



Republic of the Philippines
DEPARTMENT OF EDUCATION



K to 12 Basic Education Curriculum

Technology and Livelihood Education

Learning Module



PLUMBING

EXPLORATORY COURSE
Grade 7 and Grade 8

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What Is This Module About?

Welcome to the world of **Plumbing!**

This Module is an exploratory and introductory course on **Plumbing** which leads you to **Plumbing** National Certificate Level I (NC I)¹. It covers 5 basic competencies in **Plumbing** that a Grade 7/Grade 8 Technology and Livelihood Education (TLE) student like you ought to possess, namely:

- 1) Prepare plumbing materials and tools;
- 2) Perform mensuration and calculation;
- 3) Interpret Technical Drawings and Plans;
- 4) Maintain tools and equipment; and
- 5) Practice occupational health and safety procedures

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

Lesson 1: Prepare Plumbing Materials and Tools

- LO 1. Identify and select materials and tools
- LO 2. Request appropriate materials and tools.
- LO 3. Receive and inspect materials and tools.

Lesson 2: Perform Mensuration and Calculation

- LO 1. Select measuring instrument.
- LO 2. Carry out mensuration and calculation.

Lesson 3 : Interpret Technical Drawings and Plans

- LO1 Analyze signs, symbols and data.
- LO 2. Interpret technical drawing.
- LO 3 Apply free hand drawing.

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.

Lesson 5 : Practice Occupational Health and Safety Procedures

- LO 1. Identify hazards and risks.
- LO 2. Evaluate hazards and risks.
- LO 3. Control hazards and risks.

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 in:

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

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



How Do You Use This Module?

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

- Learning Outcomes
- Performance Standards
- Materials
- References
- 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?

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.

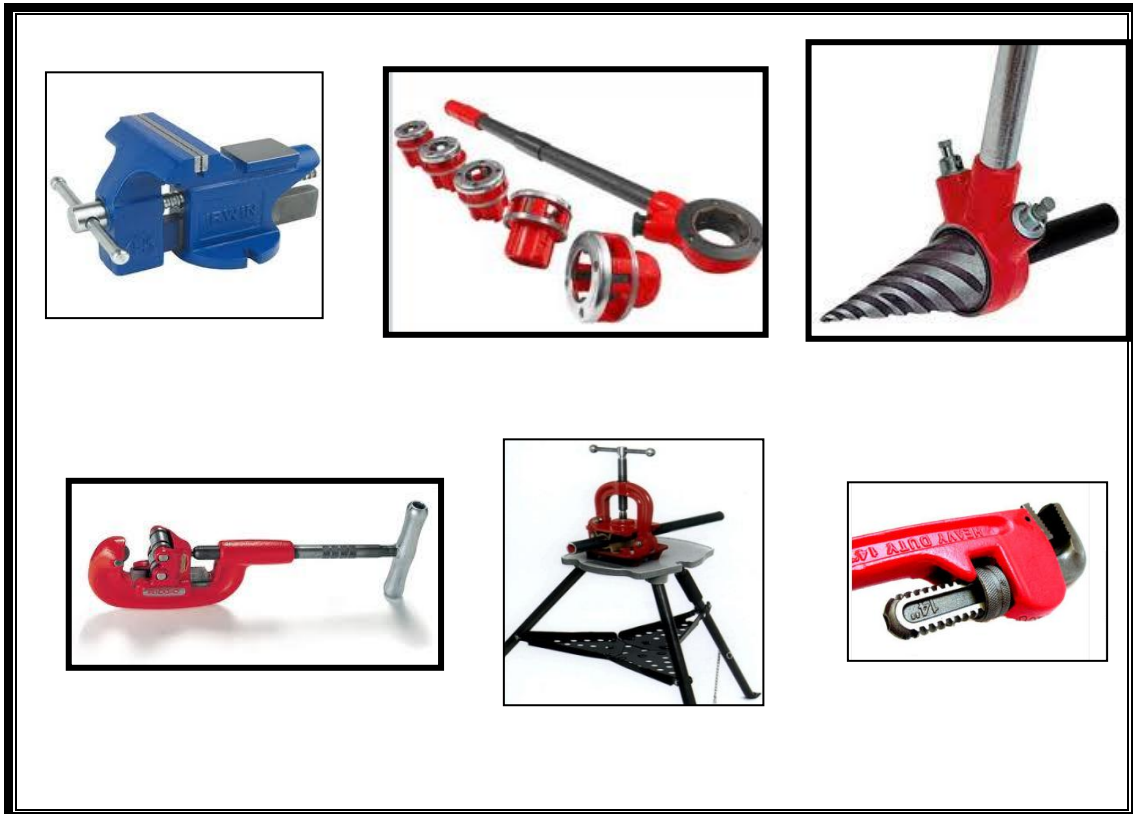
Each Lesson also provides you with references and definition of key terms for your guide. They can be of great help. Use them fully.



If you have questions, ask your teacher for assistance.

LESSON 1

Prepare Plumbing Materials and Tools



LEARNING OUTCOMES:

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

- LO 1. identify and select materials and tools;
- LO 2. request appropriate materials and tools;
- LO 3. receive and inspect materials and tools.



Definition of Terms

Pipe	is a long hollow cylinder used chiefly to convey fluid.
Material	is the stuff from which a thing is made of or consisting of matter.
Requisition form	is a form requesting materials and supplies needed for making a project
Specification	is the description involving measurements like volume, board feet, quality, trademark manufacturer etc.
Tools	is anything which is held by hands and assists a person to do manual work.

LEARNING OUTCOME 1

Identify and select materials and tools

PERFORMANCE STANDARDS

1. Tools and materials are identified per job requirements
2. Tools are classified according to their functions per job requirements.
3. Materials are classified according to their uses for specific construction project.
4. Tools and materials are selected per job requirement.



What Do You Already Know?

Pretest LO 1

Let us determine how much you already know about the use of plumbing tools. Take this test.

Direction: Identify the following materials and tools used in plumbing. Choose your answer from the given in the box.

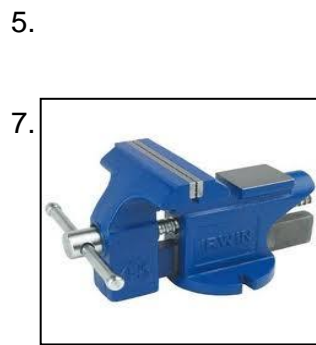
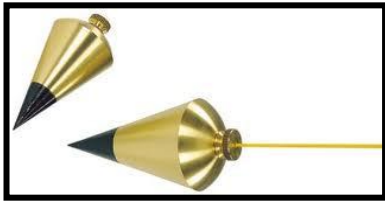
Steel Square	Hack Saw	Cross-Cut Saw	Pipe Cutter	Plumb Bob
Pipe Threader		Pipe Reamer	Spirit Level	Pipe Vice
Clamps		Bench Vise	Pipe Wrench	

1.



2.







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 the Self-check 1.1.

Information Sheet 1.1

Plumbing Materials and Tools

1. Plumbing Materials

- **Steel Pipe Characteristics**

Steel piping is designed for a long list of applications. Steel piping has gained popularity in the petroleum, oil, automobile, shipping and food industries because of its durability and versatility. Schools, hospitals and refineries also widely employ steel piping.

1. Facts



- Steel piping can be engineered to any height and strength and is easily modified on-site. There remains a variety of types of steel piping on the market. Common types of steel pipe include standard steel pipe, line steel pipe, structural steel pipe and plumbing tubes. Steel is ductile, bending rather than breaking in the presence of excessive stress. Steel will not morph or lose its strength as time passes. Also, steel is naturally resistant to rot.

Applications

- Line steel pipes are used to transport liquids and gases that are combustible. Standard steel pipes are used for transporting water, natural gas or steam. Structural steel pipes are often used for drainage piping. Plumbing tubes made of steel are used to move potable water or waterborne waste removal.

Properties

- Line steel pipes are galvanized, giving the piping corrosion-resistant properties. Standard steel pipes are fabricated to a diameter no greater than 16 inches, according to Steel Pipes & Tubing. Structural steel tubes are constructed into either square or circular shapes. Plumbing tubes are often fabricated thinner than other

types of steel pipes to allow for easier soldering.



Different Types of Pipes

PVC PIPE -refers to Poly Vinyl Chloride Plastic material. This is the most common pipe for plumbing system.

PE PIPE -refers to Polyethylene Plastic material intended for long span water system installation.

CI PIPE -is a heavy metal made of casting on molds to make fixtures. such as sink, tubs and lavatories, covered with a porcelain enamel coating.

GI PIPE -is a galvanized iron pipe which is better fitted for plumbing installation than steel pipe. It is constructed of rough iron, dipped in molten zinc and maybe identified by its dull grayishcolor

SOLVENT -is an adhesive material usually used externally.

TEFLON TAPE -is specifically used for attachment threaded pipe on fittings.

ABS CLEANER AND CEMENT -is an adhesive material used by a plumbean when working with ABS pipes.

FITTINGS -are made in different forms that are intended for plumbing joints and connections.

FAUCET -is a point of installation system where flow of water or gas could be manipulated.

MSS-refers to Manufacturer's Standardization Society.

NIPPLE -is a short length of pipe installed between couplings or other fittings.

ADAPTOR/ADAPTER-is fittings that joints two different types of pipes together, such as ABS to cast iron or threaded to non-threaded.

2. FITTINGS – are any pipe part used to join two sections of pipes.

Characteristics of Stainless Steel Pipe Fittings

Stainless steel pipe fittings is an alloy based on iron, which combines together the mechanical properties of steels and some specific features of corrosion resistance. These alloys are also liable to tarnish.

This means that they have the possibility to passivate, that means to get covered with an invisible layer of oxides that protects the underlying metal from corrosive attacks.

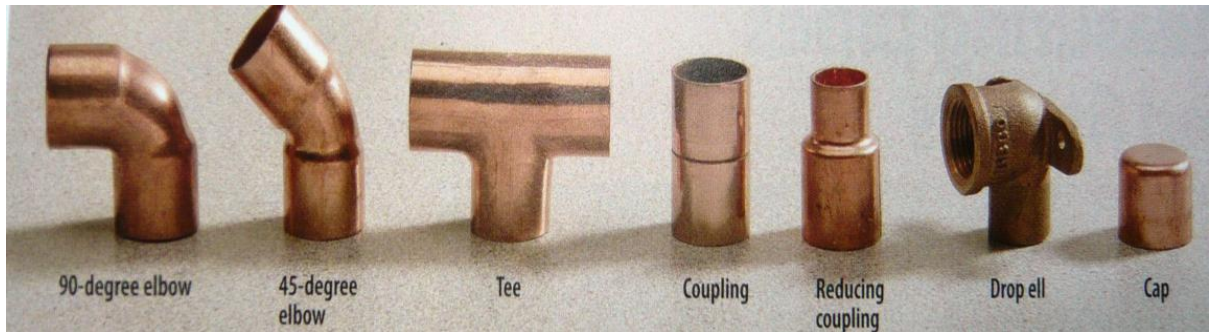
Stainless steel pipe fittings is the name given to a type of steel with high chromium contents that thanks to this feature does not rust when exposed to water and air. They are a very important class of steels, used in countless applications. In fact, nowadays both stainless steel pipe fittings furniture and construction machinery are very popular.

The discovery of this type of steel is due to Harry Brearly, who while was experimenting with various types of alloys for the reeds of guns, noticed that a type of steel with a certain percentage of chromium did not get rusted when exposed to the atmosphere. Later this property was explained by the passivation of chromium, which forms a very thin oxide film on the surface, continuous and stable. The following progresses in metallurgy between the forty and the sixty have extended their development and their applications. They are still refined and adapted to the demands of various industries such as oil/petrochemical, mining, energy, nuclear and food industries. Stainless steel pipe fittings is still refined and adapted to the demands of various industries like petroleum, petrochemical, mining, energy, nuclear, food and obviously building. A lot of machines are built with parts made of steel, from pipes to sheet to steel trolleys.

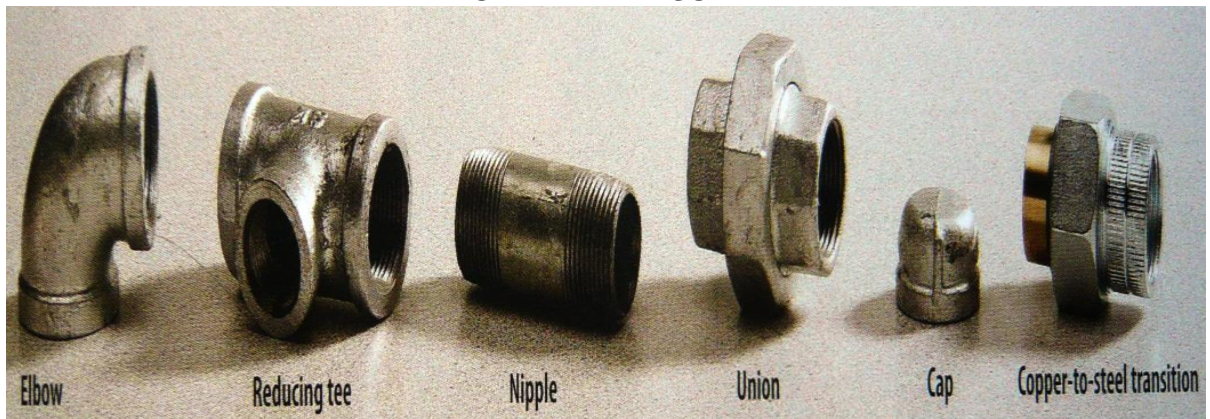


TYPES of FITTINGS

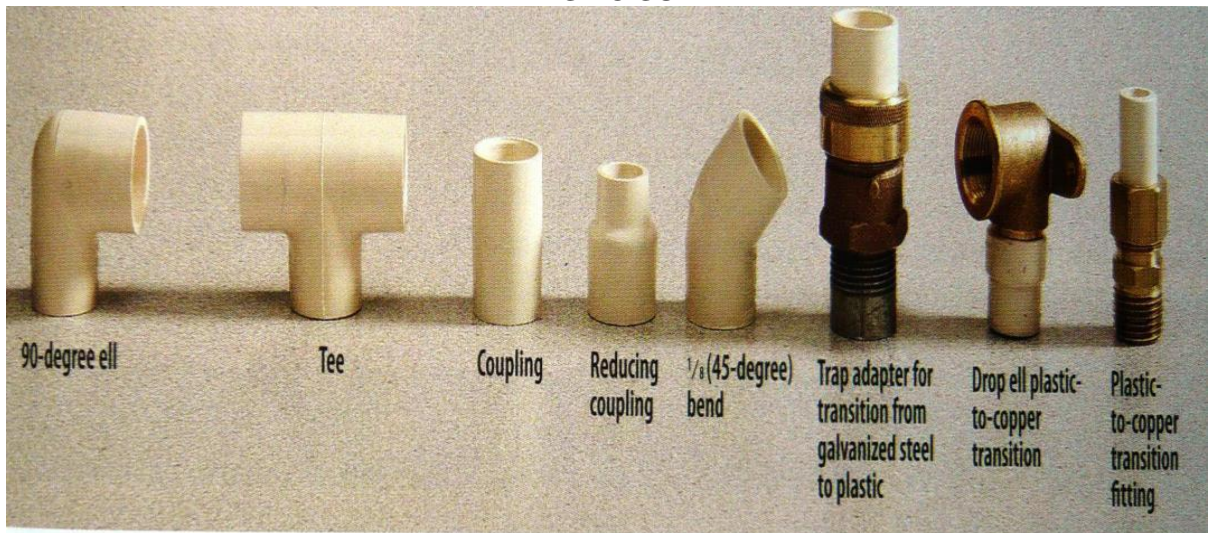
COPPER SUPPLY



GALVANIZED SUPPLY



PLASTIC SUPPLY



POLYETHYLENE (PE) AND SPIGOT FITTING

PE and PVC FITTINGS

High Quality Pipe Fittings



Tough and durable fittings for PE and PVC pipes. Fast and easy to install.

PVC Sanitary Fittings

- | | | | |
|--|--------------------------|--|--------------------------|
| | ELBOW 90 - 1/4 Bend (DH) | | ELBOW 90 - 1/4 Bend (SH) |
| | COUPLING | | ELBOW 45 - 1/8 Bend (DH) |
| | TEE | | P-TRAP WITH PLUG |
| | WYE | | TEE REDUCER |
| | WYE REDUCER | | BUSHING REDUCER |
| | | | CLEAN-OUT WITH PLUG |

PE Fittings

- | | | | |
|--|----------------------------|--|----------------------------|
| | STRAIGHT COUPLER | | EQUAL TEE |
| | MALE TEE | | FEMALE TEE |
| | MALE ADAPTOR | | FEMALE ADAPTOR |
| | COUPLING REDUCER | | TEE REDUCER |
| | EQUAL BEND | | END CAP |
| | MALE BEND | | FEMALE BEND |
| | REDUCER | | STUB END LONG COLLAR |
| | SINGLE OUTLET SADDLE CLAMP | | DOUBLE OUTLET SADDLE CLAMP |
| | REDUCING BUSH | | HEXAGON NIPPLE |
| | | | REDUCING NIPPLE |

*SOME ITEMS ARE FROM THIRD PARTIES

- **FIXTURES**

Plumbing Fixture

A **plumbing fixture** is an exchangeable device which can be connected to an existing plumbing system to deliver and drain away water but which is also configured to enable a particular use.

The most common plumbing fixtures are:

- Bathtubs
- Bidets
- Channel drains (also called trench drains)
- Drinking fountains
- Hose bibbs (connections for water hoses)
- Kitchen sinks
- Lavatories (also called bathroom sinks)
- Showers
- Tapware - an industry term for that sub-category of plumbing fixtures consisting of tap valves, also called water taps or faucets and their accessories, such as water spouts and shower heads.
- Terminal valves for dishwashers, ice makers, humidifiers, etc.
- Urinals
- Utility sinks
- Water closets- (known as toilets in the USA, loos, flush toilets or lavatories in Britain)

Outlets and drains

Each of these plumbing fixtures has one or more water outlets and a drain. In some cases, the drain has a device that can be manipulated to block the drain to fill the basin of the fixture. Each fixture also has a flood rim, or level at which water will begin to overflow. Most fixtures also have an overflow, which is a conduit for water to drain away, when the regular drain is plugged, before the water actually overflows at the flood rim level. However, water closets and showers (that are not in bathtubs) usually lack this feature because their drains normally cannot be stopped.



Each fixture usually has a characteristic means of connection. Normal plumbing practice is to install a valve on each water supply line before the fixture, and this is most commonly termed a stop or "service valve". The water supply to some fixtures is cold water only (such as water closets and urinals). Most fixtures also have a hot water supply. In some occasional cases, a sink may have both a potable (drinkable) and a non-potable water supply.

Traps and vents

This drain cover has a container underneath (which can be taken out for cleaning and revealing another container below) acting as a trap. Water inside the container forms a seal when the cover is in place. Positive air pressure will push the cover up, acting as an early warning device. The underside of the cover (centre image) is kept moist by condensation occurring and insects that go back up the drain pipe get stuck to the walls of the cover.



All plumbing fixtures have traps in their drains; these traps are either internal or external to the fixtures. Traps are pipes which curve down then back up; they 'trap' a small amount of water to create a water seal between the ambient air space and the inside of the drain system. This prevents sewer gas from entering buildings.

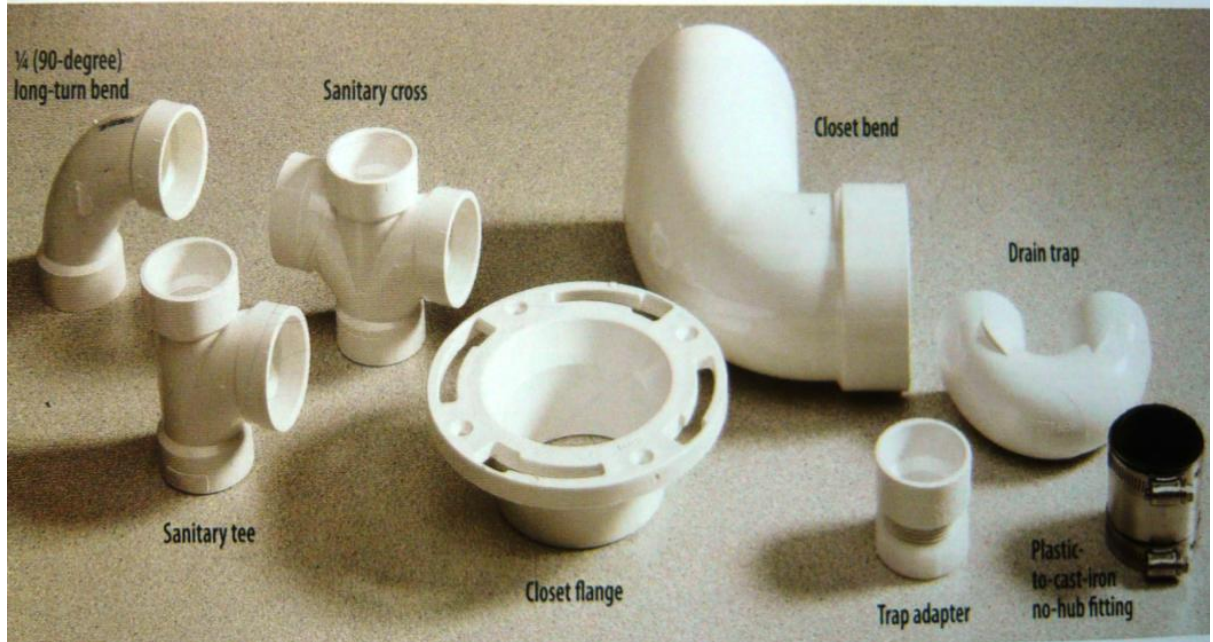
Most water closets, bidets, and many urinals have the trap integral with the fixture itself. The visible water surface in a toilet is the top of the trap's water seal.

Each fixture drain, with exceptions, must be vented so that negative air pressure in the drain cannot siphon the trap dry, to prevent positive air pressure in the sewer from forcing gases past the water seal, and to prevent explosive sewer gas buildup.

Drains The actual initial drain part in a lavatory or sink is termed a strainer. If there is a removable strainer device that fits into the fixed strainer, it is termed a strainer basket. The initial pipe that leads from the strainer to the trap is termed the tailpiece.

Floor-mounted water closets seal to the toilet flange of the drain pipe by means of a wax ring. These are traditionally made out of beeswax. However, their proper sealing depends on proper seating of the water closet, on a firm and secure base (floor), and on proper installation of the closet bolts which secure the closet to the flange, which is in turn supposed to be securely fastened to the floor.

PLASTIC DRAIN



PEX

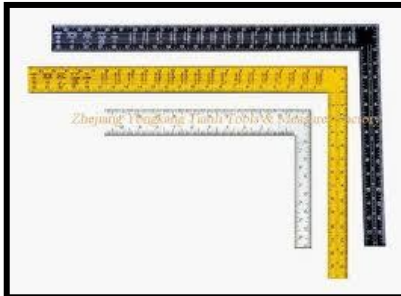


II. PLUMBING TOOLS

MEASURING TOOLS- is the activity of obtaining and comparing [physical quantities](#) of real-world [objects](#) and [events](#). Established standard objects and events are used as [units](#), and the process of measurement gives a number relating the item under study and the referenced unit of measurement.



**L-SQUARE/STEEL
SQUARE**



TRY SQUARE



PUSH-PULL RULE

CUTTING TOOLS- is any tool that is used to remove material from the workpiece by means of shear deformation. Cutting may be accomplished by single-point or multipoint tools. Single-point tools are used in turning, shaping, planing and similar operations, and remove material by means of one cutting edge. Milling and drilling tools are often multipoint tools. Grinding tools are also multipoint tools.



HACK SAW



**CROSS CUT
SAW**



PIPE REAMER



PIPE CUTTER



PIPE THREADER

BORING TOOLS-boring is the process of enlarging a hole that has already been drilled (or cast), by means of a [single-point cutting tool](#), for example as in boring a [cannon](#) barrel. Boring is used to achieve greater accuracy of the diameter of a hole, and can be used to cut a tapered hole.



HAMMER DRILL



ELECTRICAL DRILL



AUGER BRACE WITH BITS

TESTING TOOLS-used in finding out how well the finished work.



SPIRIT LEVEL



PLUMB BOB



HORSE LEVEL

DRIVING TOOLS-driving tools help hand tools and power tools work together, especially important for the variety of drilling tasks that get done in woodworking.



SLEDGER HAMMER



CLAW HAMMER



CROW BAR



DRILL PRESS



SCREW DRIVER

HOLDING TOOLS-Tool for holding firmly any material that has to be cut.



ADJUSTABLE WRENCH



CLAMP



BENCH VISE



PIPE VISE



ADJUSTABLE WRENCH



How Much Have You Learned?

Self-Check 1.1

A. Directions: Look at the Table below, from the list the appropriate plumbing materials and tools for each of the following activities.






1. Plastic Pipe	11. Pipe Reamer
2. Elbows	12. Threader
3. Fittings	13. L – Square
4. Wrench	14. Water hose
5. Floor drain	15. Auger Brace and Bits
6. Metal Pipes	16. Sledge hammer
7. Couplings	17. Screw driver
8. Faucet	18. Lavatory
9. Telephone shower	19. Cross-Cut Saw
10. Hack saw	20. Clamps

1. Cutting pipes - _____
2. Measuring the bend angle of pipes -

3. Threading pipes - _____
4. Testing the levelness of installed pipes -

5. Connecting two pipes - _____

B. Directions: according to classifications, identify the following plumbing tools.

1. 
2. 
3. 
4. 
5. 

C. Directions: List down the materials and tools required by the following task.

Write your answer on a separate answer sheet.

1. Repair of defective faucet.
2. Replacement of damaged gate valve.
3. Repair of fitting with leakage.
4. Installation of additional faucet.
5. Changing G.I. pipes with PVC pipes.

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

SELECTING MATERIALS AND TOOLS

Directions: Call your teacher and request him to check if you have executed the task based upon his observation.

1. While inside the workplace, your teacher will give you a job order or a particular work to do.
2. Based on the job order, identify all the materials and tools needed.
3. Classify the materials and tools according to their uses.
4. Let the teacher examine the list of the Tools and Materials if they conform to the job requirement.

LEARNING OUTCOME 2

Request appropriate Materials and Tools

PERFORMANCE STANDARDS

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



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 the Self-check 2.1.

Information Sheet 2.1

REQUISITION OF MATERIALS AND TOOLS

When making a request of materials and tools, the following forms should be accomplished:

A. Requisition Slip

Name of School: _____

Address: _____

**Plumbing Shop
Requisition Slip**

NAME OF PROJECT _____ DATE: _____

Purpose _____ Group: _____

Balance on Hand	Quantity	Materials and Description	Unit Price	Total

Requested by: _____

Student's Name

Foreman

Approved: _____

Shop Teacher

B. The following are the terminologies found in a requisition form:

1. Name of Project indicates the task in which the materials will be used.
Example: Repair of School Lavatory
2. Balance On Hand indicates the quantity and unit of materials still available in the stockroom
3. Requisition Quantity
and Unit is a number and units of materials requested
4. Unit write the unit of measuring quantity
5. Material/ Description write the name of material and description or Specification (e.g. PVC Pipe 12mm X 3m)
6. Unit Price is a price of material per piece or per unit
7. Total is a unit price X Quantity (ex. 3 pc x P30 = P90.00)
8. Barrower is a name and signature of the person requesting tools and materials.
9. Tool Keeper is the one who is responsible to take care the of the tool room
10. Job Order is workings sheet that server as a complete guide of the student to a certain task to be done.
11. Safety Officer is the person in-charge to monitor the safety conditioning of the workplace.
12. Material Officer is a person responsible in the release and retrieve of excess materials.
13. Lead man is a person that leads the group in the specific task.
14. Foreman is a person responsible in the overall operation of the worker in the workplace.

B. Borrower's Slip

Plumbing Shop

Borrower's Slip

Date: _____

Item No.	No. of Pc	Name and Description of Tools	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Approved by:

Tool Keeper

Borrower

Foreman

Shop Teacher

REQUISITION PROCEDURE

In making a request for materials and tools needed, the following Standard Operating Procedure (SOP) should be followed:

1. List down the materials and tools needed as per job requirement.
2. Check for the availability of the needed materials and tools in the stockroom.
3. Accomplish a requisition form
4. Let the shop teacher check the requisition form.
5. Submit the requisition form to the material officer
6. Unavailable requested materials and tools should be substituted without sacrificing the cost and quality of work
7. The material officer will prepare the requested material for issuance to the student.



How Much Have You Learned?

Self-Check 2.1

- I. Directions: Fill in the blanks with appropriate term in filling out a requisition form. Write your answer on a separate answer sheet. Choose from the choices below:

- a. Name of project
- b. Requisition quantity
- c. Balance on hand
- d. Material description
- e. Borrower

1. The specification of materials is requested for_____.
2. The task in which the materials and tools will be used is_____.
3. The price of the material per piece or per unit is_____.
4. The quantity and unit of materials still available in the stockroom is _____.
5. Name and signature of the person making the request_____.

II. Directions: Arrange the following steps in proper order. Write the letter of the correct sequence on a separate sheet of paper.

- a. Check for the availability of materials and tools needed in the stockroom
- b. Submit the accomplished requisition form to the supply officer
- c. Accomplish a requisition form
- d. Prepare a list of the materials and tools needed as per job requirements
- e. Select substitute materials and tools if the requested ones are not available
- f. Let the shop teacher check the requisition form.
- g. List down the materials needed as per job requirement

Proper order in making a request

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

LEARNING OUTCOME 3

Receive and inspect materials and tools

PERFORMANCE STANDARDS

- Received and inspected materials and tools as per quantity and specification are 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.



What Do You Already Know?

Pretest LO 3

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

Directions: Encircle the best answer from the choices given.

1. What is the importance of material management?
 - A. It provides the best service to the clientele
 - B. It maximizes efficiency
 - C. It helps in monitoring and managing inventories
 - D. All of the above.
2. What happens when the employees are not informed of the Receiving Procedure?
 - A. Productivity and efficiency of the company's employees are affected.
 - B. Wastage of resources is evident.
 - C. Misunderstanding among and between employees occurs.
 - D. All of the above.
3. Which ensures correctness of deliveries or performance of services?
 - A. Requisition procedure
 - B. Receiving procedure
 - C. Inspection procedure
 - D. any of the above

4. Which procedure generally finds out inconsistency in the required specifications of materials, tools, and equipment?

A. Requisition procedure	C. Inspection procedure
B. Receiving procedure	D. Handling procedure

5. Which shows proper carrying and safekeeping of items?

A. Requisition procedure	C. Inspection procedure
B. Receiving procedure	D. Handling procedure



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 the Self-check 3.1.

Information Sheet 3.1

PROCEDURE IN RECEIVING MATERIALS AND TOOLS

After you have made a request, you are now ready to receive the needed materials and tools. A standard operating procedure (SOP) must be followed. In connection to this, the following are safety measures and proper handling of materials and tools:

1. Check if the materials and tools are complete in terms of quantity or unit.
2. Check if the materials and tools are of correct specifications.
3. See to it that the materials and tools are of good working conditions.
4. Check the tools with accessories. See to it that nothing is missing.
5. Check the materials for damages or defects.
6. If any of the following is found, report/ return immediately to the material officer.
 - Incomplete number of materials and tools
 - Materials and tools which are not in accordance with specifications
 - Tools with missing accessories (e.g. faucet without handle or gasket)
 - Materials and tools with damages or defects
7. Get replacements for those returned materials or tools.
8. Sign an issue receipt or borrower's slip. It signifies that you have received the materials and tools issued in good conditions.
9. Take the issued materials and tools to the workplace.

Material Management

Effective material management is very essential in so many ways for the company or office: First, it provides the best service to the clientele; second, it maximizes efficiency; and, third, it helps in monitoring and managing inventories.

Receiving Procedure

Procedure for receiving requisitions varies in every office or school shop for certain purposes. Offices make it a point that everything is in proper order and perspective to ensure effectiveness and efficiency. However, it is a must that everybody in the company especially the concerned employees are well-acquainted of the process to avoid or at least minimize waste of resources which is very significant to the company's success.

Below, are samples of Receiving Procedure:

RECEIVING GUIDELINES MATRIX (WEB VERSION)

Merchandise is...	Central Receiving Department / Fiscal Office	Requisitioning Department	Accounts Payable
-------------------	----------------------------------------------	---------------------------	------------------

Purpose: The purpose of this matrix is to provide guidance to those personnel involved with receiving or accepting goods and materials on behalf of the Maricopa Community College District. Best business practices support that receiving be completed through a centralized function and location. Such guidance helps ensure that the following "Key Control Objectives" and "Process Attributes" are achieved.

- Goods are purchased only with proper authorization.
 - Goods compared to purchase orders or other purchase authorization before acceptance.
 - Unmatched receivers investigated; Unauthorized items identified for return to vendor.
 - Receipts under blanket purchase orders monitored; Quantities exceeding authorized total returned to vendor.
- Goods received are recorded correctly as to account, amount, and period.
 - Goods counted, inspected and compared to packing slips before acceptance.
 - Receiving reports issued by receiving/inspection department in pre-numbered order.
 - Receiving documentation, purchase order, and invoice matched before recording liability.

This matrix serves to provide guidelines in which the order of steps completed may vary depending on college and circumstances.

Goods POs/LPOs – Non-Capital

<ul style="list-style-type: none"> • Non-capital and delivered to Central Receiving Department. 	<ul style="list-style-type: none"> • Inspect for proper addressing before acceptance. • Inspect for proper number of packages agrees to delivery document before acceptance. • Inspect for obvious damage before acceptance. • Agree supporting documentation (packing slip/invoice) to existing PO/LPO. • Receive merchandise on-line in CFS. • Deliver merchandise to Requisitioning Department. Obtain signature from Requisitioning Department on original supporting documentation (packing slip/invoice) or Delivery Log Sheet. • Make copy(ies) of signed packing slip/invoice (Central Receiving Department & Requisitioning Department). • If invoice enclosed with shipment, forward original to Accounts Payable. Maintain original packing slip with hard-copy PO/LPO. 	<ul style="list-style-type: none"> • Sign original supporting documentation (packing slip/invoice) or Delivery Log Sheet indicating physical receipt of goods within department. • Inspect merchandise for quality and concealed damage. • Notify vendor and/or Central Receiving Department, as appropriate, of concealed damage, overshipments, or merchandise received but not ordered. 	<ul style="list-style-type: none"> • If invoice received directly from vendor, it is entered into CFS and maintained in A/P Department awaiting on-line receiving. • Pay vendor upon 3-way match of on-line PO, Invoice, and on-line Receiver.
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Fig.1. Receiving Procedure in Matrix Form

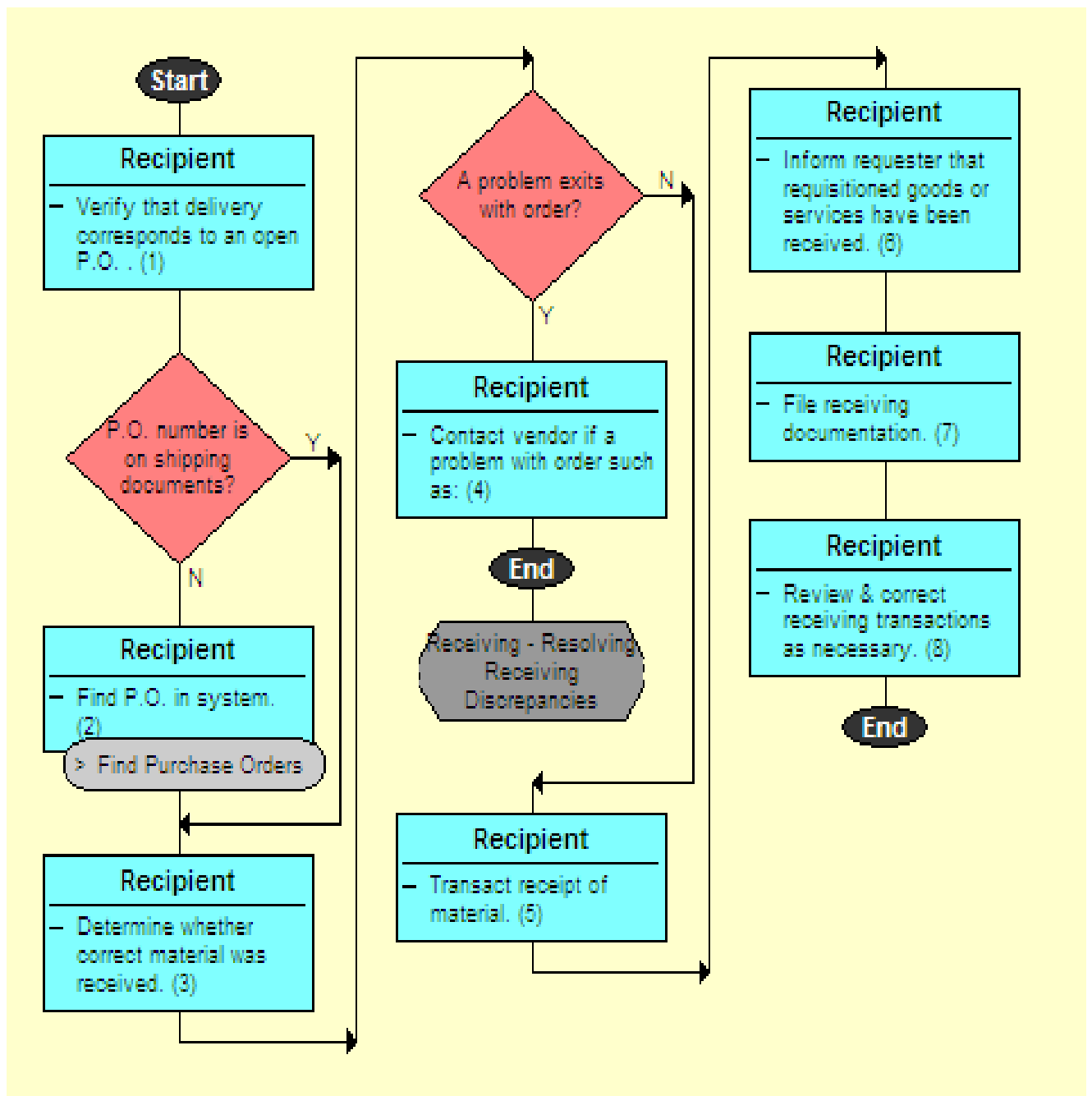


Fig. 2. Receiving Procedure in Schematic Diagram

Quality Inspection and Procedure

Delivered or issued items out of requisition should be properly inspected for accuracy in terms of quality, specifications, quantity, and functionality or workability. The act which involves monitoring, observing or testing, usually involving product sampling, to insure compliance with the requirements is known as quality inspection. It includes activities such as collecting data from the item or items to ensure quality and preciseness.

Once quality inspection has been done, the receiver signs a paper or form to attest to the completeness and compliance with the requisition; otherwise, he is obliged

to make a report of his inspection findings to persons or authorities concerned for appropriate action.

Materials Handling

Materials handling operations are carried out in most offices or plants. Each handling task poses unique demands on the worker. However, work places can help workers to perform these tasks safely and easily by implementing and upholding proper policies and procedures. For Industrial plants, regulations under Industrial Establishments (O. Reg. 851/90) made under the Occupational Health and Safety Act should be properly observed.

- Hazards

To assess the hazards of manual material handling operations, consider the load, the task, the environment in which the task is performed, and the operator. When these factors interact with each other, they can create hazards that result in injuries. A load may be hazardous because of:

- Weight
- Size
- shape (making it awkward to handle)
- coupling (type of grip on the load)
- slippery or damaged surfaces
- absent or inappropriate handles, and
- imbalance (i.e., changing centre of gravity)

The task or method of handling may be hazardous when it involves:

- lifting or lowering
 - repetitively
 - quickly
 - for extended periods of time
 - while seated or kneeling
 - immediately after prolonged flexion
 - shortly after a period of rest
- an inability to get close to the load
- moving the load over large distances
- accuracy and precision required because of
 - fragile loads, or
 - specific unloading locations
- materials positioned too low or too high
- hazardous movements or postures (e.g., twisting, extended bending and reaching)
- multiple handling requirements (e.g., lifting, carrying, unloading)

- Control Measures

The best control measure is to eliminate the need for workers to perform manual handling tasks. Since this is not always possible, design manual handling tasks so that they are within the workers' capabilities. Considerations include the load itself, the design of the workstation and work practices. Providing mechanical handling devices or aids can often eliminate the task itself or ease the demands on the worker.

- Training

Traditional training has focused on proper lifting methods and safe work procedures. More recently, workplaces have introduced fitness and back education approaches. In combination with job and workplace design changes, these approaches are effective in preventing accidents and injuries. On the job demonstrations and practice sessions are the best methods of training. Cover basic manual materials handling procedures, and the proper use of mechanical aids and techniques. Regularly reinforce the proper techniques to ensure their continued use. The objectives of material handling training are to teach the worker:

1. How to identify hazardous loads or handling tasks
2. The proper selection and use of mechanical handling aids
3. Safe postures and manual lifting techniques to minimize strain
4. Safe lifting techniques



How Much Have You Learned?

Self-Check 3.1

Directions: This part checks whether you have learned the required competencies for this particular module. Simply encircle the best answer from the choices given.

1. What is the importance of material management?
 - A. It provides the best service to the clientele.
 - B. It maximizes efficiency.
 - C. It helps in monitoring and managing inventories.
 - D. All of the above.
2. What happens when the employees are not informed of the Receiving Procedure?
 - A. Productivity and efficiency of the company's employees are affected.
 - B. Wastage of resources is evident.
 - C. Misunderstanding among and between employees occurs.
 - D. All of the above
3. Which ensures correctness of deliveries or performance of services?
 - A. Requisition procedure
 - B. Receiving procedure
 - C. Inspection procedure
 - D. Any of the above
4. Which procedure that generally finds out inconsistency in the required specifications of materials, tools, and equipment?
 - A. Requisition procedure
 - B. Receiving procedure
 - C. Inspection procedure
 - D. Handling procedure
5. Which shows proper carrying and safekeeping of items?
 - A. Requisition procedure
 - B. Receiving Procedure
 - C. Inspection procedure
 - D. Handling procedure

Refer to the Answer Key. What is your score?



How Do You Apply What You Have Learned?

Directions: Call your teacher and request him to check if you have executed the task based upon his observation.

Show that you learned something by doing this activity

Activity Sheet 3.1

	DONE	NOT DONE	UNCERTAIN
1. Materials are identified and listed based on job requirements.	_____	_____	_____
2. Quantity and specifications of materials and tools issued are checked.	_____	_____	_____
3. Materials and tools are checked for damages or defects.	_____	_____	_____
4. Defective materials and tools are returned and replaced.	_____	_____	_____
5. Materials and tools are properly issued.	_____	_____	_____

RECEIVING MATERIALS AND TOOLS

Directions: Using the materials to be used in requesting materials and tools do the following task.

Procedure:

1. Secure a job order from your teacher.
2. Make a list of materials and tools needed based on the job order.
3. Check for the availability of materials and tools in the stockroom.
4. Accomplish and submit a requisition form to the supply officer.
5. Accomplish the barrower slip and submit to the tool keeper.
6. Wait till the supply officer has prepared the needed materials and tools.
7. Receive the materials and tools by following the procedure discussed in Information Sheet #3.1



How Do You Extend Your Learning?

Show that you learned something by doing this activity

Activity Sheet 3.1

I. Directions: Call your teacher and request him to check if you have executed the task based upon his observation.

- _____ 1. Materials and tools are issued only after proper requisition process.
- _____ 2. Materials and tools should be checked before receiving.
- _____ 3. When the materials or tools are found to be defective, better ignore it.
- _____ 4. Sign an issue receipt to indicate that the materials and tools received are of good working conditions.
- _____ 5. To be able to work efficiently, the received materials and tools should be stored to a place far from your work area.

II. Directions: Call your teacher and request him to check if you have executed the task based upon his observation.

	DONE	NOT DONE	UNCERTAIN
1. Materials are identified and listed based on job requirements.	_____	_____	_____
2. Quantity and specifications of materials and tools issued are checked.	_____	_____	_____
3. Materials and tools are checked for damages or defects.	_____	_____	_____
4. Defective materials and tools are returned and replaced.	_____	_____	_____
5. Materials and tools are properly issued.	_____	_____	_____



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 2

Perform Mensurations and Calculations



LEARNING OUTCOMES:

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

- LO 1. select measuring instrument; and
- LO 2. carry out mensurations and calculations.



Definition of Terms

Accuracy	-means correctness, exactness, precision.
Area	-is any of space especially of ground or surface that is distinguishable from its surrounding in appearance or in certain distinctive features
Clearance	- is the space, allowance or gap between working part of an object.
English System	-is the old way of measurement that replaced the metric system.
Height	-may be used with reference whether high or low by a standard of companion.
Instrument	- is a device that measures or controls something.
Length	- refers to how long an object is
Measurement-	refers to the size, length, quantity or rate of something that has been measured.
Mensurations	-the calculation of geometric quantities such as length, area and volume from dimensions and angles that are already known.
Metric System	-is the System of measurement which uses 10 as its multiple in all its conversion is it in distance, volume, weight etc.
PPE	- is an acronym that stands for Personal Protective Equipment
Pressure	- is the force acting on a surface divided by the area over which it acts.
Volume	-refers to the magnitude size intent, dimension, areas, and bulk,
mass	the total amount of something.
Weight	-refers to the total quality of heaviness and things determined by their mass or control acts efforts to lift or move them.

LEARNING OUTCOME 1

Select measuring instrument

PERFORMANCE STANDARDS

- Accurate measurements are obtained according to job requirements.
- Identified and converted systems of measurement are according to job requirements.
- Measured work pieces are according to job requirements.



What Do You Already Know?

Pretest LO 1

Let us determine how much you already know about perform estimation. Take this test.

Measuring Instruments in Plumbing

Matching Type: Match the definition in Column A with the term Column B.

COLUMN A	COLUMN B
1. A tool used to measure the outside diameter of a pipe.	a. Outside Caliper
2. A tool which is made up of steel having divisions in metric system used for layout.	b. L-Square
3. A measuring tools used to measure the inside diameters or width of pipe and slots.	c. Pull Push Rule
4. A tool intended to measure the angle, if necessary.	d. Try Square
5. A tool used to measure the length of a pipe.	e. Inside Caliper



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 the Self-check 1.1.

Information Sheet 1.1

Measuring Instruments

Measuring Tools

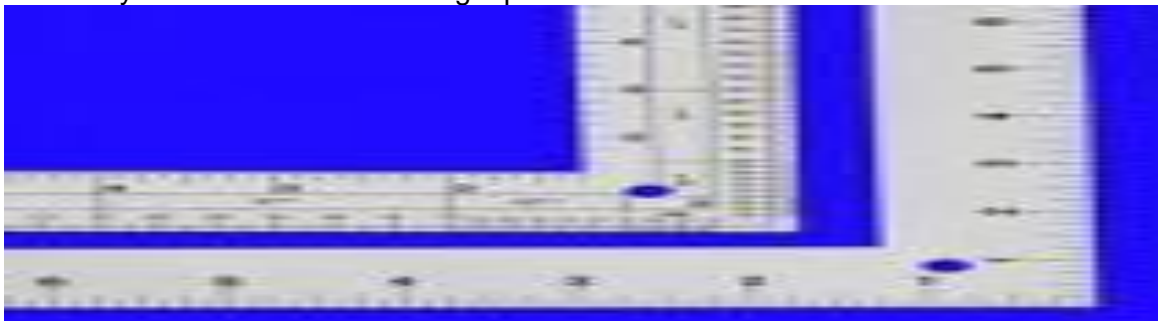
Inside Caliper is used to measure the internal size of an object.



Outside Caliper is used to measure the external size of an object



Steel Square is a tool that carpenters and other tradesman use consisting of a large arm and a smaller arm which meet at an angle 90° . Today the steel square is more commonly referred to as the framing square.



TRY SQUARE is a wood working or a metal working tool used for marking/measuring a piece of wood. It is primarily used to measure the accuracy of right angle (90° degrees) tried on any surface so as to check its straightness or correspondence to an adjoining surface.



PULL PUSH RULE (Tape Measure) is a flexible tape measure which is available in lengths up to 50 feet. Other tapes that are 12 to 25 feet are usually considered adequate. Most tapes have an automatic power return that is useful but not necessary.



Proper Handling of Measuring Instruments

How to Handle Measuring Tool

Each measuring tool has its specific way of handling. This must be followed by every student user to maintain its usefulness. Listed below are some of the measuring tools, there are also safety measures to be observed in handling each tool.

Measuring Tools

Inside Caliper is adjusted by rotating the screw to measure holes and diameters



Avoid using tip of the inside caliper to open the cover of any can. Avoid dropping it to maintain its accuracy in taking measurements.

Outside Caliper is a tool used to measure the external size of an object



Outside Caliper is a tool used to measure the external size of an object

Steel Square is a tool that a carpenter and other tradesman use. It consists of a large arm and a smaller arm which meet at an angle of 90°. Today the steel square is more commonly referred to as the framing square.



Hold the tool firmly and cautiously. See to it that it won't drop. It has a sharp pointed end and dangerous.

TRY SQUARE is a wood working or a metal working tool used for marking/measuring a piece of wood. It is primarily used to measure the accuracy of right angle (90° degrees) tried on any surface so as to check its straightness or correspondence to an adjoining surface.



Hold the try-square properly to maintain its straight edges which are used to get the desired angle. Don't use it for other purposes. Put it in its proper place.

PULL PUSH RULE (Tape Measure) is a flexible tape measure available in lengths up to 50 feet. Other tapes that are 12 to 25 feet are usually considered adequate. Most tapes have an automatic power return that is useful but not necessary.



Hold the tip of the pull push rule when removing it from its housing. Put it slowly to avoid cut from the steel tape.



How Much Have You Learned?

Self-Check 1.1

Measuring Instruments in Plumbing

I. **Matching Type:** Match the definition in Column A with the term Column B.

COLUMN A	COLUMN B
1. A tool used to measure the outside diameter of a pipe.	a. Outside Caliper
2. A tool which is made up of steel having divisions in metric system used for layout.	b. L-Square
3. A measuring tools used to measure the inside diameters or width of pipe and slots.	c. Pull Push Rule
4. A tool intended to measure the angle, if necessary.	d. Try Square
5. A tool used to measure the length of a pipe.	e. Inside Caliper

After this activity proceed to next page please.

Competent _____ Not Competent _____

Students Name: _____ Date: _____
Teacher's Name: _____ Date: _____

II. Directions: On a blank sheet. Write T if the statement is true and F if the statement is false.

A.

- _____ 1. The steel tape in the housing of pull push rule should be avoided.
- _____ 2. It is safe to bend a try square.
- _____ 3. Any user can keep the tools at any place.
- _____ 4. Holding the outside caliper tightly make difficult adjustments.
- _____ 5. To get the desired data measuring tools should be handled properly.

B. Essay

Directions: Explain how the following tools are handled properly.

1. Pull push rule
2. Try square
3. Frame square
4. Outside caliper
5. Inside caliper

Refer to the Answer Key. What is your score?

LEARNING OUTCOME 2

Carry out mensurations and calculations

PERFORMANCE STANDARDS

- Object or component to be measured are identified, classified and interpreted according to the appropriate regular geometric shape.
- Measuring tools are selected/identified as per object to be measured or job requirements.
- Correct specifications are obtained from relevant sources.
- Measuring instruments are selected according to job requirements.
- Alternative measuring tools are used without sacrificing cost and quality of work.
- Measurements are obtained according to job requirements.



What Do You Already Know?

Pretest LO 2

Let us determine how much you already know about calculation. Take this test.

Direction: Convert the following measurements as required in the given.

- 1). 64 cm - ----- inches
- 2). 59 yards - ----- feet
- 3). 95.5 dm - ----- meter
- 4). 19 inches - ----- centimetre
- 5). 47 feet - ----- inches
- 6). 4 m - -----cm
- 7). 9 yards - ----- feet
- 8). 5.5 dm - ----- meter
- 9). 9meters - ----- centimetre
- 10). 7 feet - ----- inches

1 inch	= 2.54 cm
1 cm	= 0.3937 inch
1 foot	= 12 inches
1 inch	= 0.08333 foot
1 foot	= 0.333 yard
1 yard	= 3 feet
1 foot	= 0.30481 meter
1 meter	= 3.2809 feet
1 yard	= 36 inches
1 yard	= 91.44 centimeters
1 centimeter	= 0.9144 meter

**□ METRIC CONVERSION
IN TERMS OF SQ. MEASURE**

1 sq. in.	= 6.4516 sq. cm.
1 sq. cm.	= 0.15500 sq. ft.
1 sq. ft.	= 144 sq. ft.
1 sq. in.	= 0.0094 sq. ft.
1 sq. ft.	= 929.03 sq. cm.
1 sq. cm.	= 0.00180 sq. ft.
1 sq. ft.	= 0.092903 sq. m.
1 sq. m.	= 10.764 sq. ft.
1 sq. yd	= 9 sq. ft.
1 sq. ft.	= 0.1111 sq. yd.
1 sq. yd	= 0.83612 sq. m.
1 sq. m.	= 1.196 sq. yd.
640 acres	= 1 sq. mile
30-1/4 sq. yd.	= 1 sq. pole
40 sq. pole	= 1 rod
1 rod	= 1 acre

□ AREA

Sq. Inches	Sq.	Centimeters
0.1550	1	6.4515
0.3100	2	12.9030
0.4650	3	19.3545
0.6200	4	25.8060
0.7750	5	32.2575
0.9300	6	38.7090
1.0850	7	45.1605
1.2400	8	51.6120
1.3950	9	58.0635

Sq. Feet		Sq. Meters
10.7638	1	0.0930
21.5276	2	0.1860
32.2914	3	0.2790
43.0552	4	0.3720
53.8190	5	0.4650
64.5828	6	0.5580
75.3466	7	0.6510
86.1104	8	0.7440
96.8742	9	0.8370

**□ METRIC CONVERSION
IN TERMS OF VOLUME**

1 cu. in	= 0.00051787 cu. ft.
1 cu. ft.	= 1728 cu. inches
1 cu. in.	= 0.004329 gallons
1 gallon	= 231 cu. inches
1 cu. in.	= 16.93 cu. m.
1 cu. cm.	= 0.06102 cu. in.
1 cu. in	= 0.00001639 cu. m.
1 cu. in	= 61023 cu. m.
1 cu. ft.	= 1728 cu. inches
1 cu. in	= 0.0005787 cu. ft.
1 cu. ft.	= 7481 gallons
1 gallon	= 0.1337 cu. ft.
1 cu. ft.	= 0.0283 cu. m.
1 cu. m.	= 35.31 cu. ft.
1 cu. ft.	= 28.32 liters
1 liter	= 0.03531 cu. ft.
1 cu. yd	= 27 cu. ft.
1 cu. ft.	= 0.300873 cu. yd
1 pint	= 0.4732 liters
1 liter	= 2.11327 pints
1 quart	= 2 pints
1 pint	= 0.50 quarts
1 quart	= 0.25 gallons
1 gallon	= 4 quarts
1 quart	= 57.75 cu. inches
1 cu. in	= 0.17316 quarts
1 quart	= 0.03342 cu. ft.
1 cu. ft.	= 29.9222 quarts
1 quart	= 0.9464 liter
1 liter	= 1.057 quarts
1 gallon	= 231 cu. inches
1 cu. in.	= 0.004329 gallons
1 gallon	= 3.78 liters
1 liter	= 0.2642 gallon
1 kiloliter	= 1,000 liters
	= 1.308 cu. Yards
	= 264.18 gallons
1 hectoliter	= 100 liters
	= 2.838 bushels
	= 26.418 gallons

Sq. Yards		Sq. Meters	1 liter = 0.908 quart or 1.057 quarts
1.1960	1	0.8361	1 centiliter = 0.01 liter
2.3920	2	1.6723	= 0.0610 cu. Inch
3.5880	3	2.5084	= 338 ft. ounce
4.7840	4	3.3445	1 milliliter = 0.001 liter
5.9800	5	4.1806	= 0.061 cu. inch
7.1760	6	5.0168	= .271 ft. dram
8.3720	7	5.8529	1000 cu. millimeters = 1 cu. centimeter
9.5680	8	6.6890	1000 cu. centimeters = 1 cu. decimeter
10.7640	9	7.5252	1000 cu. decimeters = 1 cu. meter
			728 cu. inches = 1 cu. foot
			27 cu. feet = 1 cu. yard
			128 cu. ft. = 1 core of wd
			24-1/4 cu. ft. = 1 ph of stone

Cubic Inches	Cubic Centimeters		OUNCES TO POUNDS
0.0610	1	16.3871	2.2046 1 0.4536
0.1220	2	32.7742	4.4092 2 0.9072
0.1830	3	49.1613	6.6139 3 1.3608
0.2440	4	65.5484	8.8185 4 1.8144
0.3050	5	81.9355	11.0231 5 2.2680
0.3660	6	98.3226	13.2277 6 2.7215
0.4270	7	114.7097	15.4323 7 3.1751
0.4880	8	131.0968	17.6370 8 3.6287
0.5490	9	147.4839	19.8416 9 4.0823
Cubic Feet	Cubic Meters		TROY (WEIGHT)
35.3145	1	0.0283	24 Grains = 1 Penny-Weight
70.6289	2	0.0566	12 Ounces = 1 Ounce Weight
105.9434	3	0.0850	12 Ounces = 1 Pound
141.2578	4	0.1133	AVOIRDUPOIS (WEIGHT)
176.5723	5	0.1416	16 Drams = 1 Ounce
211.8867	6	0.1699	16 Ounces = 1 Pound
247.2042	7	0.1982	100 Pounds = 1 Short Hundred Weight
282.5156	8	0.2266	112 Pounds = 1 Long Hundred Weight
317.8301	9	0.2550	20 Hundred = 1 Ton Weight
WEIGHT CONVERSION IN METRIC			APOTHECARIES (WEIGHT)
1 Kilogram = 100 Grams			20 Grains = 1 Scruple
= 2.205 Pounds			3 Scruples = 1 Dram
1 Hectogram = 10 Grams			8 Drams = 1 Ounce
= 3.527 Ounces			12 Ounces = 1 Ton Weight
1 Gram = 0.035 Ounce			LIQUID MEASUREMENT
1 Centigram = 0.01 Gram			Pint to Liters
= .154 Grain (Troy)			2.1134 1 0.4732
1 Milligram = 0.001 Gram (gr.)			4.2268 2 0.9464
= 0.015 Grain (Troy)			6.3402 3 1.4196
1 Ounce = 28.35 Grams			
1 Gram = 0.03537 Ounce (oz.)			
1 Ounce = 0.2835 Kilogram (kg.)			

1 Kilogram	= 35.274 Ounces.	8.4536	4	1.8928
1 Pound	= 16 Ounces	10.5670	5	2.3660
1 Ounce	= 0.0625 Pounds	12.6804	6	2.8392
1 Pound	= 453.6 Grams	14.7938	7	3.3124
1 Gram	= 0.002205 Pounds	16.9072	8	3.7856
1 Pound	= .4536 Joules Gram	19.0206	9	4.2588
OUNCES TO POUNDS				
0.03573	1	28.3495		
0.0705	2	56.6990		
0.1058	3	85.0486		
0.1429	4	113.3980		
0.1787	5	141.7475		
0.2144	6	170.0970		
0.2501	7	198.4465		
0.2858	8	226.7960		
0.3216	9	255.1455		

IDENTIFY MEASURING TOOL AND INSTRUMENT IN MEASURING OBJECTS

BASIC MEASURING TOOLS

Graduations on a Rule

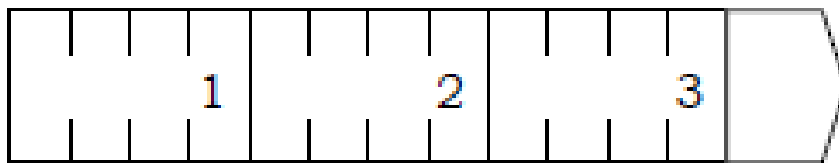
INCHES



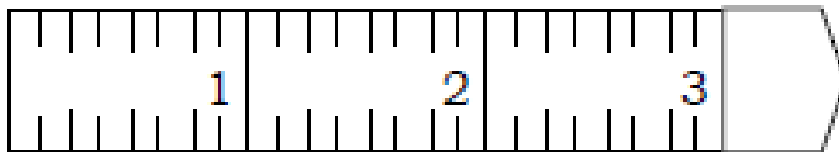
HALVES



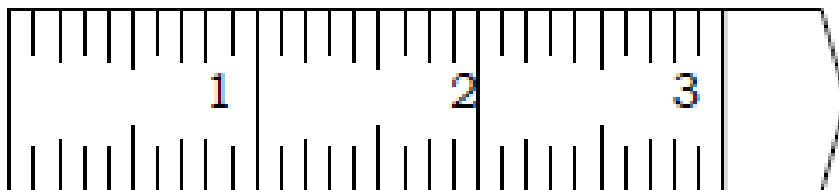
QUARTERS



EIGHTHS



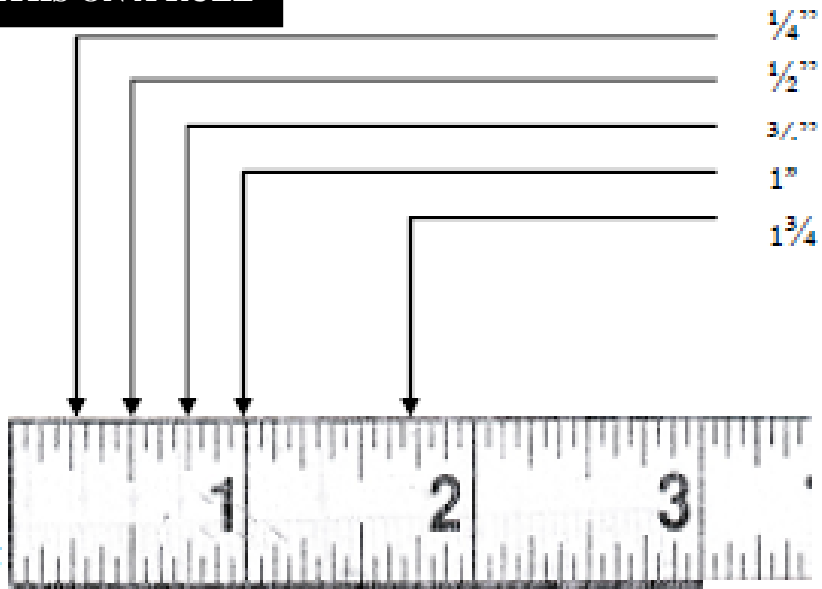
SIXTEENTH



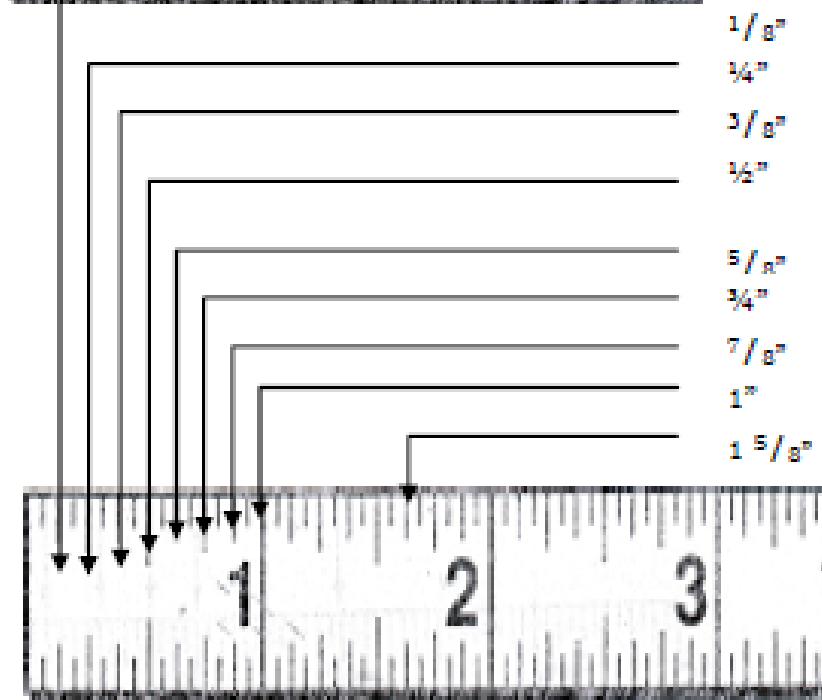
THIRTY-SECONDS



READING FOURTHS ON A RULE



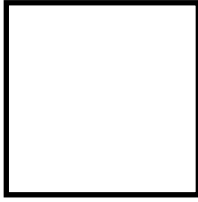
READING EIGHTHS



BASIC TYPES OF OBJECTS ON ITS REGULAR GEOMETRIC SHAPE

Types of Geometric Figures

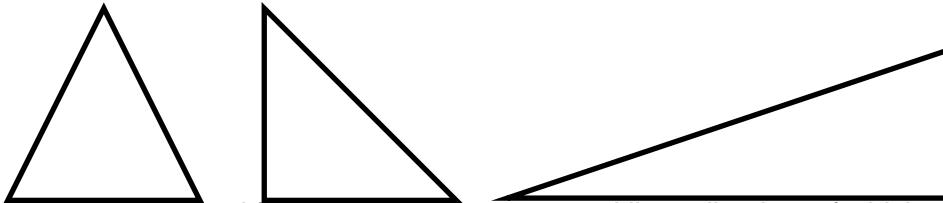
- a. Square - Figure having four sides of equal length and four right angles



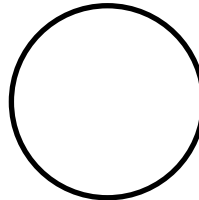
- b. Rectangle - Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles.



- c. Triangle - Figure having three sides and three angles



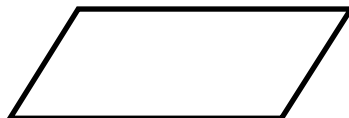
- d. Circle - Flat, round figure formed by one curved line, all points of which are equidistant from center point



- e. Rhombus - Figure having no right angles and four sides of equal length



- f. Parallelogram - Figure such as a square, rectangle or rhombus with two parallel ends of equal length and two parallel sides of equal length.



- g. Trapezoid - Figure with only one pair of parallel opposite sides.



Units of Measure and their Equivalent:

- a. Inch (") - Equal to one-twelfth of a foot (1/12) or one thirty-sixth of a yard (1/36 yard)
- b. Foot (') - Equal to twelve inches (12") or one-third of a yard (1/3 yard)
- c. Yard - Equal to three feet (3') or thirty-six inches (36")
- d. Rod - Equal to sixteen and one-half feet (16 1/2)
- e. Mile - Equal to five thousand, two hundred and eighty feet (5280')

Sample of Calculation on Conversion of unit

A. English to Metric System

1. 3 inches - cm

$$3 \text{ inches} \times \frac{2.54}{1 \text{ inch}} = 7.62 \text{ cm}$$

2. 10 cm - inch

$$10 \text{ cm} \times \frac{1 \text{ inch}}{2.54} = 3.94 \text{ inch}$$

B. Unit in Metric System

1. $79.33 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ dm}}{10 \text{ cm}} = 7.933 \text{ dm}$

C. Unit in English System

1. 13 inch - yard

$$13 \text{ inch} \times \frac{1 \text{ ft}}{12 \text{ inch}} \times \frac{1 \text{ yard}}{3 \text{ ft}} = 0.393 \text{ yards}$$



How Much Have You Learned?

Self-Check 2.1

Metric System

10 millimeter	– 1 centimeter
10 centimeter	– 1 decimeter
10 decimeter	– 1 meter

English System

12 inches	– 1 foot
3 feet	– 1 yard

Metric – English

1 millimeter	– 0.03993 inches
1 inch	– 2.54 centimeter
1 foot	– 0.3048 millimeter
1 yard	– 0.9144 millimeter

Using the given conversion table above solve for the desire units

1. 64 cm - ----- inches
2. 59 yards - ----- feet
3. 95.5 dm - ----- meter
4. 19 inches - ----- centimeter
5. 47 feet - ----- inches



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

REFERENCES

LO1

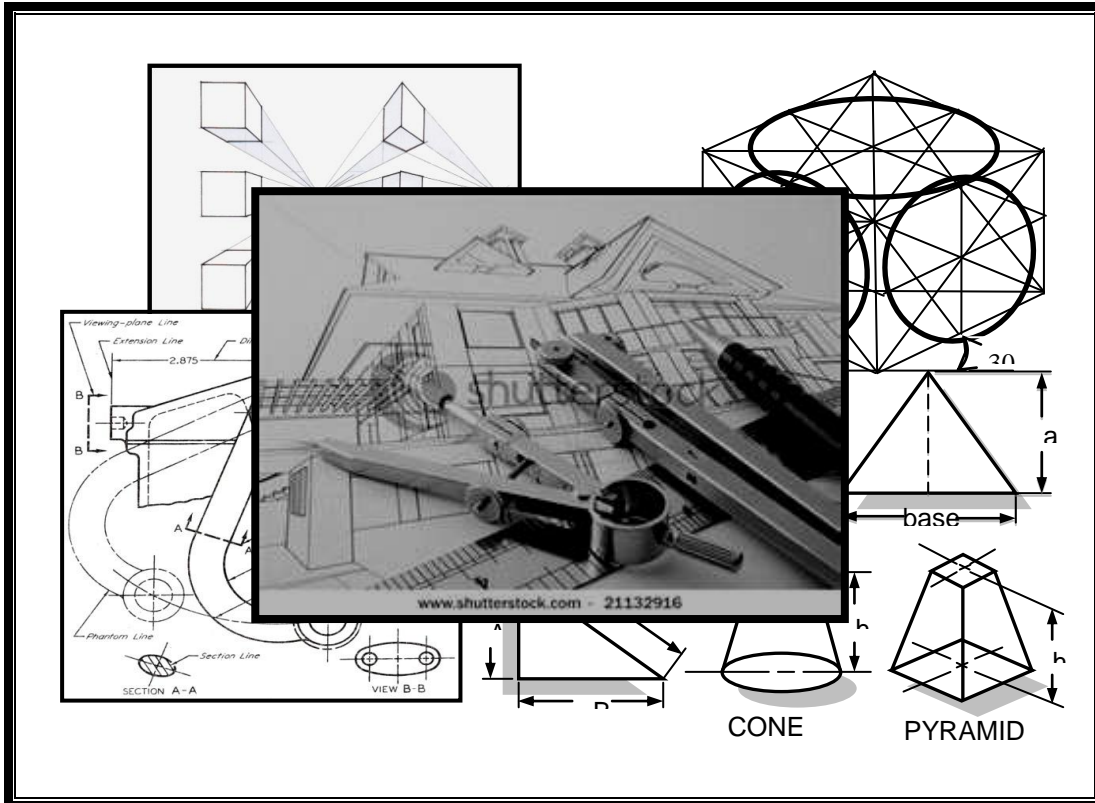
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LO 2

- Burghardt , Henry D. et al, Machine Tool Operation, 5th Edition, Mc Graw Hill Book Co., New York , 1963
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- www.google.com.ph

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
- LO 2. Interpret technical drawing



Definition of Terms

Analyze – to examine something in great detail in order to understand it better or

Block Diagram – showing the basic form or lay-out of plumbing diagram in block form labeled

Blueprint – a photographic print of technical drawing with white lines and blue backgrounds.

Construct – to build or assemble something by putting together separate parts in an

Data – factual information obtain from experiments or survey. Basis for making calculation

Dimension – measurement of one or more direction such as length, width, and height.

discover more about it.

Electrical – involving electric cables or circuits powered by electricity.

Interpret – to ascribe particular meaning of significance to something.

Mechanical – a system involving the pipe lines, and mechanical component of

or drawing conclusions.

Ordered way.

Pictorial Diagram – showing the basic form or lay-out of pictures of actual component.

Plan – method of doing something that is work out in advance.

Refrigeration and Air conditioning technology.

Schematic Diagram – showing the basic form or lay-out of plumbing symbols.

Sign – something that indicates the rule to follow.

Symbol – something that represents abstraction

with the names of plumbing components.

LEARNING OUTCOME 1

Analyze signs, symbols and data

PERFORMANCE STANDARDS

1. Sign, symbols, and data are identified according to job specifications.
2. Sign, symbols and data are determined according to classification or as appropriate in drawing.



Materials / Resources

- PLAN
- SIGN AND SYMBOLS
- PAPER
- PENCIL
- BALLPEN
- RULER
- TRIANGLE
- ERASER
- CORRECTION LIQUID
- OSLO PAPER
- SHARPENER
- COMPASS



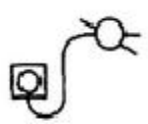
What Do You Already Know?

Pretest LO. 1

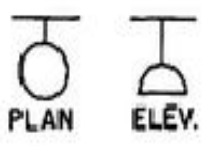
Let us determine how much you already know about Analyze Symbols and Data. .
Take this test.

IDENTIFICATION

Direction: Identify the plumbing symbols in each item. Write your answer on the space provided before each number.



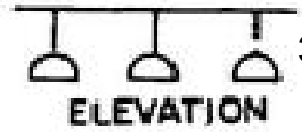
1. _____



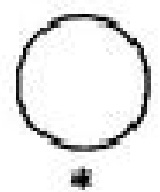
2. _____



3. _____



4. _____



5. _____

Directions: Match column A to column B

COLUMN A

COLUMN B

____ **1. Long break line**

a. *Very light line used to “block in” an object. These lines are made so light that little or no erasing is needed. They serve as base for darkening in the permanent line*

____ **2. Dimension line**

b. Heavy, solid line used to frame in the drawing

____ **3. Centerline**

c. A medium line used to show edges and contours visible to the eye.

____ **4. Invisible line**

d. A medium line used to show edges and contours not visible to the eye.

____ **5. Visible line**

e. A light line used as axis of symmetry.
Used for center of circle and arcs.
the symbol is shown

Sometimes

____ **6. Borderline**

f. Light thin lines used to show the sizes of the object. Extension lights start about 1/16” from visible or object line. The dimension line is broken near the center for the dimension.

____ **7. Construction line**

g. Wavy line draws freehand for the same purpose as long break.



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 the Self-check 3.1. , 2.2

Information Sheet 3.1

PLUMBING SYMBOLS

OTHER VALVES		BUCKET TRAP		VACUUM-PRESSURE			
VALVE	SYMBOL	FLOAT TRAP		THERMOMETER			
AUTOMATIC, OPERATED BY GOVERNOR		P TRAP		THERMOMETER, DISTANT READING, BARE BULB TYPE			
DIAPHRAGM		RUNNING TRAP		THERMOMETER, DISTANT READING, SEPARATE SOCKET TYPE			
FAUCET		TRAP		AIR CHAMBER			
<th colspan="2">STRAINERS</th> <th colspan="2">POWER AND HEATING PLANT EQUIPMENT</th> <td>BULKHEAD JOINT, EXPANSION</td> <td></td>	STRAINERS		POWER AND HEATING PLANT EQUIPMENT		BULKHEAD JOINT, EXPANSION		
TYPE	SYMBOL	UNIT	SYMBOL	BULKHEAD JOINT, FIXED			
BOX STRAINER		AIR EJECTOR		METER, DISPLACEMENT TYPE (OTHER THAN ELECTRICAL)			
DUPLEX OIL FILTER		BLOWER		ORIFICE			
DUPLEX STRAINER		BLOWER, SOOT		SEA CHEST, DISCHARGE			
STRAINER		BOILER, STEAM GENERATOR (WITH ECONOMIZER)		SEA CHEST, SUCTION			
Y STRAINER		ENGINE, STEAM		<th colspan="2">REFRIGERATION EQUIPMENT</th>		REFRIGERATION EQUIPMENT	
<th colspan="2">TRAPS</th>		TRAPS		EVAPORATOR, SINGLE EFFECT		UNIT	SYMBOL
TYPE	SYMBOL	PUMP, RECIPROCATING		COIL, PIPE			
AIR ELIMINATOR		PUMP, ROTARY AND SCREW		COMPRESSOR (ALL TYPES)			
BOILER RETURN TRAP		TURBINE, STEAM		CONDENSER, EVAPORATIVE			
		<th colspan="2">GAGES, THERMOMETERS, AND MISCELLANEOUS</th>		GAGES, THERMOMETERS, AND MISCELLANEOUS		CONDENSING UNIT, AIR COOLED	
		TYPE	SYMBOL	CONDENSING UNIT, WATER COOLED			
		LIQUID LEVEL		COOLER, BRINE			
		PRESSURE		SWITCH, CUT-OUT, HIGH PRESSURE			
		VACUUM		SWITCH, CUT-OUT, LOW PRESSURE			
				VALVE, EVAPORATOR PRESSURE REGULATING SNAP-ACTION VALVE			
				VALVE, EXPANSION, AUTOMATIC			
				VALVE, EXPANSION, MANUALLY OPERATED			
				VALVE, EXPANSION, THERMOSTATIC			

DMV/2CH04/52

Alphabets of Lines

In sketching orthographic drawing, certain conventional lines are used for a definite purpose. These lines are commonly called **Alphabet of Lines**.

USES OF ALPHABET OF LINES

Construction line	Very light line used to “block in” an object. These lines are made so light that little or no erasing is needed. They serve as base for darkening in the permanent line
Borderline	Heavy, solid line used to frame in the drawing
Visible line	A medium line used to show edges and contours not visible to the eye.
Invisible line	A medium line used to show edges and contours not visible to the eye.
Centerline	A light line used as axis of symmetry. Used for center of circle and arcs. Sometimes the symbol is shown
Dimension line	Light thin lines used to show the sizes of the object. Extension lights start about 1/16” from visible or object line. The dimension line is broken near the center for the dimension.
Long break line	Wavy line draws freehand for same purpose as long break.



How Much Have You Learned?

Self-Check 3.1

Direction: Enumerate at least 10 plumbing signs and symbols

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Self-Check 3.2

Direction: Enumerate the different kinds of lines.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Refer to the Answer Key. What is your score?



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

REFERENCES

LO1

- Barba, Joshua A., Plumbing, ConvergeLink Books Corp., Philippines, 2006.
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- www.google.com.ph

LEARNING OUTCOME 2

Interpret Technical Drawing

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.
- Freehand sketch is produced in accordance with job requirements.



Materials / Resources

- **Plumbing Symbols**
- **Blueprint**
- **Plumbing Plan**
- **Pencil**
- **Ruler**
- **Eraser**
- **Plumbing manuals**



What Do You Already Know?

Pretest LO 2

Let us determine how much you already know about technical drawings plans and plumbing plans

B. True or False.

Directions: Write letter T if the statement is true, and letter F, if it's false.

_____ 1. Blueprint is a framework gives you a solid foundation to build your project on top of, with an easy-to-use grid, sensible typography, useful plug-in, and even a style sheet for printing.

_____ 2. Mechanical Plan is a drawing done to scale using specialized instruments showing the actual part of an object.

_____ 3. Electrical Plan is a drawing done to scale using specialized instruments.

_____ 4. Sign and Symbol is very much important to plan of the worker.

_____ 5. Schematic Diagram is the design that follows of the technician when there is a problem encounter.

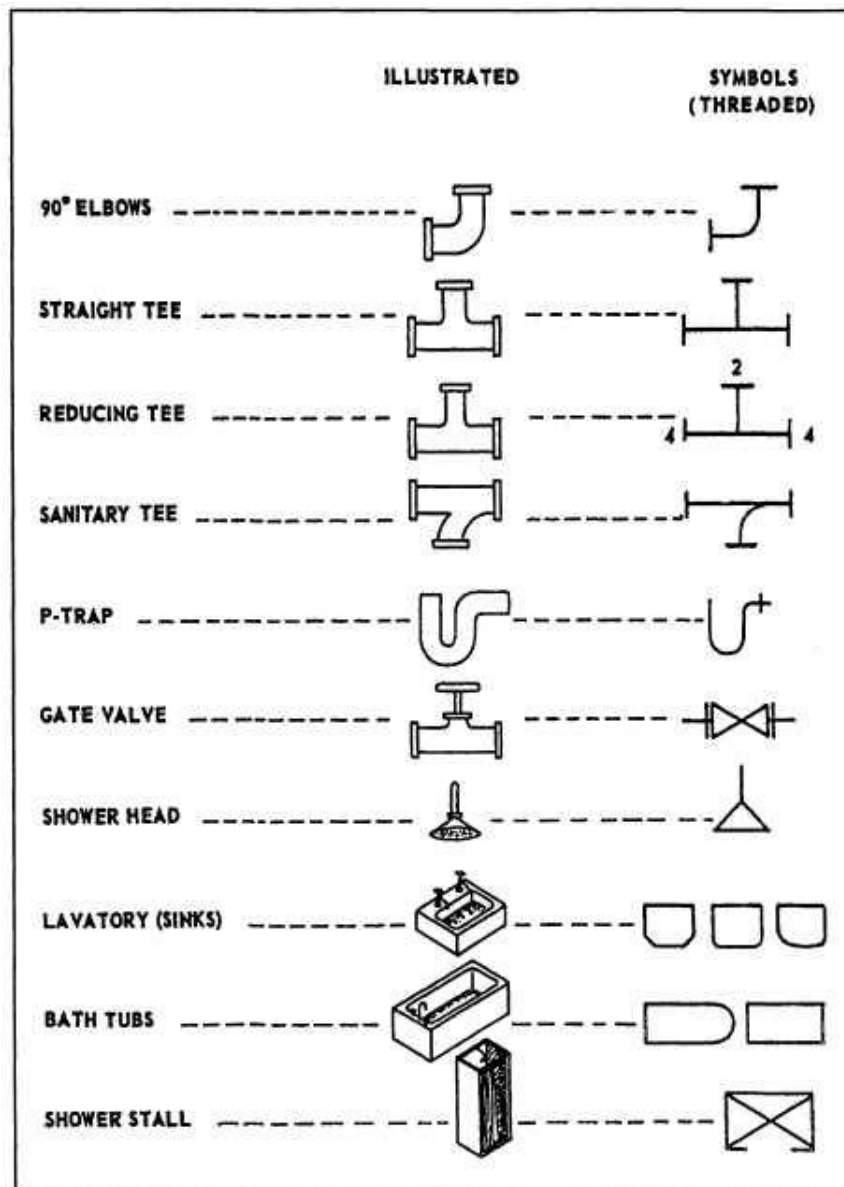


What Do You Need To Know?

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

Information Sheet 2.1

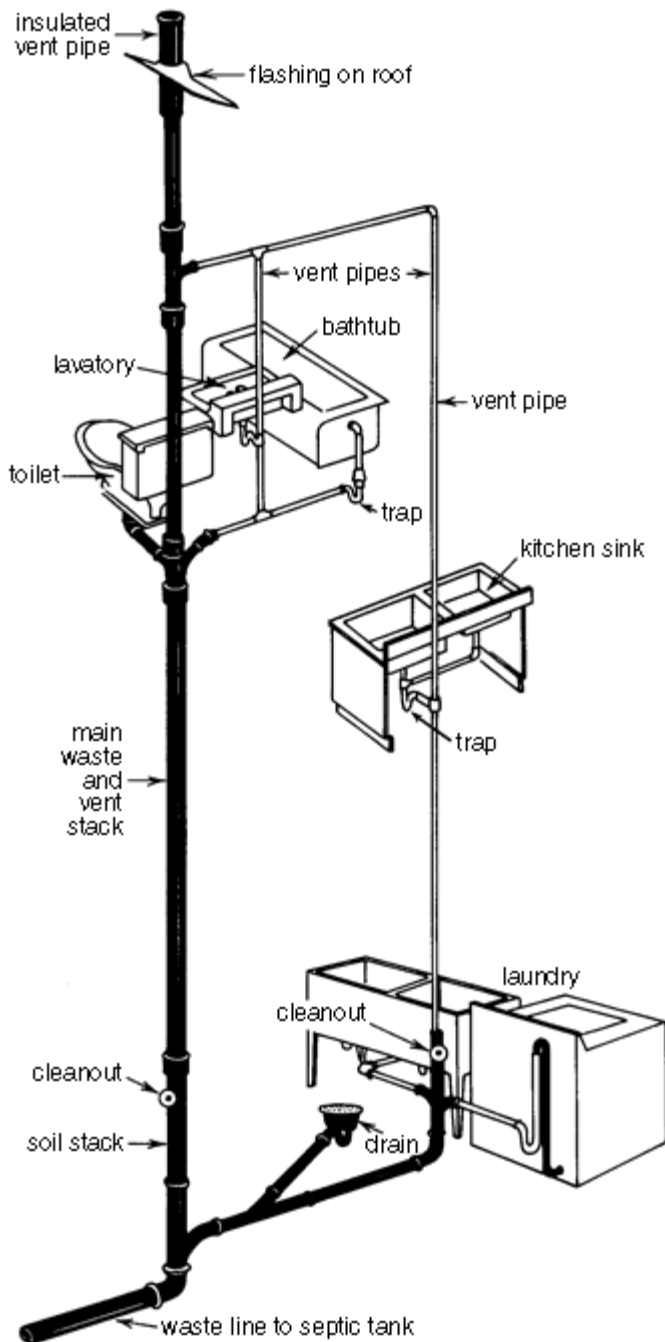
PLUMBING PARTS AND FITTINGS WITH SYMBOLS



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Information Sheet 2.2

PROPER INSTALLATION/LAYOUT OF INSULATED VENTILLATION PIPES AND PROPER INSTALLATION/LAY OUT OF LAVATORY, BATH TUB, TOILET BOWL, KITCHEN SINK AND LAUNDRY APPLIANCE



Self-Check 2.1

Draw the following signs, signals, symbols and barricades used in building construction:

1. Under Construction
2. Exit
3. Slippery When Wet
4. Directional signs
5. Danger Keep Out

Refer to the Answer Key. What is your score?



How Do You Extend What You Have Learned?

Show that you learned something by doing this activity

Assignment Sheet 2.1

Draw the plumbing lay out of residential unit with the following :

**Kitchen Sink
Toilet Bowl
Bath Tab
Laundry Appliances**



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

REFERENCES

LO2

- Giesecke, Mitchell and Spencer, Technical Drawing; The Macmillan Company: 1999
- German M. Manaois, Drafting 1 and 2; Phoenix Publishing: 1983
- Esguerra and Molino, Exploratory Drafting; Abiva Publishing: 1980
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LESSON 4

Maintain Tools and Equipment



LEARNING OUTCOMES:

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

- LO 1. Check conditions of tools and equipment
- LO 2. Perform basic preventive maintenance



Definition of Terms

Condemned	Unfunctional tools or equipment that are to be disposed
Dull	Unsharpened cutting and tools.
Equipment	A power tool usually run by motor.
Grind	to wear down, polish, or sharpen by friction.
Lubricant	A good solvent cleaner
Maintenance	The act of keeping tools and equipment in good working condition.
P.P.E	Personal Protective Equipment
Repair	The process of fixing tool or equipment to make it serviceable again.
Sharpening	the process of sharpening of tools cutting edge or fine point
Solvent	A substance, usually a liquid, capable of dissolving another substance

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.



What Do You Already Know?

Pretest LO 1

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

Direction: Given the choices below, identify the following tools and equipment used in plumbing.

PLUMB BOB OR PLUMMET
TRY SQUARE
Outside Caliper
CLAMP
BASIN WRENCH

PULL PUSH RULE (Tape Measure)
Steel Square
Inside Caliper
BENCH VISE

1. It is a tool used for testing and surveying to position a point on the ground that is not readily visible.
2. It is a flexible tape measure which is available in lengths up to 50 feet.
3. It is a wood working or a metal working tool used for marking/measuring a piece of wood. It is primarily used to measure the accuracy of right angle (90° degrees) tried on any surface so as to check its straightness or correspondence to an adjoining surface.

4. It is a tool used by carpenters and other tradesman. It consists of a large arm and a smaller arm that meet at an angle of 90° .
5. It is a tool used to measure the external size of an object.
6. It is a tool used to measure the internal size of an object
7. It is a tool used to grip and hold an object firmly such as wood, paper, plastic, and some metals for a short period time.
8. It is a tool with a mechanical screw apparatus used for holding or clamping a work piece to allow work to be performed on it using anchor.



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 the Self-check 1.1.

Information Sheet 1.1

CLASSIFICATION OF TOOLS AND EQUIPMENT

BORING TOOLS

COLD CHISEL is a tool made from hexagon or octagon-shaped steel and is commonly called cold chisel steel. Its convenient size is for handling. One end is shaped for cutting operations.



ELECTRIC DRILL is a power tool that rotates a replaced drill bit to make a hole in wood, plastic or metal. Alternately, a screw driver tip can be installed to turn screw.

HACKSAW is a tool used for cutting metal, plastic or pipe.



PIPE CUTTER is a tool used for cutting pipe and tube.



PIPE REAMER is a tool used for cleaning the inside portion of the pipe and tube to remove the burst and chips.



PIPE THREAD is a tool used for threading the pipe. **PIPE THREAD** is a tool used for threading the pipe.



DRIVING TOOLS

CLAW HAMMER is a tool used for pulling and driving the nails from some other object. Generally, a hammer is associated with woodworking but is not limited to use for any purpose.



CROW BAR is a tool consisting of a metal bar with a single curved end and flattened points, often with a small fissure on one or both ends for removing nails.



SCREW DRIVER is a tool used to insert and tighten, or to loosen and remove screw. The screw driver comprises a head or tip which engages with a screw, a mechanism to apply torque by rotating the tip, and some way to position and support screw driver.



(Screw drives types: Triple Square, Spanner head, Torque, Tri wing, Robertson, Hex Allen, Torx, Pozidive, Crosshead, Flat)

HOLDING TOOLS

ADJUSTABLE SPANNER/WRENCH, ADJUSTABLE ANGLE HEAD WRENCH is a tool which can be used to loosen and tighten a nut or bolt. It has a “jaw” of adjustable-size, which allows different sizes of nut and bolt.



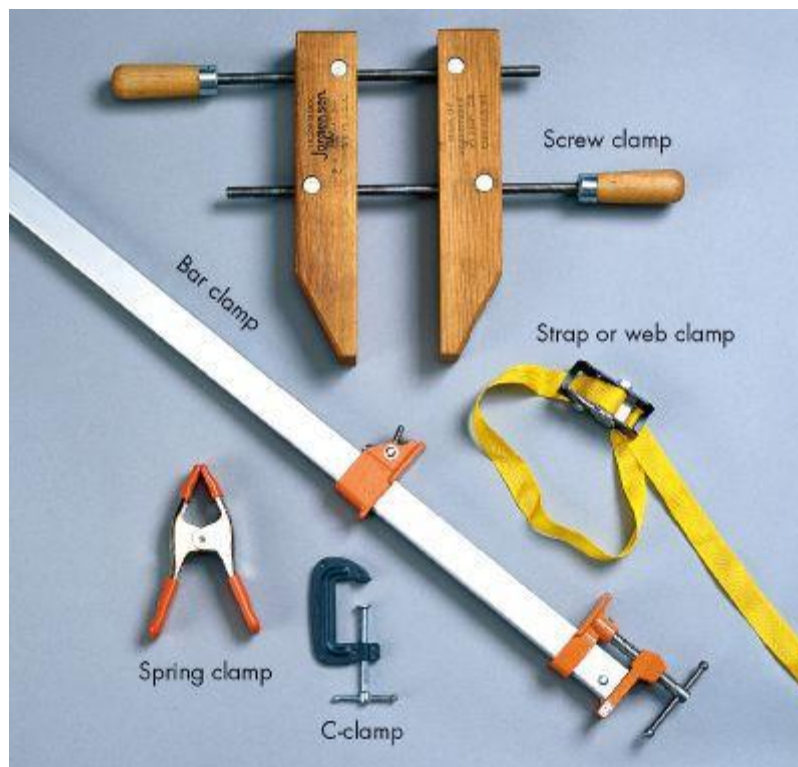
BASIN WRENCH is a specialized tool which allows one to reach tight spot under sink and basin. The jaw of the basin wrench can not only be adjusted to accommodate nuts of different sizes, but it can also be flipped over the opposite side to keep it turning without removing the wrench



BENCH VISE is a tool with a mechanical screw apparatus used for holding or clamping a work piece to allow work to be performed on it which uses an anchor. Bench vise or vice has one fixed jaw and another, parallel, jaw which is moved towards or away from the fixed jaw by the screw.



CLAMP is a tool used to grip and hold an object firmly such as wood, paper, plastic and some metals for a short period time.



PIPE WRENCH OR STILLSON WRENCH is an adjustable wrench used for turning soft iron pipes fittings with a rounded surface. The design of the adjustable jaw allows it to rock in the frame such that any forward pressure on the handle tends to pull the jaw tighter together.



Measuring Tools

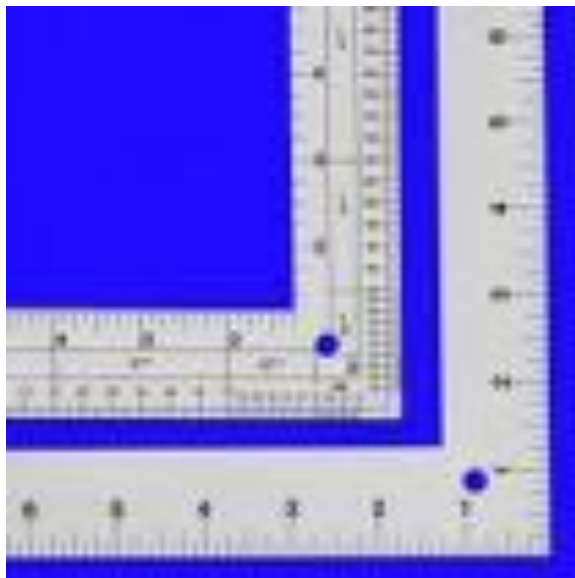
Inside Caliper is a tool used to measure the internal size of an object.



Outside Caliper is a tool used to measure the external size of an object.



Steel Square is a tool used by carpenters and other tradesman. It consists a large arm and a smaller arm that meet at an angle of 90° . Today the steel square is commonly referred to as the framing square.



TRY SQUARE is a woodworking or a metal working tool used for marking/measuring a piece of wood. It is primarily used to measure the accuracy of right angle (90° degrees) tried on any surface so as to check its straightness or correspondence to an adjoining surface.



PULL PUSH RULE (Tape Measure) is a flexible tape measure which is available in lengths up to 50 feet. Other tapes that are 12 to 25 feet are usually considered adequate. Most tapes have an automatic power return that is useful but not necessary.



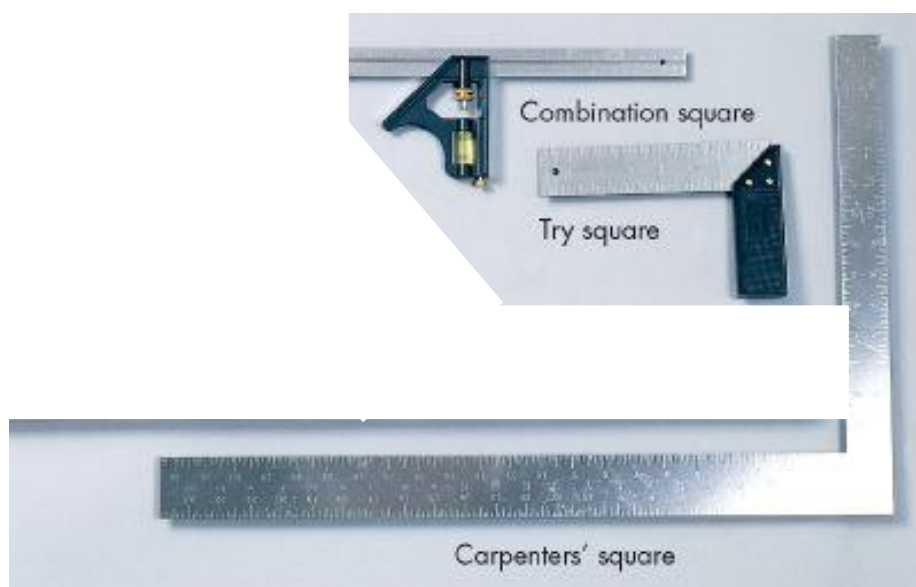
TESTING TOOLS

PLUMB BOB OR PLUMMET is a tool used for testing and surveying to position a point on the ground that is not readily visible. Plumb bob is a weight with a pointed tip at the bottom that is suspended from a string and used as a vertical reference line.



TESTING TOOLS

CARPENTERS' SQUARE - a steel square used by carpenters; larger than a try square. Square-a hand tool consisting of two straight arms at right angles.





How Much Have You Learned?

Self-Check 1.1

Directions: Call your teacher and request him to check if you have executed the task. You will be evaluated based upon his observation. You have 40 minutes to complete this exercise.

Teacher's Checklist	Acceptability	
	YES	NO
1. Tools were classified correctly.		
2. Demonstrated correct use of tools.		
3. Applied safety measures in holding tools.		
4. Recorded the damage accurately.		
5. Organized the tools properly.		

After this activity, proceed to next page please.

Competent _____ Not Competent _____

Students Name: _____ Date: _____

Teacher's Name: _____ Date: _____

Refer to the Answer Key. What is your score?



How Do You Extend What You Have Learned?

Show that you learned something by doing this activity

LO 1. : CHECK OF CONDITION OF TOOLS

TITLE: CHECKING CONDITION OF TOOLS

INTRODUCTON:

Non-functional tools and equipment must be reported and filled up in the report card. The following tools and equipment are used in checking the condition of tools.

Given below is a sample on how to fill up the Record Card.

CLASSIFICATION OF TOOLS AND EQUIPMENT:

Boring tools

Cutting Tools

Holding tools

Measuring tools

Testing tools

- Supporting materials:
Inventory sheet
Report Cards

BAR CODE LEGEND

P BOR.T – 0008 – AUGER BIT

P- Plumbing tools (shop name)

BOR.T- Classification of tools

0008- Code no. in the tool panel

AUGER BIT- Name of tools

QUANTITY	UNIT	NAME OF TOOLS	CODE	CONDITION	REMARKS
2	PCS	AUGER BIT #1	PBOR.T 0001- A. BIT	Broken thread	Replaced
1	pc	Claw Hammer # 2	PDRI.T 0002 Claw hammer	Loose Handle	Repair
1	pc	C – Clamp # 4	P Hold.T. 0004 CClmp	Broken Handle	Repair
1	pc	Inside Caliper # 8	P.Meas.T 0008 In.Cal.	Loose Legs	Repair

RECORD CARD

NAME: _____

DATE: _____

YR/SEC: _____

STUDENT

NO: _____

SHOP TEACHER: _____ **SHOP**

NAME: _____

Classification of tools

BORING TOOLS

QUANTITY	UNIT	NAME OF TOOLS	CODE	CONDITION	REMARKS

DRIVING TOOLS

QUANTITY	UNIT	NAME OF TOOLS	CODE	CONDITION	REMARKS

HOLDING TOOL

QUANTITY	UNIT	NAME OF TOOLS	CODE	CONDITION	REMARKS

MEASURING TOOLS

QUANTITY	UNIT	NAME OF TOOLS	CODE	CONDITION	REMARKS

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.
- Tools are cleaned and lubricated according to standard procedures.
- Defective equipment and tools are inspected and replaced according to manufacturer's specifications.
- Work place is cleaned and kept in safe state in line with OSHC regulations.
- OSHC regulations are followed and apply in the workplace



What Do You Already Know?

Pretest LO 2

Let us determine how much you already know about safely keep / dispose materials and outfit. Take this test.

Directions: Write T if the statement is true and F, if it is false.

- _____ 1. Safety goggles must be worn anytime the power tools are being used in the work area.
- _____ 2. Ear protection should be worn when operating tools with high noise level.
- _____ 3. Loose clothing should be worn around when operating power tools.
- _____ 4. The pockets of pants are so designed to carry sharp tools thus preventing damage to the cutting edge.
- _____ 5. The dust collection system is a large vacuum that should only be operated at clean-up time.
- _____ 6. Certain glues and most finishes are toxic. Prolonged exposure to their fumes should be avoided.
- _____ 7. Used rags should be placed in the metal container except when in use.
- _____ 8. Tools should be returned to their storage location after use.
- _____ 9. When debris accumulates on the floor it should be put into the trash container.
- _____ 10. Minor cuts and splinters need not be reported to the teacher.



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 the Self-check 2.1.

Information Sheet 2.1

CLASSIFICATION OF LUBRICANTS

Before using the tools and equipment in the installation of pipes, you have to know first the types of lubricants to be used. In this manner, you can prevent rusting and malfunctioning of the tools and equipment.

There are four types of lubricants and these are liquid including emulsion and suspension, solid, grease, and paste.

- Liquid lubricants – are known as lanolin natural water repellent lanolin which is derived from *wool grease* and is a safe alternative to the more common petrochemical based lubricants. These lubricants are also preventive agents against inhibitors such as rust, salt and acids.
- Water can also be used on its own or as a major component with one of the other base oils.
- Mineral oil is used to encompass lubricating base oil derived from crude oil.
- Vegetable oil is primarily triglyceride esters derived from plants and animals.

Purpose of Lubricating

Here are the advantages of lubricating the tools and equipment:

- Keeps moving parts apart.
- Reduces friction.
- Transfers heat.
- Carries away contaminant and debris.
- Transmits power.
- Protects against wear.
- Prevents corrosion.

GENERAL SAFETY IN THE WORKING AREA

General Safety Practices

Safety practices are an important component in performing one's job in order to prevent accidents. In relation to this, safe work habits acquired now will be useful in years to come. The following are reminders that will guide you in practicing safety measures in the working area.



1. Always think "safety first" before performing an operation.
2. Wear safety goggles, or a face shield in the danger zones or in other designed area.
3. Report even the slightest injury; small cuts or other minor injuries may become serious if left unattended. Inform your teacher immediately.
4. Notify your teacher of any unsafe conditions observed. This may include such things as dull tools and frayed electrical cords.
5. Keep the floor clear of scraps of materials.
6. Place clamped stock so it will not fall. Make sure the clamps do not extend into pathways.
7. Place all used rags in a metal fireproof container.
8. Close vise handle so they do not protrude into the aisles. However, do not tighten them.
9. Stay alert! Keep your mind on the operation of the machine all the time. Do not talk to anyone while operating machine.

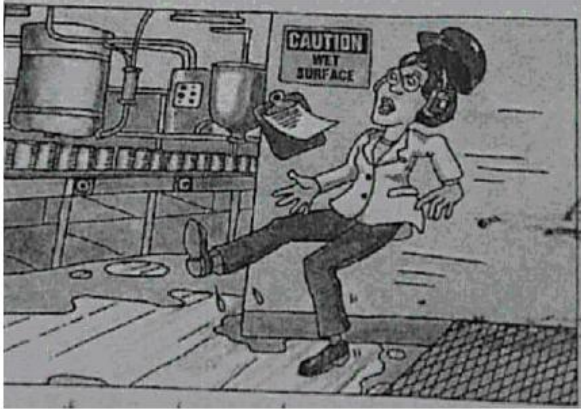


10. Ask for assistance prior to the cutting long or heavy piece.
11. Wear safe clothing. Make sure you button your shirt, and wear your shoes or sneakers. Do not wear jewelry. If you have long hair tie it back.
12. Respect the right of others and their property.
13. Wear ear protection when operating tools with high noise levels.
14. Be sure everyone is out of danger zone around a machine before beginning an operation.
15. Ask your teacher for permission before using machines.

PREVENTING SLIPS

Slips occur when there is too little friction between your feet and the ground. Common causes of slips are wet surfaces, weather hazards, and loose soil or ground. Slips often happen when you are distracted or in a hurry, but they can be prevented. Here are the following examples of accidents that normally occur if an individual is careless:

On The Job



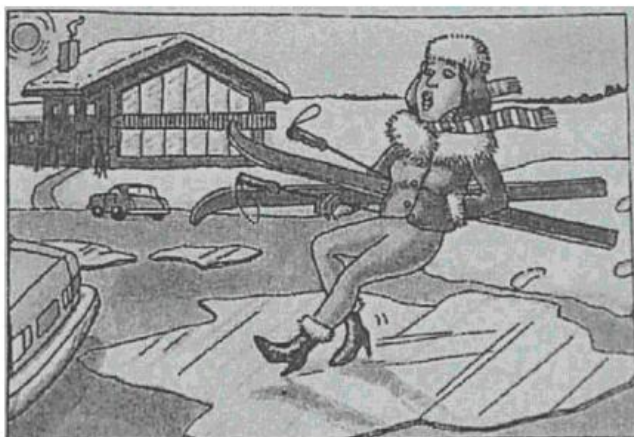
Constantly wet surfaces

Some jobs have work surfaces that are always wet. You may slip on a wet surface if you turn sharp corners quickly or don't pay attention to where you're going. Walking too quickly or taking long steps may cause you to slip. Another common problem is wearing slippery shoes that don't give you much friction.



Occasional spills

Even a minor coffee or water spill can be dangerous. You could slip if you walk with your hands in your pocket instead of keeping them free for balance. Moreover, slipping often happens if you're in a hurry.

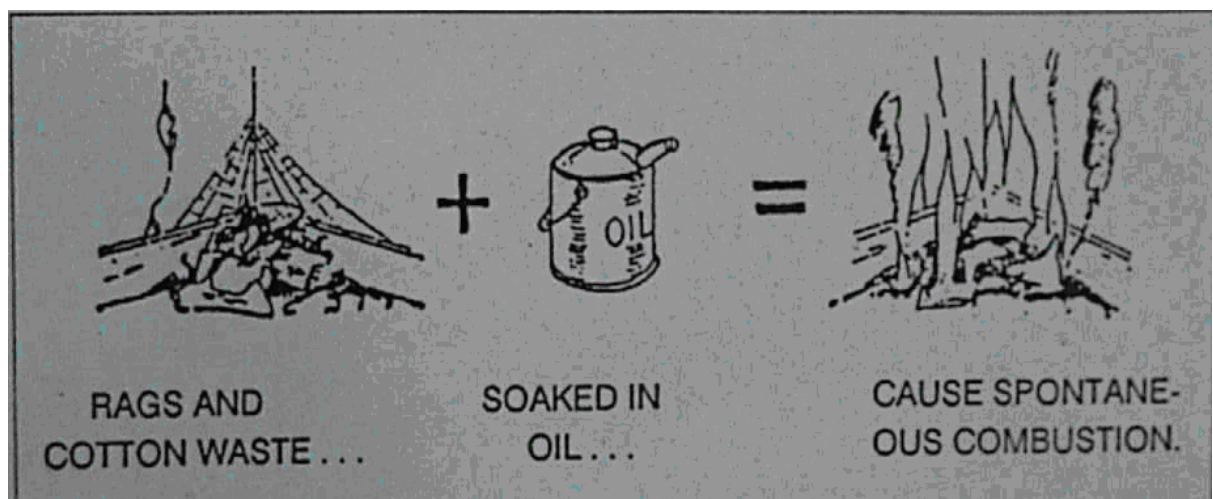
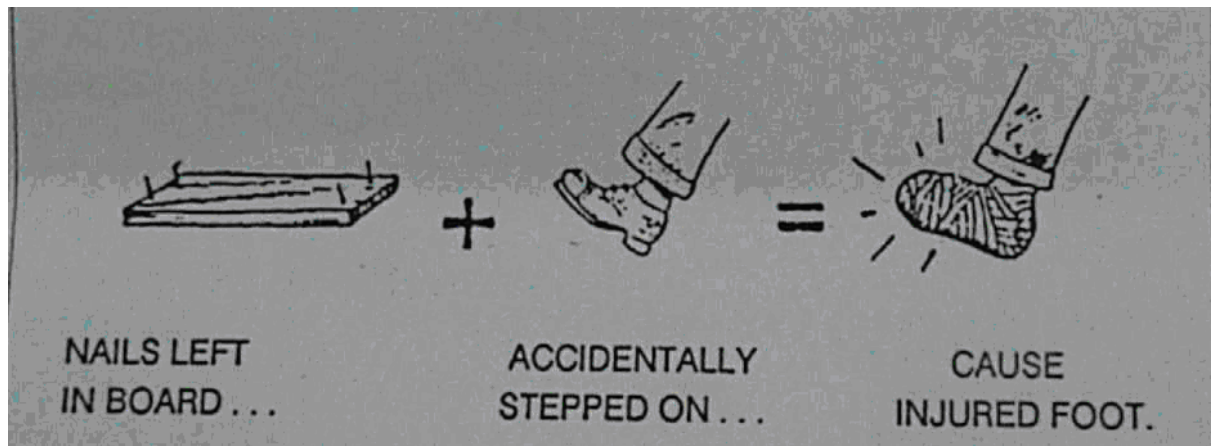


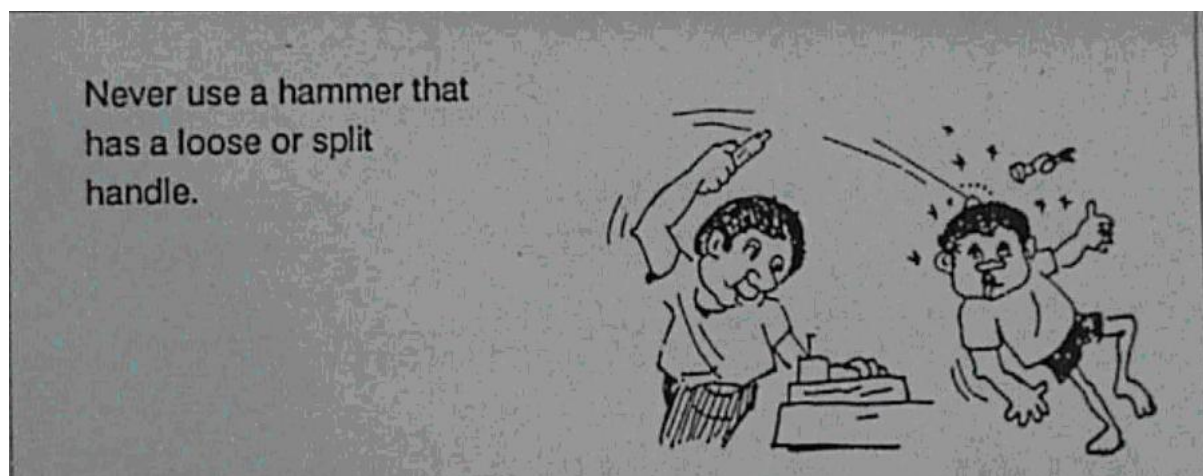
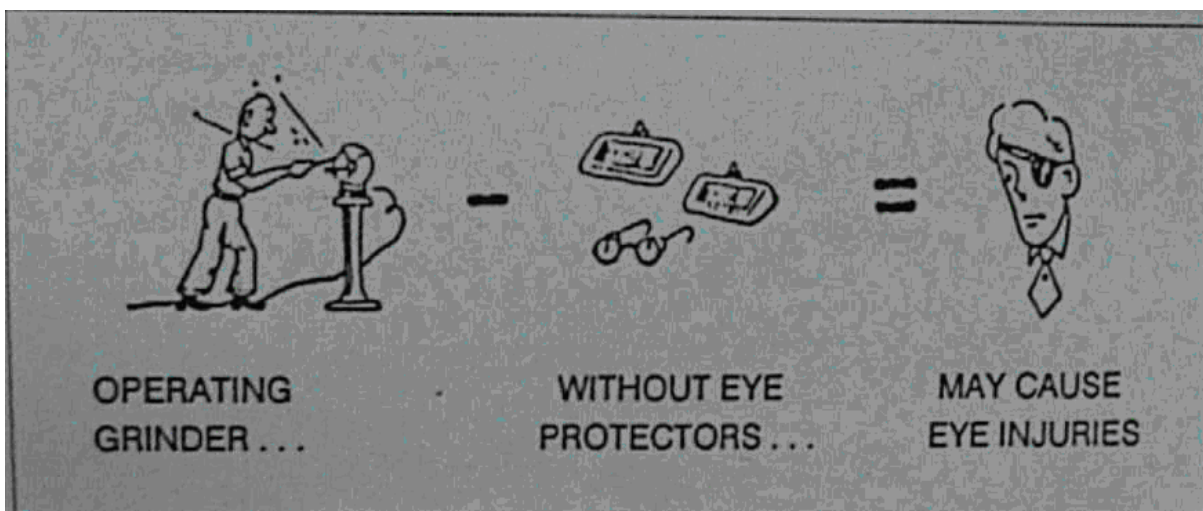
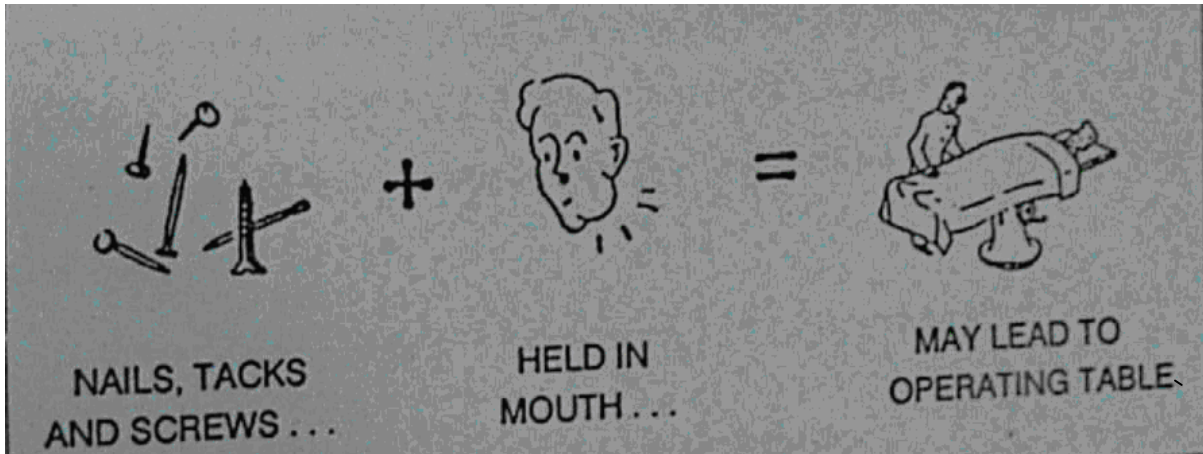
Weather Hazards

Weather hazards are present in cold countries. You slip if you don't take extra care when walking outside or if you're wearing smooth-soled or high-heeled shoes with little friction.

Safety should be the concern of everybody

In relation to this, safe work habits must also be practiced in the shop Room. The illustrations will describe the causes and effects once you are careless inside the working area.





Never use a hammer that has a loose or split handle.



THROWING TOOLS

TO OTHER PERSONS

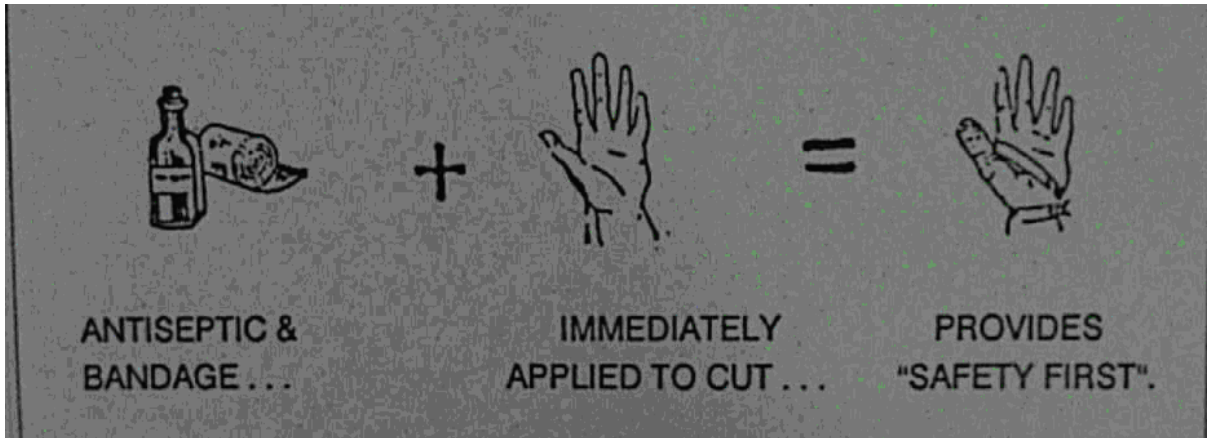
MAY CAUSE INJURY.



TOOLS ...

CARELESSLY CARRIED ...

ARE DANGEROUS WEAPONS.





How Much Have You Learned?

Self-Check 2.1

I. Directions: Call your teacher and request him to check if you have executed the task. You will be evaluated based upon his observation.

Teacher's Checklist	Acceptability	
	YES	NO
1. The tools are identified correctly according to the job requirement.		
2. The work place is kept safe.		
3. Tools are lubricated correctly.		
4. Tools are used and handled properly.		
5. The surrounding is kept clean after doing the standard procedure in applying lubricant.		

Student's Signature: _____ Date: _____
Teacher's Signature: _____ Date: _____

Competent_____ Not Competent_____

GENERAL SAFETY IN THE WORKING AREA

II. True or False

Directions: Write T if the statement is true and F if it is false.

- _____ 1. Safety goggles must be worn anytime the power tools are being used in the work area.
- _____ 2. Ear protection should be worn when operating tools with high noise level.
- _____ 3. Loose clothing should be worn around when operating power tools.
- _____ 4. The pockets of pants are designed to carry sharp tools to prevent damage to the cutting edge.
- _____ 5. The dust collection system is a large vacuum that should only be operated at clean-up time.
- _____ 6. Certain glues and most finishes are toxic. Prolonged exposure to their fumes should be avoided.
- _____ 7. Used rags should be placed in the metal container except when in use.
- _____ 8. Tools should be returned to their storage location after use.
- _____ 9. When debris accumulates on the floor. It should be put into the trash container.
- _____ 10. Minor cuts and splinters need not be reported to the teacher.

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

GENERAL SAFETY IN THE WORKING AREA

Directions: Form groups of three and do the following task.

1. Make a safety poster showing a good workplace.
2. Tour in the shop room to determine any potential safety hazards. If you find any hazards, analyze what should be done to correct the situation.
3. Research various types of fire extinguisher A, B, C, and D. Create a chart that lists the types and purpose of each type of **extinguisher**.



Congratulations! You did a great job!

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LEARNING OUTCOME 3

Store tools and equipment

PERFORMANCE STANDARDS

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



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: Choose the letter of the best answer. Write the answer on your answer sheet.

1. Which was created by virtue of Executive Order No. 307, on Nov. 1987?
 - A. Department of Labor and Employment
 - B. Office of the President
 - C. Department of Public Works and Highways
 - D. Occupational Safety and Health Center
2. Which is the mandate of this agency?
 - A. Protect the Filipino workers against accidents and illnesses.
 - B. Let the workers choose their own type of job.
 - C. Help the employers gain profits from their business.
 - D. Protect the right of the employers.
3. It is a detailed list of all the items in stock.

A. Delivery Receipt	C. Inventory
B. List of Merchandise	D. Directory
4. Which is true?
 - A. Create a sign out sheet for all shop tools.
 - B. Conduct an audit for long-term jobs.
 - C. Restrict shop tool access to one individual.

- D. All of the above.
5. Its advantage is to find out whether tools and equipment are complete, in proper quality, and quantity.
- A. Delivery Receipt
B. List of Merchandise
C. Inventory
D. Directory



What Do You Need To Know?

Read 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

STORE TOOLS AND EQUIPMENT

A. Tools and Equipment Inventory

Some companies often spend more time in tracking and managing their inventory. Others --- such as manufacturers, producers and construction companies --- may use specific equipment for specific jobs. This creates a difficult situation of attempting to manage inventory at multiple job locations. Business owners and managers typically create systems or processes that employees must follow when using the company's shop tools.

Depending on the type of company, owners or managers may require employees to use own tools for certain jobs. For example, construction companies may require employees to have their own items such as a hammer, painting equipment or welding supplies. This reduces inventory management.

Whatever is the type of company or shop, inventory taking is very important. On this context, inventory is defined as a detailed list of all the items in stock.

Reason for Maintaining Tools and Equipment Inventory

The most important point to consider is to purchase top-grade tools. They must be made 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 losses. Since the technician must work with his tools daily, regular inventory of tools/equipment is very important.

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 carefully selected tools that will take care of your most common needs and then gradually 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.

Points to Consider

- Create a sign out sheet for all shop tools. Companies can use a sign out sheet where employees must fill up with specific information relating to the inventory item and specific job use. This allows business owners and managers to know where each tool is located at all times.
- Conduct an audit for long-term jobs. Shop tools left at working place for long periods may require a manager to verify that the tool is still on the job site. A manager can visit the site unannounced and review the sign out sheet against all tools on the job.
- Restrict shop tool access to one individual. This allows companies to have one person on each job responsible for checking out, or in, various shop tools. Companies can require this individual to be a manager or foreman.
- Use a barcode system to track inventory. Companies can place barcode labels on each shop tool and require employees to electronically scan each tool when using them at different job sites. This creates an electronic record and can allow real-time reporting of tool use.



How Much Have You Learned?

Self-Check 3.1

Directions: Choose the letter of the best answer. Write the answer on your answer sheet.

1. Which was created by virtue of Executive Order No. 307, on Nov. 1987?
 - A. Department of Labor and Employment
 - B. Office of the President
 - C. Department of Public Works and Highways
 - D. Occupational Safety and Health Center
2. Which is the mandate of this agency?
 - A. Protect the Filipino workers against accidents and illnesses.
 - B. Let the workers choose their own type of job.
 - C. Help the employers gain profits from their business.
 - D. Protect the right of the employers.
3. It is a detailed list of all the items in stock.

A. Delivery Receipt	C. Inventory
B. List of Merchandise	D. Directory
4. Which is true?
 - A. Create a sign out sheet for all shop tools.
 - B. Conduct an audit for long-term jobs.
 - C. Restrict shop tool access to one individual.
 - D. All of the above.
5. One advantage of this system is to find out whether tools and equipment are complete, in proper quality, and quantity.

A. A. Delivery Receipt	C. Inventory
B. List of Merchandise	D. Directory

Refer to the Answer Key. What is your score?



How Do You Apply What You Have Learned?

Activity Sheet 3.1

- I. This is a work group.
1. Conduct a 15-minute buzz session to come up with your own inventory system as if you own a shop.
 2. Then, prepare your output on butcher's papers for presentation to and discussion with the entire class.



How Well Did You Perform?

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

Rubric to be used for assessment

PERFORMANCE CRITERIA	PERFORMANCE LEVEL		
	YES	NO	NA
1. Were the Record Book and the Inventory Form secured from your trainer before starting the performance of task?			
2. Were all tools of different sizes, conditions and quantities checked and recorded in the inventory form?			
3. Were all equipment of different ratings/capacities, conditions and quantities checked and recorded in the inventory form?			
4. Were damaged/lost tools/equipment identified and recorded?			
5. Were repair recommendations made for the damaged but repairable tools/equipment?			
6. Were reports on damaged tools/equipment submitted and accurate?			
Overall Performance	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		

Student's name: _____

Teacher's comment: _____



How Do You Extend Your Learning?

Assignment Sheet 3.1

This is a group work. Prepare for a 10-minute panel discussion on OSHC pertinent regulations for construction workers.(Plumbing Works)

Below is the rubric to be used for the group performance:

Symbols and Meaning:

___√+ **Consistently** ___√ **Usually** ___√- **Seldom**

Knowledge:

- ___ The group used research to advance arguments and defend positions.
- ___ Research was effectively applied to arguments.

Understanding:

- ___ The group demonstrates understanding of the issue.
- ___ The group presented key points.
- ___ The group presented original ideas.
- ___ The group was able to use examples or analogies to defend an argument.
- ___ The group demonstrated empathy for the cause he or she represented.
- ___ The group showed respect for others' opinions.

Communication:

- ___ The group was logical in presenting arguments.
- ___ The group was able to communicate effectively and clearly.
- ___ The group incorporated key terminology/vocabulary.

Participation:

- ___ The student contributed to the discussion.
- ___ The student tended to dominate a discussion, thereby hindering others' participation.

For group evaluation:

- ___ All students participated in the discussion.
- ___ Students within the group tended to dominate discussion within the group, hindering other group members' participation?



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 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

Accident	-is an event occurring unintentionally or by chance.
Control	-means to direct or determine.
Hazard	-is a source of danger.
Occupation	-is an activity in which one is engaged in.
OHSP	-Occupational Health and Safety Procedures
PPE	-Personal Protective Equipment
Safety	-state of being out danger, uninjured, not involving risk
Threshold	-starting point, bar stone or wood forming bottom of doorway
Toxic	-deadly, harmful and poisonous

LEARNING OUTCOME 1

Identify hazards and risks

PERFORMANCE STANDARDS

1. Hazards are identified correctly in accordance with OHS procedures.
2. Safety signs and symbols are identified and adhered to in accordance with workplace safety procedures.



What Do You Already Know?

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

Pretest LO 1

Directions: Write the letter of your choice on your answer sheet.

1. OSH means _____.
 - a) Occupational Service Healthy
 - b) Occupational Safe and Healthy
 - c) Occupational Safety and Health
2. Who should first know about the accident that happened in your shop?
 - a) principal
 - b) nurse
 - c) teacher
 - d) doctor
3. Accidents can be prevented _____.
 - a) through proper care and maintenance of tools and equipment
 - b) right attitude toward work
 - c) if you have a good knowledge about safety practices.
4. Your employer must conduct a hazard assessment in order to _____.
 - a) avoid accident
 - b) promote accident
 - c) eliminate workers

5. Identifying hazards makes you_____.
- a) safe from working
 - b) comfortable while working
 - c) work efficient
 - d) all of the above

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 Identification and Control

- **Requirements in Conducting/Identifying Hazards**

- Survey the workplace to identify hazards. This survey must be in writing and must be available to all workers
- Determine whether any hazard requires Personal Protective Equipment
- Pay special attention to working conditions or process that can produce hazards.
- Reassess hazards whenever necessary, especially when new equipment is installed, to avoid accidents.
 - Any reassessment must be written and must be available to workers upon request.

HAZARD, RISK AND EXPOSURE IN THE WORKPLACE

Plumbing works covers with a lot of activities to be done in the different workplace. While performing these activities we expose ourselves to a lot of risk. Workplace hazard is a major cause of accident, injury, or harm to a worker who performs such task. These hazards should be the major concern of all who are involved in a certain job or work.

It is important to distinguish hazard, risk and exposure when undertaking risk management.

- *Hazard* is the potential for harm, or adverse effect on an employee's health. Anything which may cause injury or ill health to anyone at or near a workplace is a hazard.
- *Risk* is the likelihood that a hazard will cause injury or ill health to anyone at or near a workplace. The level of risk increases with the severity of the hazard and the duration and frequency of exposure.
- *Exposure* occurs when a person comes into contact with a hazard.

Types of Hazard

Hazards are classified into five different types. They are:

1. **Physical** - includes floors, stairs, work platforms, steps, ladders, fire, falling objects, slippery surfaces, manual handling (lifting, pushing, pulling), excessively loud and prolonged noise, vibration, heat and cold, radiation, poor lighting, ventilation, air quality
2. **Mechanical and/or electrical** - includes electricity, machinery, equipment, pressure vessels, dangerous goods, fork lifts, cranes, hoists
3. **Chemical** - includes chemical substances such as acids or poisons and those that could lead to fire or explosion, like pesticides, herbicides, cleaning agents, dusts and fumes from various processes such as welding
4. **Biological** - includes bacteria, viruses, mold, mildew, insects, vermin, animals
5. **Psychosocial environment** - includes workplace stressors arising from a variety of sources.

Emergency procedures regarding safety working environment

1. Identify the potential emergencies.

The emergencies that may occur on plumbing site could include:

- a. Fire
 - b. Flood
 - c. Typhoon
 - d. machinery entrapment
 - e. electrical shock
 - f. chemical exposure
 - g. injuries
 - h. illness and
 - i. accidents
2. Provide emergency facilities appropriate for the sorts of emergencies that might occur on the farm (e.g. deluge showers, eye washes, firefighting equipment, first aid kits).
 3. Make sure that the correct equipment is available to contain and handle any chemical or other dangerous materials spills that might happen.
 4. To help minimize the risk of personal injury or property damage in the event of an emergency, people working on and visiting the farm need to know and understand the emergency procedures and their responsibilities.
 5. Instruct everyone working on the farm in the emergency response procedures
 6. Everyone should know the location of fire alarms, fire extinguishers and first aid kits; how and

WORKING CONDITIONS THAT CAN PRODUCE HAZARDS

1. Falling objects
2. Objects that can puncture skin
3. Objects that could roll over worker's feet
4. Toxic chemicals
5. Heat
6. Harmful Dust
7. Radiation



How Much Have You Learned?

Self-Check 1.1

Directions: Write the letter of your choice on your answer sheet.

1. Your employer must conduct a hazard assessment in order to _____.
 - a) avoid accident
 - b) promote accident
 - c) eliminate workers

2. OSH means _____.
 - a) Occupational Service Healthy
 - b) Occupational Safe and Healthy
 - c) Occupational Safety and Health

3. Identifying hazards makes you _____.
 - a) safe from working
 - b) comfortable while working
 - c) work efficient d) all of the above

4. Who should first know about the accident that happened in your shop?
 - a) principal
 - b) nurse
 - c) teacher
 - d) doctor

5. Accidents can be prevented _____.
 - a) through proper care and maintenance of tools and equipment
 - b) right attitude toward work
 - c) if you have a good knowledge about safety practices.

Refer to the Answer Key. What is your score?

LEARNING OUTCOME 2

Evaluate 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.



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: Identify the following Personal Protective Equipment (PPE)

1.



4.



2.



5.



3.





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

Signs and their location:

1. Danger Signs -are used only where immediate hazards exist. They are printed in red as the predominating color.
2. Caution Signs -are used to warn against potential hazards.
3. Exit Signs -are printed in legible red letters for exits.
4. Safety Instructions Signs
5. Accidental Prevention Tags - are used as temporary means of warning to existing hazards, such as deflection, tools and equipment.
6. Barricades -are used for protection of employees

Personal Protective Equipment (PPE)

Here are the types of Personal Protective Equipment (PPE) use for safety purposes:

A. Face protection

Goggles and face protection must be used when workers are at risk from flying particles, liquid chemicals, acids or caustic liquids and chemical gases. Various goggles for face protection must meet certain design criteria for safety.



B. Foot Protection

Safety shoes with impact protection are used in work areas where heavy objects or tools could be accidentally dropped on the feet. Safety shoes with puncture protection are required when working around nails, wire tacks, scrap metals and other objects that could pierce the feet.



C. Hand Protection

Gloves are required to protect the hands of workers from cuts, scrapes, punctures, burns, chemical absorption, and exhaust temperatures. It is crucial that the type of glove being used is the right one for the job.



D. Hearing Protection

Appropriate **ear muffs or ear plugs** must be made available as a last resort if it is not possible to make the workplace less noisy. The requirement is a small part of the occupational noise exposure standard which requires employers to ensure that workers are exposed to less than 90 decibels of noise over an 8 hour period.



E. Respirators

Appropriate **respirators** must be worn as a last resort if it is not possible to ventilate the work area properly.



How Much Have You Learned?

Self-Check 2.1

DIRECTIONS: Define and describe the following:

- a. Danger Signs- _____
- b. Caution Signs- _____
- c. Exit Signs- _____
- d. Accidental Prevention Tags- _____

Refer to the Answer Key. What is your score?

LEARNING OUTCOME 3

Control 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.



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:: Write the letter of the correct answer on your Answer Sheet

1. Conducting hazard assessment to a workplace should be done_____.
 - a) during working hours
 - b) after working hours
 - c) before working hours
 - d) all of the above
2. Observing good housekeeping _____.
 - a) prevents fire
 - b) makes for easy location of tool and materials needed
 - c) both a and b
 - d) none of the above

3. In dealing with accidents , the first thing to do is to_____.
- stay calm and study the situation
 - apply first aid
 - call the attention of your teacher
 - all of the above
4. Accidents can be prevented _____.
- thru proper cares and maintenance of tools and equipment
 - right attitude towards works
 - if you have enough knowledge about safety practices
 - all of the above
5. When an injury occurs, how soon should it be treated?
- After class hours
 - Immediately
 - Both a and b
 - Later



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

Occupation Health and Safety (OHS) Procedures for controlling hazards and risks.

- Conduct a hazard assessment like;
 - Survey workplace to identify hazards (put them in writing)
 - Determine whether any hazard required Personal Protective Equipment.
 - Pay attention to working conditions that can produce hazards
 - Reassess hazards whenever necessary, especially when new equipment is installed

- Select appropriate equipment;

Ensure that all Personal Protective Equipment used is the right kind of equipment for the job, and is maintained properly



1. Have knowledge on the following:

- Which PPE is necessary
- How to identify if it fits properly
- How to put on, remove, adjust and wear Personal Protective Equipment (PPE)
- How to dispose of Personal Protective Equipment(PPE)
- The limitation of using Personal Protective Equipment (PPE)

Procedure in dealing with workplace, accidents, fire and Emergencies

PROCEDURES:

A. DEALING WITH ACCIDENTS

1. Keep calm, don't panic and study the situation.
2. Report immediately to your teacher
3. Apply first aid to the victim while waiting for a nurse or a physician
4. Bring the patient to the nearest clinic or hospital

B. DEALING WITH FIRE

1. Do not panic, stay calm.
2. Call the attention of everybody.
3. Use your firefighting equipment to control extinguish the fire.
4. Call the office or the fire station

C. DEALING WITH EMERGENCIES

1. Stay calm and study the situation.
2. Call the attention of your teacher.



How Much Have You Learned?

Self-Check 3.1

Direction: Write the letter of the correct answer on your Answer Sheet

1. Conducting hazard assessment to a workplace should be done_____.
 - a) during working hours
 - b) after working hours
 - c) before working hours

- d) all of the above
2. Observing good housekeeping _____.
- a) prevents fire
 - b) makes for easy location of tool and materials needed
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3. In dealing with accidents , the first thing to do is to_____.
- a) stay calm and study the situation
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 - c) call the attention of your teacher
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 - b) right attitude towards works
 - c) if you have enough knowledge about safety practices
 - d) all of the above
5. When an injury occurs, how soon should it be treated?
- a) After class hours
 - b) Immediately
 - c) Both a and b
 - d) Later

Refer to the Answer Key. What is your score?



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

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Answer Key

LESSON 1:PREPARE PLUMBING MATERIALS AND TOOLS

What do you already know?

LO.1

1. Steel Square
2. Pipe cutter
3. Pipe threader
4. Pipe reamer
5. Plumb bob
6. Pipe wrench
7. Bench vise
8. Pipe vise
9. Cross cut saw
10. Pull –push rule

LO.2

1. Foreman
2. Leadman
3. Material officer
4. Safety officer
5. Job order
6. Tool keeper
7. Borrower
8. total
9. Unit price
10. Requisition quality and unit

How much have you learned?

LO.1

A.

1. Pipe cutter
2. L-square
3. Pipe threader
4. Hose level
5. Fittings

B.

1. Clamp
2. Hacksaw
3. Pipe reamer
4. Power hack saw
5. Lavatory

LO.2

I.

1. Material/description
2. Name of project
3. Unit price
4. Balance on hand
5. Requisitioner

II.

1. G
2. A
3. C
4. F
5. B
6. E

LESSON 2:PERFORM MENSURATION AND CALCULATION

What do you already know?

LO.1

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

LO.2

1. $64 \text{ cm} \times \frac{1 \text{ inch}}{2.54 \text{ cm}} = 25.20 \text{ inch}$

2. $59 \text{ yards} \times \frac{3 \text{ ft}}{1 \text{ yard}} = 177 \text{ ft}$

3. $95.5 \text{ dm} \times \frac{1 \text{ m}}{10 \text{ dm}} = 9.55 \text{ m}$

4. $19 \text{ inches} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = 48.26 \text{ cm}$

5. $47 \text{ feet} \times \frac{12 \text{ inches}}{1 \text{ ft}} = 564 \text{ inches}$

6). $4 \text{ m} - \text{-----} 400 \text{ cm}$

7). $9 \text{ yards} - \text{-----} 27 \text{ feet}$

8). $5.5 \text{ dm} - \text{-----} .55 \text{ meter}$

9). $9 \text{ meters} - \text{-----} 900 \text{ centimetre}$

10). $7 \text{ feet} - \text{-----} 84 \text{ inches}$

How much have you learned?

LO 1

I.

1. Outside caliper
2. L Square
3. Inside caliper

4. Try square
5. Pull Push rule

II.

A.

1. T
2. F
3. F
4. T
5. T

B.

Inside Caliper

Avoid using tip of the inside caliper to open the cover of any can. Avoid dropping it to maintain its accuracy in taking measurements.

Outside Caliper

Don't hold the outside caliper tightly so that you can adjust it easily. Don't take the diameter of a revolving type.

Steel Square

Hold the tool firmly and cautiously. See to it that it won't drop. It has a very pointed end which is very harmful.

TRY SQUARE

Avoid mishandling the try square to maintain their straight edges which are used to get the desired angle. Don't use it for other purposes. Put it in its proper place.

PULL PUSH RULE (Tape Measure)

Hold the tip of the pull push rule when removing it from its housing. Put it slowly to avoid cut from the steel tape.

LO 2

1. $64 \text{ cm} \times \frac{1 \text{ inch}}{2.54 \text{ cm}} = 25.20 \text{ inch}$
2. $59 \text{ yards} \times \frac{3 \text{ ft}}{1 \text{ yard}} = 177 \text{ ft}$
3. $95.5 \text{ dm} \times \frac{1 \text{ m}}{10 \text{ dm}} = 9.55 \text{ m}$
4. $19 \text{ inches} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = 48.26 \text{ cm}$
5. $47 \text{ feet} \times \frac{12 \text{ inches}}{1 \text{ ft}} = 564 \text{ inches}$

LESSON 3: INTERPRET TECHNICAL DRAWINGS AND PLAN

What do you already know?

Pre Test LO1. A.

1. Floor Drain
2. Shower Head
3. Shower Head Gang
4. Clean Out
5. Hot water tank

Pre Test B


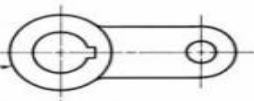
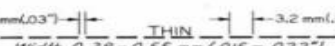
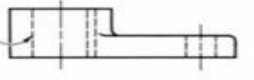



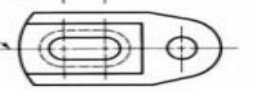

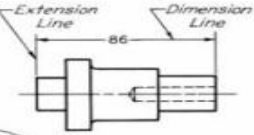

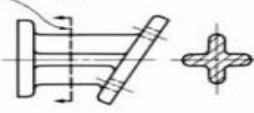
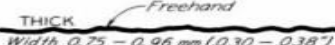
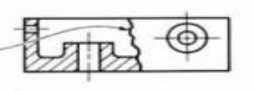
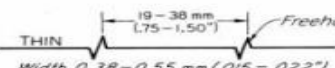
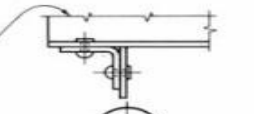

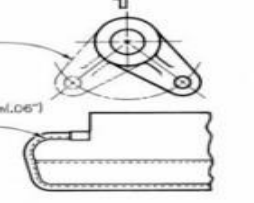
1. G
2. F
3. E
4. D
5. C
6. B
7. A

Self Check 3.1

OTHER VALVES		BUCKET TRAP		VACUUM-PRESSURE	
VALVE	SYMBOL	FLOAT TRAP		THERMOMETER	
AUTOMATIC, OPERATED BY GOVERNOR		P TRAP		THERMOMETER, DISTANT READING, BARE SOLE TYPE	
DIAPHRAGM		RUNNING TRAP		THERMOMETER, DISTANT READING, SEPARATE SOCKET TYPE	
FAUCET		TRAP		AIR CHAMBER	
POWER AND HEATING PLANT EQUIPMENT					
UNIT	SYMBOL				
AIR EJECTOR					
BLOWER					
BLOWER, SOOT					
BOILER, STEAM GENERATOR (WITH ECONOMIZER)					
ENGINE, STEAM					
EVAPORATOR, SINGLE EFFECT					
PUMP, RECIPROCATING					
PUMP, ROTARY AND SCREW					
TURBINE, STEAM					
STRAINERS		GAGES, THERMOMETERS, AND MISCELLANEOUS			
TYPE	SYMBOL	TYPE	SYMBOL		
BOX STRAINER		LIQUID LEVEL			
DUPLEX OIL FILTER		PRESSURE			
DUPLEX STRAINER		VACUUM			
STRAINER					
Y STRAINER					
TRAPS					
TYPE	SYMBOL				
AIR ELIMINATOR					
BOILER RETURN TRAP					
		REFRIGERATION EQUIPMENT			
		UNIT	SYMBOL		
		COIL, PIPE			
		COMPRESSOR (ALL TYPES)			
		CONDENSER, EVAPORATIVE			
		CONDENSING UNIT, AIR COOLED			
		CONDENSING UNIT, WATER COOLED			
		COOLER, BRINE			
		SWITCH, CUT-OUT, HIGH PRESSURE			
		SWITCH, CUT-OUT, LOW PRESSURE			
		VALVE, EVAPORATOR PRESSURE REGULATING SNAP-ACTION VALVE			
		VALVE, EXPANSION, AUTOMATIC			
		VALVE, EXPANSION, MANUALLY OPERATED			
		VALVE, EXPANSION, THERMOSTATIC			

DMV/2Ch04/52

Self Check 3.2

Lines	Width and Character of Lines	Applications
Visible line	<p>THICK Width 0.75 – 0.96 mm (.030 – .038")</p> 	
Hidden line	<p>0.8 mm (.03") THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	
Section line	<p>THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	
Center line	<p>19 – 38 mm (.75 – 1.50") THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	
Dimension line, Extension line, Leaders	<p>90.5 THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	
Cutting-plane or Viewing-plane lines	<p>1.6 mm (.06") THICK Width 0.75 – 0.96 mm (.030 – .038")</p> 	
Short-break line	<p>THICK Width 0.75 – 0.96 mm (.030 – .038")</p> 	
Long-break line	<p>19 – 38 mm (.75 – 1.50") THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	
Phantom line	<p>1.6 mm (.06") THIN Width 0.38 – 0.55 mm (.015 – .022")</p> 	

LESSON 4: MAINTAIN TOOLS AND EQUIPMENT

What do you already know?

LO.1

1. Plumb bob
2. Pull push rule
3. Try square
4. Steel square
5. Outside caliper
6. Inside caliper
7. Clamp
8. Bench vise

LO.2

1. True
2. True
3. False
4. False
5. False
6. True
7. True
8. True
9. True
10. False

How much have you learned?

LO 2

1. True
2. True
3. False
4. False
5. False
6. True
7. True
8. True
9. True
10. False

LESSON 5:PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES

What do you already know?

LO.1

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

LO.2

1. Hand Protection
2. Goggles
3. Respirators
4. Hearing Protection
5. Safety Shoes

LO.3

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

How much have you learned?

LO.1

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

LO.2

- a. Danger Signs- are used only where immediate hazards exist. They are printed in red as the predominating color.
- b. Caution Signs- are used to warn against potential hazards.
- c. Exit Signs- are printed in legible red letters for exits.
- d. Accidental Prevention Tags- are used as temporary means of warning existing hazards, such as deflection, tools and equipment.

LO.3

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

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