K TO 12 Basic Education Program

Learning Materials

Grade 7 or 8

Technology and Livelihood Education

MECHANICAL DRAFTING
Drafting is said to be the universal language of industry and modern technology. It is through the application of special lines and symbols that drafter’s use so that technical people can communicate. Through drawings, ideas and designs are transferred between draftsmen, architects and engineers. The uniformity of lines and symbols makes it possible to be widely accepted, thus, making graphic technical drawing understandable anywhere in the world.

In a fast-developing country like the Philippines, many investors are coming in so they need technical people to supervise factories and offices. New products are introduced; hence, there is a great demand for designs. The production of goods always starts from a design. Ideas are presented by pictorial sketches in the initial stages of creative work. Detailing is done with lines to represent all the features of an object, such as its edges, surfaces and contours. Lines also form the sizes, dimensions, symbols and notes to complete a description.

To understand the fundamental principles of drawing, acquired desirable values are necessary. A draftsman should possess the ability and the skills in using different drawing instruments. In general, it helps him construct output with accuracy and speed.
Table of Contents ……………………………………………………………. 1
The Module…………………………………………………………………….. 2
How Do You Use This Module………………………………………………. 3
LESSON 1 – Preparing Drafting Materials and Tools/Drawing Instrument …….. 4
LESSON 2 – Performing Basic Mensuration and Calculation …………….. 27
LESSON 3 – Interpreting Working Plans and Sketches …………………….. 69
LESSON 4 – Applying Safety Practices ………………………………………. 133
Summary/Definition of terms…………………………………………………..166
References ………………………………………………………………………170
List of Materials /Tools/Equipment /Consumables for this Module….172
Acknowledgment ……………………………………………………………… 173
This Module is an exploratory course which leads you to Mechanical Drafting NC II. It is designed to familiarize students with different drafting materials and tools, instruments for drawing mechanically the orthographic projection and pictorial drawing, the proper use of compass, triangle, T-square, pencils, erasers, and technical pens. It is important to have basic knowledge and skills in orthographic views because this will be used or applied in the competencies to be mastered in Grades 9-12.

This is also designed to teach students perform basic mensuration and calculation and how to interpret simple working drawing plans and sketches; the laboratory safety practices are also applies to make the draftsman more knowledgeable when it comes to the coverage of duty in the laboratory or working area.

It covers 4 common competencies that a Grade 7 & 8 Technology and Livelihood Education (TLE) student like you should possess, namely:

1. Preparing drafting materials and tools/drawing instruments
2. Performing basic mensuration and calculation
3. Interpreting working plans and sketches
4. Applying safety practices

These 4 common competencies are covered separately in 4 Lessons. As shown in the LEARNING GOALS.

OBJECTIVES:

At the end of this module the students are expected to:

a. Demonstrate understanding of Personal Entrepreneurial Competencies (PECs) as a mechanical draftsman. This includes drafting industrial/commercial materials, designing, measuring and plotting simple plans. In the end you will be able to harness experiences in this field of specialized skill.

b. Be familiar with the different industries/company that needs the skills related to a mechanical draftsman.

c. Study and perform the basic competencies that will lead you and prepare you to be a future draftsman.

Your success in this exploratory course on Mechanical Drafting is shown in your ability to perform the performance standards found in each Lesson.
How Do You Use This Module?

This Module has 4 Lessons. Each Lesson has the following parts.

- Learning Goals/Targets
- Performance Standards
- Materials
- What Do You Already Know? **Assessment**
- What Do You Need to Know? **Know**
- How Much Have You Learned? **Process**
- How Do You Apply What You Learned? **Reflect**
- How Well Did You Perform? **Understand**
- How Do You Extend Your Learning? **Transfer**
- Summary
- Definition of terms
- References

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

1. Begin by reading and understanding the Learning Goals/Targets and Performance Standards. These tell you the lessons that you should master along with the matching skills that you should learn by the end of this Module.

2. Find out what you already know by taking the Pretest then check your answer against the Key Answers. 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 correctly.

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 responding to the Self-check Activity then refer to the Key Answers 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.
LEARNING GOALS / TARGETS:

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

LG 1. Identify drafting materials and tools/drawing instruments applicable to a specific job.

LG 2. Request, receive and inspect drafting materials and tools/drawing instruments.
LEARNING GOALS/TARGET 1

Identify drafting materials and tools/drawing instruments applicable to a specific job.

PERFORMANCE STANDARDS

1. Identify drafting materials and tools/drawing instruments that are needed per job requirement.

2. Classify materials and tools/drawing instruments according to their use on a specific drafting project.

Materials

- T-square
- Triangles 30 x 60 and 45 x 45
- Pencils/mechanical pencils
- Compass/Divider
- Drawing paper
- Drawing board
- Triangular Scale
- Eraser
- Erasing shield
- Protractor
- Sharpener
- Drawing Tape
What Do You Already Know?

Let us determine how much you already know about drafting materials and tools/drawing instruments. This is to find out whether you are ready to become a mechanical draftsman. Take this test.

Pre-assessment test LG 1

**Direction:** Select the drafting material and tools/drawing instruments applicable to a specific job described in each item.

1. A drafting tool used for drawing horizontal lines
   A. Compass  B. Triangle  C. T-square  D. Triangular Scales

2. The drafting material used for fastening the drawing paper on the drawing table
   A. Compass  B. Divider  C. Masking Tape  D. Triangle

3. The main function of this tool is to reproduce the measurements of an object in a reduced or enlarged size.
   A. Compass  B. Protractor  C. Triangle  D. Triangular Scales

4. This drafting tool is used to protect the rest of the drawing when removing unnecessary lines.
   A. Erasing Shield  B. Eraser  C. Masking Tape  D. Pencil Sharpener

5. This drafting tool is used when drawing vertical lines.
   A. Compass  B. Triangle  C. Triangular Scales  D. Ruler

**A. DIAGNOSTIC ASSESSMENT**

Name: _____________________________  Date: _______________
Year & Section ______________________  Teacher: ____________

Directions: Below are some basic knowledge in drawing/drafting materials. Assess yourself by putting a star (*) on the YES column if you possess the competency and a star in the NO column if you don’t.

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>YES</th>
<th>NO</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the proper use of a compass and a divider.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Know the different pencil leads and their purposes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can identify tools/instruments used for drawing straight lines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpret different instruments and their uses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiate instruments according to their uses.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**B. PERFORMANCE ASSESSMENT**

Name: _____________________________ Date: _______________
Year & Section ______________________ Teacher: ____________

Directions: Below are the basic SKILLS in using drawing/drafting materials. Assess yourself by putting a star ( ★ ) on YES or NO column, then provide simple remarks at the box.

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>YES</th>
<th>NO</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I CAN…..</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**C. INSTRUMENTS USED IN MECHANICAL DRAFTING**

Name: _____________________________ Date: _______________
Year & Section ______________________ Teacher: ____________

**Direction:** Match Column A with Column B. Write only the letter of the correct answer on the space provided before each number.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Type of pencils when extreme accuracy is required</td>
<td>A. Eraser</td>
</tr>
<tr>
<td>2. Used to clean the dirt off the drawing</td>
<td>B. Medium pencils</td>
</tr>
<tr>
<td>3. An instrument used for transferring measurements</td>
<td>C. Protractor</td>
</tr>
<tr>
<td>4. Type of pencils used for general purpose in drawing</td>
<td>D. Divider</td>
</tr>
<tr>
<td>5. Best tool when measuring arcs, angles and circles</td>
<td>E. Hard pencils</td>
</tr>
<tr>
<td></td>
<td>F. Triangle</td>
</tr>
</tbody>
</table>

Now check your answers using the prepared Answer key.
If you got 90%-100% of the items correctly, proceed to the next Learning Goal.
If not, do the next Activity; try again to gain knowledge and skills required for mastery.
What Do You Need To KNOW?

Read 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

DRAFTING MATERIALS AND TOOLS, ITS USES/FUNCTIONS

There are a great variety of drafting materials and tools used in mechanical drawing. The drafting materials and tools discussed in this Module include most of the basic ones but sufficient enough for your initial understanding about mechanical drawing.

PICTURES/ILLUSTRATIONS

MATERIALS, DESCRIPTION AND FUNCTION

Drawing paper

Various types of drawing papers are available for use but hard and soft surface drawing papers are highly recommended to be used. This type does not groove easily when pressure is applied to the pencil. Oslo paper is commonly used but bond paper is also recommended.

Masking tape

This is used for fastening the drawing paper on the drawing table or drawing board because it does not damage the board and it will not damage the paper if it is removed by pulling it off.

Pencil sharpener

Pencils should be sharpened whenever they show sign of dullness. Various types and designs are available in the stores.
Eraser

This is used to clean the dirt off the drawing. A soft eraser is advantageous in removing smudges and pencil marks, whereas, a harder eraser is useful for making changes and correcting errors in the drawing.

Drawing pencil

This is one of the most important tools in drawing. It comes in various grades. The grade of pencil to be used depends on the quality of paper to be used. You have to take into consideration also the type of line work required.

Hard pencils – are used where extreme accuracy is required especially working on graphs, diagrams and charts.

Medium pencils – are used for general purpose work in drawing.

Soft pencils – are too soft to be used in mechanical drafting. They are very useful for art work of various kinds.

Triangular Scales

The architect's scale is a tool generally used when reproducing a drawing in an enlarged or reduced form to some regular proportion. Its main function is to reproduce the measurements of an object in full size, reduced size, and enlarged size.

Erasing Shield

This tool is made up of a thin metal with irregular holes. It is a useful tool to protect the rest of the drawing when clearing up smudges, unnecessary pencil lines and other erasures.
DRAWING INSTRUMENTS

Drawing instruments are used for drawing and designing purposes. Their quality is very essential if you want to have good results. Cheaper drawing tools and instruments do not only provide poor quality results but also do not last long.

PICTURES/ILLUSTRATIONS

MATERIALS AND TOOLS DESCRIPTION

T-Square

It is a drawing instrument used when making horizontal lines. It is also used for guiding triangles when drawing vertical lines. It is made of wood, plastic or the combination of both. There are three (3) types of T square, Namely:

1. Fixed Head. The head is fastened to the blade. It is used for ordinary work.

2. Movable Head or Adjustable Head. It has one fixed and one adjustable head and used only for occasional drawing.

3. Detachable Head or Removable Head. It is designed for comfort when carrying the T-square.

Triangles

It is a three-sided ruler, which typically has two equal sides meeting at a 90 degree angle and to a third side at 45, 30, including 60 degree angles. It is usually made of plastic and comes in different sizes. If in use, the base of the triangle must rest on the blade of the T square. Drawing a line always starts from the point near the base going upward.

Commonly used triangles are:

- a. 30 degrees X 60 degrees
- b. 45 degrees X 45 degrees

Compass

This drawing instrument is used when drawing arcs and circles. It is used in a similar way to a divider. It is composed of one with the pen leg and the needle point leg being held together with a handle. This drawing instrument can be used for both penciling and inking.
**Divider**

This is a drawing instrument used when transferring measurements, dividing lines and arcs into the desired number of equal parts. It can easily transfer accurate measurements by adjusting the divider points. Constant and correct practice with this is necessary before doing actual work.

**Protractor**

It is a semi-circular instrument divided into 180 equal parts, each of which is called a degree. It is used to determine gradations of the degrees when measuring arcs, angles and circles. High quality protractor is usually made of plastic.

Did you enjoy reading the given information? Which among the drafting materials, and drawing tools and instruments matter to you most? Well, you are just starting, Now, let’s move ahead to enrich your understanding.
How Much Have You Learned?

Directions:
There are twelve (12) different drafting materials and tools and drawing instruments that can be found in the puzzle. Identify at least ten (10) of them.

Refer to the Answer Key. What is your score?

GRADE 7 & 8)

false
How Do You Apply What You Have Learned?

It is not enough that you learned concepts on drafting materials and drawing instruments. Be sure that you are also able to demonstrate the skills. Do this Activity Sheet.

**ACTIVITY SHEET NO.1.1**

**PROPER MANIPULATION OF THE T-SQUARE**

**Directions:** Practice the task below by following the given procedure.

**Instrument:**
- T – Square

**Equipment:**
- Drawing Table (Drafting Table or Drawing Board)

**Procedure:**
1. Place the head of the T-square against the edge of the drafting table. (Left side of the table if you are right handed and at the right side of the table if you are left handed).
2. Slide the working head of the T-square against the working edge of the drawing table. The two edges should be in constant contact until the desired position.

*Note: Do not use the T-square on uneven or rough surface and never cut paper along its working edge.*

---

**Proper use of T-Square**

---

**MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8)**

K to 12 – Technology and Livelihood Education
Setting up a Drawing Paper on the Drawing Table

**Directions:** Below is a simple activity for you to work on. Practice the task following the given procedure.

**Materials:**
- Drawing paper
- Masking tape

**Instrument:**
- T – Square

**Equipment:**
- Drawing table

**Procedures:**

1. Press firmly the T-square against the working edge of the drawing table.
2. Place the drawing paper close to the working edge of the drawing table and working head of the T-square (depending on you if you are right or left-handed) while the paper is placed on top edge of the T-square.
3. Fasten the upper left portion of the drawing paper followed by the lower right portion and finally the remaining corners.

*Note: Always fasten larger backing sheet of thicker drawing paper on the board first.*

[Image of drawing paper placed on a T-square]

Placing drawing paper to the drawing board
Drawing a Horizontal Line

Directions: Practice the task below by following the given procedure.

Materials:
- Drawing paper
- Masking tape

Instrument:
- T-Square
- Triangles (30 deg. x 60 deg. and 45 deg. x 45 deg.)

Equipment:
- Drawing table

Procedure:

1. Press the head of the T-square against the working edge of the drawing table and lean the pencil to the desired direction of the line inclined at more or less 60 degrees with the drawing table. The head of the T-square should be at the left side if you are right handed and to the right if you are left handed.

2. Maintain the position of the pencil while you glide lightly on the blade of the T-square.

3. Draw the line from left to right rotating occasionally to produce uniform line weights.

Using the T-Square to draw Horizontal lines
Drawing a Vertical Line

Directions: Below is a simple activity for you to work on. Practice the task following the given procedure.

Materials:
- Drawing paper
- Masking tape

Instrument:
- T – Square
- Triangles (30 deg. x 60 deg. and 45 deg. x 45 deg.)

Equipment:
- Drawing table

Procedures:

1. Use 45 degrees triangle or 30 degrees x 60 degrees to draw vertical lines.

2. Place the triangle on top of the blade of the T-square with the vertical edge on the left.

3. With the left hand pressing the T-square and the triangle against the drawing board, draw the line upward, rotating the pencil slowly between the thumb and forefinger.

See figure below.

![Drawing vertical lines using triangles and T-square](image)

How did you find the activities? Did you enjoy doing them? Did you find them difficult? Challenge yourself by continuing to practice the given steps in each activity. Have fun!
Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake.

<table>
<thead>
<tr>
<th>Learners Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test attempt</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; □</td>
</tr>
<tr>
<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; □</td>
</tr>
<tr>
<td></td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; □</td>
</tr>
</tbody>
</table>

Directions:
Ask your teacher to assess your performance in the following critical task and performance criteria below.

You will be rated based on the overall evaluation on the right side.

<table>
<thead>
<tr>
<th>OVER ALL EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level Achieved</strong></td>
</tr>
<tr>
<td><strong>PERFORMANCE LEVELS</strong></td>
</tr>
<tr>
<td>4 - Can perform this skill without supervision and with initiative and adaptability to problem situations</td>
</tr>
<tr>
<td>3 - Can perform this skill satisfactorily without assistance or supervision.</td>
</tr>
<tr>
<td>2 - Can perform this skill satisfactorily but requires some assistance and/or supervision.</td>
</tr>
<tr>
<td>1 - Can perform parts of this skill satisfactorily, but requires considerable assistance and/or supervision.</td>
</tr>
</tbody>
</table>

Note: Instructor will initial level achieved.
The previous activities allowed you to learn the different drafting tools and materials, their uses and characteristics, and their proper manipulations. You are now ready to study official documents and other related forms involved when you use drafting materials, drawing tools and instruments for preparing mechanical drawings. Now proceed to other learning experiences. Enjoy and have fun!

PERFORMANCE STANDARDS

For acceptable achievement, all items should receive a "Yes" or "N/A" response.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8)
LEARNING GOALS/TARGETS

Request, receive, inspect and store drafting materials and tools

PERFORMANCE STANDARDS

1. Receive and inspect materials and tools per quantity and specification based on requisition.
2. Check tools and materials for damages and manufacturing defects.
3. Received and handle materials and tools/instruments with appropriate safety devices.

Materials

- Sample forms in requesting, receiving, inspecting and storing drafting materials and tools, drawing instrument
- Pencils/ mechanical pencils
What Do You Already Know?

Let us determine how much you already know about requesting, receiving and inspecting drafting materials and tools/drawing instruments. Take this test.

Pre-test LG 2

Directions: Read each statement carefully. Write the letter of the correct answer on a separate sheet of paper.

1. This form shows proof or receipt of goods or services.
   A. delivery receipt form  
   B. inventory form  
   C. purchase order form  
   D. requisition slip form

2. This form contains specified quantities of described goods at agreed terms and at a designated time and place.
   A. delivery receipt form  
   B. inventory form  
   C. purchase order form  
   D. requisition slip form

3. This form is a printed document on which a request is made.
   A. delivery receipt form  
   B. inventory form  
   C. purchase order form  
   D. requisition slip form

4. This form contains information about name, number, purchase information and cost of goods and displays on a balance sheet.
   A. delivery receipt form  
   B. inventory form  
   C. purchase order form  
   D. requisition slip form

5. This department is in-charge of unloading, unpacking of incoming materials, check, identify goods received with descriptions on the purchase order.
   A. accounting department  
   B. budget department  
   C. receiving department  
   D. sales department

Compare your answers using the Answer Key. If you got 90%-100% of the items correct, that means you are already familiar with the lesson covered by Learning Outcome No. 2. Therefore you can proceed to the next activity. If you got many items wrong, study the lesson again. Carefully reviewing the lesson helps you understand the concepts better. Concentrate on the parts that cover the questions you missed. After this, you are very much ready to proceed to the next learning activity.
PROCEDURES IN RECEIVING AND STORING TOOLS AND MATERIALS

The Receiving Department has the function to unload and unpack incoming materials; check quantities received against the shippers packing list; identify goods received with descriptions on the purchase order; prepare a receiving report; notify the purchasing department of descriptions discovered; arrange for inspection when necessary; notify the purchasing department of any damage in transit; and route accepted materials to the appropriate manufacturer’s location.

The form also provides a space for the inspection department to note either the complete approval of the shipment or the quantity rejected or the reason for the rejection, if inspection does not take place immediately after receipt of the materials, the receiving report is distributed as follows:

The receiving department keeps one copy and sends another copy to the purchasing department as notice of the arrival of the materials.

All other copies go to the inspection department, and are distributed when inspection is completed. After inspection, one copy of the receiving report, with the inspection result is sent to the accounting department, where it is matched with the purchase order and the vendor’s invoice and paid. Other copies go to various departments such as materials and production planning. One copy accompanies the materials, so that the storekeeper knows the quantity and the kind of materials received.

INVENTORY

Inventory is an idle stock of physical goods that contain economic value, and are held in various forms by an organization in its custody awaiting packing, processing, transformation, use or sale at future point of time.

INVENTORY FORM

The Inventory form contains information about items (name, number, sales and purchase information, and cost of goods sold account information) that any business purchases for sale, tracks in inventory, and displays on a balance sheet.

VARIOUS FORMS

Accurate entry in different forms used in drafting works is essentially important in order to purchase right, accurate and complete number of drawing materials, tools and instruments needed in a specific drafting job. Here are various sample forms used in drafting works.
A. Sample Requisition Slip Form

This is an official paper in the form of a printed document on which a request is made.

Name:
Project:
Classification:
Purpose:

<table>
<thead>
<tr>
<th>NO.</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>DESCRIPTION</th>
<th>UNIT PRICE</th>
<th>TOTAL PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Requisitioner Teacher Department Head Principal

B. Sample Purchase Requisition Form

Below is a sample purchase requisition form. For standard materials, little information other than the stock number may be needed and for other purchases/requests, it may be necessary to give particular descriptions, blueprints, catalog numbers, weights, standards, brand names, exact quantities to order, and suggested prices. One copy remains with the originating employee, and the original is sent to the purchasing department for execution of the request.
## Purchase Requisition

To Purchasing Department

<table>
<thead>
<tr>
<th>Deliver to</th>
<th>Date Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dept. No.  
Acct. No.  

Suggested Supplier

<table>
<thead>
<tr>
<th>Qty</th>
<th>Item No.</th>
<th>Description</th>
<th>Unit Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Allowance for period  
Balance Available  
Amt This Purchase  
Remaining Balance

Ordered By  
Approved By

### A. Sample Delivery Receipt Form

Delivery receipt form shows proof or receipt of goods or services. The receiver acknowledges receiving a consignment of goods from supplier. The buyer signs it before it is returned to the seller. This officially takes care of uncertainties on the part of the supplier who gets to know the safe and timely arrival of goods to their designated destination.

Name of Supplying Company:  
Delivery Receipt:  
Supplier’s Address:  
Date:
I hereby acknowledge receipt of the following in perfect condition as per the set of conditions of our supply contract from the firm of ____________________ (Name of supplying company).

Order No.: __________________

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Invoice No.: ______________       Date actually received: _____________

B. Sample Inventory Form of Drawing Tools and Instruments

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Requisitioner: ____________________  Teacher: ____________________  Department Head: ____________________  Principal: ____________________
### C. Sample Borrower’s Slip

Name of Borrower: __________________________ Date: __________________

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Noted by: __________________________

Signature of Borrower: __________________________

Date Returned: __________________________

Personnel In-Charge: __________________________

---

**MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8)**

K to 12 – Technology and Livelihood Education
How Much Have You Learned?

TEXT TWIST

A. Directions: Under column A are disarranged words of different forms used in drafting when requesting, receiving and inspecting needed materials, and tools and instruments. Arrange them to form the correct words.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ROIFYVT MNOENF</td>
<td>1. ______________________________</td>
</tr>
<tr>
<td>2. RLVCDPYT EEEEIR</td>
<td>2. ______________________________</td>
</tr>
<tr>
<td>3. PRESO ROBRWIL</td>
<td>3. ______________________________</td>
</tr>
<tr>
<td>4. SODEAR CUPREAH</td>
<td>4. ______________________________</td>
</tr>
<tr>
<td>5. FITIMEON SIRUROQ</td>
<td>5. ______________________________</td>
</tr>
</tbody>
</table>

Refer to the Answer Key. What is your score?

B. Direction: Describe briefly at least two (2) of your correct answers.

1. ________________________________________________________
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

2. ________________________________________________________
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

You did a great job! You are now familiar with the different forms, receipt, and requisition in the laboratory/shop area. All your lessons are essential in the field of mechanical drafting as well as related jobs. Rest and relax a while then move on to the next lesson. Good luck!
INTRODUCTION

This lesson is designed to familiarize students with mensuration and calculationan essential skill in determining shape. The shop worker preferably the draftsman must know the exact width, height and depth of a work piece, as well as the diameter and precise location of holes. Accuracy of measurements depends on one's ability to use measuring tools correctly.

OBJECTIVES:

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

LG 1. select and use measuring instruments;
LG 2. clean and store measuring instruments; and
LG 3. convert fraction to decimal and vice versa
LG 4. convert English to Metric measurement
LEARNING GOALS / TARGETS 1

Select and use measuring instruments

PERFORMANCE STANDARDS / PECs

1. Select and use measuring instruments according to the level of accuracy required.

2. Measurements taken are accurate to the finest gradation of the selected measuring instrument.

3. Measuring techniques applied are correct and appropriate to the instrument used.

Materials

- T-square
- Triangles 30 x 60 and 45 x 45
- Pencils/mechanical pencils
- Compass
- Drawing paper
- Drawing board
- Scale
- Eraser
- Erasing shield
- Protractor
What Do You Already Know?

Let us determine how much you already know about the measuring instruments in mechanical drafting. Take this test.

Pre-test   LG 1

Directions: Multiple Choices. Write the letter of the correct answer.

1. A measuring tool used to layout an angle or an arc.
   A. Compass       B. Divider       C. Protractor       D. Tape ruler

2. The most popular type of measuring tool, usually 6 or 12 inches in length.
   A. Tape ruler    B. Triangle    C. Ruler    D. Scale

3. Its main purpose is to reproduce, reduce or enlarge the dimension of size on a drawing.
   A. Tape ruler    B. Triangle    C. Ruler    D. Scale

4. It is used for drawing vertical and oblique lines.
   A. Ruler    B. Scale    C. Triangle    D. T- Square

5. It provides an easy means for accurately measuring curved surfaces.
   A. Compass    B. Divider    C. Protractor    D. Tape ruler

6. These are used for measuring dimensions.
   A. Cutting Tools    B. Measuring Tools    C. Lining Tools    D. Testing Tools

7. This is used as a guide in drawing horizontal lines.
   A. Ruler    B. Scale    C. Triangle    D. T- Square

8. This instrument is used to draw circles, arcs, radii, and parts of many symbols.
   A. Compass    B. Divider    C. Protractor    D. Tape ruler

9. It is a concave, spring-steel blade ranging from 1/4” to 1” wide and 6 to about 300 feet in length.
   A. Meter stick    B. Tape ruler    C. Triangle    D. Ruler

10. It helps a drafter keep the proportions accurate.
    A. Ruler    B. Scale    C. Triangle    D. T- Square

Now check your answers against the Answers keys. If you got 90%-100% of the items correctly, proceed to the next Activity. If not, carefully reviewing the lesson helps you understand the concepts better. Concentrate on the parts that cover the questions you missed. After this, you are very much ready to proceed to the next learning activity.
What Do You Need To Know?

Read the Information Sheet 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

Different Measuring Tools/instrument and their application

An understanding of measurement is essential for all parts of manufacturing and production technology. Measurements must be uniform so that people have common understanding and application in the production and use of manufactured objects. Measuring tools are used for the purpose of measuring dimensions, implementing any work with precision. The measuring tools are also used largely for carrying out different types of measurements.

Importance of Measuring Tools

Measuring tools are essential for examining a finished product or semi-finished product. The inspection or examination operations include checking, or testing an object based on the required dimensions given on a diagram or a sketch. Measurements taken must be accurate.

Different Measuring Tools

1. **T-Square** is used as guide in drawing horizontal lines and in measuring up to 48” straight line.
2. **Triangles** are used for drawing vertical and oblique lines. The most commonly used triangles are the 45° and the 30°x 60°. Illustrations below show the proper use of drawing lines and measuring angles using the T-square and triangle.

3. **Ruler** is the most popular type of measuring tool. It is usually 6 or 12 inches in length. It is needed for measuring sizes and distances.

4. **Triangular Scale** is used in general drawing. Its main purpose is to reproduce the dimension in full size or to reduce or enlarge them on a drawing. Scales help a drafter keep the proportions accurate.
Steps in Using a Scale

a. Place the edge of the scale parallel to the line being measured.

b. Face the edge of the scale that you're reading toward your non dominant side (if it's oriented vertically) or away from you (if it's oriented horizontally). This helps keep you from casting shadows on the relevant face of the scale as you work.

c. Make light marks to indicate the distance you're measuring or drawing out, as measured by the scale.

d. Adjust dividers with the scale by making a pencil line as long as the dividers should be wide, using the scale as a guide. Then adjust the dividers by orienting the points on the ends of the pencil line. Adjusting the dividers by placing the points directly on the scale might nick the surface of the scale, making it hard to read.

5. Protractor is used for measuring and setting of angles other than those obtainable with the triangles.
6. **Tape or tape ruler** is a concave, spring-steel blade ranging from 1/4” to 1” wide and 6 to about 300 feet in length, coiled inside a carrying case. Metric tape ruler comes in comparable widths and lengths up to 10 meters. It provides an easy means for accurately measuring curved surfaces.

![Tape Ruler Image]

**TAPE RULER**

7. **Compass** is used to draw circles, arcs, radii, and parts of many symbols.

![Compass Image]

**Steps in Using a Compass**

a. Place the point of the drafting compass at the center point of the circle you intend to draw. If you’re drawing an arc, imagine that the arc extends all the way around into a circle and place the point of the compass at the center of that imaginary circle.

b. Adjust the leaded end of the compass so that it touches where you’d like the edge of the arc—or circle—to be. If you’re drawing an arc at a specific distance from the center point, make a line of the desired distance, adjust the point and leaded end of the compass against the ends of that line, and then place the point of the compass back at the center point of your circle or arc.

c. Grasp the middle of the compass between your thumb and fingers. Twist your fingers, applying light downward pressure on the compass to mark out the desired length of arc or circle with the leaded end of the compass.
8. **Divider** is similar to the compass in construction. As the name implies, a divider is used for dividing distances into a number of equal parts by the trial-and-error method.

![Divider](image)

**DIVIDERS**

**Steps in Using a Divider**

a. Align each arm of the dividers so that one point is laying on the starting point of the measurement you want to transfer and the other divider point is laying on the endpoint of that same measurement.

b. Lift the dividers off the measurement you intend to transfer, being careful not to change their alignment.

c. Place the dividers over the location you’d like to transfer the measurement to, and make a pencil mark to indicate where each of the dividers’ pointers sits. This duplicates the measurement.
**Self-Check 1.1**

**How Much Have You Learned?**

**Direction:** Match Column A with Column B. Write only the letter of the correct answer on a separate sheet of paper.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It is the measuring tool used for measuring and setting of angles.</td>
<td>A. Triangle</td>
</tr>
<tr>
<td>2. It is the most popular type of measuring tools, usually 6 or 12 inches in length.</td>
<td>B. Tape Ruler</td>
</tr>
<tr>
<td>3. Its main purpose is to reproduce, reduce or enlarge the dimension or size on a drawing.</td>
<td>C. Protractor</td>
</tr>
<tr>
<td>4. It is used for drawing vertical and oblique lines.</td>
<td>D. Scale</td>
</tr>
<tr>
<td>5. It provides an easy means for accurately measuring curved surfaces.</td>
<td>E. Ruler</td>
</tr>
<tr>
<td></td>
<td>F. Divider</td>
</tr>
</tbody>
</table>

Refer to the Answer Key. What is your score?
Directions: Name the different measuring tools shown below. Use a separate sheet for your answer.

1. _______________ 2. _______________ 3. _______________

3. _______________ 5. _______________
GEOMETRIC FIGURES

The geometric figures commonly used in drawing pictures are lines, angles, triangles, quadrilaterals, regular polygons, circles and arcs and solids.

**LINE.** A line is a set of points. A portion of the line between two distinct points is called a line segment. The following are the different kinds of lines.

1. **Straight line.** It is the shortest distance between two points.
2. **Parallel lines.** These are lines on the same plane which will not meet no matter how long you extend them.
3. **Perpendicular lines.** These are two intersecting lines which form right angles.

![Illustration of straight lines, parallel lines, and perpendicular lines]

**ANGLE.** An angle is a figure formed by two rays with common end point. Angles are classified according to their measures. The following are the different kinds of angles.

1. **Straight angle.** It is an angle whose measure is 180°.
2. **Right angle.** It is an angle whose measure is 90°.
3. **Acute angle.** It is an angle whose measure is less than 90°.
4. **Obtuse angle.** It is an angle whose measure is more than 90° but less than 180°.
5. **Complementary angles.** These are two angles whose sum measures 90°.
6. **Supplementary angles.** These are two angles whose sum measures 180°.
POLYGON. A polygon is a closed figure formed by line segments intersecting at end points. The line segments are called sides of the polygon. Polygon is classified according to the number of sides. The following are the different kinds of polygon.

1. Triangle. It is a three-sided polygon. The different kinds of triangles are as follows:
   a. **Equilateral** has all three sides equal.
   b. **Isosceles** has two of the sides equal.
   c. **Scalene** has three sides of unequal length.
   d. **Right** is where one of the angles is a right angle.
2. **Quadrilateral.** It is a four-sided polygon. The different kinds of quadrilaterals are as follows:
   a. **Parallelogram** is a quadrilateral with two pairs of opposite sides parallel and equal.
   b. **Rectangle** is a parallelogram with a right angle.
   c. **Square** is a rectangle with four equal sides.
   d. **Rhombus** is a parallelogram with a right.
   e. **Trapezoid** is a quadrilateral with one pair of opposite sides parallel in which one of them is longer than the other.
   f. **Isosceles trapezoid** is a trapezoid with its non-parallel sides equal.
   g. **Trapezium** is a quadrilateral with no parallel sides and no equal angles.

3. **Pentagon.** It is a five-sided polygon. If all the sides and angles of the pentagon are equal, it is a regular pentagon. The measure of each included angle is 108°.

4. **Hexagon.** It is a polygon with six sides. If all the sides and angles are equal, it is a regular hexagon. The measure of each included angle of a regular hexagon is 120°.

5. **Heptagon.** It is a polygon with seven sides. If all the sides and angles are equal, it is a regular heptagon and the measure of each angle is approximately equal to 128.57°.

6. **Octagon.** It is a polygon with eight sides. If all the sides and angles are equal, it is a regular octagon and the measure of each angle is 135°.

7. **Nonagon.** It is a polygon with nine sides. If all the sides and angles are equal, it is a regular nonagon and the measure of each angle is 140°.

8. **Decagon.** It is a polygon with ten sides. If all the sides and angles are equal, it is a regular decagon and the measure of each angle is 144°.
CIRCLE. A circle is a closed curve; all points are equally distant from the center. An arc is a portion of the circumference of the circle. The following are terms related to a circle or parts of a circle.

1. **Concentric circles** consist of two or more circles with a common center.
2. **Eccentric circles** are circles having no common center.
3. **Ellipse** is an oblique circle with two axes, the minor axis and the major axis.
4. **Radius** is a line segment from the center to any point on the circle.
5. **Chord** is a line segment whose endpoints lie on the circle.
6. **Diameter** is a chord that passes through the center.
7. **Sector** is a portion of a circle bounded by two radii and the intercepted arc.
8. **Segment** is a portion of a circle bounded by an arc and a chord.
9. **Circumference** is the distance around the circle. The circumference is equal to the diameter multiplied by 3.1416.
10. **Quadrant** is one-fourth of the entire area of the circle.
**KINDS AND PARTS OF CIRCLE**

**TANGENT**

**CIRCUMFERENCE**

**CHORD**

**CENTER**

**RADIUS**

**DIAMETER**

**SECTOR**

**QUADRANT 90°**

**ANGLES**

**RADIUS**

**ARC**

**SEGMENT**

**CONCENTRIC CIRCLES**

**ECCENTRIC CIRCLES**

**SOLID.** A solid is a three-dimensional figure. The three dimensions are the length, width, and height. The following are the different kinds of solids.

1. **Sphere** is a three-dimensional figure whose points are located at a constant distance away from the center.
2. **Prism** is a three-dimensional figure with a polygonal base and triangular lateral faces.
3. **Cube** is a prism whose faces are congruent squares. An example of a cube is a dice.
4. **Cylinder** is a solid figure with two circular bases in parallel plane and parallel line segments connecting to these bases. An example of a cylinder is a tin can.
5. **Cone** is solid figure with a circular base and a surface formed by line segments joining every point on the edge of the base to a common point in a parallel plane.
6. **Tetrahedron** is a solid figure composed of four equilateral triangles.
7. **Dodecahedron** is a solid figure bounded by twelve equal regular pentagons.
8. **Icosahedron** is a solid figure bounded by twenty equilateral triangles.
COMMON GEOMETRICAL FIGURES

- Cylinder
- Tetrahedron
- Hexahedron
- Octahedron
- Prism
- Sphere
- Dodecahedron
- Icosahedron
- Cone
- Pyramid
How Much Have You Learned?

**SELF CHECK**

Directions:

A. Identify the correct word that has the same relationship to the word as the first pair. Write the answer on a separate sheet of paper.

1. Quadrilateral: Rhombus ; _________: Isosceles
2. Circle: Sphere ; Square: _________
3. 108°: Hexagon ; 144°: _________
4. Straight: Polygon ; _________: Circle
5. Line: Triangle ; _________: Compass

B. Identify the following geometric figures and solids below.

If all or almost all (90%-100%) your answers are correct, that is great. You may now proceed to the next Activity. If you got some items wrong, study the lesson again. Carefully review the lesson to help you understand the concepts better. Concentrate on the parts that cover the questions you missed. After this proceed to Activity 1.1
Apply What You Have Learned and HOW?

It is not enough that you learned concepts on the use of measuring instruments. Be sure that you are also able to demonstrate the skill on how to use the measuring instruments. Do this Activity Sheet.

ACTIVITY SHEET NO. 1.1

Actual Use of Measuring Instruments

The activity below is purposely required to test your retention level on the actual usage of measuring instruments.

**Supplies and Materials**

- Drawing paper
- Pencil

**Tools and Equipment**

- Measuring Instruments

**PROCEDURE:**

This is a group activity.

a. Group yourselves into two.
b. Assign a leader for each group.
c. Each group shall be provided with complete measuring instruments.
d. Each group will be given fifteen minutes to demonstrate the uses of the measuring instruments.
e. A leader or any member of the group will explain the function as well as the steps in using the tool during the demonstration.
f. The group will be evaluated based on their demonstration.

A checklist will be provided for each member of the group.
How Well Did You Perform?

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

DEMONSTRATION CHECKLIST

| Student's name: |  |
| Teacher's name: |  |
| Unit of competency | Perform Basic Mensuration and Calculation |
| Competency standards: | Uses of Measuring Instruments |
| Date of assessment: |  |
| Time of assessment: |  |

Instructions for demonstration

Given the necessary materials the student must be able to use the measuring instruments correctly.

**Materials and equipment:**
- T-square
- Triangles
- Protractor
- Compass and Divider
- Tape ruler
- Ruler
- Other measuring instruments

<table>
<thead>
<tr>
<th>During the demonstration, the student can:</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform this skill without supervision and with initiative and adaptability to problem situations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform this skill satisfactorily without assistance or supervision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform this skill satisfactorily but requires some assistance and/or supervision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform parts of this skill satisfactorily, but requires considerable assistance and/or supervision</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The student's demonstration was: Satisfactory  Not Satisfactory

MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8)  45
K to 12 – Technology and Livelihood Education
How did your group fare? How did you perform as a member? Do you think you contributed much to the group? Support your answer?

It is not enough that you learned concepts on the use of tools. Be sure that you are also able to demonstrate the skills on how to use tools. Do this Operation Sheet.

Operation Sheet 1.1

Drawing of lines, angles and circles

Supplies and Materials

- Drawing paper
- Pencil

Tools and Equipment

- Measuring Instruments

Direction: By using the correct measuring tools or instruments, draw the sample figures below.

Perpendicular Lines

Concentric Circles

Eccentric Circles

MORE THAN 90°

OBTUSE ANGLE

LESS THAN 90°

RIGHT ANGLE

LE STHAN 90°

ACUTE ANGLE

LINES, ANGLES, AND CIRCLES
Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

Criteria for Assessment:

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>The output is accurately done without any help from the teacher.</td>
<td>The output is satisfactorily done with some guidance from the teacher.</td>
<td>The output is done under the supervision of the teacher.</td>
</tr>
<tr>
<td>Layout/Presentation</td>
<td>The output is properly laid out and satisfactorily presented.</td>
<td>The output is satisfactorily laid out and presented with some guidance from the teacher.</td>
<td>Layout and presentation fairly done even with the guidance of the teacher.</td>
</tr>
<tr>
<td>Speed</td>
<td>The output is done on or before the given time.</td>
<td>The output is done after the allotted time.</td>
<td>The output is not thoroughly finished even after the given deadline.</td>
</tr>
<tr>
<td>Neatness</td>
<td>The output is free from any erasures.</td>
<td>The output has one to three erasures.</td>
<td>The output has four or more erasures.</td>
</tr>
</tbody>
</table>

Rating Scales

<table>
<thead>
<tr>
<th>POINTS EARNED</th>
<th>NUMERICAL</th>
<th>DESCRIPTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 – 20</td>
<td>90 – 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>10 – 14</td>
<td>86 – 90</td>
<td>Good</td>
</tr>
<tr>
<td>6 – 9</td>
<td>81 – 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 – 4</td>
<td>75 – 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>
LEARNING GOALS / TARGETS 2

Clean and store measuring instruments

PERFORMANCE STANDARDS

1. Ensure that measuring instruments are cleaned in accordance with established standards.

2. Measuring instruments are stored in accordance with established standards.

Materials:

- T-square
- Triangles 30 x 60 and 45 x 45
- Pencils/mechanical pencils
- Compass
- Drawing paper
- Drawing board
- Scale
- Eraser
- Erasing shield
- Protractor
What Do You Already Know?

Let us determine how much you already know about the use and care of Drafting/measuring tools. Take this test.

Pre-test LG 2

A.: Match Column A with Column B. Write only the letter of the correct answer on a separate sheet of paper.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A measuring tool used to layout an angle or an arc</td>
<td>A. TRIANGLE</td>
</tr>
<tr>
<td>2. It is the most popular type of measuring tools, usually 6 or 12 inches in length.</td>
<td>B. TAPE RULER</td>
</tr>
<tr>
<td>3. Its main purpose is to reproduce, reduce, or enlarge the dimension or size on a drawing.</td>
<td>C. T-SQUARE</td>
</tr>
<tr>
<td>4. It is used for drawing vertical and oblique lines.</td>
<td>D. SCALE</td>
</tr>
<tr>
<td>5. It provides an easy means for accurately measuring curved surfaces.</td>
<td>E. RULER</td>
</tr>
<tr>
<td></td>
<td>F. PROTRACTOR</td>
</tr>
</tbody>
</table>

B. List down at least five uses and care of drafting or measuring tools.

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________
4. ______________________________________________________________________
5. ______________________________________________________________________

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, carefully review the lesson to help you understand the concepts better. Concentrate on the parts that cover the questions you missed. After this, you are very much ready to proceed to the next learning activity.
What Do You Need To **KNOW?**

Read the Information Sheet 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**

It is better to own a few good tools than a number of poor ones. In acquiring tools, be guided by quality and durability. Quality tools are known by their popular brand names. But also consider that the life of any drawing or measuring tools will depend on how well you take care of them. Drafting measuring tools should be well maintained to continue working properly. Organizing and storing these items has a great deal to do with keeping them in tip top shape and in good working condition. You can assure that your tools will last long if you take good care of them.

Good workmanship is associated with the use of quality hand tools. Maintaining effective use of drafting tools in the production of quality projects is the concern of every craftsman.

A good tool is a lifelong investment and the craftsman’s best friend. Treat it as such and you’ll be repaid a thousand times through the results you will obtain from its use.
Clean/Store Drafting Measuring Tools

1. Be sure to inspect tools before using them. This is to check if they are in good working condition.

2. After using a tool, clean it thoroughly with a damp cloth. Wipe it dry with another piece of cloth before keeping it.

3. When not in use, the T-square should be stored by hanging the hole found at the end of its blade to a nail attached to a wall.

4. Do not abuse or misuse any piece of drawing instruments.

5. Avoid throwing a tool at anybody; instead, hand it over to them carefully.

6. Avoid setting off the distances individually by moving the scale to a new position from time to time, because slight errors in the measurements may accumulate and give rise to a large error.

7. Avoid unnecessary sliding of T-squares or triangles to protect the drawing. Pick up the triangle by its tip and tilt the T-square blade upward slightly before moving.

8. Do not pull too much of the steel tape of the pull-push rule to avoid damage on the coil spring.

9. Oil the movable parts of the measuring tools such as zigzag rules, calipers, dividers, and compasses to avoid stock-up.

10. Report defective measuring tools and any hazard to the instructor immediately.
How Much Have You Learned?

Self-Check 2.1

A. **Directions**: Write **T** if the statement is **True** and **F** if the statement is **False**. Write your answers in your notebook.

1. Avoid unnecessary sliding of the T-square or triangles across the drawing. _____
2. The T-square is preferably hung when not in use. _____
3. Immediately report defective measuring tools and hazards to the instructor. _____
4. After using a tool, clean it thoroughly with a damp cloth. _____
5. Be sure to check and clean tools before and after their use. _____

B. List down at least five uses and care of drafting or measuring tools.

6. _____________________________
7. _____________________________
8. _____________________________
9. _____________________________
10. _____________________________

Refer to the Answer Key. What is your score?
LEARNING GOALS / TARGETS 3
Convert fraction to decimal and vice versa

PERFORMANCE STANDARDS

1. Convert fraction to decimal accurately up to two (2) decimal places.
2. Convert decimal to fractions accurately to the nearest standard measurement.

Materials/Resources

- Pencils/ mechanical pencils
- Ball pen
- Eraser
- Drawing paper / Pad paper
- Drawing board
What Do You Already Know?

Let us determine how much you already know about conversion of fractions to decimal and decimal to fractions. Take this test.

Pre-test LG 3

Directions: Convert the following. Write your answers on a separate sheet of paper.

TEST I. - A. Convert fractions into decimals.

1. ¼ to decimal _______________
2. ¾ to decimal _______________
3. 7/16 to decimal _______________
4. 3/8 to decimal _______________
5. 1/8 to decimal _______________

C. Convert decimals into fractions.

6. 0.35 _______________
7. 0.24 _______________
8. 0.75 _______________
9. 0.125 _______________
10. 0.150 _______________

TEST II. Round off the following numbers to their nearest hundredths.

11. 76.3456 _______________
12. 93.674 _______________
13. 27.009 _______________
14. 4.6245 _______________
15. 5.2532 _______________

Check if your answers are correct by comparing them with those in the Key Answers.

If you got 90%-100% of the items correct, that means you already familiar with the lesson covered by Learning Goals No. 3. However you may still study the lesson to refresh your memory and learn new concepts. If you missed a lot of items, do all the activities to gain knowledge and skills required for mastery.
What Do You Need To **KNOW**?

Read the Information Sheet 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**

**CONVERSION OF FRACTION AND DECIMAL**

**Changing Fractions to Decimals**

Any rational number can be changed from fractional form to decimal form. This is done by simply dividing the numerator by the denominator.

**Illustrative Examples**

A. \[
\frac{4}{5} = \frac{5}{4} = \frac{0.8}{5/40}
\]

Therefore, \(\frac{4}{5} = 0.8\)

B. \[
\frac{3}{4} = \frac{4}{3} = \frac{0.75}{4/300}
\]

Therefore, \(\frac{3}{4} = 0.75\)

C. \[
\frac{1}{8} = \frac{8}{1} = \frac{0.125}{8/1000}
\]

Therefore, \(\frac{1}{8} = 0.125\)
Illustrative Examples

Change the fractions to decimals.

A. \[ \frac{1}{3} = \frac{0.333}{3/\,1.000} = \frac{9}{10} \]
   \[= \frac{9}{10} = \frac{1}{3} \text{ equal } 0.333 \ldots \text{ or } 0.3 \]

The digit 3 is the repeating digit

B. \[ \frac{5}{6} = \frac{0.8333 \ldots}{6/\,5.000} = \frac{48}{20} = \frac{18}{6} \]
   \[= \frac{5}{6} \text{ equal } 0.8333 \ldots \text{ or } 0.83 \]

Rounding Off Decimals

Metric measurements in decimals are often long numbers. They must often be rounded off to a convenient number of digits. In this text, most metric dimensions are either whole millimeter or two-places decimals that have been rounded off. To help you round off your own calculation, rules of rounding off are discussed below.
1. If the first number to be eliminated is less than 5, simply drop it (and the number to the right of it) and let the last significant digit stand.

Example: Round off 25.4 mm to whole millimeter.
Solution: Simply drop the .4
Answer: 25

Example: Round off 0.3125 into two significant digits.
Solution: The first number to be eliminated is 2: Simply drop it and all numbers to its right(5)
Answer: 0.31

3. If the number to be eliminated is 5 or more, drop the number, then add one to the last digit retained.

Example:

a. Round off 78.6 into its nearest ones.  
Solution: The number to be rounded off is 6 which is greater than 5, drop 6 and add one to the last digit retained.  
Answer: 79  
b. Round off 92.65 into its nearest tenths.  
Solution: The number to be rounded off is 5, drop 5 and add one to 6 which is the last digit retained.  
Answer: 92.7
Conversion of Decimals to Fractions

A decimal is changed to a fraction by using 10 or any power of 10 as denominator of the given decimal. Then reduce to lowest term when possible.

**Illustrative Examples**

A. \( 0.4 = \frac{4}{10} \) or \( \frac{2}{5} \)

B. \( 0.25 = \frac{25}{100} \) or \( \frac{1}{4} \)

C. \( 0.328 = \frac{328}{1000} \) or \( \frac{82}{250} \) or \( \frac{41}{125} \)

Millimeters Equivalent of Decimals and Fractions of an Inch.

<table>
<thead>
<tr>
<th>Inch</th>
<th>Fraction</th>
<th>Decimals</th>
<th>Millimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16</td>
<td>0.0625</td>
<td>1.588</td>
<td></td>
</tr>
<tr>
<td>1/18</td>
<td>0.1250</td>
<td>3.175</td>
<td></td>
</tr>
<tr>
<td>3/16</td>
<td>0.1875</td>
<td>4.762</td>
<td></td>
</tr>
<tr>
<td>1/4</td>
<td>0.2500</td>
<td>6.350</td>
<td></td>
</tr>
<tr>
<td>5/16</td>
<td>0.3125</td>
<td>7.938</td>
<td></td>
</tr>
<tr>
<td>3/8</td>
<td>0.3750</td>
<td>9.525</td>
<td></td>
</tr>
<tr>
<td>7/16</td>
<td>0.4375</td>
<td>11.112</td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>0.5000</td>
<td>12.700</td>
<td></td>
</tr>
<tr>
<td>9/16</td>
<td>0.5625</td>
<td>14.288</td>
<td></td>
</tr>
<tr>
<td>5/8</td>
<td>0.6250</td>
<td>15.875</td>
<td></td>
</tr>
<tr>
<td>11/16</td>
<td>0.6875</td>
<td>17.462</td>
<td></td>
</tr>
<tr>
<td>3/4</td>
<td>0.7500</td>
<td>19.050</td>
<td></td>
</tr>
<tr>
<td>13/16</td>
<td>0.8125</td>
<td>20.638</td>
<td></td>
</tr>
<tr>
<td>7/8</td>
<td>0.8750</td>
<td>22.225</td>
<td></td>
</tr>
<tr>
<td>15/16</td>
<td>0.9375</td>
<td>23.812</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.00</td>
<td>25.400</td>
<td></td>
</tr>
</tbody>
</table>

This table is used to find the equivalent measures in millimeter of a given fractional or decimal part of an inch.
How Much Have You Learned?

Self-Check 3.1

Directions:

A. Convert fractions into decimals. Write your answer on a separate sheet of paper.

1. \(\frac{1}{4}\) to decimal ____________
2. \(\frac{3}{4}\) to decimal ____________
3. \(\frac{7}{16}\) to decimal ____________
4. \(\frac{3}{8}\) to decimal ____________
5. \(\frac{1}{8}\) to decimal ____________

B. Round off the following numbers to their nearest hundredths.

1. 13.7556 ____________
2. 38.614 ____________
3. 41.009 ____________
4. 8.6245 ____________
5. 7.2532 ____________

C. Convert decimals into fractions. Write your answers on a separate sheet of paper.

1. 0.2 ____________
2. 0.8 ____________
3. 0.84 ____________
4. 0.35 ____________
5. 0.24 ____________
6. 0.75 ____________
7. 0.125 ____________
8. 0.150 ____________
9. 0.65 ____________
10. 0.375 ____________

Refer to the Answer Key. What is your score?

If you got many items wrong, study the lesson again. Carefully reviewing the lesson helps you understand the concepts better. Concentrate on the parts that cover the questions you missed. After this, you are very much ready to proceed to do activities in next page.
How Do You Apply What You Have Learned?

Show that you learned something by doing this activity.

After learning the procedure in converting fraction to decimal;

1. Inform your teacher that you are ready to solve problems in converting metric measurement to decimal and vice versa.
2. Convert the following measurements from fractions to decimal.
   a) $\frac{5}{16}$
   b) $\frac{1}{3}$
   c) $\frac{3}{16}$
   d) $\frac{7}{8}$
   e) $\frac{5}{32}$
3. When you finish answering, check your work again before submitting it to your teacher for verification and recording. If your work passes the required output, you are now ready to proceed to the next activity. If not, make the necessary corrections then submit your work again.
LEARNING GOALS / TARGETS 4

Convert English to Metric measurement system and vice versa.

PERFORMANCE STANDARDS

1. Convert English measurements to its metric equivalent and vice versa.

Materials/Resources

- Pencils/ mechanical pencils
- Ballpen
- Drawing paper / Pad paper
- Drawing board
- Erase
What Do You Already Know?

Let us determine how much you already know about the conversion of metric to English measurement. Take this test.

Pre-test LG 4

A. **Direction:** Convert the following. Write your answer and solution on a separate sheet. Round off your answers into two decimal places.

1. 25 cm to \(=\) __________ inches
2. 63 m to \(=\) __________ feet
3. 50 ft to \(=\) __________ meters
4. 13 inches \(=\) __________ meters
5. 10 mm to \(=\) __________ inch

B. **Directions:** Write the correct measurements as indicated by the extension lines below.

Use a separate sheet of paper.

![Diagram of a ruler with inches and centimeters marked]
Compare your answers using the Answer Key. If you got 90%-100% of the items correct, that means you are already familiar with the lesson covered by Learning Goal No. 4. Therefore you can proceed to the next learning activity. If you missed a lot of items, do all the activities to gain knowledge and skills required for mastery.
What Do You Need To **KNOW**?

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

**Information Sheet 4.1**

**TRADE MATHEMATICS / MEASUREMENT**

Measuring accurately is a skill that we should all develop. Inaccurate measurement leads to waste of time, effort and materials. The development of the skill in measuring starts with the ability to read measurement.

An orthographic or pictorial view of an object cannot be used as a working guide in the construction of an object without complete and accurate dimensions indicated in the drawing.

**Two systems of measurement**

There are two systems of measurement: the English system which originated in England and the Metric system or Systems International (S.I) which originated in France.

The basic unit in the Metric system is called the meter. The meter is divided into 100 centimeters. Each centimeter is divided into 10 millimeters. They are abbreviated as follows:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millimeters</td>
<td>mm</td>
</tr>
<tr>
<td>Centimeters</td>
<td>cm</td>
</tr>
<tr>
<td>Decimeters</td>
<td>dm</td>
</tr>
<tr>
<td>Meters</td>
<td>m</td>
</tr>
</tbody>
</table>
In the English system, the inch is divided into 16 graduations and the smallest graduation is read $1/16$.

To read a measurement exceeding 1 inch say, 2” and four smaller graduations, it is read and written as: 2” $4/16$ or 2” $\frac{1}{4}$.

1 foot + 2 inches + 3 smaller graduations, it is read and written as: 14” $3/16$

In the Metric system, the meter is divided into 10 millimeters. As shown below:

**Metric System of Measurement**

(Linear equivalent)

- 10 millimeters (mm.) = 1 centimeter (cm.)
- 10 centimeters (cm.) = 1 decimeter (dm.)
- 10 decimeter (dm.) = 1 meter (m.)
- 10 meters (m.) = 1 decameter (Dm.)
- 10 decameter (Dm.) = 1 hectometer (Hm.)
- 10 hectometer (Hm.) = 1 kilometer (Km.)
- 10 kilometer (Km.) = 1 mayriameter (Mn.)
English System of Measurement

(Linear equivalent)

- 12 inches (in.) = 1 foot (ft.)
- 3 feet (ft.) = 1 yard (yd.)

Metric Conversion Table

- 1 millimeter = 0.03937 inches (in.)
- 1 centimeter = .3937 inches (in.)
- 1 meter = 39.37 inches (in.)

English Conversion Table

- 1 inch (in.) = .0254 mm. = 2.54 cm. = .0254 (m.)
- 1 foot (ft.) = 304.8 mm. = 30.48 cm = 3048 (m.)
- 1 yard (yd.) = 914.4 mm = 91.4 cm = 9144 (m.)

Conversion Formulas

- Length in inches x 0.0254 = length in meters
- Length in inches x 2.54 = length in centimeters
- Length in feet ÷ 3.28 = length in meters
- Length in meters x 39.37 = length in inches
- Length in inches ÷ 39.37 = length in meters
- Length in feet x 0.305 = length in meters
- Length in feet x 30.5 = length in centimeters
How Much Have You Learned?

Self-Check 1.1

Directions: Write the correct measurements as indicated by the extension lines below. Use a separate sheet of paper.

A. English System

[Diagram of a ruler with measurements indicated by numbers 1, 2, 3, 4, 5, 6, 7, 8.]
II. Conversion: Convert the following measurement from metric to English system or vice versa.

1. 60 cm = __________ in.
2. 3 ½ in. = __________ cm.
3. 75 cm. = __________ m.
4. 10 in. = __________ cm.
5. 30 cm = __________ ft.

Refer to the Answer Key. What is your score?

At this time you should now be familiar with the mathematics related to taking measurements. You should also gain and learn how to use different types of instruments in taking measurements. These skills are not only important in being a mechanical draftsman but for any field of work you may enter in the future.
LESSON 3
INTERPRETING WORKING PLAN AND SKETCHES

At the end of lesson the students should be able to
IDENTIFY ASSEMBLY AND DETAILED DRAWING

INTRODUCTION:

This lesson will familiarize you in drawing mechanically the orthographic and pictorial projections using compass, triangle, T-square, pencils, erasers, and technical pens. It is important to have basic knowledge and skills in orthographic projection because this can be used or applied in any construction to be undertaken.

This is also designed to teach you on how to interpret simple working drawing as well as to familiarize them with the assembly and detailed drawing. Furthermore, this lesson will enable you to practice the correct use of different lines in drawing for the construction of work.
LEARNING GOALS / TARGET 1

LG 1. Identify assembly and detailed drawing

PERFORMANCE STANDARDS

1. Interpret orthographic and pictorial drawings according to drawing standards.
2. Interpret assembly and detailed drawing according to drawing standard.

Materials

- T-square
- Triangles 30 x 60 and 45 x 45
- Pencils/mechanical pencils
- Compass
- Drawing paper
- Drawing board
- Scale
- Eraser
- Erasing shield
- Protractor
What Do You Already Know?

Let us determine how much you already know about the assembly and detailed drawing. Take this test.

Pre-test LG 3

A. Directions: Read each statement carefully and select the letter of the word/s it describes.

1. It is the system for graphically representing an object by line a drawn on a flat surface.
   A. Orthographic Projection  B. Pictorial Drawing  C. Multi-view Drawing  D. Isometric Drawing

2. What angles of projection is generally used for drafting purposes?
   A. Ninety degrees and Forty five Degrees  B. First Angle and Third Angle  C. Second Angle and Fourth Angle  D. Thirty Degrees and Sixty Degrees

3. The standard projection used by many European countries (ISO Standard).
   A. Orthographic Projection  B. Third-angle Projection  C. Isometric Projection  D. First-angle Projection

4. It refers to the common views used in multi-view drawing.
   A. front, top, and sides  B. front, rear and sides  C. front, sides and rear  D. front, top and rear

5. It is a type of dimensioning that requires all dimension be lettered between guide lines that are parallel to the bottom edge of the drawing paper.
   A. Aligned Method  B. Location Dimension  C. Overall Dimension  D. Uni-directional Method

6. It refers to the orthographic view drawn directly above the front view.
   A. Auxiliary view  B. Top View  C. Right side view  D. Left Side View

7. It is the standard of projection used by Americans, British and Canadians (ANSI Standard). American National Standard Institute
   A. First-angle Projection  B. Orthographic Projection  C. Diametric Projection  D. Third-angle Projection
8. A line used to show the limits of a dimension.
   A. Extension line  B. Object line
   C. Dimension line  D. Center line

9. An oblique drawing in which the depth axis lines are in full size.
   A. Cabinet Oblique  B. Cavalier Oblique
   C. General Oblique  D. Oblique Perspective

10. In a scale 1: 20 meters, this is the equivalent of 5 meters.
    A. 20 cm.  B. 15 cm.  C. 5 cm.  D. 10 cm.

11. This is the type of oblique pictorial view where the dimension of the receding features of the object is drawn half-scale.
    A. Cabinet Projection  B. Cavalier Projection
    C. Isometric Projection  D. Orthographic Projection

12. The point where the horizontal line in the perspective view seems to converge or meet.
    A. Station Point  B. Vanishing Point
    C. Center Point  D. Piercing Point

13. It is a type of dimensioning that requires all dimension figures, except to angular contours, be lettered between guide lines that are parallel to the dimension lines.
    A. Aligned Method  B. Location Dimension
    C. Overall Dimension  D. Uni-directional Method

14. The process of describing the object by placing sizes and related information on a drawing.
    A. Dimensioning  B. Sectioning
    C. Scaling  D. Tolerancing

15. This is the dimension that gives the detail and overall sizes of the object.
    A. Location dimension  B. Figure Dimension
    C. Shape dimension  D. Size Dimension
B. Directions: Write the names of the kind of lines indicated by the numbers 1 to 10. Use a separate sheet of paper for writing your answers.

C. Directions: Base your answers on the drawing above, write the name of the view where you find the different kinds of lines listed below.

<table>
<thead>
<tr>
<th>Kind of Lines</th>
<th>Name of Views</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Center line</td>
<td>-</td>
</tr>
<tr>
<td>2. Long-break line</td>
<td>-</td>
</tr>
<tr>
<td>3. Cutting-plane line</td>
<td>-</td>
</tr>
<tr>
<td>4. Leader line</td>
<td>-</td>
</tr>
<tr>
<td>5. Section line</td>
<td>-</td>
</tr>
</tbody>
</table>

Compare your answers using the Answer Key. If you got 90-100% of the items correct, that means you are already familiar with the lesson covered by Learning Outcome No. 1. Therefore you can proceed to the next learning activity. If you missed a lot of items, do all the activities again to gain knowledge and skills required for mastery.
What Do You Need To **KNOW**?

Information Sheet 1.1

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

*A drawing is made up of different lines. Each line represents something. A surface, hidden surface, an extension of a surface, a center of a hole, or a line with dimensions on it. In order to make the drawing easier to read and understand, each kind of line is drawn with a different line weight. Read and understand the following.*

**ALPHABET OF LINES**

Visible line – a thick line that represents the visible edges or outline of the object; also known as the object line

Hidden line – a medium thick line composed of short dashes about 2-3 millimeters long with space between dashes about 1-2 millimeters wide; it represents the surface or edges that cannot be seen

Center line – a thin line consisting of two long dashes and short dash drawn alternately with a gap of at least 2 millimeters in between; it represents the axis or center of symmetrical shapes like a ball, washer, rectangular block, cube

Section line – a thin lines to show the surface that has been cut; they are spaced evenly at 45 degrees with the horizontal to make shaded effect

Extension line – a thin line that extends from the object in order to show dimension limits

Dimension line – a thin line with an arrowhead in one end used to indicate the measurements of the object

Long-break line – a medium thick line consisting of broken and straight lines drawn alternately. This is also known as the limiting line. This limits the length of an elongated object without changing the size of its view.

Short-break line – thick line drawn in freehand to show details that a part has been cut off or broken out.

Leader line – a short inclined thin line with an arrowhead at the end and short horizontal line on the other end.

Phantom line – a thin line that shows position(s) of part of an object that moves drawn by two short dashes and one long dash.

Cutting-plane line – thick lines used to indicate an imaginary cut through an object along the line. Made up of two long dashes broken in one end with an arrowhead and two short dashes drawn in between the long dashes.
<table>
<thead>
<tr>
<th>Lines</th>
<th>Width and Character of Lines</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible line</td>
<td>THICK: 0.15 - 0.26 mm (0.006 - 0.010&quot;)</td>
<td></td>
</tr>
<tr>
<td>Hidden line</td>
<td>THIN: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td></td>
</tr>
<tr>
<td>Section line</td>
<td>THIN: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td></td>
</tr>
<tr>
<td>Center line</td>
<td>Width: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td></td>
</tr>
<tr>
<td>Dimension line,</td>
<td>Extension line,</td>
<td></td>
</tr>
<tr>
<td>Extension line,</td>
<td>Leaders</td>
<td></td>
</tr>
<tr>
<td>Cutting-plane line</td>
<td>THICK: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td></td>
</tr>
<tr>
<td>Viewing plane lines</td>
<td>Width: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td></td>
</tr>
<tr>
<td>Short-break line</td>
<td>THICK: 0.15 - 0.26 mm (0.006 - 0.010&quot;)</td>
<td>Freehand</td>
</tr>
<tr>
<td>Long-break line</td>
<td>THIN: 0.38 - 0.55 mm (0.015 - 0.022&quot;)</td>
<td>Freehand</td>
</tr>
<tr>
<td>Phantom line</td>
<td>THICK: 0.15 - 0.26 mm (0.006 - 0.010&quot;)</td>
<td></td>
</tr>
</tbody>
</table>
How Much Have You Learned?

Self-Check 1.1

Directions: Read and interpret the given figure below. Identify the lettered lines used (A – N) to draw the object. Place your answer on a separate sheet of paper.

A. ________________________
B. ________________________
C. ________________________
D. ________________________
E. ________________________
F. ________________________
G. ________________________
H. ________________________
I. ________________________
J. ________________________
K. ________________________
L. ________________________
M. ________________________
N. ________________________

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 NO. 1.1**

**Directions:** Sketch the line being referred to in the Table below. Draw your answer on the opposite box of your paper

<table>
<thead>
<tr>
<th>Kind of Lines</th>
<th>Sketch of the Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-break line</td>
<td></td>
</tr>
<tr>
<td>Center line</td>
<td></td>
</tr>
<tr>
<td>Extension line</td>
<td></td>
</tr>
<tr>
<td>Dimension line</td>
<td></td>
</tr>
<tr>
<td>Leader line</td>
<td></td>
</tr>
<tr>
<td>Phantom line</td>
<td></td>
</tr>
<tr>
<td>Section line</td>
<td></td>
</tr>
<tr>
<td>Hidden line</td>
<td></td>
</tr>
<tr>
<td>Long-break line</td>
<td></td>
</tr>
<tr>
<td>Cutting-plane line or</td>
<td></td>
</tr>
<tr>
<td>Viewing-plane line</td>
<td></td>
</tr>
<tr>
<td>Visible line</td>
<td></td>
</tr>
</tbody>
</table>
How Well Did You Perform?

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

Criteria for Assessment:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>All lines are drawn appropriately and freehand</td>
<td>Some lines are drawn inappropriately and NOT in freehand</td>
<td>Most of the lines are inappropriately drawn and NOT in freehand</td>
</tr>
<tr>
<td>Neatness</td>
<td>Finished output was neatly done, pleasing, and has no erasures/smudges</td>
<td>Pleasing but erasures and smudges are observable on the finished output</td>
<td>Finished output have so many erasures and smudges and quite unpleasant</td>
</tr>
<tr>
<td>Time Management</td>
<td>Finished the task 10 minutes before the given time</td>
<td>Finished the task on time</td>
<td>Unable to finish the given task</td>
</tr>
</tbody>
</table>

Rating Scale:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Numerical</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 15</td>
<td>91 - 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>8 - 11</td>
<td>86 - 90</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 7</td>
<td>81 - 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 - 3</td>
<td>75 - 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Remarks:
What Do You Need To Know?

Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.2.

Information Sheet 1.2

Artist’s drawing is generally called freehand drawing, drawings are made without the use of drawing instruments or straightedges. Freehand drawing is synonymous to sketching. This technique is necessary in any area of drafting and an important skill for everyone. Skills in freehand drawing can be achieved through constant training and practice.

Line Sketching

One advantage of freehand sketching is that it needs only patience and continuous practice.

Basic Line Sketching

<table>
<thead>
<tr>
<th>Kind of lines</th>
<th>Direction of strokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal lines</td>
<td></td>
</tr>
</tbody>
</table>
For right-handed
Strokes are drawn from left to right for right-handed and from right to left for left-handed individuals. |
For left-handed

Vertical lines

<table>
<thead>
<tr>
<th>Kind of lines</th>
<th>Direction of strokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical lines</td>
<td>Strokes are drawn downward.</td>
</tr>
</tbody>
</table>
Inclined to the right

Inclined strokes (diagonal) are drawn downward

Inclined to the left

Curved strokes are drawn downward for either right-handed or left-handed

Curved line
Directions: Using a separate sheet of paper, sketch the following lines indicated in each box.

Lines should be drawn freehand.

Vertical line

Horizontal line

Inclined to the left

Inclined to the right
Curved to the left

Curved to the right

Refer to the Answer Key. What is your score?
How Do You Apply What You Have Learned?

Show that you learned something by doing this activity

**Operation Sheet 1.2**

**Directions:** Below is a suggested activity on line exercises. Choose at least twelve (12) from the given examples on line sketching. Observe accuracy. Place your drawings in a separate sheet of paper.
How Well Did You Perform?

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

Criteria for Assessment:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>All lines are drawn appropriately and freehand</td>
<td>Some lines are drawn incorrectly and NOT in freehand</td>
<td>Most of the lines are incorrectly drawn and NOT in freehand</td>
</tr>
<tr>
<td>Neatness</td>
<td>Finished output was neatly done, pleasing, and has no erasures/smudges</td>
<td>Pleasing but erasures and smudges are observable on the finished output</td>
<td>Finished output have so many erasures and smudges and quite unpleasant</td>
</tr>
<tr>
<td>Time Management</td>
<td>Finished the task 10 minutes before the given time</td>
<td>Finished the task on time</td>
<td>Unable to finish the given task</td>
</tr>
</tbody>
</table>

Rating Scale:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Numerical</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 15</td>
<td>91 - 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>9 - 11</td>
<td>86 - 90</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 7</td>
<td>81 - 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 - 3</td>
<td>76 - 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Remarks:

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

How did you find this activity? Did you enjoy answering it? Was it hard? Challenge yourself to finish this activity. Be patient. Have self confidence.
THEORIES AND PRINCIPLES OF ORTHOGRAPHIC PROJECTION

Multi-view drawing – a drawing that shows more than one view of an object.

Orthographic Projection – A system for graphical representation of an object by a line drawing on a flat surface.

Orthographic View – a drawing that shows a side of an object viewed directly from 90 degrees.

Six (6) Principal Views of an Object:

The simple work piece below shows the six (6) principal sides or views.
An orthographic view is made by projecting the edge of the object perpendicular to a plane of projection.

### Planes of Projection

Three planes of projection are used in orthographic drawing. These are called the horizontal plane, frontal plane, and the profile plane.

The planes of projection join and form quadrants. The quadrants are called first angle, second angle, third angle, and fourth angle. The first and the third quadrants are used for drafting purposes.
UNFOLDING THE GLASS BOX IN ONE PLANE SHOW

Overall Size of the Object
1. Height is the perpendicular distance between two horizontal planes
How Much Have You Learned?

Self-Check 1.3

Directions: Write the correct word on each blank to complete the statements.

1. The system of orthographic projection that places the object on the first quadrant is called ________________.

2. Located below the top view is the ________________ of the Third angle projection.

3. The system of orthographic projection that places the object on the third quadrant is called ________________.

4. Located below the first is the ________________ of the first-angle projection.

5. The perpendicular distance between horizontal planes is referred to as ________________.

6. The perpendicular distance between profile planes is called ________________.

7. The perpendicular distance between frontal planes is called ________________.

Refer to the Answer Key. What is your score?
What Do You Need To **KNOW**?

Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.4.

Information Sheet 1.4

Mechanical drawing is describing the shapes of objects completely and exactly by the use of orthographic views. Although there are six principal views that can be drawn in an object, only the three regular views are normally required in the preparation of a working plan.

**ORTHOGRAPHIC PROJECTIONS**

1. **First-Angle Projection (ISO Standard)**

The first-angle projection is a system of orthographic projection used by the European countries which places the object on the first quadrant.

Here the horizontal plane is below the object.
- The top of the object is projected down the horizontal plane.
- The rear projects to the frontal plane.
Unfolded Planes

With the planes unfolded and laid flat, the front view is above the top view.

The position of the unfolded planes in the first-angle projection

2. Third-angle Projection (ANSI)

The third-angle projection is a system used in the United States which places the object in the third quadrants.
The third-angle projection places the object in the third quadrant. (An observer here would be facing the frontal plane).

- Observe that the object is placed below the horizontal plane.
- The top view of the object projects up to it, therefore, the top view is in the horizontal plane.
- The object is behind the frontal plane. The front view of the object projects forward to it, therefore, the view is on the frontal plane.
- The side of the object projects to the profile plane, therefore, the side view will be seen in the profile plane.

UNFOLDED PLANES
If the planes are unfolded and laid flat, the top view would be above the front view.

![Diagram of unfolded planes](image)

The position of the unfolded planes in the third-angle projection

![Symbol used for third angle](image)
How Much Have You Learned?

Self-Check 1.4

DIRECTION:

You have just finished the study of the basic principles of orthographic projection. To ensure understanding, try your best to supply the needed information to complete the following statements.

1. The system for graphically representing the object by a line drawing on a flat surface is called __________________.

When the three planes of projections are joined together, they will form quadrants. They are the following: (in any order)

2. __________________
3. ________________
4. __________________
5. __________________

The quadrants used for drafting purposes are (in any order)

6. __________________ and
7. __________________

Orthographic view is drawn by projecting the edge of the object perpendicular to these planes of projection.

8. __________________
9. __________________
10. __________________

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 NO. 1.4

Directions: Below (Fig. 1) is a simple activity for you to work on. Sketch the three regular views using the Third-angle projection. Practice the task following the given procedure.

Tools and materials:
- Drawing paper or a long bond paper
- Pencil
- Eraser

Equipment:
- Drawing Table (Drafting Table or Drawing Board)

Procedures:

1. Prepare all the tools and materials needed.

2. Study the given object (Figure 1) carefully. Observe its dimensions: width, height and depth.

3. Sketch two parallel vertical projection lines representing the width of the object.

4. Draw two parallel horizontal lines projection representing the height of the object.

5. To locate the top view, measure the depth of the top then draw two horizontal parallel lines representing the top view, or if you prefer to locate the right-side view, measure the depth of the right-side then draw two parallel vertical lines representing the right side view. To transfer the depth of the top view to the right-side view or vice versa, please refer to the accepted methods shown below.
Two accepted methods used to transfer the depth of the top view to the side view.

6. Complete the drawing by applying all appropriate lines to make the object visible.

7. Erase unnecessary lines then double check your drawing.
Pictorial drawings are important elements of working drawings because they show the graphic representation of an object as it appears to the observer's eyes. Even a person, who has no technical knowledge in technical drawing, can easily understand the object being presented in the drawing. A pictorial drawing shows likeness (shape) of an object as viewed by the observer. It represents a portion of the object and shows the method of its construction. In some presentations, the whole object is shown in one view.

Types of Pictorial Drawing:

A. Axonometric Pictorial Drawing

1. Isometric drawing – a pictorial drawing showing the three surfaces of the object tilted 30 degrees in front of the observer.

   ![Isometric Drawing]

   Width: Scale 1:1
   Height: Scale 1:1
   Depth: Scale 1:1

   Isometric drawing according to standard

2. Dimetric drawing – the angle that is used for the horizontal planes varies according to the angle of view that has been chosen. This type is not widely used.

3. Trimetric drawing - a classification of an axonometric projection where in a cube is positioned in the way that no axes and angles are equal when projected to the plane projection.
B. Oblique Pictorial Drawing

1. Cavalier drawing – an oblique drawing in which the depth axis lines are full scale or in full size.

2. Cabinet oblique – depth axis lines are drawn one-half scale.

3. General oblique – depth axis lines vary from one-half to full size.
C. Perspective Pictorial Drawing

1. 1-pt. or Parallel perspective – a perspective drawing using one vanishing point, the front view is drawn in its true shape in full or scale size.

2. 2-pt. or Angular perspective – a perspective drawing using having two vanishing points.
3. 3-pt. or Oblique perspective – a perspective drawing using three vanishing points.
**How Much Have You Learned?**

**Self-Check 1.5**

**Instructions:** Supply the needed information to complete the following statements

1. A drawing showing more than one side of an object tilted in front of the observer.
   a. pictorial drawing  
   b. artistic drawing  
   c. multi-view drawing  
   d. orthographic drawing

2. The place or point where the observer is supposed to stand while viewing the object.
   a. vanishing point  
   b. center point  
   c. piercing point  
   d. station point

3. The point where the horizontal line in the perspective view seems to converge or meet.
   a. station point  
   b. vanishing point  
   c. center point  
   d. piercing point

4. The object is placed on the horizon at the eye-level of the observer.
   a. bird’s eye view  
   b. worm’s eye view  
   c. man’s-eye view  
   d. orthographic view

5. An oblique drawing in which the depth axis lines are in full size.
   a. cabinet oblique  
   b. cavalier oblique  
   c. general oblique  
   d. oblique perspective

6. Iso means equal, metric means ________________.

7. A circle becomes ellipse in ________________.

8. Lines that are not parallel to the three base lines in isometric are called ________________.

Refer to the Answer Key. What is your score?
What Do You Need To **KNOW**?

Information Sheet 1.6

ISOMETRIC DRAWING

Axes used in Isometric Drawing

1. Vertical axis
2. Right-cross axis
3. Left cross axis
**Isometric drawing** – a pictorial drawing showing the three surfaces of the object tilted 30 degrees in front of the observer.

**Isometric lines** – are lines drawn parallel to the isometric axes.

**STEPS IN DRAWING ISOMETRIC FROM A GIVEN ORTHOGRAPHIC VIEWS**

1. Study the given orthographic views carefully. Estimate the width, height and the depth of the object, then sketch the axes used in isometric drawing.

2. Transfer the height (A), the width (B), and the depth (C) of the object to the corresponding axis respectively.
3. Sketch isometric lines to complete the isometric box.

4. Layout the details of the object inside the box then finish the pictorial view by drawing the object lines.
CONSTRUCTING ISOMETRIC CIRCLES

Circle or Ellipse in Isometric Drawing.

1. Prepare the following tools and materials
   - T-square
   - Triangle (30x60 & 45x45)
   - Compass
   - Pencil
   - Technical pen
   - Drawing paper
   - Eraser
   - Masking tape

2. Procedure:
   1. Draw an isometric box using a 30 x 60 triangle
2. Draw a 60 degree line from the upper and lower corner of the Isometric box.

3. Draw arcs using x and y as the centers.

4. Draw arcs using A and B as center.
1. Draw a vertical lines connecting the two ellipse in order to produce the outline of the cylinder

SELF CHECK

Isometric Pictorial Drawing with Circular Features

Direction: Draw the Isometric Pictorial drawing based on the given dimensions in the Orthographic views with circular features below.
Directions: Sketch the isometric pictorial of the given orthographic views. Practice the given task below by following the given procedure.

Tools and materials:
- Drawing paper or a long bond paper
- Pencil
- Eraser

Equipment:
- Drawing Table (Drafting Table or Drawing Board)

Procedure:
1. Study the given orthographic views carefully. Estimate the width, height and the depth of the object, then sketch the axes used in isometric drawing.

2. Transfer the height (A), the width (B), and the depth (C) of the object to the corresponding axes respectively.

3. Sketch isometric lines to complete the isometric box.

4. Layout details of the object inside the box then finish the pictorial view by drawing the object lines.

5. Double check your drawing then erase unnecessary lines.
How Well Did You Perform?

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

Criteria for Assessment:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>All lines are drawn appropriately and freehand</td>
<td>Some lines are drawn inappropriately and NOT in freehand</td>
<td>Most of the lines are inappropriately drawn and NOT in freehand</td>
</tr>
<tr>
<td>Neatness</td>
<td>Finished output was neatly done, pleasing, and has no erasures/smudges</td>
<td>Pleasing but erasures and smudges are observable on the finished output</td>
<td>Finished output have so many erasures and smudges and quite unpleasant</td>
</tr>
<tr>
<td>Time Management</td>
<td>Finished the task 10 minutes before the given time</td>
<td>Finished the task on time</td>
<td>Unable to finish the given task</td>
</tr>
</tbody>
</table>

Rating Scales:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Numerical</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 15</td>
<td>91 - 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>8 - 11</td>
<td>86 - 90</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 7</td>
<td>81 - 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 - 3</td>
<td>75 - 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Remarks: ____________________________________________
Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.7.

Information Sheet 1.7

More information on Oblique Drawing

**Oblique drawing** – the kind of pictorial drawing of an object one surface of which is shown parallel to the frontal plane and the other is inclined to

Axes in Oblique Drawing  
Variations in Direction of Receding

Axis
Classifications of Oblique Pictorial Drawing

1. **Cavalier drawing** – An oblique drawing in which the depth axis lines are full scale or in full size. The receding lines are true depth – that is makes an angle of 45 degrees and 30 degrees with the plane of projection.

![Cavalier projection](image)

2. **Cabinet oblique** – Depth axis lines are drawn one-half scale. When the receding line is drawn to half – size, and the projectors makes an angle of 30, 45, 60 degrees respectively.

![Half measurements projected backwards](image)

3. **General oblique** – Depth axis lines vary from one-half to full size. Drawn at any convenient angle and the receding lines are drawn to full size, one third size, one-half size, or one fourth-size.

![Variable from half to full scale](image)
Procedure in Sketching Oblique Pictorial View

1. Study carefully the given orthographic views. Sketch the vertical line OB and horizontal line OA.

2. Draw line OC as the receding line.

3. Complete the oblique box by sketching parallel lines to the oblique axes.

4. Layout the details of the object inside the oblique box.
5. Erase the unnecessary lines to complete the drawing.
Self-Check 1.6

Instructions: You have just finished the study of the basic principles of oblique drawing.

Answer the following items by writing the letter of the correct word/s being described in each statement.

1. A drawing that shows a front view in its true relations and dimensions just as it would be in working drawing.
   a. Isometric drawing  
   b. Oblique drawing  
   c. Orthographic drawing  
   d. Perspective drawing

2. This type of oblique pictorial view where you can see the exact dimension of the object.
   a. Cabinet projection  
   b. Cavalier projection  
   c. Isometric projection  
   d. Orthographic projection

3. The receding lines in oblique pictorial drawing regularly used
   a. 30 degrees  
   b. 45 degrees  
   c. 60 degrees  
   d. 75 degrees

4. This is the type of oblique pictorial view where the dimension of the receding features of the object are drawn half-scale.
   a. Cabinet projection  
   b. Cavalier projection  
   c. Isometric projection  
   d. Orthographic projection

5. Give at least three rules to be followed in sketching oblique views.
   5.1  
   5.2  
   5.3

Refer to the Answer Key. What is your score?
How Do You Apply What You Have Learned?

Show that you learned something by doing this activity

ACTIVITY SHEET NO. 1.6

Directions: Sketch the oblique pictorial of the given orthographic views. Practice the given task below by following the given procedure.

Tools and materials:
- Drawing paper or a long bond paper
- Pencil
- Eraser

Equipment:
- Drawing Table (Drafting Table or Drawing Board)

Procedure
1. Study carefully the given orthographic views. Sketch the vertical line and horizontal line that will serve as your axes.

2. Draw the receding line.

3. Complete the oblique box by sketching parallel lines to the oblique axes.

4. Layout details of the object inside the box then finish the pictorial view by drawing the object lines.

5. Double check your drawing then erase unnecessary lines

Sample orthographic views

[Orthographic Views Diagram]
How Well Did You Perform?

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

Criteria for Assessment:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>All lines are drawn appropriately and freehand</td>
<td>Some lines are drawn inappropriately and NOT in freehand</td>
<td>Most of the lines are inappropriately drawn and NOT in freehand</td>
</tr>
<tr>
<td>Neatness</td>
<td>Finished output was neatly done, pleasing, and has no erasures/smudges</td>
<td>Pleasing but erasures and smudges are observable on the finished output</td>
<td>Finished output have so many erasures and smudges and quite unpleasant</td>
</tr>
<tr>
<td>Time Management</td>
<td>Finished the task 10 minutes before the given time</td>
<td>Finished the task on time</td>
<td>Unable to finish the given task</td>
</tr>
</tbody>
</table>

Rating Scale:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Numerical</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 15</td>
<td>91 - 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>8 - 11</td>
<td>86 - 90</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 7</td>
<td>81 - 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 - 3</td>
<td>75 - 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Remarks:
Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.8.

**SCALING**

**Proportion** – a size or distance in comparison to another.

**Proportion Scale** – a scale for measuring distances for drawings. Marks on a proportion scale indicate the reduced size in proportion to the full or actual scale.

**Scale** – a graduated measurement to allow production of a drawing to any size desired.

**The Scale**

To draw accurate drawings, you must measure accurately; develop the ability to measure distances. The measuring tool, called the scale (*commonly known as the metric scale*), has several edges. Each edge is called the proportion scale. It helps the drafter to reduce or enlarge the drawing of an object in proportion to its actual size.

**Function of a Scale**

1. To measure or layout line distances accurately either in full size and larger or smaller than full size.
2. To produce drawing to a certain sizes (making drawing into scale)

**The Scale Ratio (Object/Drawing)**

Scale ratio 1: 1 – means that 1 mm. on the drawing represent 1 mm. on the actual product or work piece.
Each mark you pass from zero represents one millimeter.

Proportion Scales

Most drafting scales are equipped with proportion scales. Each of these scales aids the drafter in reducing an object on a drawing in a different proportion.

Commonly Used Scale

**Full-Size Scale** – has a ratio of 1:1. This means that 1 mm on the drawing represents 1 mm of the actual object. The views on the drawing paper are the same size as those of the actual object.

**Reduced Scale** (Scaled-down) – has a ratio of 1:2. This means that 1 mm on the drawing represents 2 mm on the actual object. The views of the actual object are twice the size of the views on the drawing paper.
Sometimes you want to show the shapes of the objects clearly and to be able to show the dimension more convenient, you have to prepare drawings that are larger than the actual object. Listed below are sample of enlarged scale.

Enlarged Scale (Scaled-up)

**Scale 2:1** - This means that every 2 mm on the drawing represent 1 mm on the actual object. The views on the drawing paper are twice the size of those of the actual object.

**Scale 5:1** - This means that every 5 mm on the drawing represent 1 mm on the actual object. The views on the drawing paper are five times larger than those of the actual object.

**Things to Remember in Scaling a Drawing**

1. Whenever possible, the work piece must be drawn into full-size.
2. When dimensioning, always enter the actual dimension of the work piece.
3. Angular dimensions remain the same regardless of the scale to which an object is drawn.
4. The first figure of a scale designation refers to the dimension used to construct the views. The second figure of a scale designation refers to the actual dimensions of the object being drawn.
How Much Have You Learned?

Self-Check 1.8

Directions:

You have just finished the study of the basic principles of scaling. To ensure understanding, try your best to interpret the following scale designations.

1. 3:1
2. 10:1
3. 1:15
4. 1:1
5. 1:20
6. 50:1
7. 1:75
8. 100:1
9. 1:200
10. 500:1

Refer to the Answer Key. What is your score?
What Do You Need To KNOW?

Information Sheet 1.9

Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.9.

Dimensioning – placing sizes and related information on a drawing

Size dimension – gives the detail and overall sizes of the object

Location dimension – merely locates part or parts and features of the object

DIMENSIONING METHOD

Aligned Method

All dimensions are placed aligned with the dimension line and be read from either the bottom or right side of the paper.
Unidirectional Method

In the unidirectional method, all dimensions are read from the bottom of the page as illustrated. This is a new method.

KINDS OF DIMENSIONS

Over-all dimension – every object, regardless of its shape, has three over-all dimensions. An over-all dimension indicates the over-all width, height and depth of an object.
**Detail dimensions** – provides size or location information concerning any feature or details of an object other than its over-all dimension.

**Rules in Dimensioning**

For a beginner like you, remember these dimensioning rules when placing measurements in your drawing.

1. Dimensions should be placed between the views.
2. Avoid repetition of dimensions.
3. Use outside dimension if the space is limited, and use an inside dimension if there is enough space.
4. Continuous dimensions should be used whenever possible.
5. Staggered dimensioning should be used when the space for dimensioning is limited.
6. When dimensioning a circle, it should be from center to center.
7. Dimensions are entered in millimeters without measures.
8. Extension lines must have a distance of about 10 mm from the object edge and an approximate 2 millimeters after the dimension lines.
**How Much Have You Learned?**

**Self-Check 1.9**

**Directions:** You have just finished the study of the basic principles in dimensioning. To ensure understanding, try your best to supply the needed information to complete the following statements.

1. This is the dimension that gives the detail and overall sizes of the object.
   - A. Location Dimension
   - B. Figure Dimension
   - C. Shape Dimension
   - D. Size Dimension

2. This kind of dimension merely locates part or parts of the object.
   - A. Location Dimension
   - B. Figure Dimension
   - C. Shape Dimension
   - D. Size Dimension

3. This dimension represents the total width, height and depth of an object.
   - A. Detail Dimension
   - B. Location Dimension
   - C. Overall Dimension
   - D. Size Dimension

4. The process of describing the object by placing sizes and related information on a drawing.
   - A. Dimensioning
   - B. Sectioning
   - C. Scaling
   - D. Tolerancing

5. Type of dimensioning that requires all dimension figures, except to angular contours, and be lettered between guide lines that are parallel to the dimension lines.
   - A. Aligned Method
   - B. Location Dimension
   - C. Overall Dimension
   - D. Uni-Directional Method

6. This dimension represents the width, height and the depth of each part of the same object.
   - A. Detail Dimension
   - B. Location Dimension
   - C. Overall Dimension
   - D. Size Dimension

7. Type of dimensioning that requires all dimension figures be lettered between guide lines that are parallel to the bottom edge of the drawing paper.
   - A. Aligned Method
   - B. Location Dimension
   - C. Overall Dimension
   - D. Uni-directional Method

Refer to the Answer Key. What is your score?
How Do You Apply What You Have Learned?

Show that you learned something by doing this activity

Operation Sheet 1.9

Directions: Sketch the orthographic views of the given object. Practice the task below by following the given procedure.

Provide the appropriate dimensions in each view

Tools and materials:
- Drawing paper or a long bond paper
- Pencil
- Eraser

Equipment:
- Drawing Table (Drafting Table or Drawing Board)

Procedure:

1. Study the given object below carefully.

2. Sketch the regular views of the given object then provide dimensions in each view using the Aligned Method of dimensioning.

3. Observe strictly the following dimensioning rules:
   a. Dimensions should be placed between the views.
   b. Avoid repetition of dimensions.
   c. Use outside dimension if the space is limited, and use an inside dimension if there is enough space.
   d. Continuous dimensions should be used whenever possible.
   e. Staggered dimensioning should be used when the space for dimensioning is limited.
   f. Dimensions are entered in millimeters without measures.
   g. Extension lines must have a distance of about 10 mm from the object edge and an approximate 2 millimeters after the dimension lines.
Note: Do not include the two (2) holes in your orthographic views.
How Well Did You Perform?

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

<table>
<thead>
<tr>
<th>Criteria</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>All lines are drawn appropriately and freehand</td>
<td>Some lines are drawn inappropriately and NOT in freehand</td>
<td>Most of the lines are inappropriately drawn and NOT in freehand</td>
</tr>
<tr>
<td>Neatness</td>
<td>Finished output was neatly done, pleasing, and has no erasures/smudges</td>
<td>Pleasing but erasures and smudges are observable on the finished output</td>
<td>Finished output have so many erasures and smudges and quite unpleasant</td>
</tr>
<tr>
<td>Time Management</td>
<td>Finished the task 10 minutes before the given time</td>
<td>Finished the task on time</td>
<td>Unable to finish the given task</td>
</tr>
</tbody>
</table>

Rating Scale:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Numerical</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 15</td>
<td>91 - 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>8 - 11</td>
<td>86 - 90</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 7</td>
<td>81 - 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 - 3</td>
<td>75 - 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Remarks:
What Do You Need To **KNOW**?

Information Sheet 1.10

Read the Information Sheet very well then find out how much you can remember and how much you learned by doing Self-check 1.10.

**Preparation of Working Plans**

**Assembly Working Plans**

An assembly working plan is one that indicates how the individual parts of a machine or products are assembled to make a complete unit. An assembly working plan serves the following purposes:

1. It describes the shape of the assembled unit or product.
2. It shows how the parts of the assembled unit are positioned in relation to each other.
3. It identifies each component that forms part of the assembled product.
4. It provides parts list that describes and essential data concerning each part of the assembled unit or product.
5. It provides, when necessary, reference information concerning the physical or functional characteristics of the assembled unit.

**Sample Assembly Working Drawing**

**Detail Working Plans**
A technical working plan of a single part of a machine or mechanism gives enough information to allow the part to be made. It describes the shape and indicates the dimensions of the object.

Sample Detail Working Drawing

Parts List

A parts list is a list of all parts required to put an assembly together. This list itemizes important data about each part of an assembled machine or product such as part name, material, quantity required, and size specifications.

Sample figure below shows a simple parts list along with suggested dimensions. In the material column STD abbreviation represents for all standard parts. This means that they must be purchased. Complete specifications for standard parts must always be listed in the name column together with the part name.

Only the names of non-standard parts are listed in the name column. The material from which the standard parts are made is listed by abbreviations in the material column such as C.I., H.R.S., C.R.S., Alum.

The upper or lower right-hand corner of an assembly working plan is usually reserved for the parts list.
3.0 TO 6.0 mm LETTERING

8.0 mm SPACES FOR PARTS REQUIRING SINGLE LINES OF LETTERING

10

8.0

15 55 15 15

PARTS LIST

<table>
<thead>
<tr>
<th>PART</th>
<th>NAME</th>
<th>QUAN</th>
<th>MATL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOUSING</td>
<td>1</td>
<td>Cl.</td>
</tr>
<tr>
<td>2</td>
<td>COVER PLATE</td>
<td>2</td>
<td>Cl.</td>
</tr>
<tr>
<td>3</td>
<td>SLEEVE</td>
<td>4</td>
<td>C.R.S.</td>
</tr>
<tr>
<td>4</td>
<td>COLLAR</td>
<td>1</td>
<td>ALUM</td>
</tr>
<tr>
<td>5</td>
<td>M8X1.5X40LG. SOCKET-HEAD CAP SCREW</td>
<td>2</td>
<td>STD.</td>
</tr>
</tbody>
</table>

13 TO 18 mm SPACES FOR PARTS REQUIRING DOUBLE LINES OF LETTERING

Sample Parts List
How Much Have You Learned?

Self-Check 1.10

Directions: You have just finished the study of the basic principles in assembly and detail working plans. To ensure understanding, carefully study the given samples below and complete the table for the parts list.

Figure 3) Vee Block
Directions: You have just finished the study of the basic principles in assembly and detail working plans. To ensure deeper understanding on reading and interpreting working plans, do the given sample tasks below and by completing the table for the parts list. (Figures 4 and 5)
(Figure 4) Special Flaring Tool

<table>
<thead>
<tr>
<th>Part</th>
<th>Name</th>
<th>Quantity</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Directions: Provide the complete parts list of the Toolmaker’s Vise on the table below.

(Figure 5) Toolmaker’s Vise
You are now equipped with the different knowledge in working plans and sketches the basic knowledge and skills in dimensioning, scaling, orthographic projection, isometric drawing, oblique drawing and perspective drawing. These are the basic elements needed to proceed in the next level of knowledge and skills in mechanical drafting specifically house planning. As a draftsman you are now leading to a job of an assistant draftsman where you can perform simple drawing plans and designs.

Congratulations!
You did a great job! Rest and relax a while then move on to the next lesson. Good luck!
LESSON 4
APPLYING SAFETY PRACTICES

LEARNING GOALS / TARGETS:
At the end of this Lesson, you are expected to do the following:

LG 1. identify hazardous areas;
LG 2. use personal protective clothing and devices
INTRODUCTION

This lesson covers the knowledge, skills and attitudes required to comply with the regulatory and organizational requirements for occupational health and safety such as identifying, evaluating and maintaining occupational health and safety (OHS) awareness.

LEARNING GOALS / TARGETS 1

Identifying Hazardous Area

PERFORMANCE STANDARDS

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

MATERIALS:

a. Drawing paper
b. Pencil
c. Any coloring medium
Let us determine how much you already know about identifying hazardous areas. Take this test.

Pre-test LG 1

A. Multiple Choice. Write the letter of the correct answer.

_____ 1. It will be used only to warn or caution against practices.
   A. Caution sign   B. Danger sign   C. Exit sign   D. Safety sign

_____ 2. This preventive sign shall be used only where an immediate hazard exists.
   A. Caution sign   B. Danger sign   C. Exit sign   D. Safety sign

_____ 3. This is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment.
   A. Occupational Safety and Health   B. Department of Labor and Employment   C. Department of Trade and Industry

_____ 4. Occupational safety and health requirements may be reinforced in civil law and/or criminal law.
   A. Economic   B. Labor   C. Legal   D. Moral

_____ 5. Take out unnecessary items and dispose.
   A. Seiri   B. Seiketsu   C. Seiso   D. Shitsuke.

_____ 6. Arrange necessary items in good order for use.
   a. Seiri   b. Seiketsu   c. Seiso   d. Seiton

_____ 7. Do things spontaneously without being told or ordered.
   A. Seiri   B. Seiketsu   C. Seiso   D. Shitsuke.

_____ 8. This type of hazards is solid, liquid, vapor or gaseous substances, dust, fume or mist.
   A. Biological   B. Chemical   C. Ergonomic   D. Safety

_____ 9. Refers to inadequate and insufficient machine guards, unsafe workplace conditions, unsafe work practices.
   A. Biological   B. Chemical   C. Ergonomic   D. Safety

_____ 10. This is caused by organisms such as viruses, bacteria, fungi and parasites.
   A. Biological   B. Chemical   C. Ergonomic   D. Safety

Check if your answers are correct by comparing them with those in the Answer Key. If you got 90%-100% of the items correct, that means you already familiar with the lesson covered by Learning Outcome No. 3. However you may still study the lesson to refresh your memory and learn new concepts. If you missed a lot of items, do all the activities again to gain knowledge and skills required for.
OCCUPATIONAL SAFETY AND HEALTH

Occupational Safety and Health is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. As a secondary effect, it may also protect co-workers, family members, employers, customers, suppliers nearby communities, and other members of the public who are affected by the workplace environment.

Occupational Health should aim to:

1. promote and maintain the highest degree of physical, mental and social well being of workers in all occupations;
2. place and maintain the worker in an environment suitable to his physiological and psychological capabilities;
3. protect workers from risk resulting from factors adverse to health; and
4. prevent workers from resignation due to health caused by poor working conditions.

The reasons for establishing good occupational safety and health standards are frequently identified as:

- Moral – an employee should not have to risk injury at work, nor should others associated with the work environment.
- Economic – many governments realize that poor occupation and health conditions results to cost to the State (e.g. through social security payments to the incapacitated, costs for medical treatment, and the loss of the “employability” of the worker). Economic studies human welfare in terms of the production, distribution, and consumption of goods and services.
- Legal – Occupational safety and health requirements may be reinforced in civil law and/or criminal law. Safety Standards are standards designed to ensure the safety of products, activities or processes and others.

Safety Standards are standards designed to ensure the safety of products, activities or processes and others.
OSHCA Workplace Regulations

1. The place and all equipment and furnishings are maintained in thoroughly safe, clean and hygienic condition and in good repair.
2. Keep the place free from rodents, cockroaches and other vermin.
3. Provide adequate facilities for hand washing, cleaning and disposing of waste.
4. Establish proper procedures for infection control.
5. Keep the floor area and free from waste, water and grease.
6. Keep cabinets dry, clean and close tightly.

Directions: Identify the following terms below. Use a separate sheet of paper for your answers.

__________ 1. The standards designed to ensure the safety of products, activities or processes and others.
__________ 2. An employee should not have to risk injury at work, nor should others associated with the work environment.
__________ 3. Occupational safety and health requirements may be reinforced in civil law and/or criminal law.
__________ 4. A cross-disciplinary area concerned with protecting the safety, and welfare of people engaged in work or employment.
__________ 5. It refers to human welfare in terms of the production, distribution, and consumption of goods and services.

Refer to the Answer Key. What is your score?
Directions: Identify the following terms below. Use a separate sheet of paper for your answers.

__________ 1. The standards designed to ensure the safety of products, activities or processes and others.

__________ 2. An employee should not have to risk injury at work, nor should others associated with the work environment.

__________ 3. Occupational safety and health requirements may be reinforced in civil law and/or criminal law.

__________ 4. A cross-disciplinary area concerned with protecting the safety, and welfare of people engaged in work or employment.

__________ 5. It refers to human welfare in terms of the production, distribution, and consumption of goods and services.

Refer to the Answer Key. What is your score?
Information Sheet 1.2

One of the principal means of promoting efficiency in drafting is orderliness and neatness. Efficiency in turn will produce accuracy in drawing. The drawing area should be kept clear of equipment not in direct use.

Procedure in Setting up Drawing Tools, Materials and Equipment and Standard Procedure

In preparation for and materials for a particular drawing activity. This is to ensure the correct setting of standard procedure and accuracy of drawings.

Drawing tools, materials and equipment are very expensive items; however these are important in all drafting tasks. Considering its cost and value in drafting activity, it is also important to take care and maintain its usability.

With this, the following considerations are strictly emphasized as Standard Operating Procedure (SOP) during and after the utilization of the drafting tools, materials and equipment:

a. Before the start of drafting activity:

1. Select the tools, materials and equipment needed in the assigned task.
2. Properly set up the required tools and materials in a place convenient for you to move and execute your work.
3. Clean the table and tools, see to it that these are free from dust and other elements that would cause damage to your work.
4. Wash your hands with clean water.
b. Activity proper:
1. Perform the activity by following the standard operating procedure per job requirement.
2. Properly manipulate all the tools and equipment that are used in the activity.
3. In case of errors or mistakes along the way (for instance misprinting of lines, letters, and other forms of mistakes) use the appropriate eraser.
b. After the activity:

1. Submit your output to your teacher for checking
2. Check all the tools and materials to ensure that nothing is lost.
3. Return the tools and materials to the tool keeper
4. Withdraw your borrower's card from the tool keeper and signed out that you have returned the borrowed tools and materials.
5. Clean your work station before leaving.
Other Important Practices that Must be Observed in the Work Station or Workplace

There are important practices that must be observed in the work setting. The following are:

1. Observe safety precautions:
   a. Never smoke inside the work station.
   b. Never use any tools and equipment without cleaning it first.
   c. Avoid talking with your co-students during working period.
   d. Always turn off the lights, air condition, ceiling fan, computer units, and other equipment before leaving the work station.
   e. Maintain cleanliness in the work station.
   f. Use tools and equipment properly.

2. Observe punctuality of attendance.
3. Avoid quarreling with your co-students.
4. Observe and practice the value of respect.
5. Return the borrowed tools and equipment on time.
6. Observe and practice proper disposal of waste.
**Self-Check 1.2**

**Directions:** List down some of the pointers and considerations done before, during and after the activity in preparation for a required task in Mechanical Drafting. Use a separate sheet of paper.

A. Before the start of drafting activity:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

B. During the drafting activity:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

C. After the activity proper:

________________________________________________________________________

________________________________________________________________________

Refer to the Answer Key.

What is your score?
What Do You Need To **KNOW**?

Read the Information Sheet 1.3 very well then find out how much you can remember and how much you learned by doing Self-check 1.3.

**Information Sheet 1.3**

**Keep Your Workplace Clean and Organized**

It is important to consider safety measures whether in the industrial arts laboratory shop, drafting room or in the home workshop. Good housekeeping is one of the sure ways to keep a safe workplace. It is not the result of cleaning up once a week or even once a day. It is the result of keeping the workplace cleaned-up all the time. It is an essential factor in a good safety program, to promote safety, health, production, and morale. Besides preventing accidents and injuries, good housekeeping saves space, time, and materials. When a workplace is clean, orderly, and free of obstruction, work can get done safely and properly. Workers feel better, think better, do better work, and increase the quantity and quality of their work. Japanese companies innovated a productivity philosophy called "5S," which stands for five Japanese words that refer to a methodology not only for cleaning, but for business. The 5S methodology is all about eliminating waste, speeding up daily tasks, and improving the quality of the workplace. You can use the 5S methodology to help you organize your tasks at the end of every working day.

**Seiri (Sorting)**

Take out unnecessary items and dispose. Keep only the items you need at work, and discard or store everything else.
Seiton
"Set in order" means that there's a place for everything and everything should be in its place. Arrange necessary items in good order for use.

Seiso (Sweeping)
At the end of each working day, take time to clean up your office space. Clean up any mess you make.

Seiketsu (Standardizing)
Maintain high standard of housekeeping
Shitsuke (Sustaining)

Do things spontaneously without being told or ordered. A systematic and productive workplace is not a one-day-affair just because somebody is observing you.

The 5S system may sound simple, but it demands dedication and commitment. With 5S, you can be sure to complete your cleaning tasks in your workshop in no time.
Direction: Match the different 5’S in Column A with illustrations or symbols in column B. Write only the letter of the correct answer. Use a separate sheet of paper.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______ 1. Shitsuke (Sustaining)</td>
<td><img src="image" alt="A" /></td>
</tr>
<tr>
<td>_______ 2. Seiso (Sweeping)</td>
<td><img src="image" alt="B" /></td>
</tr>
<tr>
<td>_______ 3. Seiketsu (Standardizing)</td>
<td><img src="image" alt="C" /></td>
</tr>
<tr>
<td>_______ 4. Seiton (Set in Order)</td>
<td><img src="image" alt="D" /></td>
</tr>
<tr>
<td>_______ 5. Seiri (Sorting)</td>
<td><img src="image" alt="E" /></td>
</tr>
</tbody>
</table>

Refer to the Answer Key. What is your score?
Information Sheet 1.4

Since 1980’s, there were about 327,000 people employed in some type of drafting job. Nine out of ten drafters work in industry. Many work in industries making machinery, electrical equipment, and metal products. In the manufacturing sector most drafters work for engineering or architectural consulting firms, construction companies, and public utilities. Some work in local governmental agencies. In this case a student or an individual involved in this kind of work should consider the following facts in the prevention of accidents and hazards.

The Department of Labor and Employment (DOLE) and the Occupational Health and Safety Standards (OHSS) issued D.O. 13, ss 1998, known as the Guidelines Governing Occupational Safety and Health in the Industry. It requires employers and establishments to use a safety sign where there is a significant risk to health and safety that has not been avoided or controlled by the methods required under other relevant law, provided the use of a sign can help reduce the risk.

ACCIDENT PREVENTION SIGNS AND SYMBOLS

General

Signs and symbols are required to be visible at all times when work is being performed, and shall be removed or covered promptly when the hazard no longer exists.

Danger Signs

Danger signs shall be used only where an immediate hazard exists. It should be read as the predominating color for the upper panel; outline on the borders; and a white lower panel for additional sign wording.
Caution signs shall be used only to warn against or caution against practices.

Caution sign shall have yellow as the predominating color; black upper panel and borders; yellow lettering of "caution" on the black panel; and the lower yellow panel for the additional sign wording.

Black lettering shall be used for additional wording.

Standard color of the background shall be yellow; and the panel, black with yellow letters. Any letter used against the yellow background shall be black. The colors shall be those of opaque glossy samples.

Exit Signs

Exit signs, when required, shall be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters shall be at least three fourths in width.

Safety Instructions Signs

Safety instruction signs, when used, shall be with green upper panel with white letters to convey the principal message. Any additional wording on the sign shall be black letters on the white background.
Directional Signs

Directional signs, other than automotive traffic signs specified shall be white with a black panel and white directional symbol. Any wording on the sign shall be black letters on the sign.

![Directional Signs Image]

Traffic Signs

Construction areas shall be posted with legible traffic signs at point hazard. All traffic control signs or devices used for protection of construction workers shall conform to Occupational Safety and Health Administration (OSHA) standards.
Table shows other signs and symbols you have to follow at all times while doing your works inside and outside the shop.

<table>
<thead>
<tr>
<th>Example</th>
<th>Classification</th>
<th>Meaning/ Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="No Electronic Devices" /></td>
<td>Prohibition</td>
<td>Do not use in any specified places. It may interfere in the operations of other electronic gadgets in the vicinity</td>
</tr>
<tr>
<td><img src="image" alt="Danger" /></td>
<td>Hazard alerting</td>
<td>BE CAREFUL Warning. It warns everybody of potential dangers around the workplace.</td>
</tr>
<tr>
<td><img src="image" alt="Prohibition" /></td>
<td>Prohibition</td>
<td>NOT ALLOWED Danger, alarm. This prohibition reduces risks of fire and prevents personal injury.</td>
</tr>
<tr>
<td><img src="image" alt="Prohibition" /></td>
<td>Prohibition</td>
<td>When you see this symbol, picking, smoking, or touching is prohibited</td>
</tr>
<tr>
<td><img src="image" alt="Hazard Alerting" /></td>
<td>Hazard alerting</td>
<td>Do not perform any activity when your eyes are unprotected.</td>
</tr>
<tr>
<td><img src="image" alt="Danger" /></td>
<td>Hazard alerting</td>
<td>Danger of electrocution. Do not ignore this sign in the workplace.</td>
</tr>
<tr>
<td>Hazard alerting</td>
<td>Avoid getting into contact to places, equipment or tools with this sign.</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Hazard alerting</td>
<td>High voltage is dangerous and fatal. Keep out of areas where you see signs like this.</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>In all offices, workplaces, and establishments, it is mandatory to have this sign for first aid displayed on conspicuous places. This is where you should run to if accidents happen.</td>
<td></td>
</tr>
<tr>
<td>Hazard avoidance/safety</td>
<td>For good housekeeping, these symbols indicate “recycling” materials. This means that the material is recyclable or where you should place recyclable objects/wastes in the work area.</td>
<td></td>
</tr>
<tr>
<td>Hazard Avoidance</td>
<td>Be careful with falling objects and from being pressed from lathe and other moving machines</td>
<td></td>
</tr>
</tbody>
</table>
**How Much Have You Learned?**

**Self-Check 1.4**

**Directions:** Match Column A with Column B. Write only the number of your answer on a separate sheet of paper.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DIRECTIONAL SIGN</td>
<td>[DANGER DO NOT ENTER]</td>
</tr>
<tr>
<td>2. CAUTION SIGN</td>
<td>[STOP]</td>
</tr>
<tr>
<td>3. EXIT SIGN</td>
<td>[Israel Exit]</td>
</tr>
<tr>
<td>4. SAFETY SIGN</td>
<td>[Explosive]</td>
</tr>
<tr>
<td>5. DANGER SIGN</td>
<td>[Running Man]</td>
</tr>
</tbody>
</table>

Refer to the Answer Key. What is your score?
What Do You Need To KNOW?

Read the Information Sheet 1.5 very well then find out how much you can remember and how much you learned by doing Self-check 1.5.

Information Sheet 1.5

Hazards in the Workplace

There are many things that affect the health of a person, such as his environment, his lifestyle, etc. Work is an important determinant of health. It can influence health in a positive or in a negative way.

A place that is safe, healthy and work-conducive entails more productivity. In fact, with a healthy workplace you will be doing more work with less effort.

Hazard is a term used to describe something that has the potential to cause harm.

Risk on the other hand, is a measure of the possibility of a specific harmful effect in given circumstances. It is very important to know the difference between a hazard and a risk.

Types of workplace hazards include:

- **Safety hazards** - Inadequate and insufficient machine guards, unsafe workplace conditions, unsafe work practices.

- **Biological hazards** - Caused by organisms such as viruses, bacteria, fungi and parasites.

- **Chemical hazards** - Solid, liquid, vapor or gaseous chemicals, dust, fume or mist.

- **Ergonomic hazards** - Anatomical, physiological, and psychological demands on the worker, such as repetitive and forceful movements, vibration, extreme temperatures, and awkward postures arising from improper work methods and improperly designed workstations, tools, and equipment.

- **Physical hazards** - Noise, vibration, energy, weather, electricity, radiation and pressure.

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

What are examples of a hazard?

Workplace hazards can come from a wide range of sources. General examples include any substance, material, process, practice, etc that has the ability to cause harm or adverse health effect to a person under certain conditions. See Table 1.
As shown in Table 1, workplace hazards also include practices or conditions that release uncontrolled energy like:

- an object that could fall from a height (potential or gravitational energy),
- a run-away chemical reaction (chemical energy),
- the release of compressed gas or steam (pressure; high temperature),
- entanglement of hair or clothing in rotating equipment (kinetic energy), or
- contact with electrodes of a battery or capacitor (electrical energy).
How Much Have You Learned?

Self-Check 1.5

Direction. Select from the list below the type of workplace hazard that matches the given definition or description. Use a separate sheet of paper.

<table>
<thead>
<tr>
<th>BIOLOGICAL</th>
<th>CHEMICAL</th>
<th>ERGONOMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICAL</td>
<td>PSYCHOLOGICAL SAFETY</td>
<td></td>
</tr>
</tbody>
</table>

1. Refers to Inadequate and insufficient machine guards, unsafe workplace conditions, unsafe work practices.
2. This is caused by organisms such as viruses, bacteria, fungi and parasites.
3. Some examples of this type of hazard are solid, liquid, vapor or gaseous substances, dust, fume or mist.
4. Anatomical, physiological, and psychological demands on the worker, such as repetitive and forceful movements, vibration, extreme temperatures, and awkward postures arising from improper work methods and improperly designed workstations, tools, and equipment.
5. Noise, vibration, energy, weather, electricity, radiation and pressure.

Refer to the Answer Key. What is your score?
Select and Use personal protective clothing and devices

PERFORMANCE STANDARDS

1. Identify personal protective clothing/equipment (PPE) as per job requirements
2. Observe proper wearing of PPE in accordance with workplace safety policies.

Materials

a. Drawing paper
b. Pencil
c. Any coloring medium
d. PPE's
Let us determine how much you already know about personal protective clothing and devices. Take this test.

**Pretest LO 2**

A. **Multiple Choices.** Write the letter of the correct answer.

_____ 1. The main purpose of wearing this kind of PPE is to protect our limbs and body from metal dusts, flaming combustion, flying chips, minute particles and stray metallic objects from abrasive wheels, drills and cutting tools.
   A. Cover all  B. Protective Headgear  C. Safety goggles  D. Safety shoes

_____ 2. A safety helmet or wide-brimmed hat for head protection.
   A. Cover all  B. Protective Headgear  C. Safety goggles  D. Safety shoes

_____ 3. A pair of protective coverings for the hands, usually with separate divisions for the fingers and for the thumb.
   A. Apron  B. Gloves  C. Goggles  D. Pot holder

_____ 4. Safety shoes in the shop designed specifically with hard or metallic materials in the toe areas.
   A. Cover all  B. Protective Headgear  C. Safety goggles  D. Safety shoes

_____ 5. This is a protective instrument for the eyes with transparent eye-pieces.
   A. Cover all  B. Protective Headgear  C. Safety goggles  D. Safety shoes

B. **Directions:** Write T if the statement is True and F if the statement is False. Use separate sheet of paper.

_____ 1. Protective helmets must be worn only where there is a risk of falling debris.

_____ 2. The equipment should be well maintained and stored correctly.

_____ 3. A respirator may be required in all workplaces.

_____ 4. Aprons, gloves and shields are necessary where there is possible spillage or splashes of chemical, blood or other hazardous material.

_____ 5. Mechanical Drafting requires headwork and must be done in quiet surroundings.

Check if your answers are correct by comparing them with those in the Answer Key. If you got 90%-100% of the items correct, that means you already familiar with the lesson covered by Learning Outcome No.2. However you may still study the lesson to refresh your memory and learn new concepts. If you missed a lot of items, do all the activities to gain knowledge and skills required for mastery.
Information Sheet 2.1

Mechanical Drafting requires headwork and must be done in quiet surroundings. But sometimes draftsmen are also need to do fieldwork to see the actual project site they are developing and planning for. They have to think and explore other designs that will fit the needs of present technology. In this case they must be aware of using the PPE.

**Personal Protective Equipment (PPE)**

Using personal protective equipment (PPE) helps to prevent the transmission of communicable diseases between patients and health care providers. It can also help to prevent the contamination of exposed wounds or sores from germs or bacteria that can travel from a health care provider to the patient. Knowing how to properly use PPE can help to insure the safety and well-being of health care providers and emergency responders.

Engineering and administrative controls are not exempted in the different hazardous things normally happened in the workplace, the use of Personal Protective Equipment (PPE) protects workers from injury. Personal Protective Equipment must be used and worn in many work situations in order to protect employees from harm.

**Types and Uses**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name of Personal Protective Equipment</th>
<th>Uses and Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Protective Headgear</td>
<td>A safety helmet or wide-brimmed hat for head protection. This can be used by a draftsman during the actual visitation of the project site.</td>
</tr>
<tr>
<td></td>
<td>Over-all or Cover-all</td>
<td>The main purpose of wearing this kind of clothing is to protect our limbs and body from metal dusts, flaming combustion, flying chips, minute particles and stray metallic objects from abrasive wheels, drills and cutting tools.</td>
</tr>
</tbody>
</table>
Personal Protective Equipment Inspection Checklist
Here are some requirements with which workplaces must abide

Assessments
- A hazard assessment will identify when PPE needs to be used, in what circumstances, and who must wear it.

Maintenance
- The equipment should be well maintained and stored correctly. It must be repaired or replaced when necessary.
- Protective helmets must be worn where there is a risk of falling debris.
- Aprons, gloves and shields are necessary where there is possible spillage or splashes of chemical, blood or other hazardous material.
- Protective, steel-toe boots should be worn where there is a risk of damage to worker’s feet.
Goggles or other eye-protection devices should be worn whenever there is a danger of the eyes being splashed or damaged in the course of work.

**Compliance**

- Safety boots or head-protection equipment is worn, it must comply with the Standards Safety Requirements.
- A respirator may be required in some workplaces.
- Eye wash material will need to be kept on the site where there is a danger of splashes in the eyes. Where PPE such as goggles or safety helmets are required, a notice to this effect should be posted at the entrance to the workplace.
Self-Check 2.1

**Direction:** Identify the following Personal Protective Equipment PPE as shown below:

Refer to the Answer Key. What is your score?
Tools and Materials

- Drawing paper
- Pencil
- Any coloring medium

Direction:

1. Design a poster showing the proper use of PPE including the drawing tools and instruments used in the shop. You are free to choose any available coloring medium. The poster should be informative and should clearly show the main message. You will need to undertake some research to complete this activity.

   Your poster could focus on:
   - Hazard identification and risk assessment in general;
   - The responsibility of your teacher and you as a student.

2. Your work will be graded based on the Evaluation Sheet given.
How Well Did You Perform?

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

Criteria for Assessment: Analytic Scoring Rubrics

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>5 points</th>
<th>3 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme</td>
<td>The output is very relevant to the theme</td>
<td>The output is moderately relevant to the theme</td>
<td>The output is quite relevant to the theme</td>
</tr>
<tr>
<td>Originality</td>
<td>The idea or concept is very original</td>
<td>The idea or concept is moderately original</td>
<td>The idea or concept is quite original</td>
</tr>
<tr>
<td>Visual Impact</td>
<td>The output is very attractive</td>
<td>The output is moderately attractive</td>
<td>The output is quite attractive</td>
</tr>
<tr>
<td>Neatness</td>
<td>The output is free from any erasures</td>
<td>The output has one to three erasures</td>
<td>The output has four or more erasures</td>
</tr>
</tbody>
</table>

Rating Scales

<table>
<thead>
<tr>
<th>POINTS EARNED</th>
<th>NUMERICAL</th>
<th>DESCRIPTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 – 20</td>
<td>90 – 100</td>
<td>Very Good</td>
</tr>
<tr>
<td>10 – 14</td>
<td>86 – 90</td>
<td>Good</td>
</tr>
<tr>
<td>5 – 9</td>
<td>81 – 85</td>
<td>Fair</td>
</tr>
<tr>
<td>1 – 4</td>
<td>75 – 80</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Congratulations! You did a great job!
SUMMARY:

This MODULE is designed to enhance the knowledge, skills and positive attitudes of the students. The primary aim is to prepare every student for their own capability and enhance them to comply with the basic requirements in the field of work. Provide them with the different level of competencies that is required for their specialized jobs.

Every student will be equipped to identify their role and responsibility of a draftsman, promote career growth as a person, comply with regulatory and organizational requirements for occupational health and safety, take accurate measurements and calculations, identify, analyze and interpret symbols in plans and drawings.

This module will help every student to gain basic skills and knowledge to prepare them to be a draftsman.

DEFINITION OF TERMS:

Definition of Terms

- Assembly drawing – a drawing that shows how different parts go together
- Compass – an instrument used when drawing arcs and circles
- Delivery receipt – a form that shows proof or receipt of goods or services
- Detailed drawing – a drawing that shows a single part of a machine
- Dimensioning – the process of placing measurements in a drawing in the Metric or English system
- Divider – a drawing instrument used when transferring measurements, dividing lines, arcs into the desired number of equal parts
- Drawing – a picture, diagram made of lines, a graphic representation of real thing, an idea or a design for production or construction
- Drawing pencil – one of the most important tools of a draftsman, used for drawing
- English system – a system of linear measurement based on standard Foot
Erasing shield – used when clearing up smudges and unnecessary pencil lines

Geometrical construction – the process wherein geometric problems are solved accurately in mechanical drawings

Mechanical drafting – a process for making accurate drawings using special drawing tools and instruments

Metric system – a system of linear measurement based on the standard meter

Orthographic drawing – the object is presented into two or more views by projecting the outline into the planes of projection perpendicular to each other

Pictorial view – the presentation of an object where it is viewed showing the three faces of an object.

Protractor – used for determining gradations of the degrees when measuring arcs and circles

Requisition form – an official form, a printed document on which a request is made

Sketch – a quickly executed freehand drawing that is not intended as a finished work

Triangular scale – a tool generally used when reproducing a drawing in an enlarged or reduced version to some regular proportion

T-Square – a drawing instrument used when drawing horizontal and vertical line.

Angle - geometrical figure composed of two straight lines intersecting at one of their Extremities

Calculation - act or process of or result of calculating

Circle - closed curve where all points are equally distant from the center

Concentric circles - consist of two or more circles with a common center.

Decimal - number expressed in a counting system that uses units of 10, especially a decimal fraction

Dimension - measurable extent of length, thickness and width

Eccentric circles - circles having no common center.

English system – scaled in inches where one foot equals 12 inches.

Formula - special kind of equation. It is a mathematical rule expressing the relationship of two or more quantities by means of numerals, variables and operating symbols

Geometric shapes - characterized by straight lines, regular curves, and angles

Graduation - scale of a measuring tool
**Mensuration** – act of art of measuring

**Metric system** – system of measurement based on the meter

**Perpendicular lines** – lines which make a 900 angle with each other

**Radius** - length of a straight line connecting the center of a circle with a point on the circumference of a circle.

**Standard** - measure of reference

**Axonometric** – method of projection in which an object is drawn with its horizontal and vertical axes to scale but with its curved lines and diagonals distorted

**Detailed drawing** – drawing of a detail part usually in orthographic projection

**Detail dimension** – measurements of the detail part or parts of the object

**Dimensioning** – process of placing measurements in a drawing in the Metric or English System

**Isometric axes** – light lines used as bases in constructing an isometric view of an object

**Isometric drawing** – pictorial drawing showing the three views of the object tilted 30 degrees in front of the observer

**Multi-view drawing** – drawing that shows more than one view of an object

**Notation** – all lettering and other dimension found in a drawing or working sketch

**Oblique drawing** – kind of pictorial drawing of an object one surface of which is shown parallel to the frontal plane and the other is inclined to it

**Orthographic projection** – presentation of an object in two or more views by projecting the outline of the object to the plane of projection perpendicular to each other

**Overall dimension** – the total width, height and depth of the object

**Perspective drawing** – a drawing which shows an object as it appears to our eyes

**Pictorial view** – the presentation of an object where it is viewed showing the three faces of an object

**Working plan** – a freehand drawing showing all the information needed to construct an object

**Ergonomic principles** - a principle of handling a delicate object or task.

**First aid** - it implies includes all forms of remedies given immediately to humans in order to minimize or prevent casualties or fatalities caused by accidents or normal course of time.
Hazard - particular place, thing, or situation that is a risk or danger to the person involved.

Health – overall condition of the body

Injury - damage or harm caused to the structure or function of the body caused by an outside agent or force, which may be physical or chemical.

Quality standards - set of exact specifications to become patterns of actions.

Sanitize - maintain high standard of housekeeping.

Self-Discipline - refers to doing things spontaneously without being told or ordered.

Standard - any established measure; an accurate type; an authoritative model as an example or comparison.

Symbols - generally common illustrations printed on the signs which sometimes carry a descriptive word or few words.

Waste disposal - proper discharge of any solid waste into or in any hand

Workplace - office, premises or worksite where a worker is temporary or habitually assigned.

OHSC – Occupational Health and Safety Commission

OHSS - Occupational Health and Safety Standards

PPE - Personal Protective Equipment actions


LESSON 1

BOOKS:
- Allan Jefferis, David A. Madsen, Architectural Drafting and Design 5th Ed. Thomson Delmar Learning, USA 2005, (pages 32-33)
- Esguerra and Molino, Exploratory Drafting; Abiva Publishing: 1980, (pages 23-35)

READING MATERIALS:
K to12 BASIC EDUCATION CURR. TLE Learning Module 2012
INTERNET:
http://www.images.search.yahoo.com/search/image

LESSON 2

LG 1

BOOKS:
- German M. Manoais. Drafting 1 and 2 Phoenix Publishing:1983

READING MATERIALS:
- Competency Based Learning Material, Civil Technology
- Competency Based Learning Material, Drafting Technology
- K to12 BASIC EDUCATION CURR. TLE Learning Module

INTERNET:
http://images.search.yahoo.com/search/image
http://www.ehow.com/how_4880813_use-drafting-tools.html

LG 2

BOOKS:

READING MATERIALS:
- Competency Based Learning Material, Drafting Technology
- Competency Based Learning Material, Machine Shop
- K to12 BASIC EDUCATION CURR. TLE Learning Module 2012

LG 3

BOOKS:
- German M. Manoais. Drafting 1 and 2 Phoenix Publishing:1983

READING MATERIALS:
- Competency Based Learning Material, Drafting Technology
- Competency Based Learning Material, Machine Shop
- K to12 BASIC EDUCATION CURR. TLE Learning Module 2012

LG 4

BOOKS:
- Esguerra and Molino, Exploratory Drafting; Abiva Publishing: 1980, (pages 63 – 69)

READING MATERIALS:
- Competency Based Learning Material, Drafting Technology
- Competency Based Learning Material, Machine Shop
- K to12 BASIC EDUCATION CURR. TLE Learning Module 2012

MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8) 170
K to 12 – Technology and Livelihood Education
LESSON 3

BOOKS:
- Esguerra and Molino, Exploratory Drafting; Abiva Publishing: 1980, (pages 70-86)

LESSON 4

LG1

BOOKS:

READING MATERIALS:
- Competency Based Learning Material, Civil Technology
- Competency Based Learning Material, Drafting Technology
- Competency Based Learning Material, Machine Shop
- Procedural Guidelines Governing Occupational Safety and Health in the Construction
- K to 12 BASIC EDUCATION CURR. TLE Learning Module

INTERNET:
- http://images.search.yahoo.com/search/image
- http://www.sofweb.vic.edu.au/safe@work
- www.workcover.nsw.gov.au

LG 2

BOOKS:

READING MATERIALS:
- Competency Based Learning Material, Civil Technology
- Competency Based Learning Material, Drafting Technology
- Competency Based Learning Material, Machine Shop
- Procedural Guidelines Governing Occupational Safety and Health in the Construction
- K to 12 BASIC EDUCATION CURR. TLE Learning Module

INTERNET:
- http://images.search.yahoo.com/search/image
- http://www.sofweb.vic.edu.au/safe@work
- www.workcover.nsw.gov.au

MECHANICAL DRAFTING (EXPLORATORY GRADE 7 & 8)

K to 12 - Technology and Livelihood Education
LIST OF MATERIALS / TOOLS / EQUIPMENT / CONSUMABLES FOR THIS MODULE

Drafting Materials

- Drawing Paper
- Drawing or Pen Ink
- Masking Tape
- Pencil-Ink Eraser
- Pencil Sharpener
- Pentel Pen
- Poster Color / Water Color / Coloring Pen or Pencils
- Tracing Paper
- CD / DVD Tapes

Drafting Tools and Instruments

- Drawing Pencil (Hard, Medium, Soft)
- Erasing Shield
- Triangular Scales
- Compass
- Divider
- Drawing Templates
- French Curve
- Protractor
- Ruler
- Scales
- Tape or Tape Ruler
- Technical pens / Drawing Pen / Sign Pen
- T-Square
- Triangles

Equipment

- Computer Hardware
- Drawing Table / Drawing Board
- White Board
- Printer
- LCD Projector

Learning Materials

- Multimedia Materials (print, video, audio)
- Bibliography
Bibliography

All brand names, trademarks, trade names, and WebPages used in this Learning Material (LM) are owned by their respective holders. The Publisher and the Authors do not represent nor claim ownership over them.

While every effort and precaution have been made to ensure complete and accurate information with reference to the materials presented in this LM, the Publisher and Authors can neither guarantee nor be held legally responsible for any mistake in printing or faulty instructions in the LM.

The Publishers and Authors appreciate receiving notice of any errors or misprints.

Acknowledgement

This Learning Module is developed for the Mechanical Drafting NC – II Exploratory Courses in Technology and Livelihood Education, for Grades 7 and 8 of the K to 12 Curriculum with the assistance of the following persons:

The BSE staff, lecturer, linguist specialist, cartoonist illustrators and other members of the BSE family and especially thanks to The TECH-VOC. module writers.

I personally acknowledge the wisdom of this people most of their ideas/work is being introduced on constructing this module. This module is also develop for the Open High School Students wishing and welcoming them to the future National Certificate (NC – II) holder in Mechanical Drafting.

To

ALMIGHTY GOD TO HIM I GIVE ALL GLORY, HONOR and PRAISEs

LAMBERTO M. DIONISIO
Head Teacher VI
GNVHS - Tech'I Voc'I Educ. Department

GUIGUINTO NAT’L VOC’L HIGH SCH./ ANNEX
Officer In Charge (OIC)
Malis, Guiguinto, Bulacan
Acknowledgement

This is to acknowledge the different practitioners, experts, and specialists who made this learning materials and teaching guides for grade 8 possible.

<table>
<thead>
<tr>
<th>Writers (INDUSTRIAL ARTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Joel Castillo</td>
</tr>
<tr>
<td>2. Lamberto Dionisio</td>
</tr>
<tr>
<td>3. Marlon Ocampo</td>
</tr>
<tr>
<td>4. Robert Palma</td>
</tr>
<tr>
<td>5. Cris Diñoso</td>
</tr>
<tr>
<td>6. Romeo Vicmudo</td>
</tr>
<tr>
<td>7. Antonio Blanco Jr.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraluman R. Giron</td>
</tr>
<tr>
<td>Perla Cuanzon</td>
</tr>
<tr>
<td>Ofelia C. Flojo</td>
</tr>
<tr>
<td>Lando T. Guzman</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maria Teresa A. Namoro, Ed.D.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reviewers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Robert Daquil</td>
</tr>
<tr>
<td>2. Leonilo Santelices</td>
</tr>
<tr>
<td>3. Fernando Dela Cruz</td>
</tr>
<tr>
<td>4. Arnel Anonical</td>
</tr>
<tr>
<td>5. Marlon Malaluan</td>
</tr>
<tr>
<td>6. Alexandria Kalalo</td>
</tr>
<tr>
<td>7. Antonio Blanco Jr.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lay-Out Artist/Illustrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcos, Henry Allen M.</td>
</tr>
<tr>
<td>Pili, Francis C.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dr. Lolita M. Andrada</td>
</tr>
<tr>
<td>2. Ms. Bella O. Marinas</td>
</tr>
<tr>
<td>3. Dr. Jose D. Tuguinayo, Jr.</td>
</tr>
<tr>
<td>4. Cristeta M. Arcos</td>
</tr>
<tr>
<td>5. Albert Erni</td>
</tr>
<tr>
<td>6. James Julius M. Liquigan</td>
</tr>
<tr>
<td>7. Milambiling, Owen M.</td>
</tr>
<tr>
<td>8. Emmanuel S. Valdez</td>
</tr>
</tbody>
</table>

All pictures and graphic illustrations crafted from the internet are properties of the original owners and were used only as supplemental materials for education purposes.