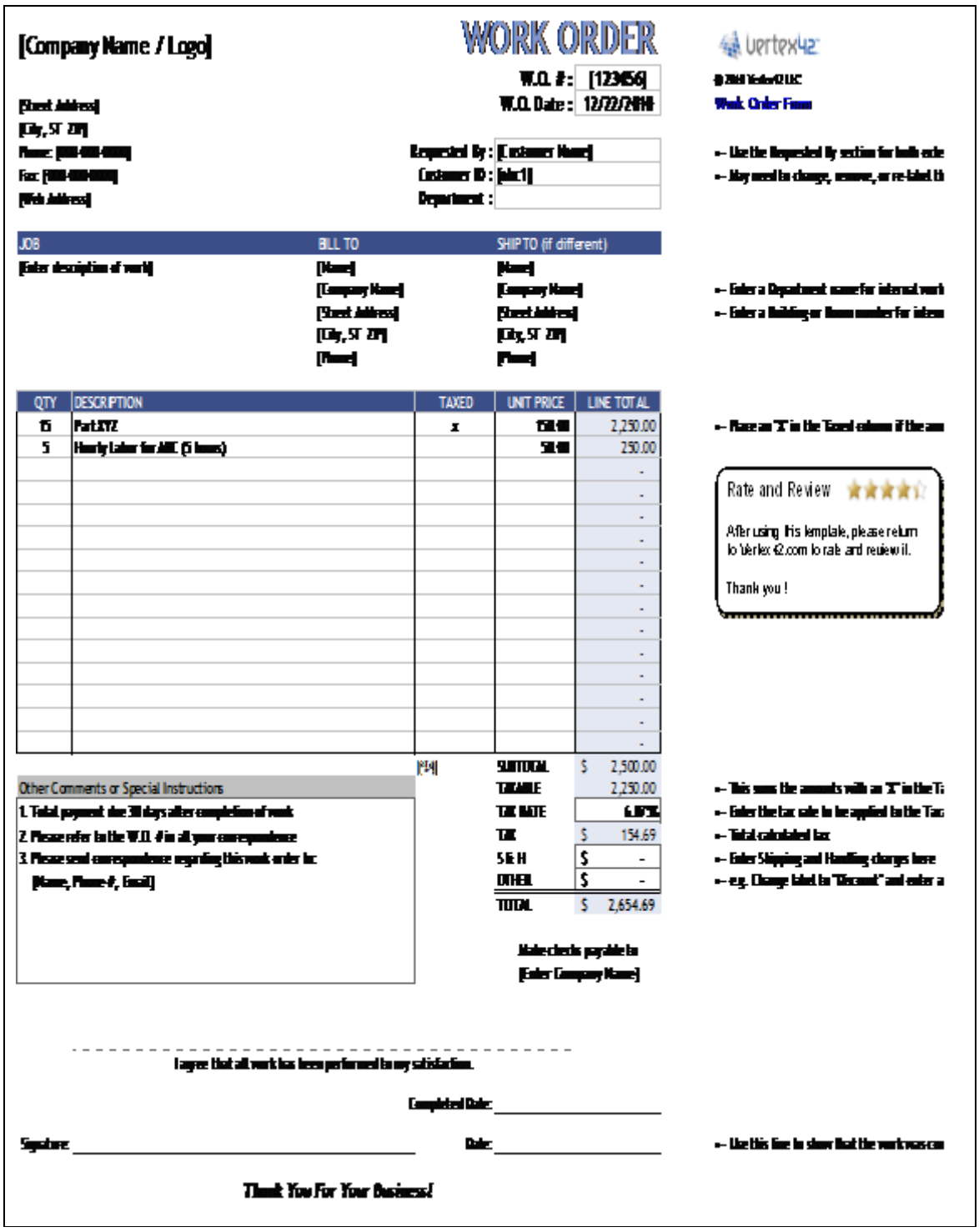
| Tools/ Equip-ment | Qty. | No. of Functional | No. of not Functional but Repairable | No. of Condemn-able | No. of Borrowed | No. of Missing |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| REQUISITIONER | TEACHER | HEAD | PRINCIPAL |
|---|---|---|---|

Date:_____

3. **Job order or Work Order form** is a written instruction to perform a work according to specified requirements, within specified timeframe and cost estimates.

## SAMPLE OF JOB ORDER FORM OR WORK ORDER FORM



[Company Name / Logo]

WORK ORDER

vertex42

W.O. #: [123456]

W.O. Date: 12/22/2008

[Street Address]
[City, ST ZIP]
Phone: [000-000-0000]
Fax: [000-000-0000]
[Web Address]

Requested By: [Customer Name]
Customer ID: [abc1]
Department:

| JOB | BILL TO | SHIP TO (if different) |
|---|---|---|
| [Enter description of work] | [Name]<br>[Company Name]<br>[Street Address]<br>[City, ST ZIP]<br>[Phone] | [Name]<br>[Company Name]<br>[Street Address]<br>[City, ST ZIP]<br>[Phone] |

| QTY | DESCRIPTION | TAXED | UNIT PRICE | LINE TOTAL |
|---|---|---|---|---|
| 15 | Part XYZ | x | 150.00 | 2,250.00 |
| 5 | Hourly Labor for ABC (5 hours) | | 50.00 | 250.00 |
| | | | | - |
| | | | | - |
| | | | | - |
| | | | | - |
| | | | | - |
| | | | | - |
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Thank you !

| | | |
|---|---|---|
| | SUBTOTAL | $ 2,500.00 |
| | TAXABLE | 2,250.00 |
| | TAX RATE | 6.85% |
| | TAX | $ 154.69 |
| | S & H | $ - |
| | OTHER | $ - |
| | TOTAL | $ 2,654.69 |

Other Comments or Special Instructions

1. Total payment due 30 days after completion of work
2. Please refer to the W.O. # in all your correspondence
3. Please send correspondence regarding this work order to:
   [Name, Phone #, Email]

Make checks payable to
[Enter Company Name]

I agree that all work has been performed to my satisfaction.

Completed Date: _____

Signature: _____ Date: _____

Thank You For Your Business!

4. **BORROWER'S FORM** is a form used to request for tools and equipment needed for a particular job. It indicates the department that the borrower is connected, the date, the job that is to be done, who is the person to approve the request, when it was returned and if it was in good condition.

EQUIPMENT BORROWERS FORM

*(Revised 31August2010; Accomplish in duplicate)*

REQUEST NO: _____ *(do not fill up this item*) DATE: _____

MR / MS _____ _____ _____

*(Please encircle)* SURNAME GIVEN NAME MIDDLE

_____ _____ _____

ADDRESS: CONTACT NO. E-MAIL ADDRESS:

Please check:

□ Student Student No. _____ _____ Subject: _____

□ Dept Faculty Employee No. _____

□ Dept.

REPS/Staff Department College:_____

□ Others Office Address. _____

Accompanying DGE-TCAGP Member: _____

PURPOSE: _____

INTENDED PERIOD OF USE: _____ to _____ LOCATION:

_____

CHECKLIST OF REQUESTED ITEMS *:

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

** If more than 8 items, provide another attachment.*

*** Do not fill this part; to be countersigned by authorized staff upon receipt and return.*

RECOMMENDING APPROVAL (for DGE students): _____

Thesis Adviser/Faculty-in-Charge)

Borrower's Name in Print and Signature

Date: _____

(Fill this portion only during the time of borrowing.)

APPROVED:

_____

JUAN DELA CRUZ JR., Dr. Eng.

AG&ST Lab Coordinator

This is to certify that:

1. I have read, understood, and agreed to the "Terms of Use for AG&ST Equipment" (back of this page).
2. I received the above listed equipment(s) completely and in good order.
3 JR.. I swear to use the above listed equipment(s) with due care and diligence.
4. In case of damage or loss, I shall be responsible for repair or replacement:

APPROVED:

_____ _____

JUAN DELA CRUZ JR., Dr. Eng. (Borrower's Name over printed name)

Chair, DGE and Director, TCAGP

---

To be accomplished upon return of equipment

Date returned: _____

All items in good condition? ____ YES ____ NO, (If no, please attach damage report)

Any missing item? _____ YES ____ NO, Please describe: _____

Received by: _____

# How Much Have You Learned?

Self-Check 2.1

**Directions:** Accomplish the table.

| COMMON TYPES OF FORMS | DESCRIPTION | PURPOSE |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 2.1

## DRAMATIZATION/ROLE PLAY

**OBJECTIVE:**

To be able to understand and perform how to make requisition of supplies, materials, and tools for a specific job

**Materials:**

- Borrower's Slip/ Form
- Different electrical supplies and materials in the laboratory

**Tools:**

All available tools to be requested in the dramatization

**Persons Involved:**

Minimum of 3 students (1 will act as the tool keeper and the others are the borrowers)

**Time limit:**

7 to 10 minutes

# LEARNING OUTCOME 3

**Receive and inspect electrical supplies, materials, and tools**

## PERFORMANCE STANDARDS

- Received and inspected materials and tools as per quantity and specification based on requisition.
- Tools and materials are checked for damages and manufacturing defects.
- Materials and tools received are handled with appropriate safety devices.
- Materials and tools are set aside to appropriate location nearest to the workplace.

## Materials/ Resources

1. Sample of official receipt form
2. Delivery receipt form

## What Do You Already Know?

**Let us determine how much you already know about receiving and inspecting electrical supplies, materials, and tools. Take this test.**

Pretest LO 3

**Direction**:

A. Complete the missing word to complete the three key words in receiving a shipment or supplies and materials:

1. Is it _____?

2. Is it _____?

3. Is the piece count _____?

B. Answer the following questions and write the correct answer on the space provided.

1. Who is responsible for requesting inspection for damaged goods and packaging? _____

2. What should you do with the copy of your request for inspection?

_____

3. What should a person do with the findings of the inspection?

_____

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

## What Do You Need To Know?

**Read the Information Sheet 3.1 very well then find out how much you can remember and how much you learned by doing Self-check 3.1.**

Information Sheet 3.1

### RECEIVING AND INSPECTING FREIGHT SHIPMENTS

One of the tasks of a supply officer or logistics officer is the purchase of the company's supplies, materials and anything that the company needs. But his duty does not end in just purchasing but also in receiving the deliveries of what he purchased.

In receiving the deliveries, understand that you need to ensure that the right materials and supplies were delivered and all in good condition without defects.

**A. When you receive a shipment, ask the shipper the following questions:**

1. **Is it for me?** Check the delivery receipt for the consignee's name and address. If your agency has more than one location, make sure the goods are for this exact address. Check the freight to see if it is the same as described on the delivery receipt. Look at the label on each item to make sure the shipment belongs to you.

2. **Is it damaged?** Do not sign the receipt before inspecting for damage. Check for holes, water, stains, and tears. Pick up cartons if you can. Check for rattling. Listen for something broken inside. Check to see if any package has been opened or if the sealing tape has been tampered with.

3. **Is the piece count correct?** Count the pieces and match the number on the delivery receipt to the number you have counted. If the shipment is on a pallet, check to make sure the pallet is solid with no voids inside the stack. If the shipment is shrink or stretch wrapped, make sure the wrap hasn't been cut and pieces removed. Sign only for the type of unit you receive. For example: two pallets. Don't sign for the number of packages that are supposed to be on the pallet. However, if time permits or the pallet is not banded or shrink wrapped, count the packages, and only then sign for the number of packages.

**B. If your delivery doesn't check out, do one of the following:**

1. Refuse shipment if it isn't yours, if the shipment does not meet the terms specified by your agency, or is damaged to the point where it no longer has a value.
2. If yours, and only partially damaged or short, accept it and note exceptions on the delivery receipt.

**C. How to note exceptions:**

1. **Damage Notations:** Be specific. Describe the damage accurately. Pinpoint the locations of all defects. If you can see the damage, have the driver wait while you open and inspect the packages. Write down the number and identity of the damaged pieces. This is called a "joint inventory."

2. **Shortage Notations:** If part of shipment is missing, write the number of pieces actually delivered on the delivery receipt and circle it. Then write down the number of pieces missing and note them as "short."

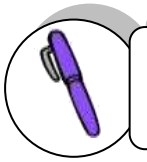
3. **Signatures:** Write down all exceptions on both copies of the delivery receipt. Have the driver sign both copies of the delivery receipt in his full name (not initials or nicknames). After the driver signs, you sign also. Write your agency's name, your full name, the date, and the time of day.

**D. Follow these steps when requesting an inspection:**

1. The receiving person is responsible for requesting the carrier to inspect the damaged goods and packaging. The formal request should be made by phone right after discovering any loss or damage.

2. After the phone request, make a request for inspection by the carrier in writing. Note the date and time of your previous phone call and the person contacted. Keep a copy of your request letter on file.

3. Once contacted about damage or shortage, the carrier may waive inspection and tell you so. If so, write down the name of the person who waived the inspection, and the date and time of waiver. Then conduct your own detailed inspection. Write up your findings in a report and attach it to the file. If you can, take photographs to confirm your inspection report.



## How Much Have You Learned?

Self-Check 3.1

a. Complete the missing word to complete the ***three key words*** in receiving a shipment or supplies and materials:

   1. Is it _____?
   2. Is it _____?
   3. Is the piece count _____?

b. Answer the following questions and write the correct answer on the space provided.

   1. Who is responsible for requesting inspection for damaged goods and packaging? _____
   2. What should you do with the copy of your request for inspection? _____
   3. What should a person do with the findings of the inspection? _____

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 3.1

**DRAMATIZATION ON RECEIVING SUPPLIES, MATERIALS, TOOLS AND EQUIPMENT**

**I. OBJECTIVE**

To practice how to receive and inspect supplies and materials for a specific job

**II. PERSONS INVOLVED**

1 student to act as supply officer/ tool and 1 student will act as delivery personnel

**III. SITUATION**

The delivery man arrived to deliver the electrical supplies and materials. The supply officer (the other student) will inspect before receiving the supplies and materials.


**Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!**

## REFERENCES


- Philippine Electrical Code. 2000 Edition.
- Cardenas, Elpidio.1989, Fundamental and Elements of Electricity. Philippines: national Bookstore.
- http://sam.dgs.ca.gov/TOC/3800/3861.htm
- http://electrical.about.com/od/electricaltools/tp/top16electricaltools.htm

LESSON 2

# Performing Mensuration and Calculation


## LEARNING OUTCOMES:

**At the end of this Lesson, you are expected to do the following:**

**LO 1. select measuring tools and instruments; and**
**LO 2. carry out measurements and calculations.**

# Definition of Terms

**Amperage (Amps)** - a unit of measurement of electrical current flow

**Ampere** - a unit of measurement which describes the amount of electric current passing a certain point at a particular time

**Centimeter** - hundredth of a meter

**Inch** - a portion of a foot, which is an English unit of linear measurement

**Megger** - an instrument used to measure the insulation resistance of conductors or wire. It gives measurement in ohms or meg-ohms

**Millimeter** - one-thousandth of a meter

**Multi-tester** - an electrical measuring instrument used to measure the voltage, the resistance or the current of a circuit. It is connected either through parallel or series with the circuit depending on what to measure

**Ohm** - the unit of measurement used to express resistance

**Ohmmeter** - an instrument used to measure resistance in ohms

**Volt** - a unit of measurement of electrical pressure or voltage

**Voltmeter** - an instrument specially designed for measuring voltage

**Wire Gauge** - used to measure the diameter of magnetic wire

# LEARNING OUTCOME 1

**Select Measuring Tools and Instruments**

## PERFORMANCE STANDARDS

- Measuring tools and instruments are selected/ classified as per object to be measured on job requirements.
- Measurements are obtained according to job requirements.
- Computation of resistance, current, and voltage using Ohms Law are obtained.

## Materials/ Resources

1. Ruler
2. Push-pull tape rule
3. Multi-meter
4. zigzag rule
5. Wire gauge
6. Micrometer caliper
7. Vernier caliper
8. Activity Sheets

# What Do You Already Know?

**Let us determine how much you already know about selecting measuring tools and instruments. Take this test.**

Pretest LO 1

I. **Direction:** Match the electrical measuring tools and instruments in **Column A** to their descriptions in **Column B**. Write the letter of your answer in the space provided before each number.

| Column A | Column B |
|---|---|
| _____1.  | A. Voltmeter |
| _____2.  | B. Volt-ohmmeter |
| _____3.  | C. Micrometer |
| _____4.  | D. Clamp Ammeter |
| _____5.  | E. Wire gauge |

**II. Multiple Choice:**

**Direction:** Choose the correct answer and write only the letter on your answer sheet.

**1.** An instrument used to measure the amount of electrical current intensity in a circuit.
   a. Voltmeter
   b. Ammeter
   c. Micrometer
   d. Ohmmeter

**2.** A pocket sized tool used to test the line wire or circuit if there is current in it.
   a. Test light
   b. Wire gauge
   c. Ruler
   d. Pull-push rule

**3.** A measuring tool used to measure the length of an object in centimeter and inches.
   a. Test light
   b. Wire gauge
   c. Ruler
   d. Pull-push rule

**4.** It is used to measure the diameter of wires/conductors in circular mils. It can measure small and big sizes of wires and cables.
   a. Voltmeter
   b. Ammeter
   c. Micrometer
   d. Ohmmeter

**5.** It is used to measure the voltage, resistance and current of a circuit. It connected in parallel or series with the circuit depending on what to measure.
   a. Volt-Ohm-Milliammeter
   b. Micrometer
   c. Ohmmeter
   d. Ammeter

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 1.1

## MEASURING TOOLS AND INSTRUMENTS

**Measurement** is the process or the result of determining the ratio of a physical quantity, such as a length, time, temperature, etc., to a unit of measurement, such as the meter, second or degree Celsius. The science of measurement is called metrology.

The English word *measurement* originates from the Latin *mēnsūra* and the verb*metiri* through the Middle French *mesure*.

Electrical measuring tools and instruments are sensitive and delicate so extra care is necessary in handling them. These are used to measure currents, voltages, resistances, wattages and other important elements in electrical works. This topic, will tackle the function/use of each measuring tool and instrument used in doing a electrical task. Different kinds of measuring tools and precision measuring instruments are as follows:

| Measuring tool/instrument | Description |
|---|---|
|   | ***Test Light*** is a pocket size tool used to test the line wire or circuit if there is current in it. |
|  | ***Micrometer*** is used to measure the diameter of wires/conductors in circular mils. It can measure small and big sizes of wires and cables. |

| | |
|---|---|
|  <br>  <br>  | ***Wire Gauge*** is used in determining the size of wires/conductors. The gauge ranges from 0 to 60 awg ( American wire gauge).<br><br>**Ruler/foot rule** is a measuring tool used to measure length, width and thickness of short flat object and in sketching straight lines<br><br>**A ruler/rule is a tool used in, for example, geometry, technical drawing, engineering, and carpentry, to measure lengths or distances or to draw straight lines. Strictly speaking, the ruler is the instrument used to **rule** straight lines and the calibrated instrument used for determining length called a measure. However, common usage calls both instruments rulers and the special name straight edge is used for an unmarked rule.* |
|  <br>  | ***Pull-Push Rule*** is a measuring tool used to measure the length of an object in centimeter and inches<br><br>. |

| | |
|---|---|
|  | ***Ammeter*** is an instrument used to measure the amount of electrical current intensity in a circuit. The unit of measure is ampere (a). It is connected along or series to the circuit. |
|  | ***Voltmeter*** is an instrument used to measure electrical pressure or voltage of a circuit. The unit of measure is volt (v). This is connected across or parallel to the circuit. |
|  | ***Clamp Ammeter*** is also called tong-tester. It is used to measure current flowing in a conductor. It is clamped or hanged in a conductor. |
|  | ***Volt-Ohmmeter (VOM)*** otherwise called as Multi-tester; is used to measure the voltage, resistance and current of a circuit. It is connected in parallel or series with the circuit depending on what to measure. |

# How Much Have You Learned?

Self-Check 1.1

**Text Twist:**

**A. Directions:** Inside **Box A** are jumbled letters. Arrange the letters to form words pertaining to electrical measuring tools and instruments. Then write the words inside **Box B**.

| **Box A** | **Box B** |
|---|---|
| 1. GEWIGREAU | 1. |
| 2. MVLTETEOR | 2. |
| 3. AACMPLMMTREE | 3. |
| 4. RPPULLUSHULE- | 4. |

**B. Directions**: Describe at least two of your answer in activity A.

1._____
_____
_____
_____

2._____
_____
_____
_____

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity**

Activity Sheet 1.1

**Directions:** Using a pull-push rule measure the length, width, and thickness/height of teacher's table and blackboard eraser. Write your answer inside the corresponding box.

| **Object to be Measured** | **Measurement of length** | | **Measurement of width** | | **Measurement of thickness/height** | |
|---|---|---|---|---|---|---|
| | Inches | Centi-Meter | Inches | Centi-meter | Inches | Centi-meter |
| **1. Teacher's table** | | | | | | |
| **2. Blackboard eraser** | | | | | | |
| **3. Teacher's cabinet** | | | | | | |
| **4. Door of the classroom** | | | | | | |

# LEARNING OUTCOME 2

**Carry out measurements and calculations**

## PERFORMANCE STANDARDS

- Numerical computations are self-checked and corrected for accuracy.
- Accurate measurements are obtained according to job requirements.
- Identified and converted systems of measurements to job requirements.
- Measured work pieces according to job requirements.

## Materials

1. Paper
2. Ball pen
3. Ruler
4. Push-pull tape
5. Steel rule
6. Activity Sheets

## What Do You Already Know?

**Let us determine how much you already know about carrying out measurement and calculations. Take this test.**

Pretest LO 2

**A. Directions:** Write the equivalent value of the given unit.

_____ 1. 1cm is _____ mm

_____ 2. 1 yard is _____ inches

_____ 3. 1dm is _____ cm

_____ 4. 10mm is _____ cm

_____ 5. 1foot is _____ inches

**B. Directions:** Write the correct unit abbreviation of the following:

_____ 6. Centimeter

_____ 7. Meter

_____ 8. Decimeter

_____ 9. Yard

_____10. Feet

**C. Directions:** Convert the following:

1. 10 feet = _____cm
2. 70 cm = _____mm
3. 15 inches = _____ ft
4. 5 meters = _____ yard

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing Self-check 2.1.**

Information Sheet 2.1

## SYSTEM OF MEASUREMENT

A ***system of measurement*** is a set of units which can be used to specify anything can be measured.

These are common units of measurement used in making layout and installation of electrical materials:

### A. Linear measures

1. **English system** provides the creative way on how people can measure by themselves. For example, people measure shorter distance on the ground with their feet. They measure long distances by their palms which is equal to a yard.
   - Inch
   - Yard
   - Miles

2. **Metric system** is a decimalized system of measurement. It exists in several variations with different choices of base units. Metric units are widely used around the world for personal, commercial and scientific purpose.
   - Millimeter
   - Centimeter
   - Decimeter
   - Meter

### B. English units and each equivalent

- 12 inches = foot(ft)
- 1 foot = 3yard (yd)
- 1 yard = 36 inches

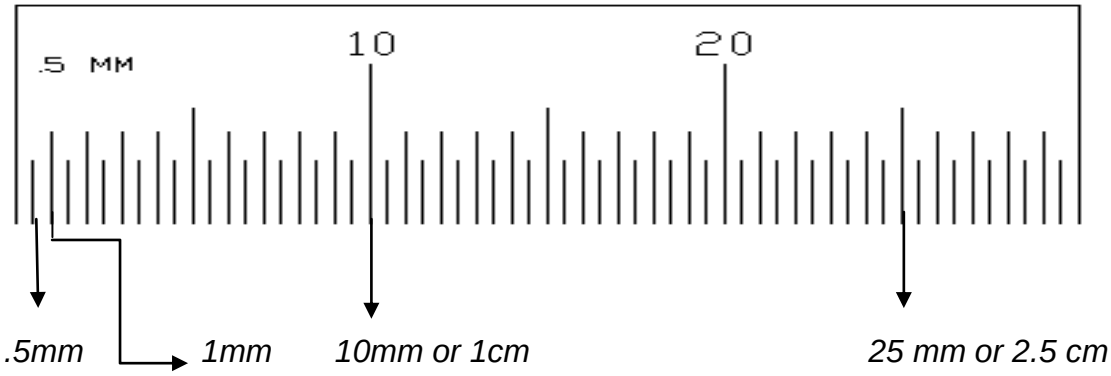
**C. Metric units and each equivalent**

- 10millimeter (mm) = 1centimeter (cm)
- 10centimeter = 1decimeter(dm)
- 10 decimeter = 1meter

**D. English to metric equivalent**

- 1 inch = 2.54 cm
- 1 foot = 30.48 cm
- 1 yard = 91.44 cm

**E. The centimeter graduation**



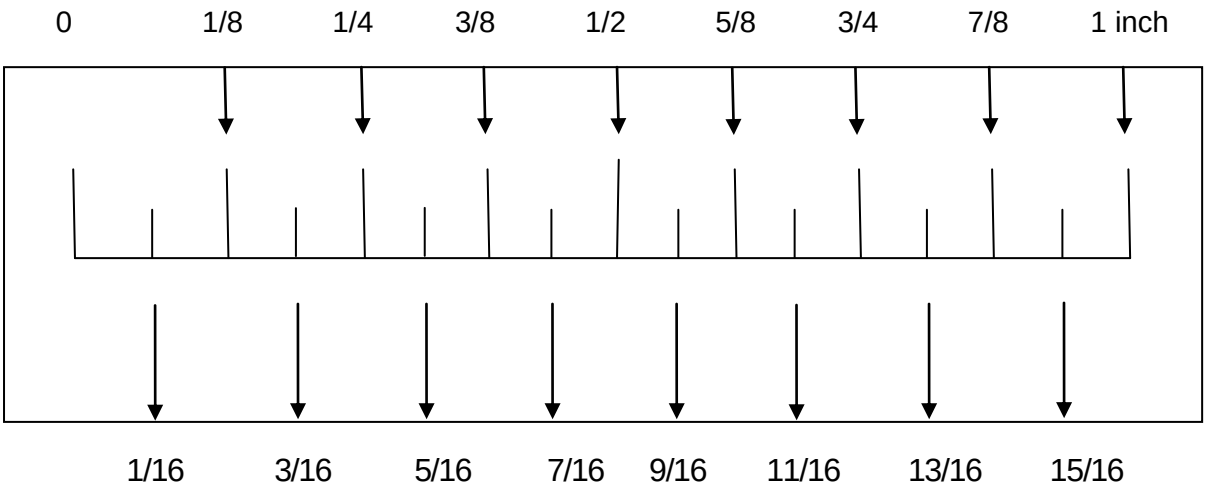

*The graduation shows that every digit is .5mm*

How to read the cm graduation:

1. First graduation is .5 mm
2. Second graduation is 1mm
3. Third graduation is 1.5mm
4. Fourth graduation is 2mm

**Note:** If the graduation reaches 10mm, it is equivalent to 1cm.

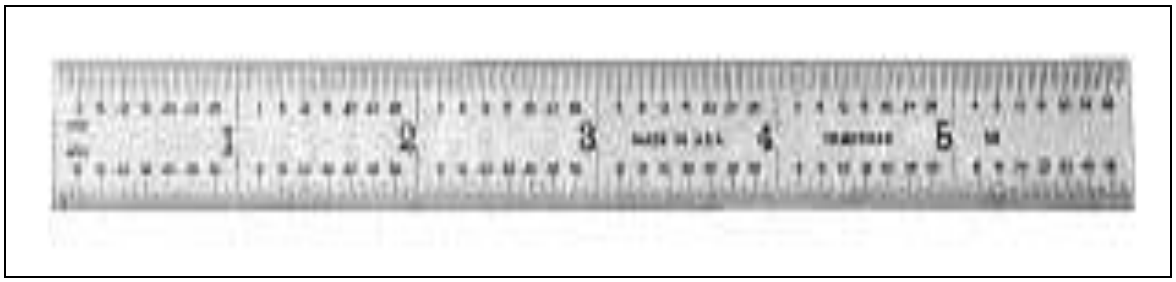
## F. The inch graduation




How to read the inch graduation:

1. First graduation is 1/16
2. Second graduation is 18
3. Third graduation is 3/16
4. Fourth graduation is 1/4, then follow the given scale above.

The inch graduation in a steel rule:



**Converting the unit of measurement from English to metric and vice versa**

Example:

1. 12 inches = _____ cm

   Since

   $12\ \text{inches} = 2.54\ \text{cm}$

   $\frac{}{1\ \text{inch}}$

   $12 \times 2.54\ \text{cm}$

Cancel the common unit and apply cross multiplication.

Perform the indicated operation.

$$\frac{\quad\quad\quad\quad}{1}$$

Therefore: 12 inches = 30.48 cm

2. 6 feet = _____ inches

   Since

   6 ~~feet~~ = 12 inches

   $$\frac{\quad\quad\quad}{1 \text{ ~~feet~~}}$$

   $$\frac{6 \times 12 \text{ inches}}{1}$$

   Therefore: 6 feet = 72 inches

## THE MULTITESTER

### INTRODUCTION

The **Multitester** or **multimeter** is sometimes called the VOM (voltmeter, ohmmeter, milliammeter). It is the best instrument that can measure voltage, resistance and current. It is generally made of two types: the analog and the digital.

### A. PARTS OF A MULTI TESTER


**POINTER**. The needle-shaped rod that moves over the scale of a meter.

**Pointer** It is mechanically connected to the moving coil. it indicates the measured values on the multimeter

**RANGE SELECTOR KNOB (Selector switch)** makes it possible to select different functions and range of the meter.

**Adjustment screw** makes it possible to adjust the pointer to the zero position of the scale.

**SCALE** is a series of marking used for reading the value of a quantity

**SCALE -**can have different types of scale, for voltage and current readings the scales have mostly **linear** which means equal division. For resistance


**Test probe positive** (red) **negative** (black) is used to connect the circuit to the electrical components being tested

**Zero-ohm adjustingKnob** is used to zero-in the pointer before measuring resistance.

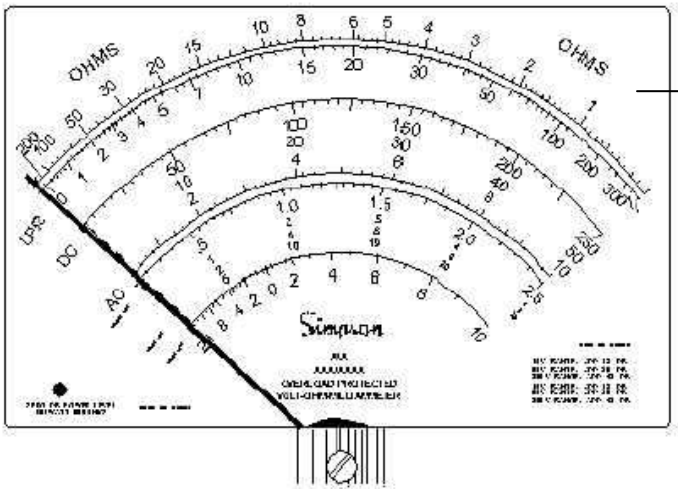
## A. Proper care and maintenance of the multi tester

1. Read manual of instructions on how to operate the multi-tester.
2. In reading the amount of voltage, always start with the highest range to avoid reading voltage higher than the tester setting.
3. Be sure that the tester is set to the correct range setting: resistance range when measuring the ohm, voltage range when measuring voltage and ammeter range when measuring the value of electric current.
4. Always check the condition of its battery. Worn out batteries will damage the internal setting of the tester.
5. When the tester is not in used or will be stored, set the selector switch to 1000V or to OFF position.
6. Never drop the tester.

**B. How to read the meter scale of the multi tester**

To read the resistance range of the multi-tester, the given table below will be used. The unit of measurement to be used to determine its resistance is **ohm**.

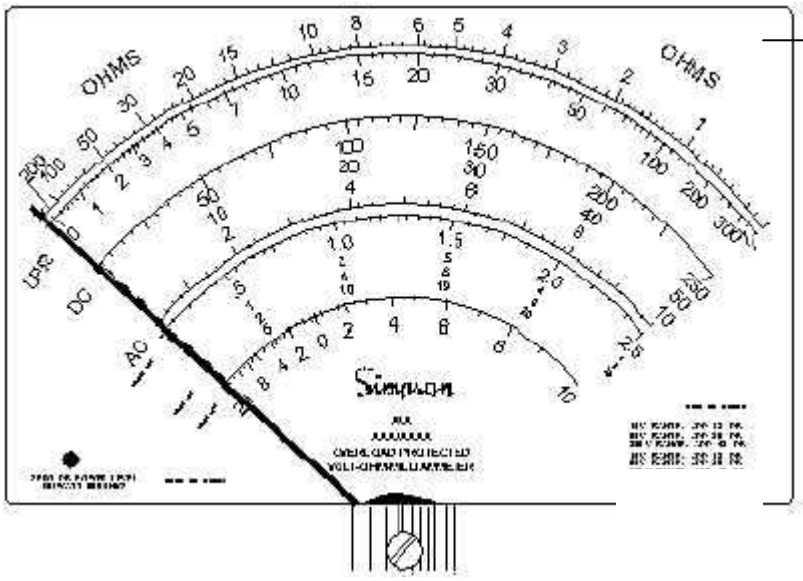
| Range | 0-2 | 2-10 | 10-20 | 20-50 | 50-100 | 100-200 |
|---|---|---|---|---|---|---|
| Range x1 | 0.2 | 0.5 | 1 | 2 | 5 | 20 |
| Range x10 | 2 | 5 | 10 | 20 | 50 | 200 |
| Range x1k | 20 | 50 | 100 | 200 | 500 | 2K |
| Range x 10k | 200 | 500 | 1K | 2K | 5K | 20K |




Pointer deflection

Range setting is X1

Reading is 2.5ohms



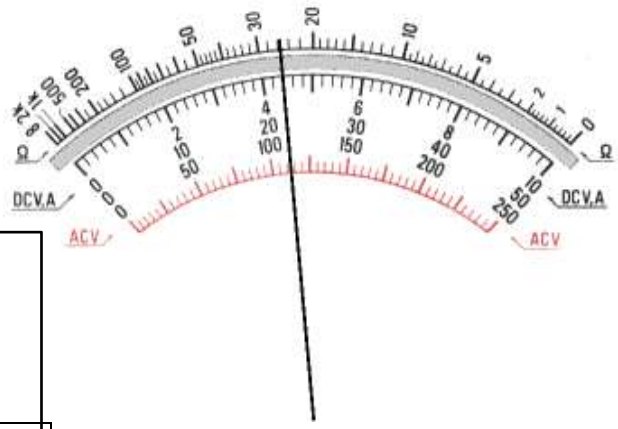

Pointer deflection

Range setting is X10

Reading is 25 ohms

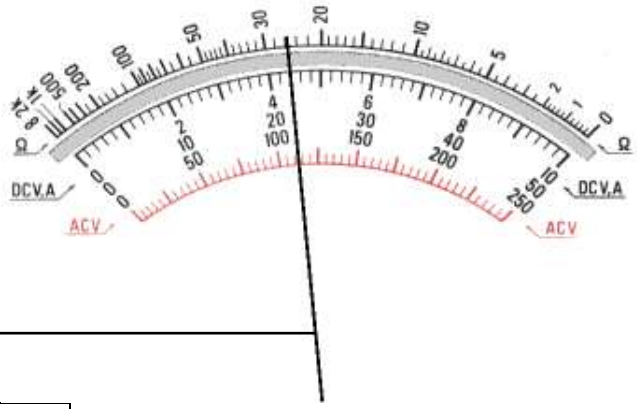
**Voltage scale**

| Range | Value/div |
|---|---|
| Range 10V | 0.2V |
| Range 50V | 1V |
| Range 250V | 5V |
| Range 100V | 20V |



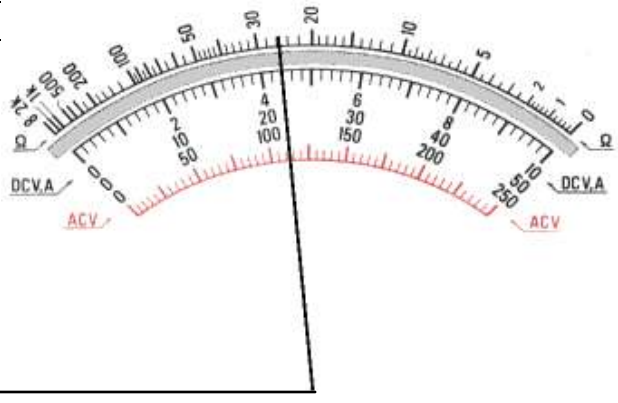

Voltage scale
Range setting is 10 V
(used 0-10 scale)
Reading is 4.4V

| Range | Value/div |
|---|---|
| Range 10V | 0.2V |
| Range 50V | 1V |
| Range 250V | 5V |
| Range 100V | 20V |




Voltage scale
Range setting is 50V (used 0-10 scale)
Reading is 24V

| Range | Value/div |
|---|---|
| Range 10V | 0.2V |
| Range 50V | 1V |
| Range 250V | 5V |
| Range 1000V | 20V |




Voltage scale

Range setting is 250V (used 0-10 scale)

Reading is 110V

# How Much Have You Learned?

Self-Check 2.1

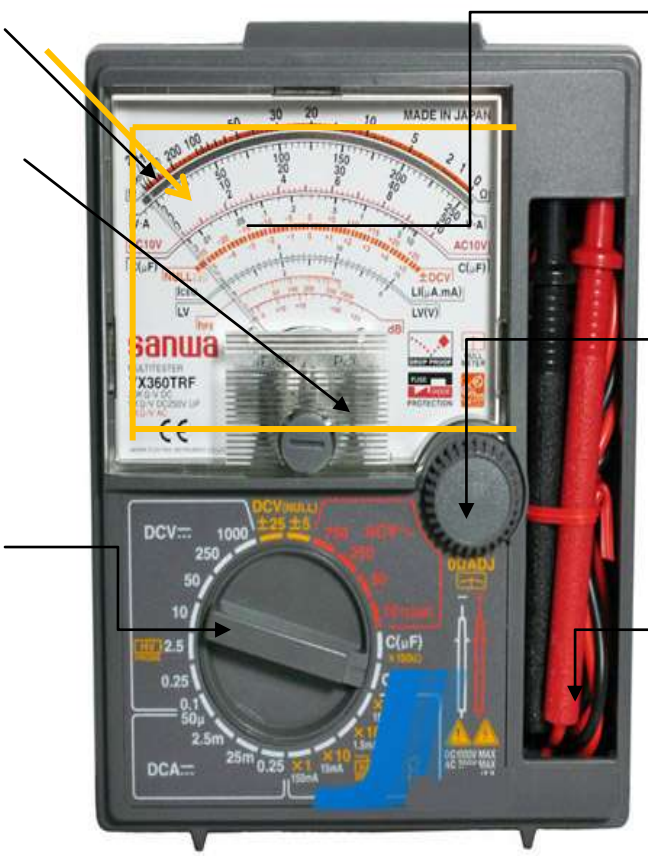
## PARTS OF MULTITESTER

**A. DIRECTION**. Given a Multi-\tester below, write the parts indicated by the arrow and give their functions.

1_____ _____

2_____ _____

3_____ _____




**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity**

Job Sheet 2.1

## I. USE MEASURING TOOLS

### Supplies and Materials

- Sheet of paper
- Pencil

### Tools and Equipment

- Steel rule
- Bench rule
- Metric rule
- Foot rule

**Direction:** Using any of the given measuring tools, read the actual measurement of the given samples. Write your answer on the space provided.

| Sample | Actual measurement in centimeter |
|---|---|
| **Teacher's Table** | |
| **Length of eraser** | |
| **Height of cabinet** | |

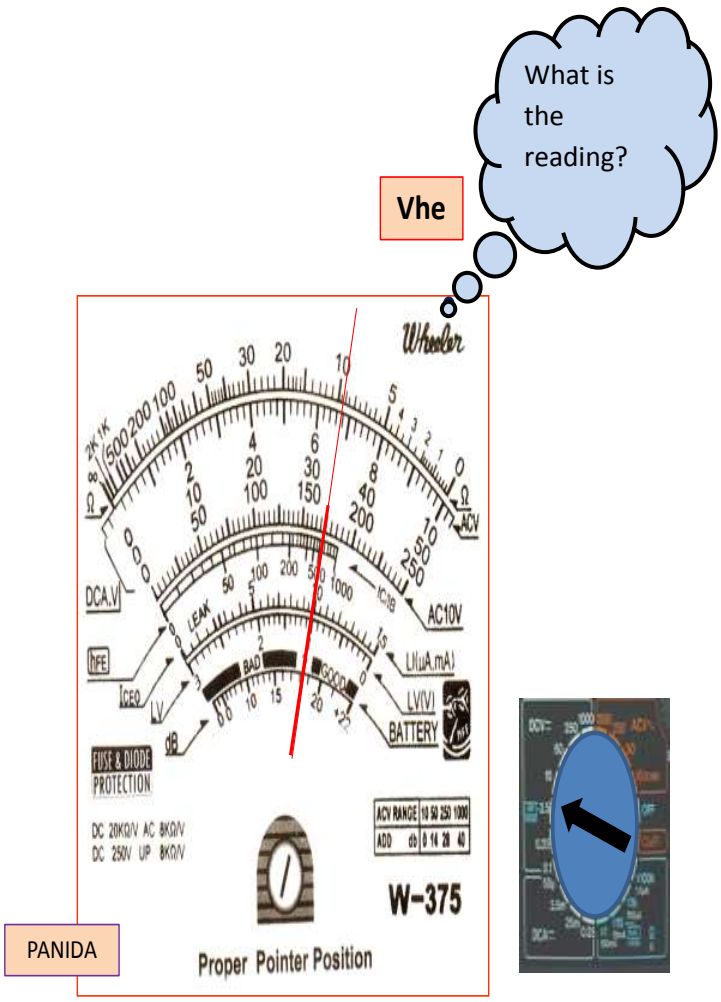
## II. READING A VOLTMETER

**Indicate the voltage reading of the voltmeter below**

**Directions:** Write your answer on the space provided.

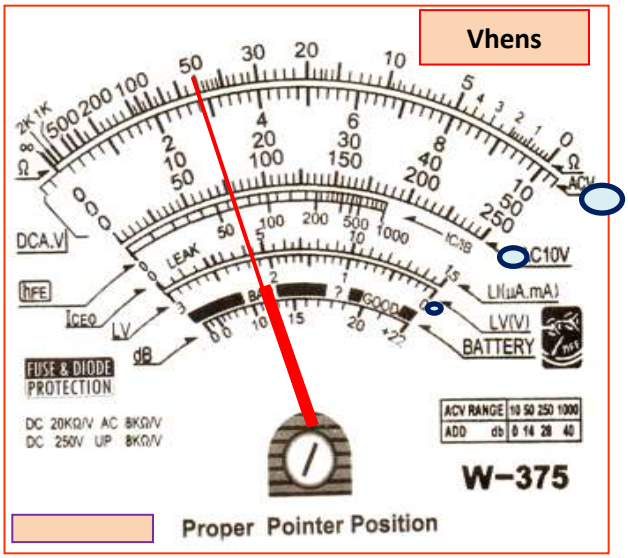
1._____ VOLTS

**AC/DC**




10

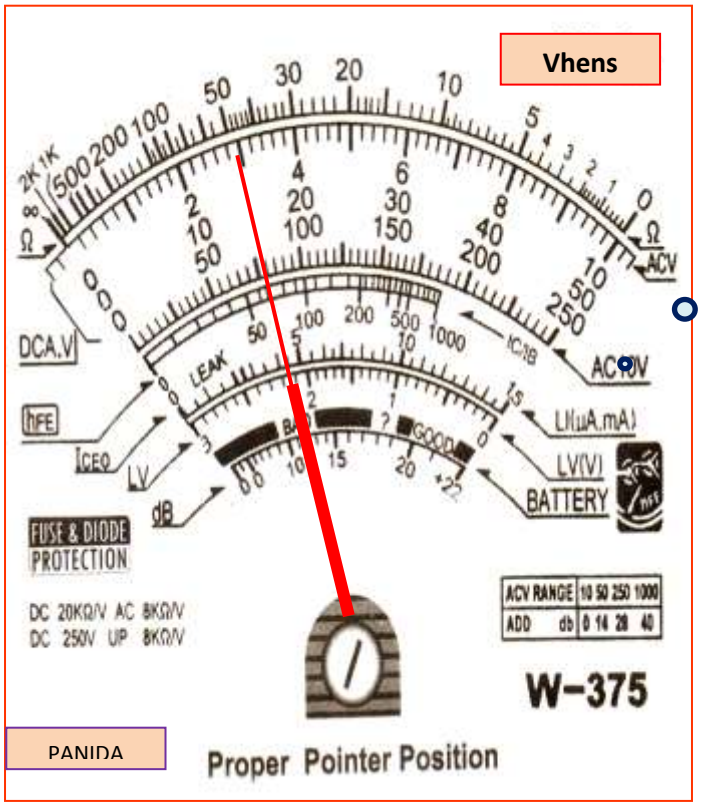
2.____VOLTS




1000 ACV

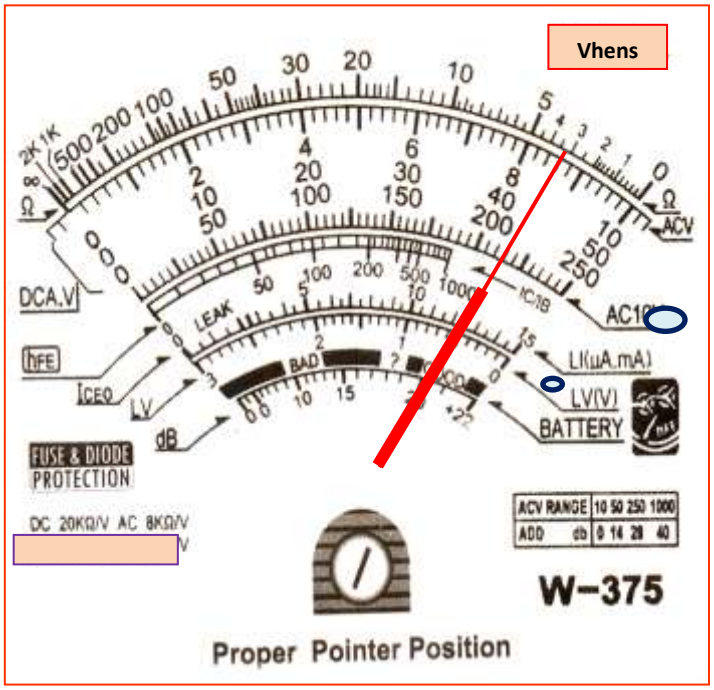
## III. READING AN OHMMETER

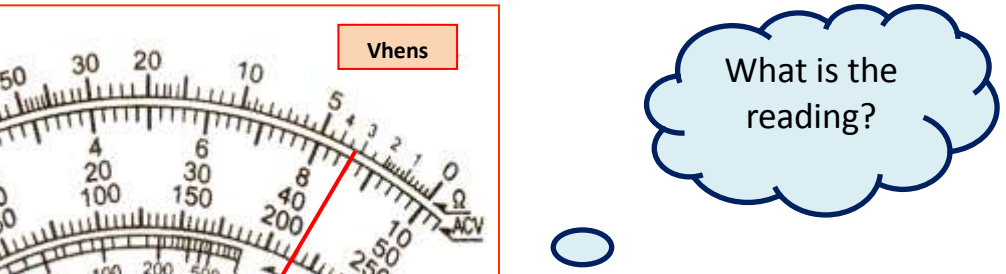
A. Indicate the resistance reading of the ohmmeter below.
Direction: WRITE YOUR READING AT THE SPACE PROVIDED.




Rx1k

1. _____OHMS

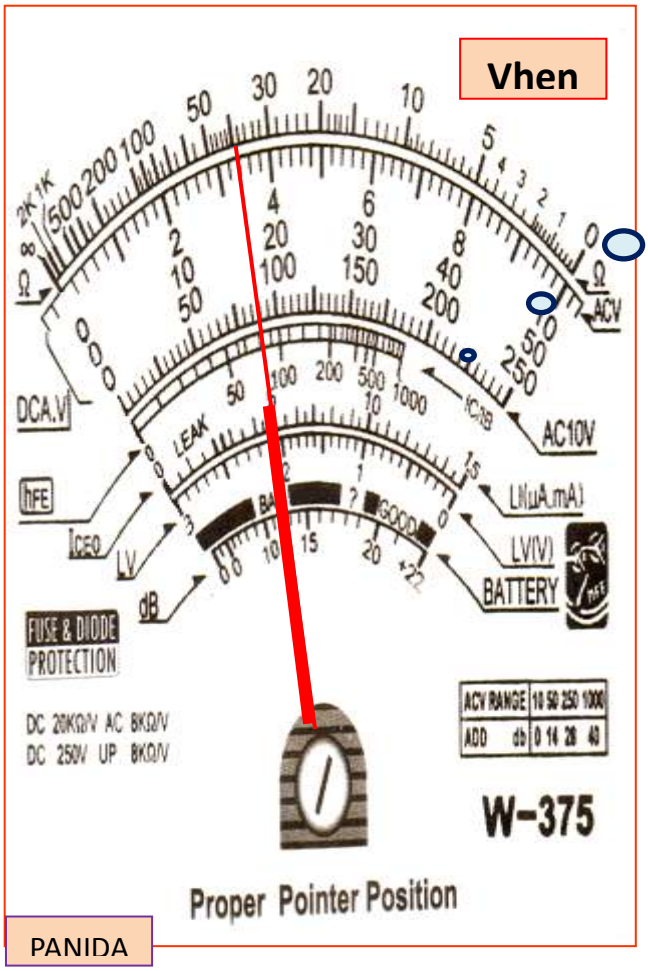



Rx1

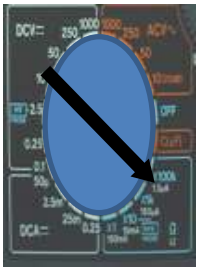
2._____

OHMS




What is the reading?

Rx1k



PANIDA

3.

_____OHMS


What is the reading?

Rx1

4._____OHMS

## IV. ACTUAL READING OF VOLTMETER AND OHMMETER

**Directions:** Using a volt-ohmmeter measure the voltage of an existing convenience outlets inside your room, voltage of a dry cells/battery and resistance of resistors. Write your answer in the space provided.

| Device/Component to be Measured | First | Second | Third |
|---|---|---|---|
| **1. Voltage of the outlets** | volts | volts | volts |
| **2. Voltage of a dry cells/battery** | volts | volts | volts |
| **3. Resistance of a resistors** | ohms | ohms | ohms |


**Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!**

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LESSON 3

# Interpret Technical Drawings and Plans



## LEARNING OUTCOMES:

**At the end of this Lesson, you are expected to do the following:**

**LO 1. analyze signs, symbols and data; and**
**LO 2. interpret technical drawings and plans.**

# Definition of Terms

**Ampere (I)** - the unit of electrical current (coulombs per second)

**Caution** - indicates some precautionary measures against potential hazardous situation which, if not avoided, may result to a minor or moderate injury

**Danger** - specifies hazardous situation which, if not avoided, will result to a serious injury or even death

**Isometric** - a kind of drawing which shows the object in 3 dimensional views

**Joule (J)** - a metric unit of energy: watt per second. 1 Kw hr = 2,655,000 ft-lb = 1.341 hp-hr = 3413 Btu = 3,600,000 joules

**Kilovolt-ampere (KVA)** - a measurement of apparent electric power

**Kilowatt hour (Kwhr)** - a unit of electrical energy or work performed

**Ohm -** the unit of electrical resistance (volts/ampere)

**Orthographic** - a drawing which shows the front top and side view of the object

**Volt (E)** - the unit of electric pressure or electromotive force which will produce a current of 1 ampere through a resistance of 1 ohm

**Watts (W)** and **kilowatts (KW**) - are units of electric power

# LEARNING OUTCOME 1

**Analyze signs, symbols and data**

## PERFORMANCE STANDARDS

- Electrical symbols and signs are identified according to job specifications.
- Electrical symbols and signs are determined according to classification or as appropriate in drawing.

## Materials/ Resources

1. Oslo paper
2. Drawing Pencil
3. Ruler
4. Black pen
5. Electrical symbols
6. Various Company/ industry warning signs
7. Cartolina
8. Illustration board

## What Do You Already Know?

**Let us determine how much you already know about analyzing signs, symbols and data. Take this test.**

Pretest LO 1

**Analyze signs and symbols**

**a. Direction:** Match the electrical symbols in Column A with the corresponding description in column B. Write the letter of your answer in the space provided before each number.

| Column A | | Column B |
|---|---|---|
| _____1. |  | a. Push button |
| _____2. |  | b. Switch |
| _____3. |  | c. Wires connected |

_____4. 

_____5. 

d. Incandescent lamp

e. Battery

**b.** Identify what are the meaning of different signs enumerated below. Write your answer at the box provided for you.

| | |
|---|---|
|  | . _____ |
|  | _____ |
|  | _____ |
|  | _____ |
|  | _____ |
|  | _____ |
|  | _____ |

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

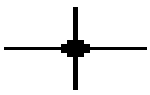
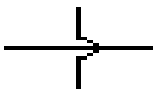
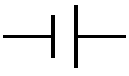
**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

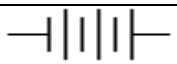
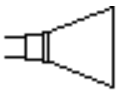
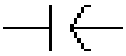
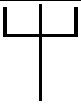
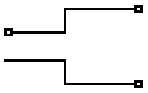
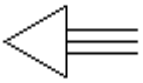
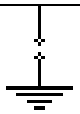
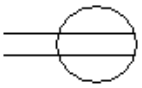
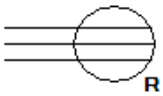
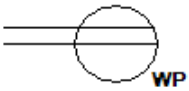
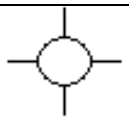
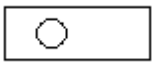
Information Sheet 1.1

## COMMON ELECTRICAL SYMBOLS

***Electrical Symbols*** are small drawings or pictograms used to represent various electrical devices in a diagram or plan of an electrical circuit. These symbols are used in sketching schematic diagrams and electrical plans for numerous types of electrical works. Practically any electrical fixture found in a house has a symbol that coincides to said fixture on an electrical wiring diagram. These are very useful guide for an electrician or electrical contractor, thus, making the wiring easier to install as well.

The following are common electrical symbols used in sketching wiring plan and diagram.

| Symbol | Description | Symbol | Description |
|---|---|---|---|
|  | Conductor/Wire |  | Ammeter |
|  | Terminal |  | Voltmeter |
|  | Switch |  | Galvanometer |
|  | Fuse |  | Wattmeter |
|  | Connected Wires |  | Wires Not Connected |
|  | Circuit Breaker |  | Push Button |
|  | Cell |  | Bell |
| | | | |

| | | | |
|---|---|---|---|
|  | Battery |  | Buzzer |
|  | Resistor |  | Speaker |
|  | Capacitor |  | Antenna |
|  | Diode |  | Male plug |
|  | Ground |  | Service Entrance (3 wires) |
|  | Lightning Arrester |  | Duplex Convenience Outlet |
|  | Kilowatt-Hour Meter |  | Range Outlet |
|  | Power Panel Board |  | Special Purpose Outlet |
|  | Lighting Panel Board |  | Weatherproof Outlet |
|  | Incandescent Lamp |  | Floor Outlet |
|  | Fluorescent Lamp | $S_1$ | Single Pole Switch |

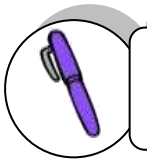
## ELECTRICAL SIGNS

Your power tool with its manual may contain "WARNING ICONS" (a picture symbol intended to alert you to, and/or to instruct you how to avoid a potentially hazardous condition). Knowing and understanding these symbols will help you operate your tool better and more safely.

Electrical signs and stickers alert students, workers, and visitors to electrical hazards in the area. Alerting workers to high voltage areas, electrical hazards, power lines and other electrical equipment in the area, can help prevent fires and injuries. Proper electrical signs can inform workers of the dangers in the area.

| | |
|---|---|
|  | **CAUTION** indicates some precautionary measures against potential hazardous situation which, if not avoided, may result to a minor or moderate injury. |
|  | **SAFETY ALERT** indicates that a person should observe extra awareness |
|  | **PROHIBITION** means that any activity is not allowed as stated by the symbol. |
|  | **DANGER** specifies hazardous situation which, if not avoided, will result to a serious injury or even death. |
|  | **WARNING** specifies a potentially hazardous situation which, if not avoided, could result to serious injury or even death. |
|  | **READ AND UNDERSTAND INSTRUCTION MANUAL** means that a person should make some reading before doing any activity. |
|  | **WEAR EYE PROTECTION** indicates that a person should wear safety goggles or any related protection for the eyes. |

| | |
|---|---|
|  | **ELECTRICAL HAZARD** indicates that electrical hazard is present in the area. |
|  | **VOLTAGE DANGER** indicates high voltage in the area and surrounding equipment. |



## How Much Have You Learned?

Self-Check 1.1

**Analyze electrical symbols and signs.**

A. **Directions:** Match the electrical symbols in **Column A** to their corresponding descriptions in **Column B**. Write the letter of your answer in the space provided before each number.

| **Column A** | | **Column B** |
|---|---|---|
| _____1. |  | a. Push button |
| _____2. |  | b. Switch |
| _____3. |  | c. Wires connected |
| _____4. |  | d. Incandescent lamp |
| _____5. |  | e. Battery |

B. **Directions** Fill out the grid with at least five (5) electrical symbols and write their descriptions.

| Symbols | Description |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 1.1

a. **Direction:** Locate and **box** the different ***electrical signs*** below.

| X | X | X | H | H | H | B | B | O | O | O | O | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | R | O | H | I | B | I | T | I | O | N | E | S |
| X | X | X | N | S | B | X | S | S | S | G | J | S |
| X | C | R | X | A | B | X | W | W | N | J | J | S |
| X | A | X | W | F | B | X | L | A | L | J | J | X |
| W | U | X | S | E | M | X | D | R | R | J | L | X |
| O | T | X | S | T | M | E | J | N | J | N | L | L |
| O | I | X | S | Y | G | X | J | I | L | L | L | X |
| O | O | S | S | A | M | X | J | N | L | L | L | X |
| O | N | H | T | L | M | X | J | G | L | L | L | X |
| O | H | L | J | E | M | X | R | R | R | R | R | X |
| O | O | H | P | R | O | H | I | B | A | R | R | X |
| V | H | H | J | T | M | X | S | S | S | S | S | S |

b. **Direction:** Draw the electrical signs of the following:

| | |
|---|---|
| **1. Safety alert** | |
| **2. Prohibition** | |
| **3. Voltage danger** | |
| **4. Warning** | |
| **5. Electrical hazard** | |

# LEARNING OUTCOME 2

**Interpret technical drawings and plans**

## PERFORMANCE STANDARDS

- Necessary tools, materials and equipment are identified according to the plan.
- Components, assemblies or object are recognized as per job requirement.
- Dimensions and specification are identified according to job requirements.

## Materials/Resources

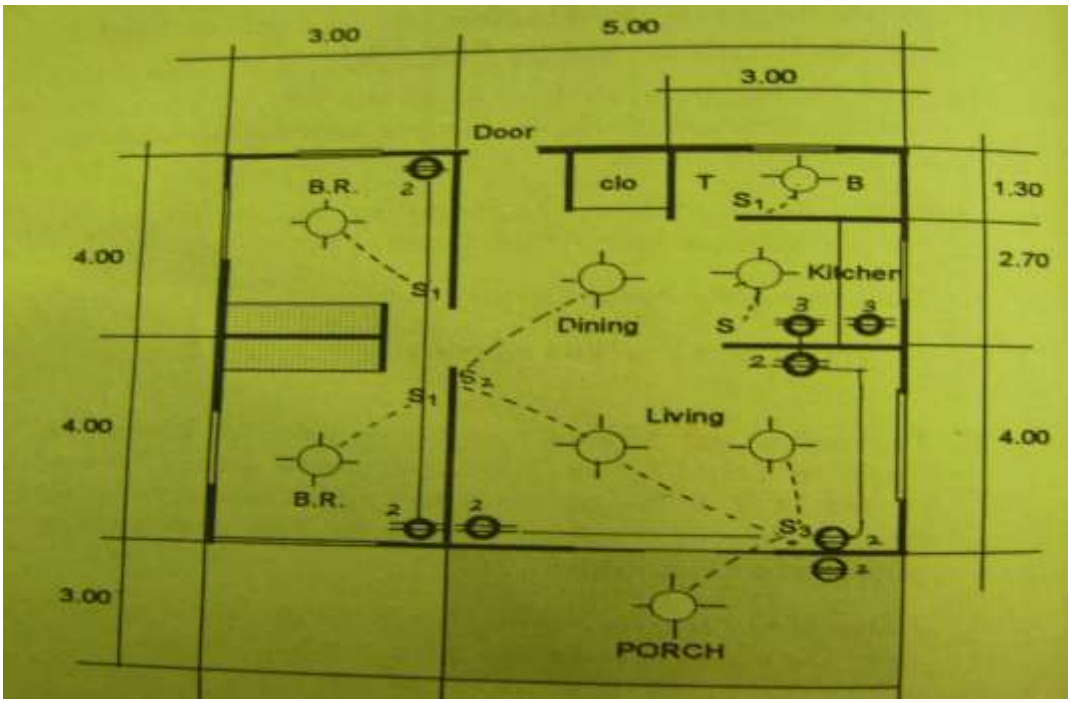
1. Bulb receptacles – 4 pcs.
2. Toggle switch - 2 pcs.
3. Electrical lay-out
4. Ruler

# What Do You Already Know?

**Let us determine how much you already know about interpreting technical drawings and plans. Take this test.**

Pretest LO 2

**Directions:** Below is a drawing of an electrical plan. Enumerate the number of outlets, bulbs, one-gang switch, two-gang switch and three-gang switch.




**Number of electrical fixtures found in the electrical plan**

| QUANTITY | ELECTRICAL FIXTURES |
|---|---|
| | Lamp outlets |
| | Duplex convenience outlets |
| | Single gang switches |
| | Two gang switch |
| | Three gang switch |

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

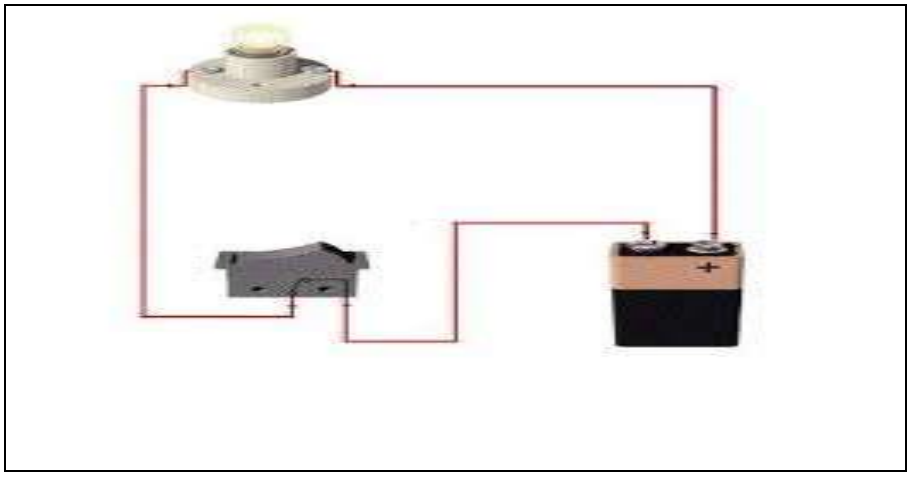
**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 2.1

## ELECTRICAL WIRING DIAGRAM

The flow of current in a conductor or wire can be represented by diagram. There are two types of diagram: ***pictorial diagram*** and ***schematic diagram***.

A. ***Pictorial diagram*** is a sketch of electrical circuit that shows the external appearance of each component. It is much like a photograph of the circuit and uses simple images of parts.



Sample Pictorial diagram of one bulb controlled by single pole switch using 9 volt battery source.

B. ***Schematic diagram*** is a sketch showing the components of the circuit using standard electrical symbols. It shows the actual number of components and how the wiring is routed but not the actual location.

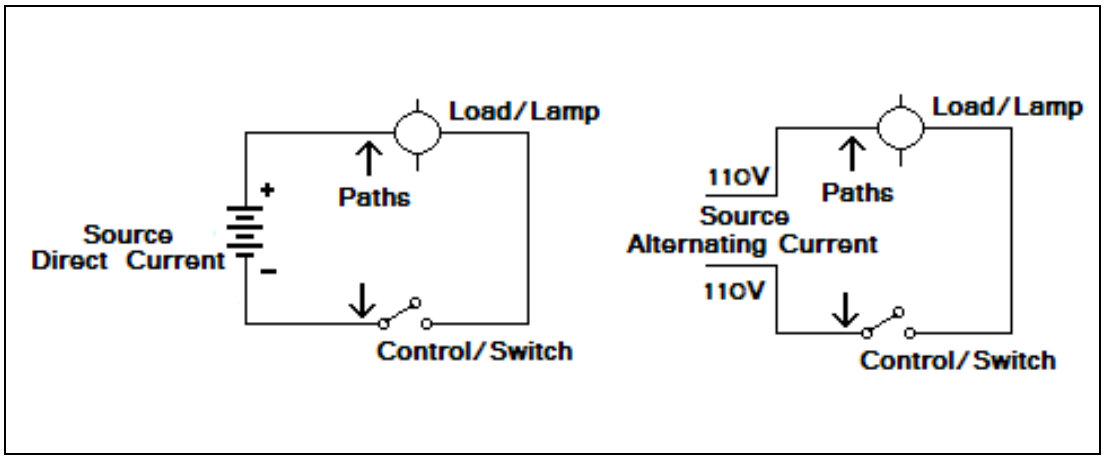


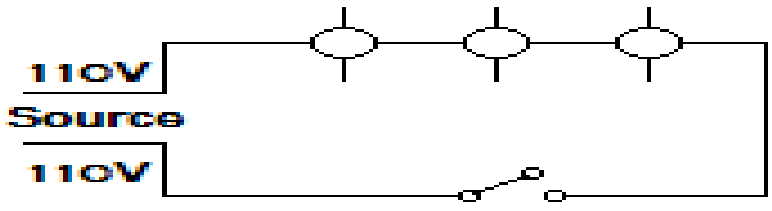

**Diagram A** **Diagram B**

Sample schematic diagrams of one bulb controlled by single pole switch using *direct current* (Diagram A) and alternating current (*Diagram B*) source.

### *C.* Types of Circuit

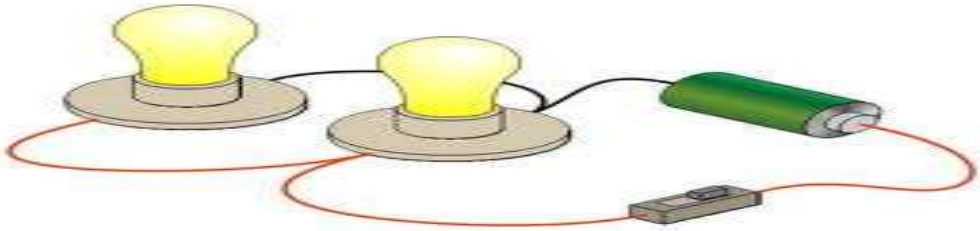
1. **Series Circuit** is a circuit in which lamps are arranged in a chain, so that the current has only one path to take. The current is the same through each load. Example of this is the Christmas lights. It consists of a number of bulbs that are connected side by side to meet the voltage requirement which is 220 volts for alternating current.


**Pictorial diagram of Christmas light in series circuit**

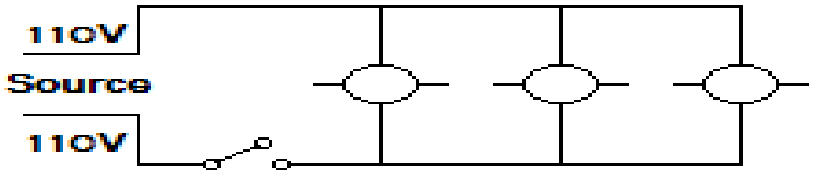



**Schematic diagram of three bulbs connected in series controlled by a single pole switch**.

2. **Parallel Circuit** is a circuit in which lamps are connected across the wires. The voltage across each load on parallel circuit is the same. The advantage of using parallel circuit is that even if one of the lamps fails, still the remaining lamps will function.



**Pictorial diagram of two bulbs connected in parallel circuit controlled by a single pole switch.**



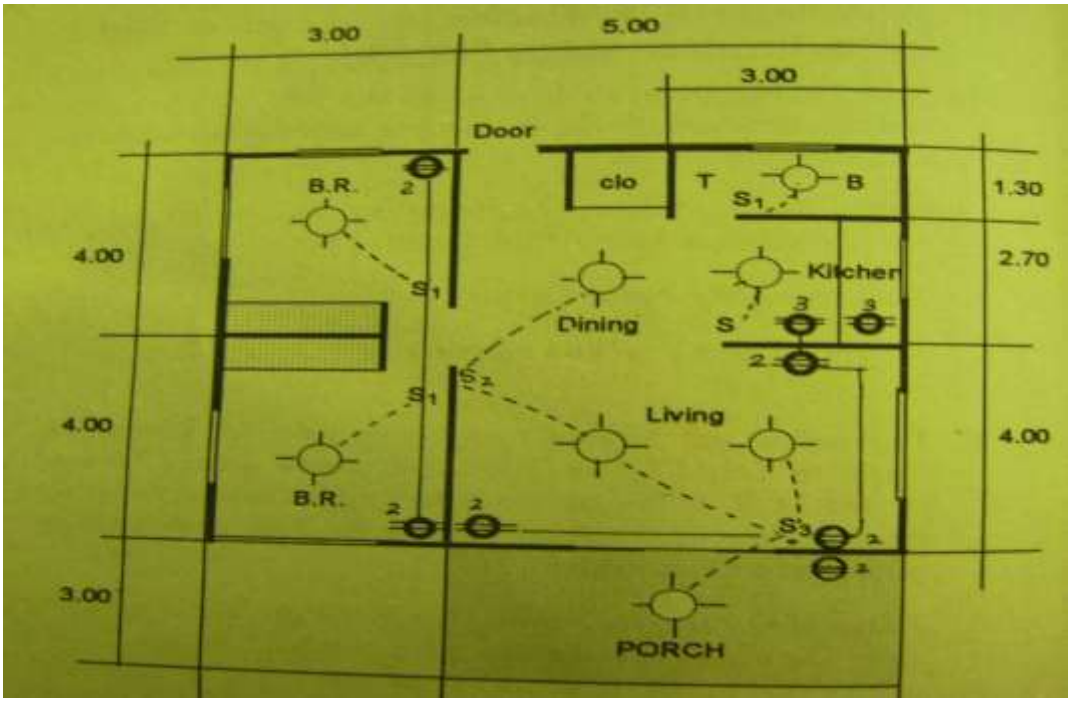

**Schematic diagram of three bulbs connected in parallel circuit controlled by a single pole switch.**

## ELECTRICAL PLAN

***Electrical plan*** is a graphical presentation of electrical wiring connections to install in a particular house or building. It indicates the position of electrical fixtures such as convenience outlets, switches, lightings, door bells, and others to be installed.

**Sample electrical plan of**

**Single family dwelling**




**Number of electrical fixtures found in the electrical plan:**

| QUANTITY | ELECTRICAL FIXTURES |
|---|---|
| 8 pieces | Lamp outlets |
| 8 pieces | Duplex convenience outlets |
| 4 pieces | Single gang switches |
| 1 piece | Two gang switch |
| 1 piece | Three gang switch |

# How Much Have You Learned?

Self-Check 2.1

**Directions:** Draw the schematic diagram of the following:

1. Two bulbs connected in series controlled by a single pole switch using direct current.
2. Four bulbs connected in parallel controlled by a single pole switch using alternating current.

**1.**

**2.**

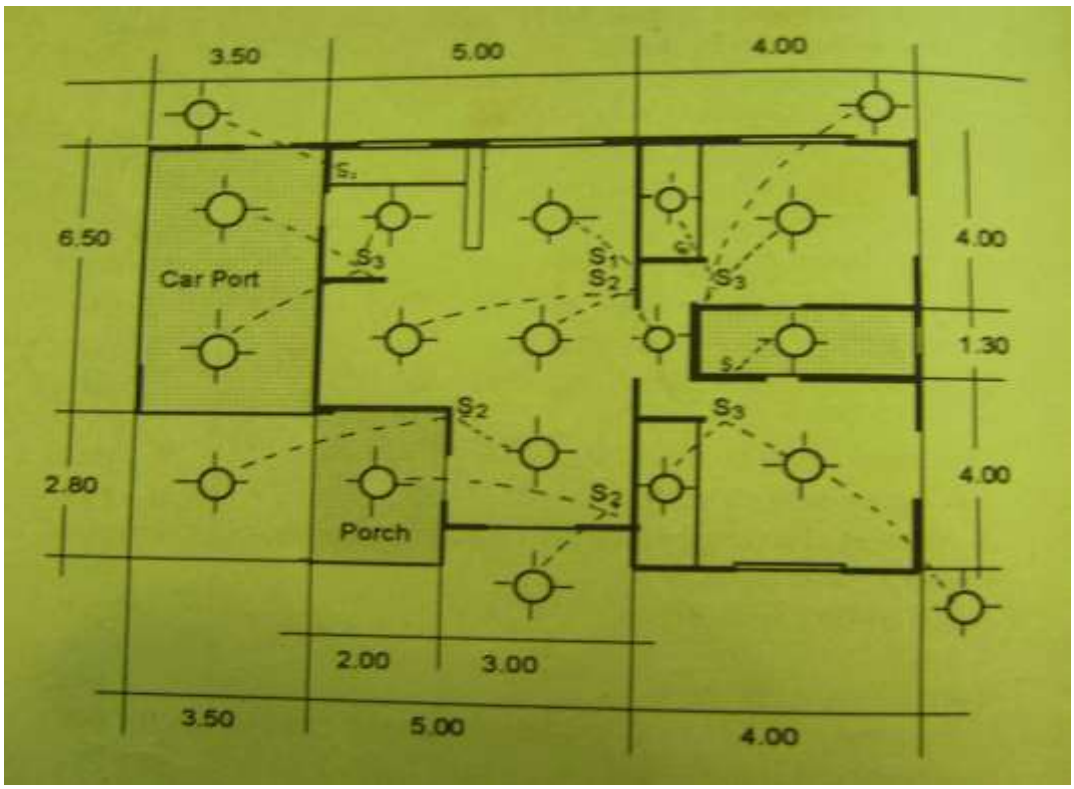
**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 2.1

**Directions:** Based on the electrical plan below count the number of electrical fixtures and then write it in table provided after the drawing.




**Number of electrical fixtures found in the electrical plan:**

| QUANTITY | ELECTRICAL FIXTURES |
|---|---|
| | Lamp outlets |
| | Duplex convenience outlet |
| | Single gang switches |
| | Two gang switches |
| | Three gang switches |


**Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!**

## REFERENCES

LO1

- Azares, Efren F. and Recana, Cirilo B. 1999, Practical Electricity III; Philippines: Adriana Publishing:.
- Agpaoa, Feleciano. 1991, Interior and Exterior Wiring Troubleshooting; Philippines National Bookstore.

LO 2

- Azares, Efren F. and Recana, Cirilo B. 1999, Practical Electricity III; Philippines: Adriana Publishing:.
- Agpaoa, Feleciano. 1991, Interior and Exterior Wiring Troubleshooting; Philippines National Bookstore.
- Acorda, Aidaida V. and Robles, Rosemarie D. Drafting I & II

LESSON 4

# Maintain Tools and Equipment


## LEARNING OUTCOMES:

**At the end of this Lesson, you are expected to do the following:**

**LO 1. check condition of tools and equipment;**
**LO 2. perform basic preventive maintenance; and**
**LO 3. store tools and equipment.**

# Definition of Terms

**5S** - Sort, Systematize, Sweep, Sanitize, and Self-Discipline

**Functional tools and equipment** - those that are in good condition and can perform its regular functions

**Lubricant** - a substance introduced to lessen *friction* between moving surfaces; also functions to transport external particle

**Lubrication additives-** many of the physical properties of various oils and greases

**Non-functional tools and equipment** - those that are not able to perform its regular function because of impaired and damage part

**Nonpolar solvents** - solvents which do not dissolve/are insoluble in water

**Pneumatic tool** - instrument activated by air pressure

**Polar solvents** - solvents which dissolve/are soluble in water

**Solvent** - a component of a solution that dissolves solute and is usually present in large proportion or amount

**Sorting** - to sort everything in a work area

# LEARNING OUTCOME 1

**Check conditions of tools and equipment**

## PERFORMANCE STANDARDS

- Tools and equipment are identified according to classification/ specification and job requirements.
- Non-functional tools and equipment are segregated and labeled according to classification
- Safety of tools and equipment are observed in accordance with manufacturer's instructions
- Conditions of PPE are checked in accordance with manufacturer's instructions.

## Materials/ Resources

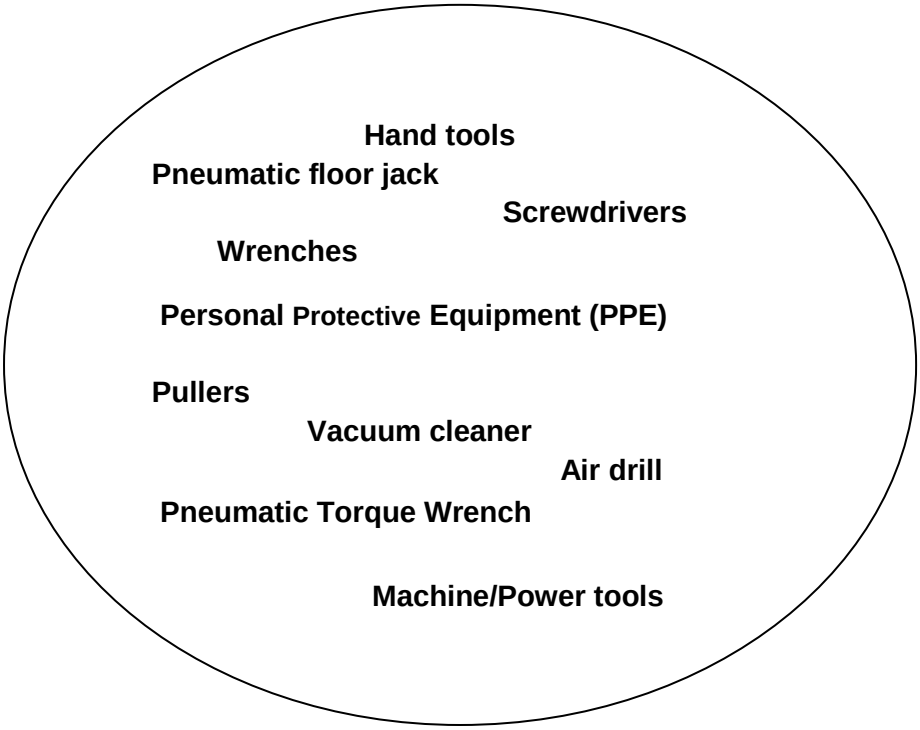
1. Checklist of tools and materials
2. Functional tools in the shop
3. Non-functional tools in the shop

# What Do You Already Know?

**Let us determine how much you already know about checking conditions of tools and equipment. Take this test.**

Pretest LO 1

**Directions**: Read each statement and identify what is being described. Choose your answer inside the circle and write them in the space provided before each number.




_____1. Uses compressed air to flow into the jack cylinder and causes the ram to extend and raise the vehicle.

_____2. These are tools manipulated by our hands without using electrical energy.

_____3. Are used to drive, or turn screws. The common type has a single flat blade for driving screws with slotted heads. The other type has the cross slotted head.

_____4. A tool used to turn screws, nuts and bolts with hexagonal heads. "Hexagonal" means six-sided. A variety of wrenches are used in the shop.

_____5. A tool used to remove gears and hubs from shafts, bushings from blind holes, and cylinders' liners from the engine blocks.

_____6. This is used for cleaning the floor and car interiors after service.

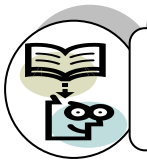
_____7. This is lighter than a comparable electric drill. Repeatedly stalling or overloading does not damage or overheat the air drill.

_____8. A gadget that protects workers from injury or illness caused by having contact with the dangers/hazards in the workplace, Used by linemen to remove insulation of wire and cables in low and high voltage transmission lines.

_____9. This wrench uses compressed air to quickly and powerfully turn nuts, bolts, and other objects.

_____10. These are tools manipulated by our hands and with the use of electrical energy

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.



## What Do You Need To Know?

**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 1.1

## Classification of Tools and Equipment

A **tool** is a device that can be used to produce an item or accomplish a task, but that is not consumed in the process. It can be considered as extension of the human hand thus increasing speed, power, and accuracy and on the other hands **equipment** includes any machine powered by electricity.

1. **Hand tools** are tools manipulated by hands without using electrical energy such as: puller, hacksaw, pull-push rule, pliers, hammer, and others.

2. **Machine/Power tools** are tools manipulated by our hands and with the use of electrical energy such as: electric drill, grinding wheels, vacuum cleaner and others.

3. **Pneumatic tools** are tools or instruments activated by air pressure. Pneumatic tools are designed around three basic devices: the *air cylinder*, the *vane motor*, and the *sprayer*.

## A. Hand tools

They include screwdrivers, hammers, pliers, wrenches and pullers.
1. **Screwdrivers** are used to drive, or turn screws. The common type has a single flat blade for driving screws with slotted heads. The other type has the cross slotted head.

1. **Hammers** are mostly used tools in the shop. They should be gripped at the end of the handle.

2. **Pliers** are specified types of adjustable wrenches. The two legs move on a pivot so that items of various sizes can be gripped.

3. **Wrenches** are used to turn screws, nuts and bolts with hexagonal heads. “Hexagonal” means six-sided. A variety of wrenches are used in the shop.

4. **Pullers** are used to remove gears and hubs from shafts, bushings from blind holes, and cylinders’ liners from the engine blocks.

## B. Machine/Power Tools

1. **Electric drill** has an electric motor that drives a chuck. The chuck has jaws that can be opened and then closed to grip a drill kit.

2. Grinding tool can be either bench-mounted or installed on a pedestal. They may either have a grinding wheel, view wheel, or two grinding wheels.

3. **Vacuum cleaner** is used for cleaning the floor and car interiors after service.

## C. Pneumatic tools

1. **Pneumatic Torque Wrench.** This wrench uses compressed air to quickly and powerfully turn nuts, bolts, and other objects.

2. **Air chisel** uses reciprocating motion to drive a cutting hammering tool. An air hammer drives a chisel to cut off a nut that has frozen to a stud. It can be used with a variety of tools-cutters and punches to do many jobs.

3. **Air drill** is lighter than a comparable electric drill. Repeatedly stalling or overloading does not damage or overheat the air drill.

4. **Air racket** uses the sockets and attachments from a standard socket set.

5. **Pneumatic floor jack** uses compressed air to flow into the jack cylinder and causes the ram to extend and raise the vehicle.

# How Much Have You Learned?

Self-Check 1.1

**Directions:** Inside the tools box are hand, pneumatic, and power tools. Identify and write them in their corresponding column provided below.

Air Chisel Hammers

Air Racket

Air Drill

Electric drill

Vacuum Cleaner

Grinding wheels

Wrenches

Screwdrivers

Pullers

| Hand tools | Power tools | Pneumatic tools |
|---|---|---|
| 1. | 1. | 1. |
| 2. | 2. | 2. |
| 3. | 3. | 3. |
| 4. | 4. | 4. |

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Operation Sheet 1.1

## A. Basic Maintenance of Electrical Tools and Equipment

To ensure that your electric tools work when you need them, you must take proper care of them. A good routine of maintenance for your tools is one thing that you can do to make sure that the tool you need is working when you need it.

1. **Clean out the Dust.** To make sure that your electric tools are ready to go when you are, keep them clean and free of dust. Spend some time to clean out the dust every once in a while on your tools while they are inactive in storage.


2. **Check the Cords.** Look for tear/cut insulator on the power cords on your electric tools. This will ensure that your electric tool can get the power that it needs to function without an accident.


3. **Use the right tool correctly.** Use tools correctly and for their intended purposes. Follow the safety directions and operating procedures recommended by the manufacturer. When working on a circuit, use approved tools with insulated handles.


4. **Protect your Tools.** Keep tools and cords away from heat, oil, and sharp objects. These hazards can damage insulation. If a tool or cord heats up, stop using it. Report the condition to a supervisor or instructor immediately.


5. **Use double-insulated tools -** Portable electrical tools are classified by the number of insulation barriers between the electrical conductors in the tool and the worker.

6. **Storing Your Tools-** Keep your electric tools stored in their original cases and containers. This will keep them free of dust and dirt while they are not being used.

**Note:** proper care of your electric tools is the key to making sure that they last for many years

## B. Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) are gadgets to protect workers from injury or illness caused by having contact with the dangers/hazards in the workplace whether they are chemical, biological, radiation, physical, electrical, mechanical and others.

These are the common Personal Protective Equipment gadgets:

Hard Hats/ Helmets


Gloves

Goggle

Mask

Work boots

Pants

**Pictures of electricians working using Personal Protective Equipment**

**Pictures of Linemen's working using Personal protective Equipment**

**REMEMBER**

1. Personal protective equipment should be taken cared as of the other tools and equipment. Wipe your helmets, gloves, safety shoes before keeping it.
2. It should also be cleaned, kept in proper tool rack/ cabinet.
3. It should be stored in dry places so that it will not have mold build-up.
4. Over-all suites should be washed regularly so that perspirations and other dirt will be washed clean.

## C. Classification of non-functional and functional tools

Tools are very useful to us in our homes especially to our job. But tools that are no longer functional may cause harm.

A. Make an inventory of functional and non-functional tools in your shop.
B. Classify your tools according to is function.

- **Method of identifying non-functional tools and equipment**

1. ***Visual inspection.*** It refers to the visual observation of an expert on the appearance of the tools and equipment.
2. ***Functionality.*** Vibration or extra noise from the operation means problems on parts and accessories started to develop.
3. ***Performance.*** When there is something wrong with the performance of either hand tools or equipment they need an immediate repair or maintenance.
4. ***Power supply (for electrically operated only).*** Failure to meet the required power supply, malfunction will occurs in the part of hand tools or equipment.
5. ***Person's involved.*** It refers to the technical person who has the knowledge and skills about the technology.

- **Classifications of tools and equipment according to their uses:**

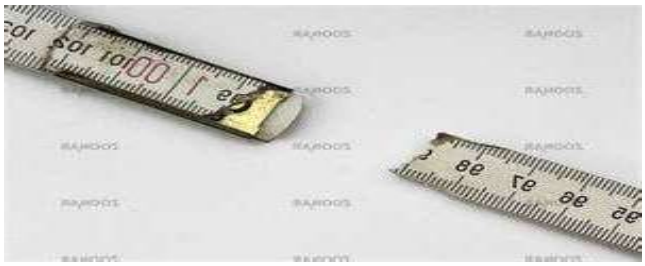
1. Measuring tools
2. Holding tools
3. Cutting tools
4. Driving tools
5. Boring tools
6. Electrical equipment
7. Miscellaneous tools/instrument/equipment

***Non-functional tools and equipment*** are those that are not able to perform its regular function because of impaired and damage part. Examples of these are the following:

**Hammer with a broken handle**

**Screw driver with a broken handle**

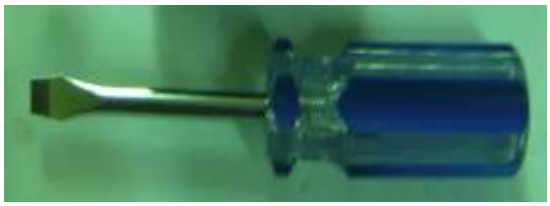
**Long Nose Pliers with damage jaw**



**A broken/cut foot rule**


**Electrical equipment with damage cord**

***Functional tools and equipment*** are those that are in good condition and can perform its regular functions. Examples of these are the following:



**Standard screw driver**

**Philips Screw Driver**

**Combination pliers**

**Long Nose Pliers**

**Wire Stripper**

**Portable Electric Drill**

# LEARNING OUTCOME 2

**Perform basic preventive maintenance**

## PERFORMANCE STANDARDS

- Lubricants are identified according to types of equipment.
- Tools and equipment are lubricated according to preventive maintenance schedule or manufacturer's specifications.
- Measuring instruments are checked and calibrated in accordance with manufacturer's instructions.
- Tools are cleaned and lubricated according to standard procedures.
- Defective equipment and tools are inspected and replaced according to manufacturer's specification.
- Work place is cleaned and kept in safe state in line with OSHC regulations.

## Materials/Resources

1. Lubricating oils
2. Lubricating spray
3. Kerosene
4. Detergent
5. Gasoline
6. Clean rugs
7. Paint brushes

# What Do You Already Know?

**Let us determine how much you already know about performing basic preventive maintenance. Take this test.**

Pretest LO 2

**A. Directions:** Match the cleaning solvents in **Column A** with their corresponding uses in **Column B**. Write the letter of your answer in the space provided before each number.

| Column A | Column B |
|---|---|
| ____1. Gasoline | a. It is used to wash dust in the floor, walls. |
| ____2. Kerosene | b. It is used to wash/clean benches, tables, cabinets, etc. |
| ____3. Thinner | c. It is used to remove dust, grease oil, paint, etc. |
| ____4. Water | d. It is used to wash greasy tools/ equipment. |
| ____5. Detergent Soap and water | e. It is used to remove spilled paint on the floor, walls and tools. |

**B. Directions:** Choose the best answer from the choices given and write letter of your answer on the space before each number.

_____1. An action to clean your work place thoroughly so that there is no dust on floor, machines and equipment?

a. sorting b. sweeping c. sanitizing d. self-discipline

_____2. A condition of training people to follow cleaning disciplines independently.

a. sorting b. sweeping c. sanitizing d. self-discipline

_____3. An action to identify and eliminate all unnecessary items from your work place and dispose them.

a. sorting b. sweeping c. sanitizing d. self-discipline

_____4. An action to arrange or put every necessary item in good order so that s they can be easily picked for use. ” A place for everything, everything is in place”

a. sweeping b. systematizing c. sanitizing d. sorting

_____5. A condition of maintaining high standard of cleaning and workshop organization at all times.

a. sweeping b. systematizing c. sanitizing d. sorting

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing Self-check 2.1.**

Information Sheet 2.1

A **lubricant** is a substance introduced to lessen *friction* between moving surfaces. It may also transport external particles. The property of reducing friction is known as *lubricity*.

| **Types and Uses of lubricants** | |
|---|---|
| **Anti-rust lubricant spray:**<br>○ loosen rusted part<br>○ cleans and protect<br>○ drives out moisture<br>○ stops squeaks<br>○ free sticky mechanisms |  |
| **Wire Pulling Lubricant:**<br>○ does not damage insulation<br>○ cling to wire and dries to a slippery film<br>○ suitable for use with wire or cable covered with rubber (t, thw, thhn, etc) |  |
| **All Purpose Anti Rust Lubricant:**<br>○ anti-rust<br>○ lubricating<br>○ rust removal<br>○ decontamination<br>○ conductance |  |
| **Lubricant Oil and Engine Oil:**<br>○ lubricating the gear<br>○ cleans and protect<br>○ drives out moisture |  |

**Silicon Lubricant:**

- heat stable
- lubricates
- protects
- reduces friction
- water repellent

**Reminders**

**A good lubricant possesses the following characteristics:**

- High boiling point.
- Low freezing point.
- High viscosity index.
- Thermal stability.
- Corrosion prevention.
- High resistance to oxidation.

### Types and Kinds of Cleaning Solvents

***Solvent*** is a component of a solution that dissolves solute and is usually present in large proportion or amount. It can be classified as ***polar*** and ***nonpolar.*** Polar solvents are solvents which dissolve/are soluble in water; while nonpolar solvents are solvents which do not dissolve/are insoluble in water.

Solvents are usually used for cleaning in workshops. They are water, gasoline, kerosene, thinner and detergent soap.

The table below shows the kinds of cleaning solvent based on their solubility in water.

| Cleaning Solvents | Solubility in Water | Polar | Nonpolar |
|---|---|---|---|
| a. water | soluble | x | |
| b. gasoline | insoluble | | x |
| c. kerosene | insoluble | | x |
| d. thinner | insoluble | | x |
| e. detergent soap | soluble | x | |

**Uses of Cleaning Solvents**

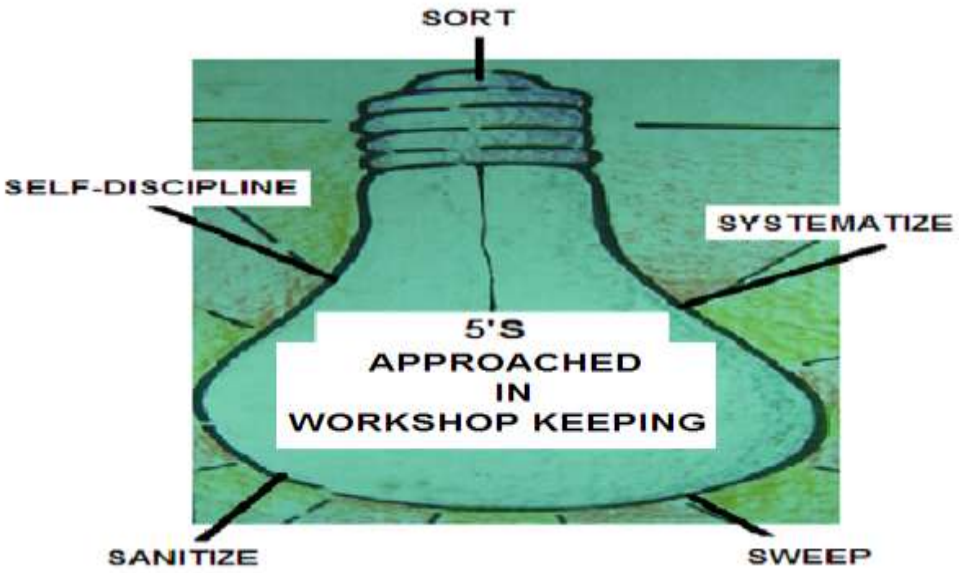
| Cleaning Solvents | Uses |
|---|---|
| Gasoline | Wash greasy tools/ equipment. |
| Kerosene | Remove dust, grease oil, paint, etc. |
| Thinner | Remove spilled paint on the floor, walls and tools. |
| Water | Wash dust in the floor, walls, etc. |
| Detergent Soap and water | Wash/clean benches, tables, cabinets, etc. |

## 5's Approach in workshop keeping

**5'S** is a reference to a list of five Japanese words translated into English. This is an approached of organizing and managing the workplace and work flow with the intent to improve efficiency by eliminating wastes, improving flow of production, reducing process delays.

These words are:

| Japanese words | English translation |
|---|---|
| Seiri | Sort |
| Seiton | Set in order (systematize) |
| Seiso | Sweep |
| Seiketsu | Standardize (sanitize) |
| Shitsuke | Sustain (Self-discipline) |




**5's APPROACH IN WORKSHOP KEEPING**

| Sort | Systematize | Sweep | Sanitize | Self-Discipline |
|---|---|---|---|---|
| Sorting is an action to identify and eliminate all unnecessary items from your work place and dispose them. | Systematizing is an action to arrange or put every necessary item in good order so that they can be easily picked for use.<br>○ A place for everything<br>○ Everything is in place | Sweeping is an action to clean your work place thoroughly so that there is no dust on floor, machines and equipment. | Sanitizing is a condition of maintaining high standard of cleaning and workshop organization at all times. | Self-discipline is a condition of training people to follow cleaning disciplines independently. |

# How Much Have You Learned?

Self-Check 2.1

**A. Directions:** Put a ( ✓) after each word if the solvent is **polar** and (X) if it is **nonpolar**.

1. water ( )
2. kerosene ( )
3. detergent soap ( )
4. gasoline ( )
5. thinner ( )

**B. Directions:** Identify the lubricants below by writing their names on the space provided.

1.  _____

2.  _____

3.  _____

4. 

_____

5. 

_____

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Operation Sheet 2.1

Title: **Procedure in Cleaning Tools and Work Area**

Instructions: Bring cleaning solvents, rags and brooms, washing pan, electric fan and safety apparel. Clean tools and work area.

**Procedure:**

**A. Tools**

1. Wear protective clothing and goggles.
2. Gather the tools to be cleaned in the designated area for cleaning.
3. Classify the tools to be cleaned according to how dirty they are.
4. Measure and pour enough amount of cleaning solvent to the washing pan.
5. Submerge the tools in the washing pan.
6. Use paint brush to remove the dirt from the tools.
7. Get the tools from the washing pan and wipe them with rags until dry.
8. Clean and keep all materials used for cleaning.

**B. Work Area (Application of 5's)**

1. Wear protective clothing and goggles.
2. If there is dirt on the floor such as paint, used oil, grease, rust, etc., remove it first using the appropriate cleaning solvent.
3. Use the broom in cleaning the remaining dirt in the work area and an electric fan to facilitate the drying of the floor.
4. *Assessment:* The teacher will assess the students based on the performance criteria listed below.

| PERFORMANCE CRITERIA | PERFORMANCE LEVEL | | |
|---|---|---|---|
| | YES | NO | NA |
| 1. Were protective clothing and goggles worn at all times? | | | |
| 2. Were tools and equipment free of dust, grease, oil and other substances? | | | |
| 3. Was the work area dry, free of dust, grease and other substances? | | | |

| | | | |
|---|---|---|---|
| 4. Were excess cleaning substances cleaned and kept in proper places? | | | |
| Overall Performance | ☐ Satisfactory<br>☐ Unsatisfactory | | |

Student's name: _____

Teacher's comment: _____
_____
_____

# LEARNING OUTCOME 3

**Store tools and equipment**

## PERFORMANCE STANDARDS

- Inventory of tools, instruments, and equipment are conducted and recorded as per company practices.
- Tools are inspected, and replaced after use.
- Tools and equipment are stored safely in accordance with manufacturer's specifications or company procedures.

## Materials

1. Inventory forms
2. Record book/memorandum
3. Receipts
4. Ball pen and
5. Correction fluid

## What Do You Already Know?

**Let us determine how much you already know about storing tools and equipment. Take this test.**

Pretest LO 3

**Directions: Write TRUE if the statement is correct and FALSE if the statement is not correct.**

**For hand tools**

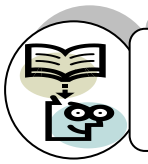
1. Clean dirt and debris from tools after each use.
2. Oil metal and wooden parts to prevent rust.
3. Lightly sand rough wooden handles and apply linseed oil.
4. Repair loose handles.
5. Sharpen blades of cutting tools.

6. Store tools in a clean wet storage area.
7. Protect surfaces of cutting tools in storage.

**For equipment**

8. Store equipment in a clean wet storage area.
9. Rinse and clean spray equipment after each use.
10. Clean spreaders and check wheel-driven gears.

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.



## What Do You Need To Know?

**Read the Information Sheet 3.1 very well then find out how much you can remember and how much you learned by doing Self-check 3.1.**

Information Sheet 3.1

**Why Maintain Inventory of Tools and Equipment**

The most significant point to think at the start of your career is to acquire branded tools. They must be made out of high-quality steel and manufactured for precision. Special consideration is given to balance so that the tool/equipment will be properly maintained and prevent loses. Since the technician must work with his tools daily, regular inventory of tools/equipment is very significant.

The initial cost of a minimum number of tools is high but there is accompanying warranty guarantees satisfaction and many years of service. It is better, in the long run, to start with a few cautiously selected tools that will take care of your most common needs and then slowly build-up to a complete set. It is sometimes hard to identify and memorize the huge number of tools and equipment in the workshop, maintaining the inventory record is of great value.

**Maintaining and Storing Tools & Equipment**

An important aspect of any business is the maintenance and storage of tools and equipment. The investment in tools and equipment is a significant part of the overhead expenses in any operation. Proper selection and maintenance of equipment are important factors in managing business. Selecting the proper tool for the job and using the tool properly will increase efficiency and reduce maintenance problems. Purchase tools, which are well-made and suited to the intended use. Commercial usage may entail more heavy duty demands on equipment.

**Hand tools:**

1. Clean dirt and debris from tools after each use.
2. Oil metal parts to prevent rust.
3. Lightly sand rough wooden handles and apply linseed oil.
4. Repair loose handles.
5. Sharpen blades of cutting tools.
6. Store tools in a clean dry storage area.
7. Protect surfaces of cutting tools in storage.

**Power tools:**

1. Read and follow the maintenance schedule in the owner's manual for each piece of power equipment.
2. Change the oil.
3. Clean the air filter.
4. Lubricate moving parts.
5. Sharpen dull blades or replace worn blades according to the owner's manual.
6. Replace spark plugs.
7. Drain oil and gasoline before long-term storage.
8. Check electric cords and connections on electric-powered tools.
9. Store tools in a clean dry storage area.

**Equipment:**

1. Store equipment in a clean dry storage area.
2. Rinse and clean spray equipment after each use.
3. Clean spreaders and check wheel-driven gears.

4. Clean carts and wheelbarrows after use.

**Sample Proper Arrangement and storage of tools and equipment**

You can see in the pictures that all tools and equipment are arranged and stored properly in their own racks. Like for example the screw drivers are arranged by type and sizes, hammers, saws, c-clamps, etc. are in their racks.

# How Much Have You Learned?

Self-Check 3.1

Direction: Enumerate the proper maintaining and storing of tool and equipment.

HANDTOOLS:

1.
2.
3.
4.
5.
6.
7.

EQUIPMENT:

1.
2.
3.
4.

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Operation Sheet 3.1

**INVENTORY OF TOOLS AND EQUIPMENT**

Instruction: Given the record book/memorandum, receipts, inventory form, ball pen and correction fluid, conduct inventory of tools and equipment, identify, record and report damaged tools and equipment and give repair recommendations if repairable.

**Procedure:**

1. Secure inventory forms/memorandum receipt of tools and equipment.
2. Study the parts of the Inventory Form.
3. Check whether the list of tools and equipment in the memorandum receipt tallies with the existing tools and equipment found in the workshop including their specifications and condition.
4. List down any losses and damages you find while conducting the inventory
5. Fill out the remarks column of the inventory forms for any losses/ damages.
6. Recommend for replacement of lost tools and equipment and repair of damaged tools and equipment if reparable.

**SAN FRANCISCO HIGH SCHOOL**
Misamis St. Bago Bantay Quezon City

**INVENTORY FORM OF TOOLS AND EQUIPMENT**

| Item No. | Quantity | Unit | Description | Condition | Remarks |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |
| 6. | | | | | |
| 7. | | | | | |
| 8. | | | | | |
| 9. | | | | | |
| 10. | | | | | |
| 11. | | | | | |
| 12. | | | | | |
| 13. | | | | | |
| 14. | | | | | |
| 15. | | | | | |
| 16. | | | | | |
| 17. | | | | | |
| 18. | | | | | |
| 19. | | | | | |
| 20. | | | | | |

Prepared by:

_____ Date: _____

Name and Signature

Operation Sheet 3.2

**PROCEDURE IN ARRANGING AND STORING TOOLS AND EQUIPMENT**

Instruction: In a specific tool cabinet and a tool rack assigned to you, arrange and store tools and equipment accordingly.

*Procedure:*

1. Classify the tools and equipment according to their types.
2. Arrange the tools by their types in the shelves/racks.
3. Place equipment in designated places or location.

*Assessment:* The teacher will assess you based on the performance criteria listed below.

| PERFORMANCE CRITERIA | PERFORMANCE LEVEL | | |
|---|---|---|---|
| | YES | NO | NA |
| 1. Were the tools and equipment ready before performing the task? | | | |
| 2. Were the tools arranged according to their types? | | | |
| 3. Were the equipment placed in their proper location and arranged according to their types? | | | |
| 4. Were the tools/equipment placed in their respective location and accessible for use when needed? | | | |
| Overall Performance | ☐ Satisfactory<br>☐ Unsatisfactory | | |

Student's name: _____

Teacher's comment: _____

_____

_____


**Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!**

## REFERENCES


LO1

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- Cardenas, Elpidio.1989, Fundamental and Elements of Electricity. Philippines: national Bookstore.
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LO 2

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LO 3

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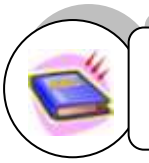
LESSON 5

# Practice Occupational Health and Safety Procedures


## LEARNING OUTCOMES:

**At the end of this Lesson, you are expected to do the following:**

**LO 1. identify hazards and risks;**
**LO 2. evaluate risks and hazards; and**
**LO 3. control hazards and risks.**



# Definition of Terms

**Ampere** - unit of measurement for electric current

**Circuit** - the path of electric current

**Conductor** - a wire or a cord which provides path for current flow

**Connectors** and **Adapters -** accessories that are used to connect from boxes to conduits or raceways to the other boxes in the electrical system

**Corrugated plastic conduit (CPC)** - commonly known as flexible non-metallic conduit or the *"moldflex".*

**Hot wire** - a wire through which current flows

**Insulator** - a plastic, rubber, or asbestos material used to cover electric wires

**Kilowatt** - a unit of power

**Metallic Conduits** - metal raceways that was classified into four; rigid steel conduit (RSC); intermediate metallic conduit or tubing (IMC or IMT); electrical metallic conduit or tubing (EMC or EMT); and the flexible metallic conduit (FMC)

**Non-metallic conduits** - plastic conduits or raceways designed to be a channel of wire that are classified as; rigid non-metallic conduit or the PVC, the flexible non-metallic or CPC, and the surface plastic molding

**Philippine Electrical Code (PEC)** - the governing rules and regulations that ensure safety and fire-free environment

**Resistance** - the quality of electric current measured in ohms.

**Threshold limit value (TLV)** - a level to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects.

# Acronyms

**OSHA** - Occupational Safety and Health Administration

**PPE** - Personal Protective Equipment

# LEARNING OUTCOME 1

**Identify hazards and risks**

## PERFORMANCE STANDARDS

- Workplace hazards and risks are identified and clearly explained.
- Hazards/risks and its corresponding indicators are identified in with the company procedures.
- Contingency measures are recognized and established in accordance with organizational procedures.

## Materials/ Resources

Video clips on hazards and risks

# What Do You Already Know?

**Let us determine how much you already know about identifying hazards and risks. Take this test.**

Pretest LO 1

Direction: Match **Column A** with **Column B.** Write the letter only.

| **A** | **B** |
|---|---|
| _____ 1. Adverse health effect | a. is the chance or the probability that a person will be harmed. |
| _____ 2. Hazards | |
| _____ 3. Chemical hazards | b. caused by organism such as viruses, bacteria fungi and parasites |
| _____ 4. Risks | |
| _____ 5, Physical hazards | c. Is a source of potential damage, harm or adverse health effects |
| _____ 6. Wet floor | |
| _____ 7. Ergonomic hazards | d. safety hazard |
| _____ 8. Psychological hazards | e. Vapor or gaseous substance |
| . | |
| _____ 9.Unsafe work practices | f. Slips, falls |
| _____10.Biological hazards | g. hot or cold condition |
| | h. decrease in life span |
| | i. those that are basically causing stress |
| | j. awkward posture arising from improper work methods |

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 1.1

## HAZARDS AND RISKS

**What is the difference between 'hazard' and 'risk'?**

A **hazard** is something that can cause harm, eg electricity, chemicals, working up a ladder, noise, a keyboard, a bully at work, stress.

**Risk** is the chance or probability that a person will be harmed or experience an adverse health effect once to a hazard. It may also apply to situations with property or equipment loss.

A risk is the chance, high or low, that any hazard will actually cause somebody harm.


For example, working alone away from your office can be a hazard. The risk of personal danger may be high. Electrical repair is a hazard. If someone accidentally turned-on the power the worker's life will be in a 'high-risk' category.

## Five Basic Workplace Hazards

There are five major types of hazards which can put both your health and your safety at risk.

1. Chemical hazards
2. Physical hazards
3. Biological hazards
4. Ergonomic hazards or job related hazards
5. Psychological hazards or stress

### CHEMICAL HAZARDS

If you are working with cleaning products, bleaches, paints, and other chemical agents, you need to understand what a chemical hazard is as well as how to protect yourself.

Chemical hazards include:

- liquids such a cleansers,
- acids, and paints
- vapours and fumes such as
- welding fumes
- gases such as carbon monoxide
- products that can catch fire or explode


### PHYSICAL HAZARDS

Physical hazards include:

- Machinery
- Electrical power
- Noise
- Power and hand tools
- Working and walking surfaces
- Trip and fall hazards
- Ladders and scaffolds
- Heat and cold
- ventilation

### BIOLOGICAL HAZARDS

Why be careful around ticks, mouse droppings, bird poop and wild animals? Because you might get sick from working around certain animals, including

people. Biological hazards include bacteria, viruses, insects, plants, birds, animals, and humans. The risks run from skin irritation and allergies to infections.

Dangers can come from:


- unclean restrooms
- mold and fungus
- bacteria
- insect stings
- animal bites
- poorly stored medical waste

**ERGONOMIC HAZARDS**

If your job is poorly designed, you can develop long term health problems. These problems can arise from simple things, like working for long periods in an awkward position or having to make the same motions over and over again.

Problems can come from:

- lghting
- chairs
- lifting
- repeated movements
- computer screens

**PSYCHOLOGICAL HAZARDS**

Those that are basically causing stress to a worker. This kind of hazard troubles an individual very much to an extent that his general well-being is affected

Stress can lead to long-term health problems. Headaches, anxiety, and impatience are early signs of stress.

Workplace causes of stress include:

- heavy workloads
- lack of control over the pace of work
- shift work
- noise
- working by yourself
- fear of job-loss
- conflict with the employer

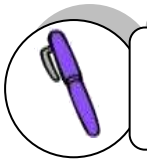
**What are examples of a hazard?**

| Workplace Hazard | Example of Hazard | Example of Harm Caused |
|---|---|---|
| thing | knife | cut |
| substance | benzene | leukemia |
| material | asbestos | mesothelioma |
| source of energy | electricity | shock, electrocution |
| condition | wet floor | slips, falls |
| process | welding | metal fume fever |
| practice | hard rock mining | silicosis |

## THRESHOLD LIMIT VALUE

One of the most critical among the hazards that one may encounter is the chemical hazard. Chemical may produce reactions that may endanger ones health and life. This is the reason why the American Conference of Governmental Hygienist (ACGIH) established a threshold limit value (tlv).

TLV is the term used by the American Conference of Governmental Hygienists (ACGIH*) to express the airborne concentration of a material to which nearly all persons can be exposed day after day, without adverse health effects



# How Much Have You Learned?

Self-Check 1.1

Given below is the list of common workplace hazards. Write at least three examples of each type of hazard.

1. Chemical hazard
   _____
   _____
   _____
2. Physical hazard
   _____
   _____
   _____
3. Biological hazard
   _____
   _____
   _____
4. Ergonomic hazard or Job related
   _____
   _____
   _____
5. Psychological hazards
   _____
   _____
   _____

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Job Sheet 1.1

## RESEARCH WORK

a. Make an internet research on different hazards and risks.
b. Be able to identify these different hazards.
c. Make a write-up on your research on workplace hazards and risks.

# LEARNING OUTCOME 2

**Evaluate hazards and risks**

## PERFORMANCE STANDARDS

- Terms of maximum tolerable limits are identified based on threshold limit values (TLV)
- Effects of hazards are determined.
- OHS issues and concerns are identified in accordance with workplace requirements and relevant workplace OHS legislation.

## Materials/ Resources

1. Threshold limit value table (tlv)
2. Video clips about hazards and risks

## What Do You Already Know?

**Let us determine how much you already know about evaluating hazards and risks. Take this test.**

Pretest LO 2

Direction: Multiple Choice: Select the letter of the correct answer.

_____1. The cross disciplinary area concerned with the safety, health and welfare of people engaged in work or employment.

a.) Waste management b) PEC c) ACGIH d) OHS

_____2. the collection, transport, processing or disposal, managing and monitoring of waste materials.

a) Waste management b) PEC c) ACGIH d) OHS

_____3. TLV means;

a) Threshold limited value b) Threshold live value c)) Threshold limit value

_____4. TWA means:

a) Time-wasted Average b) Time-weighted average c) Total-weighted average

_____5. TLV-C means;

a) Threshold limit value-ceiling b) Threshold limited value-ceiling c) Threshold live value-ceiling

_____6. One type of hazard that needs careful evaluation before extinguishing

a) Chemical b) Water c) Fire

_____7. It is a fifteen minutes exposure to risk.

a) TLV-STEL b) TLV-C c) TLV-TWA

_____8. Chemicals with lower flash points present a greater _____.

a) Personal hazard b) flammability hazard c) explosion hazard

_____9. Process where a person identify, evaluate and determine the solution to the risks.

a) Chemical assessment b) Risk assessment c) Physical assessment

_____10. ) Any alteration of the physical, chemical and biological properties of the atmospheric air, or any discharge thereto of any liquid, gaseous or solid substances that will or is likely to create or to render the air resources of the country harmful, detrimental, or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational, or other legitimate purposes.

a) Pollution b) atmospheric pollution c) air pollution

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing Self-check 2.1.**

Information Sheet 2.1

## What is a risk assessment?

**Occupational Safety and Health (OHS)** is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment.

The goal of all occupational safety and health programs is to foster a safe work environment. As a secondary effect, it may also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment. It may involve interactions among many subject areas, including occupational medicine, occupational (or industrial) hygiene, public health, safety engineering / industrial engineering, chemistry, health physics.

Risks include acute and chronic health effects, for example, irritation or cancer, and physical effects such as fires or explosions. The hazards are physical and health hazards.

### II. Risk assessment

A. Risk assessment is the process where you:

1. identify hazards
2. analyze or evaluate the risk associated with that hazard
3. determine appropriate ways to eliminate or control the hazard

B. Factors that influence the degree of risk include:

- how much a person is exposed to a hazardous thing or condition
- how the person is exposed (e.g., breathing in a vapor, skin contact), and how severe are the effects under the conditions of exposure

**ACGIH has established TLV's for approximately 850 chemical.**

***TLVs may appear as:***

**TLV-TWA or time-weighted average,** which is an average eight-hour exposure limit;

**TLV-STEL or short-term exposure limit,** which is a fifteen-minute exposure limit, or

**TLV-C or ceiling,** which is a limit which should never be exceeded without protection.

**II. Fire and Explosion Hazard Assessment**

Fire is one type of hazard that needs careful evaluation before extinguishing it. Not all fire could be extinguished by water that is why it is necessary that we knew first the cause of fire before dealing the fire.

1. Flash Point and Method Used: Lowest temperature at which a liquid will give off enough flammable vapors to ignite. Since flash points vary according to how they are obtained, the method used must be listed. Chemicals with lower flash points present a greater flammability hazard.

2. Flammable Limits: Range of concentrations over which a flammable vapor mixed with air will flash or explode if an ignition source is present. Range extends between lower explosive limit (LEL) and upper explosive limit (UEL) and is expressed in percentage of volume of vapor or gas in air (0 – 100%).

Chemicals with a broad flammable range (i.e., range between the LEL and the UEL) and/or a flammable range in the lower percentages, present a greater flammability hazard.

3. Extinguishing Media: Fire-fighting material for use on substance that is burning, Fire-fighting material should be indicated by its generic name (e.g. water, foam, dry chemical, etc.).

**III. Waste management** is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics.

Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. The management of wastes treats all materials as a single class, whether solid, liquid, gaseous or radioactive substances, and tried to reduce the harmful environmental impacts of each through different methods.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management for non-hazardous waste residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

**PHILIPPINE CLEAN AIR ACT OF 1999**

*(Refer to **Appendix 1** for elaboration)*

The Philippine Clean Air Act of 1999 under its "*Declaration of Principles"* stated that the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature.

*Declaration of Policies*. The State shall pursue a policy of balancing development and environmental protection. To achieve this end, the frame-work for sustainable development shall be pursued.

*Recognition of Rights.* Pursuant to the above-declared principles, the following rights of citizens are hereby sought to be recognized and the State shall seek to guarantee their enjoyment.

*Definitions*.- As used in this Act:

a) *"Air pollutant"* means any matter found in the atmosphere other than oxygen, nitrogen, water vapor, carbon dioxide, and the inert gases in their natural or normal concentrations, that is detrimental to health or the environment, which includes, but not limited to smoke, dust, soot, cinders, fly ash, solid particles of any kind, gases, fumes, chemical mists, steam and radioactive substances;

b) *"Air pollution"* means any alteration of the physical, chemical and biological properties of the atmospheric air, or any discharge thereto of any liquid, gaseous or solid substances that will or is likely to create or to render the air resources of the country harmful, detrimental, or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational, or other legitimate purposes;

c) *"Ambient air quality guideline values"* means the concentration of air over specified periods classified as short-term and long-term which are intended to serve as goals or objectives for the protection of health and/or public welfare. These values shall be used for air quality management purposes such as determining time trends, evaluating stages of deterioration or enhancement of the air quality, and in general, used as basis for taking positive action in preventing, controlling, or abating air pollution;

d) *"Ambient air quality"* means the general amount of pollution present in a

broad area; and refers to the atmosphere's average purity as

distinguished from discharge measurements taken at the source of

pollution;

e) *"Certificate of Conformity"* means a certificate issued by the Department of Environment and Natural Resources to a vehicle manufacturer / assembler or importer certifying that a particular new vehicle or vehicle type meets the requirements provided under this Act and its rules and regulations;

f) *"Department"* means the Department of Environment and Natural Resources;

g)*"Eco-profile"* means the geographic-based instrument for planners and decision makers which present an evaluation of the environment quality and carrying capacity of an area. It is the result of the integration of primary data and information on natural resources and antropogenic activities on the land which were evaluated by various environmental risk assessment and forecasting methodologies that enable the Department to anticipate the type of development control necessary in the planning area.

h)*"Emission"* means any air contaminant, pollutant, gas stream or unwanted sound from a known source which is passed into the atmosphere;

i) *"Greenhouse gases"* means those gases that can potentially or can

reasonably be expected to induce global warming, which include

carbon dioxide, oxides of nitrogen, chloroflourocarbons, and the like;

j) *"Hazardous substances"* means those substances which present either: (1) short-term acute hazards such as acute toxicity by ingestion, inhalation, or skin absorption, corrosivity or other skin or eye contact hazard or the risk of fire explosion; or (2) long-term toxicity upon repeated exposure, carcinogecity (which in some cases result in acute exposure but with a long latent period), resistance to detoxification process such as biodegradation, the potential to pollute underground or surface waters;

k) *"Infectious waste"* means that portion of medical waste that could transmit an infectious disease;

l) *"Medical waste"* means the materials generated as a result of patient diagnosis, treatment, or immunization of human beings or animals;

m) *"Mobile source"* means any vehicle propelled by or through combustion of carbon-based or other fuel, constructed and operated

principally for the conveyance of persons or the transportation of property goods;

n) *"Motor vehicle"* means any vehicle propelled by a gasoline or diesel engine or by any means other than human or animal power, constructed and operated principally for the conveyance of persons or the transportation of property or goods in a public highway or street open to public use;

o) *"Municipal waste"* means the waste materials generated from communities within a specific locality;

p) *"New vehicle"* means a vehicle constructed entirely from new parts that has never been sold or registered with the DOTC or with the appropriate agency or authority, and operated on the highways of the Philippines, any foreign state or country;

q) *"Octane Rating or the Anti-Knock Index(AKI)"* means the rating of the anti-knock characteristics of a grade or type of automotive gasoline as determined by dividing by two (2) the sum of the Research Octane Number (RON), plus the Motor Octane Number (MON); the octane requirement, with respect to automotive gasoline for use in a motor vehicle or a class thereof, whether imported, manufactured, or assembled by a manufacturer, shall refer to the minimum octane rating of such automotive gasoline which such manufacturer recommends for the efficient operation of such motor vehicle, or a substantial portion of such class, without knocking;

r) *"Ozone Depleting Substances (ODS)"* means those substances that significantly deplete or otherwise modify the ozone layer in a manner that is likely to result in adverse effects of human health and the environment such as, but not limited to, chloroflourocarbons, halons and the like;

s) *"Persistent Organic Pollutants (POPs)"* means the organic compounds that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment. These compounds resist photolytic, chemical and biological degradation, which shall include but not be limited to dioxin, furan, Polychlorinated Biphenyls (PCBs), organochlorine pesticides, such as aldrin, dieldrin, DDT, hexachlorobenzene, lindane, toxaphere and chlordane;

t) *"Poisonous and toxic fumes"* means any emissions and fumes which are beyond internationally - accepted standards, including but not limited to the World Health Organization (WHO) guideline values;

u) *"Pollution control device"* means any device or apparatus used to prevent, control or abate the pollution of air caused by emissions from identified

pollution sources at levels within the air pollution control standards established by the Department;

v) *"Pollution control technology"* means the pollution control devices, production process, fuel combustion processes or other means that effectively prevent or reduce emissions or effluent;

w) *"Standard of performance"* means a standard for emissions of air pollutant which reflects the degree of emission limitation achievable through the application of the best system of emission reduction, taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirement which the Department determines, and adequately demonstrates; and

x) *"Stationary source"* means any building or immobile structure, facility or installation which emits or may emit any air pollutant.

# How Much Have You Learned?

Self-Check 2.1

**DIRECTIONS:** Multiple choice. Write the letter of the correct answer and write it in the space provided.

_____1. Chemicals with lower flash points present a greater _____.

a) Personal hazard b) flammability hazard c) explosion hazard d) skin hazard

_____2. Process where a person identify, evaluate and determine the solution to the risks.

a) Chemical assessment b) Risk assessment c) Physical assessment d) NC assessment

_____3. Any alteration of the physical, chemical and biological properties of the atmospheric air, or any discharge thereto of any liquid, gaseous or solid substances that will or is likely to create or to render the air resources of the country harmful, detrimental, or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational, or other legitimate purposes.

a) Pollution b) atmospheric pollution c) air pollution

_____4. The cross disciplinary area concerned with the the safety, health and welfare of people engaged in work or employment.

a.) Waste management b) PEC c) ACGIH d) OHS

_____5. the collection, transport, processing or disposal, managing and monitoring of waste materials.

a) Waste management b) PEC c) ACGIH d) OHS

**Refer to the Answer Key. What is your score?**

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 2.1

**A. Do the activity at home or during vacant time**

1. Download and watch video presentation on different hazards and risk.

2. Make a short write-up on the video presentation you have watched.

**B. Answer the following questions**

1. What type of hazard was viewed in the video?

2. What risks were involved?

3. If you are going to evaluate the hazard and risk you had viewed, what possible recommendations will you give? Why?

# LEARNING OUTCOME 3

**Controlling hazards and risks**

## PERFORMANCE STANDARDS

- OHS procedures for controlling hazards and risk are strictly followed.
- Procedures in dealing with workplace accidents, fire and emergencies are followed in accordance with the organization's OHS policies.
- Personal protective equipment (PPE) is correctly used in accordance with organization's OHS procedures and practices.
- Procedures in providing appropriate assistance in the event of workplace emergencies are identified in line with the established organizational protocol.

## Materials

1. Personal protective equipment:

    - Safety goggles
    - Safety shoes
    - Safety helmet
    - Safety gloves
    - Safety shoes
    - Safety belt

2. First aid kit

# What Do You Already Know?

**Let us determine how much you already know controlling hazards and risks. Take this test.**

Pretest LO 3

**A. DIRECTION:** Select the correct answer that corresponds to the statement in each number. Write the correct answer at the space provided

_____ 1. It includes ear and eye protection, respirators, and protective clothing.
_____2. Changing a piece of machinery (for example, using proper machine guards) or a work process to reduce exposure to a hazard

_____3. Working a limited number of hours in a hazardous area
_____4. The process where you identify hazards, **a**nalyze or evaluate the risk associated with that hazard, and determine appropriate ways to eliminate or control the hazard.
_____5. Identify the source of the problem

| |
|---|
| IDENTIFY THE HAZARD ASSESS THE RISK<br>PERSONAL PROTECTIVE EQUIPMENT<br>ENGINEERING CONTROL<br>ADMINISTRATIVE CONTROL<br>ELIMINATE HAZARDS |

**B.DIRECTION: TRUE OR FALSE.** In the statements below write true if the statement is correct and **False** if the statement is incorrect.

1. General cleanliness in the workplace is an important method of controlling hazards.
2. Good housekeeping reduces the risk of fire and is cost-effective.
3. Safety signs are method of hazard control.
4. Hygiene (cleanliness) is not so important as a method of controlling hazards
5. Before you leave work, wash/shower and change your clothes when necessary to prevent bringing workplace contaminants home to your family.

Now check your answers using the Answer Key. If you got 90-100% of the items correctly, proceed to the next Learning Outcome. If not, do the next activity/ies again to gain knowledge and skills required for mastery.

# What Do You Need To Know?

**Read the Information Sheet 3.1 very well then find out how much you can remember and how much you learned by doing Self-check 3.1.**

Information Sheet 3.1

## 3A. HAZARD CONTROL

All workplace hazards (chemical, physical, etc.) can be controlled by a variety of methods. The goal of controlling hazards is to **prevent workers from being exposed to occupational hazards**. Some methods of hazard control are more efficient than others, but a combination of methods usually provides a safer workplace than relying on only one method. Some methods of control are cheaper than others but may not provide the most effective way to reduce exposures.

To control **hazard**s in your workplace you need to ***identify*** and ***understand*** those hazards. Your first priority should always be to eliminate the hazards. If the hazards can't be eliminated, try finding safer ways to carry out those tasks by substituting less harmful substances or changing the work environment through engineering controls. Also consider changing how work activities are organized and performed. For example, reduce the time workers are exposed to a hazard by rotating them to another task.

### A. Controlling workplace hazards

Once a hazard has been identified and the risk assessed, control measures should be put into place.A simple list of control measures can be utilized - the hierarchy of control.

**1. Identify the Hazard**

Identify the source of the problem

**2. Assess the Risk**

Risk assessment is the process where you:

- Identify hazards,
- Analyze or evaluate the risk associated with that hazard.

- Determine appropriate ways to eliminate or control the hazard

**3. Eliminate the Hazard Or Risk**

Elimination of a specific hazard or hazardous work process, or preventing it from entering the workplace, is the most effective method of control. Eliminating a hazard means removing it completely.

**4. Engineering Control** may mean changing a piece of machinery (for example, using proper machine guards) or a work process to reduce exposure to a hazard.

**5. Administrative Controls**

Working a limited number of hours in a hazardous area is an example of an administrative control for example, job rotation.

6. Substitution is one measure of replacing one hazardous agent or work process with a less dangerous one. It is important to consider worker health and safety when work processes are still in the planning stages.

**Provide Personal Protective Equipment**

**Personal Protective Equipment** (PPE) includes ear and eye protection, respirators, and protective clothing.


***Remember**: it is always better to control the hazard as close to the source as possible. Using personal protection is the least acceptable and least effective of all control measures.*

# How Much Have You Learned?

Self-Check 3.1

**DIRECTIONS:** Select the correct answer that corresponds to the statement in each number. Write the correct answer at the space provided

_____ 1. It includes ear and eye protection, respirators, and protective clothing.

_____2. It may mean changing a piece of machinery (for example, using proper machine guards) or a work process to reduce exposure to a hazard.

_____3. Working a limited number of hours in a hazardous area

_____4. The process where you identify hazards, analyze or evaluate the risk associated with that hazard, and determine appropriate ways to eliminate or control the hazard.

_____5. Identify the source of the problem.

IDENTIFY THE HAZARD ASSESS THE RISK

PERSONAL PROTECTIVE EQUIPMENT

ENGINEERING CONTROL

ADMINISTRATIVE CONTROL

ELIMINATE HAZARDS

**Refer to the Answer Key. What is your score?**

# What Do You Need To Know?

**Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing Self-check 1.1.**

Information Sheet 3.2

## YOUR HEALTH AND SAFETY AT WORK

### Personal hygiene

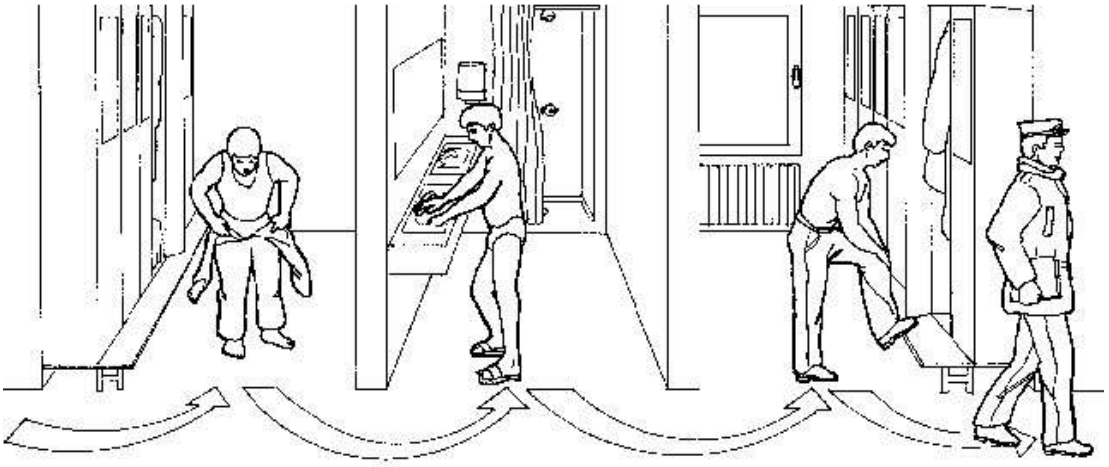
Finally, personal hygiene (cleanliness) is also very important as a method of controlling hazards. Your employer should provide facilities so you can wash and/or take a shower every day at the end of your shift, no matter what your job is. Wash your skin and hair with a mild soap, rinse and dry your skin completely to protect it. Washing hands regularly, and eating and smoking away from your work area help to prevent ingesting contaminants.

*Do not take workplace hazards home with you!*

Lack of personal cleanliness can affect your family's health.

Your family can be exposed to hazards you work with if you bring chemicals and other workplace contaminants home with you on your clothes, hair or skin. Before you leave work, wash/shower and change your clothes when necessary to prevent bringing workplace contaminants home.

**Leave your dirty clothes at work or, if you must wash them at home, wash them separately — not with the family wash.**



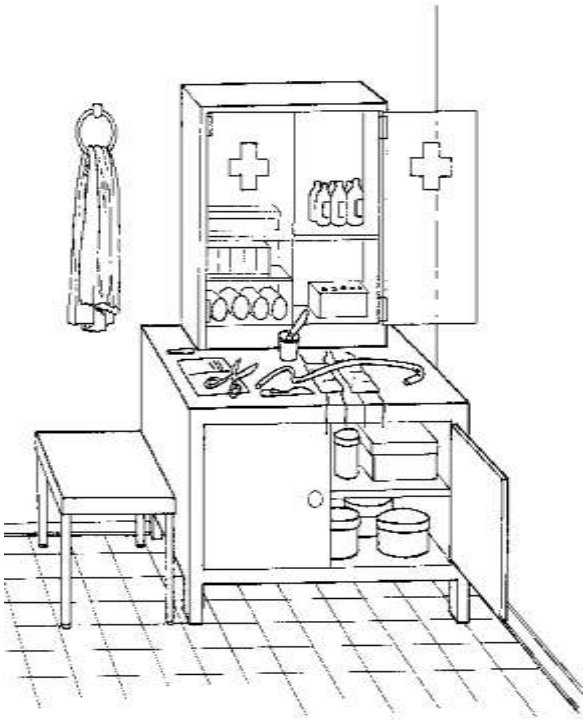
It may seem that the amount of contaminant you can bring home on your clothes or skin is very small and cannot hurt your family. In reality a small exposure every day for months can add up to a big exposure. A classic example of this “spreading the hazard” involves asbestos, where wives of asbestos workers have developed asbestosis from exposure to the asbestos on their husbands' work clothes. Similarly, children have developed lead poisoning from exposure to lead which comes home on their parents' work clothes.

If you wear protective clothing at work, such as aprons, laboratory coats, overalls, etc., these should be cleaned regularly and you should inspect them for holes or areas that are worn out. Workers who launder these clothes should be trained in the types of hazards they may work with and how they can be controlled. Inspect your underclothes at home for any signs of contamination with oils, solvents, etc. If you find any signs, then it means your protective clothing at work is not effective.

**Every workplace should have some kind of first-aid facility**

Every workplace should have at least minimal first-aid facilities as well as adequate personnel trained to provide first aid. First-aid facilities and trained personnel are important components of a healthy and safe workplace.

*A basic first-aid facility*



1. General cleanliness in the workplace is an important method of controlling hazards.
2. Good housekeeping reduces the risk of fire and is cost-effective.
3. Good housekeeping measures should be planned when work processes are in the design stage.
4. Safety signs are **not** a method of hazard control.
5. Personal cleanliness is an important method of controlling hazards.
6. Your employer should provide facilities so you can wash and/or take a shower every day.
7. Before you leave work, wash/shower and change your clothes when necessary to prevent bringing workplace contaminants home to your family.
8. Leave your dirty clothes at work. If you must wash them at home, wash them separately — never wash your work clothes with your family's wash.
9. Your protective clothing should be cleaned regularly. Inspect your protective clothing for holes and worn areas that could leave you open to exposures.
10. Inspect your undergarments for signs of contamination.
11. Your workplace should have at least minimal first-aid facilities.

## EMERGENCY PREPAREDNESS

Process of ensuring that an organization has complied with the preventive measures, is in a state of readiness to contain the effects of a forecasted disastrous event to minimize loss of life, injury, and damage to property, can provide rescue, relief, rehabilitation, and

other services in the aftermath of the disaster, and has the capability and resources to continue to sustain its essential functions without being overwhelmed by the demand placed on them.

Preparedness for the first and immediate response is called emergency preparedness.




Always remember that disaster comes in the most unexpected time and place. Being ready is always a necessity in all circumstances. The government is giving trainings that everybody needs in all our localities. One should participate in this disaster training so that we will not be caught unaware when calamity struck.

# How Much Have You Learned?

Self-Check 3.2

DIRECTIONS: TRUE OR FALSE. In the statements below write **true** if the statement is correct and **false** if the statement is not correct

a. General cleanliness in the workplace is an important method of controlling hazards.
b. Good housekeeping reduces the risk of fire and is cost-effective.
c. Safety signs are method of hazard control.
d. Hygiene (cleanliness) is not so important as a method of controlling hazards.
e. Before you leave work, wash/shower and change your clothes when necessary to prevent bringing workplace contaminants home to your family.
f. Your protective clothing should be cleaned regularly.
g. Inspect your undergarments for signs of contamination.
h. Your employer should provide facilities so you can wash and/or take a shower at least once a week.

# How Do You Apply What You Have Learned?

**Show that you learned something by doing this activity.**

Activity Sheet 3.1

## POSTER MAKING

**DIRECTION:** Draw a poster in consonance with the theme "**Control Hazard, Before It Starts"**

MATERIALS:

1. Pencil
2. Poster paint or oil paint or crayon
3. Whole cartolina (yellow)
4. Ruler

TIME ALLOTMENT:

3 hours

# How Well Did You Perform?

**Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!**

**Speed 20%**

10 minutes before/ on allotted time ---------- **20%**

1minute up to 10 minutes after the allotted time - 10%

11 minutes and more than the allotted time ------- 05%

**Originality 50 %**

based on judges deliberation **----------50%**

**Blending of colors 25%**

based on judges deliberation **----------25%**

**Good Housekeeping 5%**

all the materials were kept clean and the work area was properly cleaned **----------05%**

Total 100%


**Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!**

## REFERENCES


- Philippine Electrical Code. 2000 Edition.
- Cardenas, Elpidio. 1989, Fundamental and Elements of Electricity; Philippines: National Bookstore.
- http://sam.dgs.ca.gov/TOC/3800/3861.htm
- http://old.iupac.org/goldbook/TT06915.pdf

# Answer Keys

# LESSON 1

**HOW MUCH DO YOU ALREADY KNOW?**

**PRE-TEST**

2. Combination Pliers
3. Long Nose Pliers
4. Philips Screw driver
5. Claw Hammer
6. Wire Stripper
7. Portable electric drill
8. Stubby screw driver
9. Electrician's knife
10. Male plug
11. Fuse
12. Utility box
13. Conduits
14. Connectors
15. Circuit Breaker
16. Junction box

**SELF CHECK**

1. rat tail
2. plain tap
3. duplex cross
4. y splice

**PRE-TEST**

1. b
2. a
3. d
4. c

**SELF CHECK**

1. Requisition form
2. Inventory form
3. Job order or work order form
4. Borrower's form

**PRE-TEST**

**a.**

1. For me

2. Damaged
3. Correct

**B.**

1. The receiving person
2. Keep a copy
3. Write the findings and if posible, take a picture

# LESSON 2

**WHAT DO YOU ALREADY KNOW?**

**PRE-TEST**

**I Matching Type:**

1. C
2. E
3. A
4. B
5. D

**II . Multiple Choice:**

1. **B**
2. **A**
3. **D**
4. **C**
5. **A**

**LO2- CARRY OUT MEASUREMENTS AND CALCULATIONS**

**A**.

1. 10 mm
2. 36 inches
3. 10 cm
4. 1 cm
5. 12 inches

**B**.

6. cm
7. m
8. dm
9. yd
10. ft

**C**.

1. 304.8 cm
2. 700 mm
3. 1.25 ft
4. 5.468 yd

# LESSON 3

**PRETEST**

**LO1: A.**

1. b
2. d
3. a
4. e
5. c

**B.**

1. Warning
2. Read and understand instruction manual
3. Electrical hazard
4. Voltage danger
5. Power panel
6. Circuit breaker
7. Battery

**PRE-TEST**

**LO2:**

| QUANTITY | ELECTRICAL FIXTURES |
|---|---|
| 8 pieces | Lamp outlets |
| 8 pieces | Duplex convenience outlets |
| 4 pieces | Single gang switches |
| 1 piece | Two gang switch |
| 1 piece | Three gang switch |

**SELF CHECK**

**LO1.**

1. b
2. d
3. a
4. e
5. c

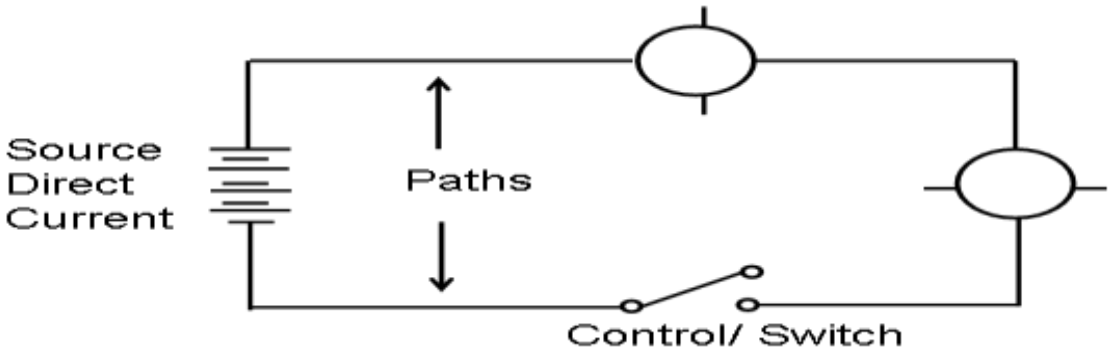
**HOW MUCH DO YOU LEARNED?**

**SELF CHECK**

**Electrical Plan and Layout**

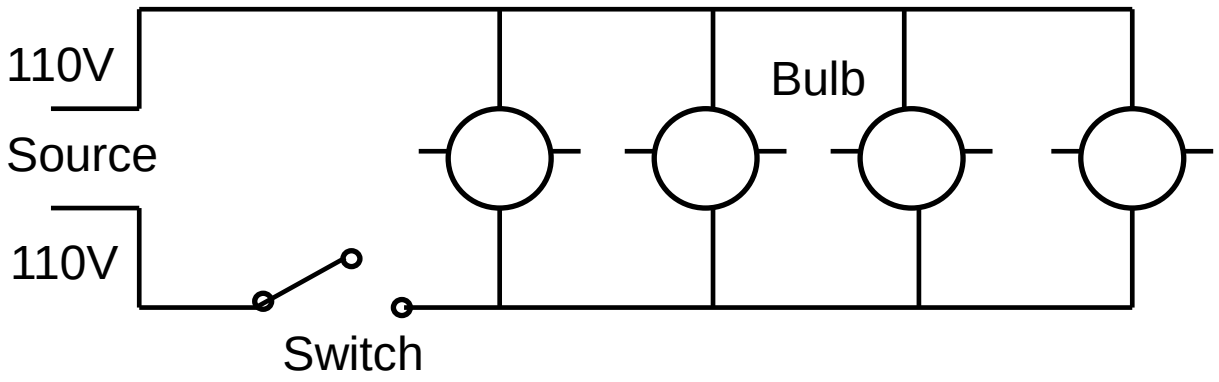
**LO2.**

1.




**Schematic Diagram of Series Circuit**

2.




**SCHEMATIC DIAGRAM OF PARALLEL CIRCUIT**

**HOW DO YOU APPLY WHAT YOU LEARNED?**

**ELECTRICAL SIGNS**

**LO1. Analyze electrical symbols and signs.**

**A.**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| P | R | O | H | I | B | I | T | I | O | N | E | |
| | | | | S | | | | | | G | | |
| | C | | | A | | | | W | N | | | |
| | A | | | F | | | | A | | | | |
| | U | | | E | | | D | R | | | | |
| | T | | | T | | E | | N | | | | |
| | I | | | Y | G | | | I | | | | |
| | O | | | A | | | | N | | | | |
| | N | | T | L | | | | G | | | | |
| | | L | | E | | | | | | | | |
| | O | | | R | | | | | | | | |
| V | | | | T | | | | | | | | |

**B**.

| | |
|---|---|
| **a. Safety alert** |  |
| **b. Prohibition** |  |
| **c. Voltage danger** |  |
| **d. Warning** |  |
| **e. Electrical hazard** |  |

**SELF CHECK**

**Electrical Plan**

**LO2**

| QUANTITY | ELECTRICAL FIXTURES |
|---|---|
| 19 pieces | Lamp outlets |
| 0 | Duplex convenience outlet |
| 4 pieces | Single gang switches |
| 3 pieces | Two gang switches |
| 3 piece | Three gang switches |

**HOW MUCH HAVE YOU LEARNED?**

**SELF CHECK**

**I. Text Twist:**

1. Wire gauge
2. Voltmeter
3. Clamp meter
4. Push pull rule

**II. Parts of Multi-tester**

1. Scale
2. Adjustment screw
3. Range selector knob
4. Pointer
5. Zero-ohm adjustment knob
6. Test probe

# LESSON 4

**LO1: Check condition of tools and equipment**

1. Pneumatic floor jack
2. Hand tools
3. Screw drivers
4. Wrench
5. Puller
6. Vacuum cleaner
7. Air drill
8. Personal Protective Equipment (PPE)

9. Pneumatic Torque Wrench

10. Machine/Power tools

**SELF CHECK**

**LO1. Check condition of tools and equipment**

| Hand tools | Power tools | Pneumatic tools |
|---|---|---|
| 1. Screw drivers | 1.Grinding Wheels | 1.Air Racket |
| 2.Wrenches | 2.Vacuum Cleaner | 2.Air Drill |
| 3.Pullers | 3.Electric Drill | 3.Air Chisel |
| 4.Hammers | 4. | 4. |

**Pre-Test**

**LO2: Perform basic preventive maintenance**

**A.**

1. D
2. C
3. E
4. A
5. B

**B.**

1. b. sweeping[i]
2. d. self-discipline
3. a. sorting
4. b. systematizing
5. c. sanitizing

**HOW MUCH HAVE YOU LEARNED**

**Self-Check**

**LO2. Perform basic preventive maintenance**

**a.**

1. Water ( ✓ )
2. Kerosene (X)
3. Detergent soap ( ✓ )
4. Gasoline (X)
5. Thinner (X)

**b.**

1. SILICON LUBRICANT
2. WIRE PULLING LUBRICANT
3. LUBRICATING OIL/ ENGINE OIL
4. ANTI-RUST LUBRICANT SPRAY
5. ALL PURPOSE ANTI-RUST LUBCANT

**WHAT DO YOU ALREADY KNOW?**

**LO 3: Store tools and equipments**

**Pre-test**

**For hand tools;**

1. TRUE
2. FALSE
3. TRUE
4. TRUE
5. TRUE
6. FALSE
7. TRUE

**For equipment;**

8. FALSE
9. TRUE
10. TRUE

**SELF CHECK**

**HOW MUCH HAVE YOU LEARNED?**

**LO3: Store tool and equipment**

**Hand tools:**

1. Clean dirt and debris from tools after each use.
2. Oil metal parts to prevent rust.
3. Lightly sand rough wooden handles and apply linseed oil.
4. Repair loose handles.
5. Sharpen blades of cutting tools.
6. Store tools in a clean dry storage area.
7. Protect surfaces of cutting tools in storage.

**Power tools:**

1 Read and follow the maintenance schedule in the owner's manual for each piece power equipment.
2. Change the oil.
3. Clean the air filter.
4. Lubricate moving parts.
5. Sharpen dull blades or replace worn blades according to the owner's manual.
6. Replace spark plugs.
7. Drain oil and gasoline before long-term storage.
8. Check electric cords and connections on electric-powered tools.
9. Store tools in a clean dry storage area.

# LESSON 5

**HOW MUCH HAVE YOU ALREADY KNOW?**

**PRE-TEST**

**LO1. Identify hazards and risks.**

8. H
9. C
10. E
11. A
12. G
13. F
14. J
15. I
16. D
17. B

**SELF CHECK**

**LO 1: Identify Hazards And Risks**

Given below is the list of common workplace hazards. Write at least three examples of each type of hazard. (***Choose only 3 from the given answers below***).

1. Chemical hazard

- liquids such a cleansers,
- acids, and paints
- vapours and fumes such as welding fumes
- gases such as carbon monoxide
- products that can catch fire or explode

2. Physical hazard

- Machinery
- ladders and scaffolds

trip and fall hazards
electrical power

- heat and cold — heat and cold
- noise — ventilation
- noise — working and walking surface
- power and hand tools

3. Biological hazard

- unclean restrooms
- mold and fungus
- bacteria
- insect stings
- animal bites
- poorly stored medical waste

4. Ergonomic Hazard or Job related hazard

- lighting
- chairs
- lifting
- repeated movements
- computer screens

5. Stress

- heavy workloads
- lack of control over the pace of work
- shift work
- noise
- working by yourself
- fear of job loss
- conflict with the employer

**HOW MUCH HAVE YOU ALREADY KNOW?**

**PRETEST**

**LO 2: EVALUATE HAZARDS AND RISKS**

**A.**

**1. Personal Protective Equipment**

**2. Eliminate hazards**

**3. Administrative control**

**4. Asses the risk**

**5. identify hazard**

A. DIRECTION. TRUE OR FALSE. In the statements below write true if the statement is true and false if the statement is not correct.

1. General cleanliness in the workplace is an important method of controlling hazards.

2. Good housekeeping reduces the risk of fire and is cost-effective.
3. Safety signs are method of hazard control.
4. Hygiene (cleanliness) is not so important as a method of controlling hazards
5. Before you leave work, wash/shower and change your clothes when necessary to prevent bringing workplace contaminants home to your family.

**B**.

1.TRUE

2.TRUE

3.FALSE

4.FALSE

5.TRUE

**SELF CHECK**

**Lesson 2: Evaluate hazards and risks**

1. b
2. b
3. c
4. d
5. b

**SELF CHECK**

**LO3: PERSONAL HYGENE**

1. TRUE
2. TRUE
3. FALSE
4. FALSE
5. TRUE
6. TRUE
7. TRUE

# *Acknowledgement*

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