Ethiopian TVET-System

Electro Mechanical Equipment And Machinery Maintenance
NTQF Level –II

Based on March, 2017G.C. Occupational Standard

Module Title: Using maps, plans, drawing and specification

TTLM Code: EIS EME2 TTLM 0920v1

This module includes the following learning guides

LG10: Interpret maps, plans and drawings

LG Code: EIS EME2 M04 LO1-LG 10

LG 11: Read and interpret engineering drawings and specifications

LG Code: EIS EME2 M04 LO2-LG-11

LG 12: Draw a map or plan

LG Code: EIS EME2 M04 LO3-12

LG 13: Prepare engineering drawing and parts

LG Code: EIS EME2 M04 LO4-13

LG 14: Prepare for work

LG Code: EIS EME2 M04 LO5-14

LG 15: Use maps and site plans to support Work activities

LG Code: EIS EME2 M04 LO6-15

LG 16: Cleanup work area and maintain Equipment

LG Code: EIS EME2 M04 LO7-16

Instruction Sheet 1	Learning Guide 10: **Interpret maps, plans and drawings**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Types of maps**,** plans and drawings and specifications
- Identification of parts of work systems and their interrelationship
- Key features of maps and site plans and commonly used symbols and abbreviations
- Legend
- Natural and man-made features on maps, plans and drawing
- Identification of environmental requirements and controls from job plans

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Find out what types of maps, plans and drawings and specifications are used to support work tasks.
- Parts of work systems and their interrelationship on a range of drawing types are identified.
- Key features of maps and site plans and commonly used symbols and abbreviations are checked and interpreted.
- Function of the legend is identified and explained.
- Natural and man-made features on maps, plans and drawings are checked and explained.
- Environmental requirements and controls are identified from job plans, specifications and environmental plan.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below

3. Read the information written in the “Information Sheets 1- 6”. Try to understand what are being discussed on pages 5, 17, 22, 28, 31 and 36.
4. Accomplish the “Self-check 1, 2, 3, 4, 5 and 6” on pages 15, 20, 26, 29, 34 and 37.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheet” on page 39 and do the “LAP Test” on page 40
7. After you accomplish operation sheets and LAP tests, ensure you have a formative assessment and get a satisfactory result; then proceed to the next LG.

Information Sheet 1	Types of maps, plans and drawings and specifications

Introduction

The idea and knowledge of a person or institution can be expressed via orally, written or diagrammatically. The diagrammatical representation of ideas is aided by dots, lines, curves, shades, arrows, symbols, abbreviation and text. These representations could be plan, map or drawing.

Depending on point of focus the diagram gives full information like location, dimension, material, direction, manufacturing process, part location and so on.

1.1 Map

Definition

A **map** is a **representation** of all or part of the Earth drawn on a **flat surface** (Usually paper of different type and size) at a specific **scale** (It is the ratio of the actual dimension to the diagrammatic representation). Maps use a variety of symbols and colors to represent selected features of an area. A globe can be useful when we want to study the earth as a whole. Maps were devised because they are much easier to use, store, and transport than globes, and they facilitated the development of much larger scaled representations than was the case with a globe.

Figure1.1 *a) Globe* *b) Map*

Types of maps

Maps are usually classified according to their use.

- **General purpose maps**, sometimes referred to as **reference** maps, show both natural and human-made features such as coastlines, lakes, rivers, boundaries, settlements, roads, rail lines, and others. The emphasis in general purpose maps is on location. All data at same level of importance.

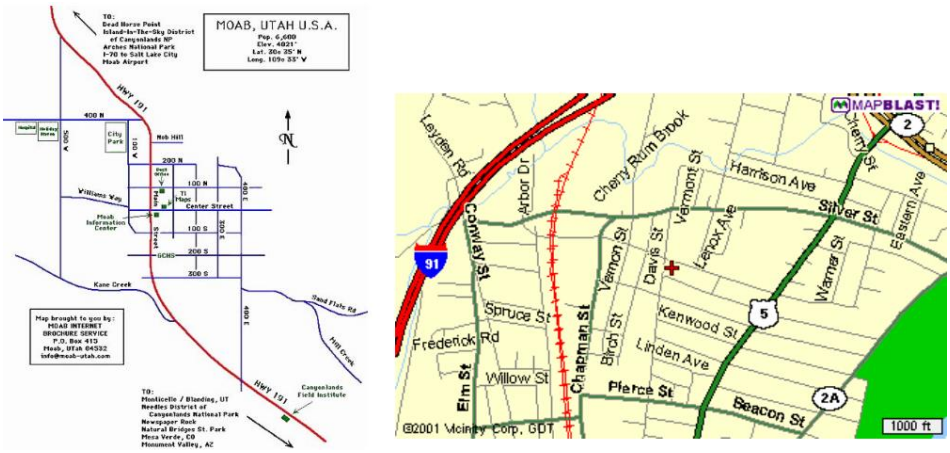


Figure1.2 *General Purpose (street) maps*

- **Thematic maps**, also referred to as special-purpose maps, illustrate the geographical distribution of a particular theme or phenomenon. Example:
  - ✓ **Qualitative** thematic maps simply show the location or spatial distribution of a phenomenon.
  - ✓ **Quantitative** maps display aspects of numerical data associated with the phenomenon shown. Landforms, aspects of climate, vegetation and soil types, demographics, industry, manufacturing, and natural resources

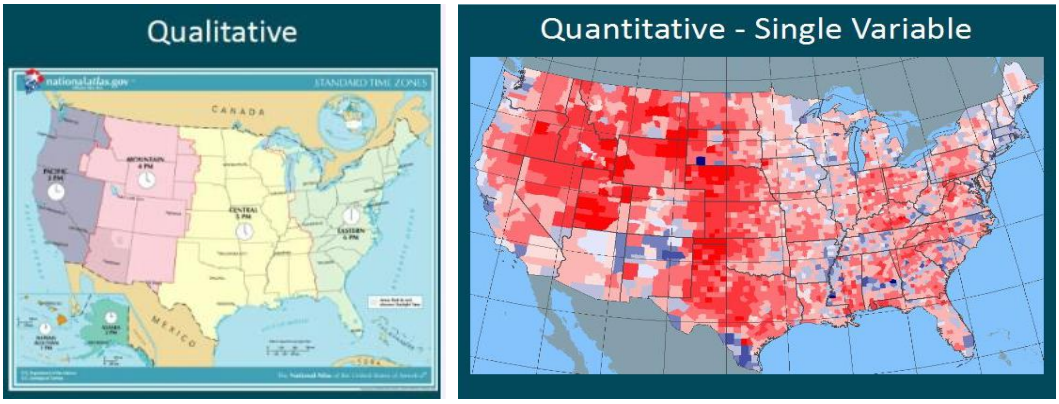


Figure1.3 *Thematic maps*

- **Topographic maps**: As the term suggests, these maps show the topography or surface features of the landscape through the use of **contour lines**. Contours are lines on a map that join places of equal elevation above sea level. This three-dimensional effect allows for detailed study of landscape and drainage features. Topographic maps are usually of a large scale and show many of the features of general purpose maps in considerable detail.

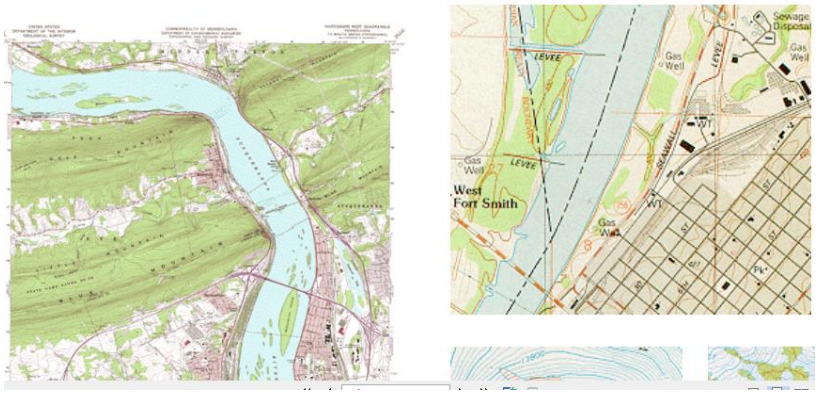


Figure1.3 *Topographic maps*

- **Mental maps** can also be thought of as a map classification. These are images stored in our minds, about features and locations in our environment. Unlike other map types, mental maps may not be very accurate in terms of distances and directions. Nevertheless, they are very meaningful and useful to all of us on a daily basis.

1.2 Drawing

Technical drawing, drafting or drawing, is the act and discipline of composing drawings that visually communicate how something functions or is constructed.

It is essential for communicating ideas in industry and engineering. To make the drawings easier to understand, people use familiar symbols, perspectives, units of measurement, notation systems, visual styles, and page layout. Together, such conventions constitute a visual language and help to ensure that the drawing is unambiguous and relatively easy to understand. Many of the symbols and principles of technical drawing are codified in an international standard called ISO 128.

The need for precise communication in the preparation of a functional document distinguishes technical drawing from the expressive drawing of the visual arts. Artistic drawings are subjectively interpreted; their meanings are multiply determined. Technical drawings are understood to have one intended meaning.

A drafter, draftsperson, or draughtsman is a person who makes a drawing (technical or expressive). A professional drafter who makes technical drawings is sometimes called a drafting technician.

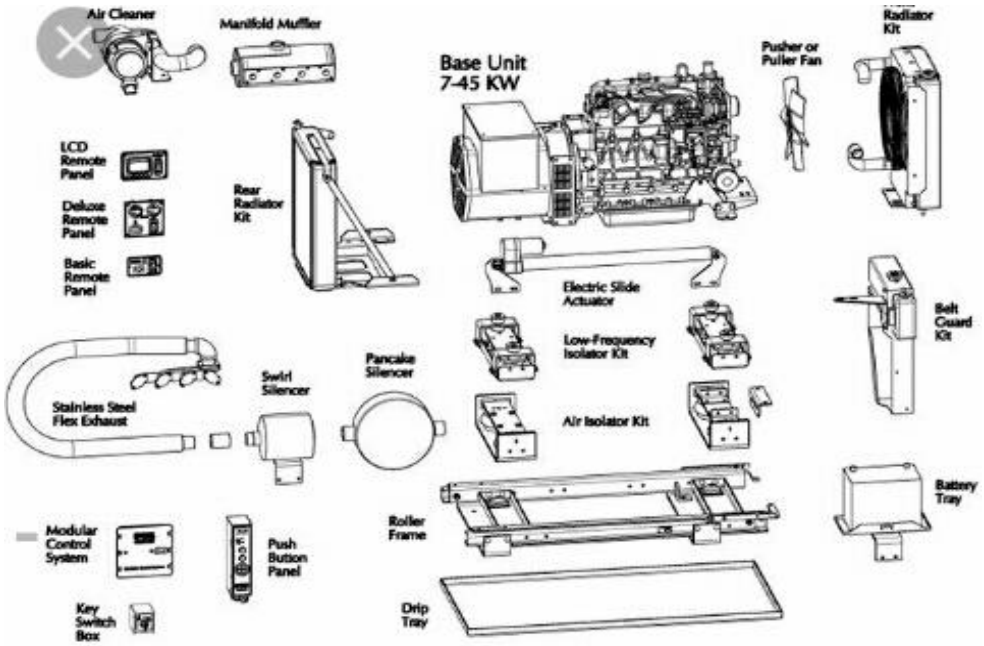


Figure1.4 *Example of drawing showing generator parts*

Sketch

A sketch is a quickly executed, freehand drawing that is usually not intended as a finished work. In general, sketching is a quick way to record an idea for later use.

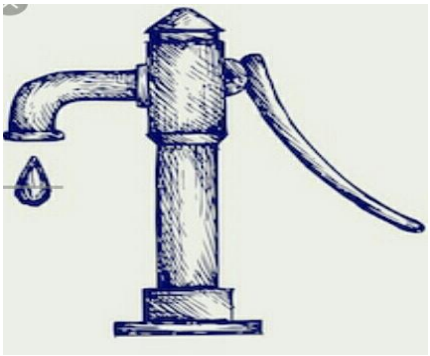


Figure1.5 *Example of Sketch showing water pump*

1.3 Plans

Definition

Plans are a set of drawings or two-dimensional diagrams used to describe a place or object, or to communicate building or fabrication instructions. Usually plans are drawn or printed on paper, but they can take the form of a digital file.

These plans are used in a range of fields from architecture, urban planning, landscape architecture, mechanical engineering, civil engineering, industrial engineering to systems engineering.

Plans are often for technical purposes such as architecture, engineering, or planning. Their purpose in these disciplines is to accurately and unambiguously capture all the geometric features of a site, building, product or component. Plans can also be for presentation or orientation purposes, and as such are often less detailed versions of the former.

The end goal of plans is either to portray an existing place or object, or to convey enough information to allow a builder or manufacturer to realize a design.

The process of producing plans, and the skill of producing them, is often referred to as technical drawing.

Because plans represent three-dimensional objects on a two-dimensional plane, the use of views or projections is crucial to the legibility of plans. Each projection is achieved by assuming a vantage point from which to see the place or object, and a type of projection.

Planning approach

There is no universal standard for sheet order; however the following describes a common approach:

- General Information: The first sheets in a set may include notes, assembly descriptions, a rendering of the project, or simply the project title.
- ***Site: Site plans***, including a key plan, appear before other plans and on smaller projects may be on the first sheet. A project could require a landscape plan, although this can be integrated with the site plan if the drawing remains clear.
- ***Specific plans: Floor plans***, starting with the lowest floor and ending with the roof plan usually appear near the beginning of the set. Further, for example, reflected Ceiling Plans (RCP) s showing ceiling layouts appear after the floor plans.

- ***Elevations :*** Starting with the principal or front elevation, all the building elevations appear after the plans. Smaller residential projects may display the elevations before the plans. Elevation details may appear on the same sheets as the building elevations.
- ***Sections:*** Building sections that describe views cut through the entire building appear next, followed by wall sections, then detail sections.
- ***Details:*** Details may appear on any of the previous sheets, or may be collected to appear on detail sheets. These details may include construction details that show how the components of the building fit together.
- ***Schedules:*** Many aspects of a building must be listed as schedules on larger projects. These include schedules for windows, doors, wall or floor finishes, hardware, landscaping elements, rooms, and areas.

Where additional systems are complex and require many details for installation, specialized additional plan drawings may be used, such as:

- ***Structural:*** While smaller projects may only show structural information on the plans and sections, larger projects have separate sheets describing the structure of the building.
- ***Mechanical:*** Mechanical drawings show plumbing, heating, ventilation and air conditioning systems, or fire protection systems.
- ***Electrical*** : Electrical plan drawings may include equipment and cable tray layout, lighting and power, grounding, telephone, local area network, special communications or signal systems, or a reflected lighting plan.

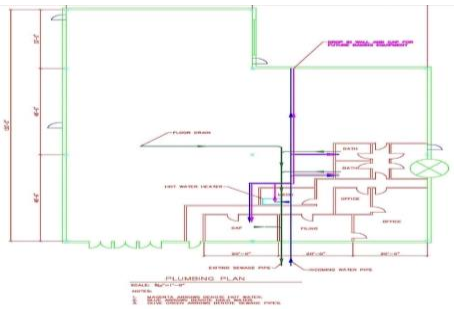


Figure1.6 *Plan a) Plumbing b) Heating, Ventilation and air conditioning system (HVAC)*

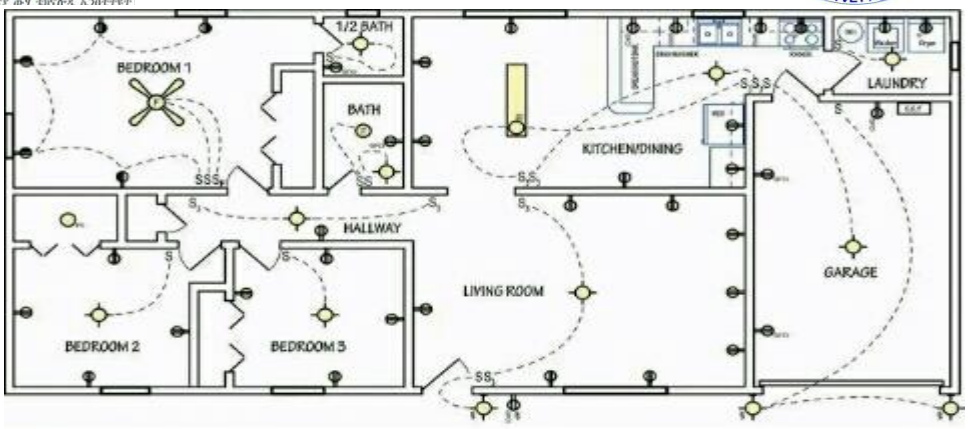


Figure1.7 *Electrical plan*

1.4 Specification

- A specification often refers to a set of documented ***requirements*** to be satisfied by a material, design, product, or service. A specification is often a type of ***technical standard***.
  - ✓ ***A requirement*** is a singular documented physical or functional need that a particular design, product or process aims to satisfy. It is commonly used in a formal sense in engineering design. It is a broad concept that could speak to any necessary (or sometimes desired) function, attribute, capability, characteristic, or quality of a system for it to have value and utility to a customer, organization, internal user, or other stakeholder.
  - ✓ ***A technical standard*** is an established norm or requirement for a repeatable technical task. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes, and practices. In contrast, a custom, convention, company product, corporate standard, and so forth that becomes generally accepted and dominant. It may be developed privately or unilaterally, for example by a corporation, regulatory body, military, etc. Standards can also be developed by groups such as trade unions and trade associations. Standards organizations often have more diverse input and usually develop voluntary standards: these might become mandatory if adopted by a government (i.e., through legislation), business contract, etc.
- There are different ***types of technical or engineering specifications*** (specs), and the term is used differently in different technical contexts. They often refer to particular documents, and/or particular information within them. The word specification is broadly defined as "to state explicitly or in detail" or "to be specific".

- ✓ ***A requirement specification*** is a documented requirement, or set of documented requirements, to be satisfied by a given material, design, product, service, etc. It is a common early part of engineering design and product development processes, in many fields.
- ✓ ***A functional specification*** is a kind of requirement specification, and may show functional block diagrams. [Citation needed].
- ✓ ***A design or product specification*** describes the features of the solutions for the Requirement Specification, referring to either a designed solution or final produced solution. It is often used to guide fabrication/production.
- ✓ ***An "in-service" or "maintained as" specification***, specifies the conditions of a system or object after years of operation, including the effects of wear and maintenance (configuration changes).

- Specifications are a type of technical standard that may be ***developed by any*** of various kinds of organizations, both public and private. Example organization types include a corporation, a consortium (a small group of corporations), a trade association (an industry-wide group of corporations), a national government (including its military, regulatory agencies, and national laboratories and institutes), a professional association (society), a purpose-made standards organization such as ISO, or vendor-neutral developed generic requirements. It is common for one organization to refer to (reference, call out, cite) the standards of another. Voluntary standards may become mandatory if adopted by a government or business contract.
- The ***engineering design process*** is a common series of steps that engineers use in creating functional products and processes. The process is highly iterative - parts of the process often need to be repeated many times before another can be entered - though the part(s) that get iterated and the number of such cycles in any given project may vary.
- ***A datasheet***, data-sheet, or spec sheet is a document that summarizes the performance and other characteristics of a product, machine, component (e.g., an electronic component), material, subsystem (e.g., a power supply), or software in sufficient detail that allows a buyer to understand what the product is and a design engineer to understand the role of the component in the overall system. Typically, a datasheet is created by the manufacturer and begins with an introductory page describing the rest of the document, followed by listings of specific characteristics, with further information on the connectivity of the devices. In cases

where there is relevant source code to include, it is usually attached near the end of the document or separated into another file. Datasheets are created, stored, and distributed via product information management or product data management systems.

- It is a decision making process (often iterative) in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation
- ***Guidance and content of specification***

  - ✓ Sometimes a guide or a standard operating procedure is available to help write and format a good specification. A specification might include:

- Descriptive title, number, identifier, etc. of the specification
- Date of last effective revision and revision designation
- A logo or trademark to indicate the document copyright, ownership and origin
- Table of Contents (TOC), if the document is long
- Person, office, or agency responsible for questions on the specification, updates, and deviations.
- The significance, scope or importance of the specification and its intended use.
- Terminology, definitions and abbreviations to clarify the meanings of the specification
- Test methods for measuring all specified characteristics
- Material requirements: physical, mechanical, electrical, chemical, etc. Targets and tolerances.
- Acceptance testing, including performance testing requirements. Targets and tolerances.
- Drawings, photographs, or technical illustrations
- Workmanship
- Certifications required.
- Safety considerations and requirements
- Environmental considerations and requirements
- Quality control requirements, acceptance sampling, inspections, acceptance criteria
- Person, office, or agency responsible for enforcement of the specification.

- Completion and delivery.
- Provisions for rejection, reinsertion, rehearing, corrective measures
- References and citations for which any instructions in the content maybe required to fulfill the traceability and clarity of the document
- Signatures of approval, if necessary
- Change record to summarize the chronological development, revision and completion if the document is to be circulated internally[16]
- Annexes and Appendices that are expand details, add clarification, or offer options

➢ For sample specification refer this link DWU Standard tech specs water –w/water

Self-Check 1	Written Test

Instruction I **Answer the following question accordingly**

1. What is map?
2. List types of maps
3. What is Drawing?
4. What is plan?
5. List types of plan
6. What is specification

Answer Sheet

Score = _____

Rating: _____

Part I short answer

1. _____

   _____

2. _____

   _____

3. _____

   _____

4. _____

   _____

5. _____

6. _____

   _____

   _____

   _____

   _____

Name of Trainee: _____ Date: _____

Information Sheet 2	Identification of parts of work systems and their interrelationship

Work systems

A work system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce products/services for internal or external customers. Typical business organizations contain work systems that procure materials from suppliers, produce products, deliver products to customers, find customers, create financial reports, hire employees, coordinate work across departments, and perform many other functions.

The work system concept is like a common denominator for many of the types of systems that operate within or across organizations. Operational information systems, service systems, projects, supply chains, and ecommerce web sites can all be viewed as special cases of work systems.

An ***information system*** is a work system whose processes and activities are devoted to processing information.

A ***service system*** is a work system that produces services for its customers.

A ***project*** is a work system designed to produce a product and then go out of existence.

A ***supply chain*** is an inter organizational work system devoted to procuring materials and other inputs required to produce a firm's products**.**

Work systems and their interrelationship

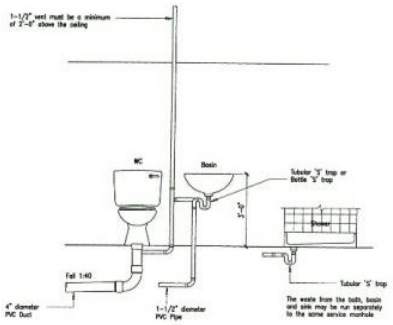
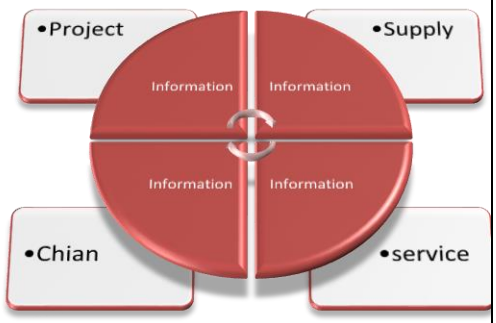
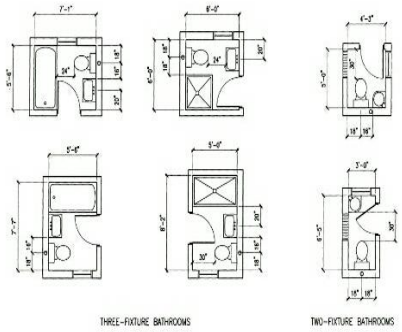
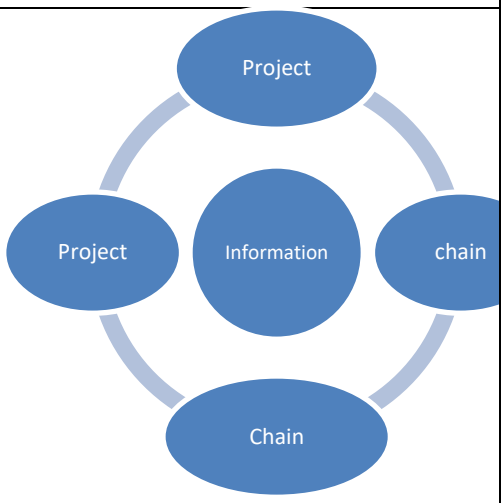
The relationship between work systems in general and the special cases implies that the same basic concepts apply to all of the special cases, which also have their own specialized vocabulary. In turn, this implies that much of the body of knowledge for the current information systems discipline can be organized around a work system core.

Specific information systems exist to support (other) work systems. Many different degrees of overlap are possible between an information system and a work system that it supports**.**

- ***For example***, an information system might provide information for a non-overlapping work system, as happens when a commercial marketing survey provides information to a firm's marketing managers In other cases, an information system may be an integral part of a work system, as happens in highly automated manufacturing and in ecommerce web sites. In these situations, participants in the work system are also participants in the information system, the work system cannot operate properly without the information system, and the information system has little significance outside of the work system.
- The table below shows the interrelationship of work system and drawing range

  - ✓ Information system(Schematic and technical drawing)
  - ✓ Service system
  - ✓ Supply system
  - ✓ Chain system

Table 1.1 Sample of Work system and inter relationship of range of drawing

Drawing	Work systems	
	Activities to be done(Identification)	**Interrelationship of work system**
	• Understand the schematic drawing (Information system) • Visualize the project (Information system) • Reading the specification (Information system) • Interpret and cross check the schematic drawing and Specification(project system) • Order materials needed(supply system) • Assign the personnel as per specification (Chain system)	
	• Understand the technical drawing (Information system) • Interpret and cross check the technical drawing and Specification(project system) • Allocate, and mark the drawing on the ground(Information and project system) • Cross check the marked and dimension on the drawing(chain) • Start installation of the appliance (Project)	

Self-Check 2	Written Test

Instruction I Answer the following questions accordingly

1. What is work system?
2. What are the main components of work system?
3. List types of work system

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

_____

2_____

_____

3_____

_____

4_____

_____

5_____

6_____

Score = _____

Rating: _____

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Information Sheet 3	Key features of maps and site plans and commonly used symbols and abbreviations

3.1 Key features of map and site plans

- **There are some basic features that most maps will include:**
  - ✓ **Roads** tend to be marked in different colors depending on the type of road depicted. Roads on a map range from thick blue lines, showing motorways, to dashed lines, indicating an unfenced minor road.
  - ✓ **Footpaths** are marked on Ordnance Survey maps in various colors. On a 1:25000 scale OS Explorer Map the public rights of way are marked in green and on a 1:50 000 scale OS Land ranger Map they are marked in magenta. There are various types of public rights of way and public access, so please check the map key for full information.
  - ✓ **Woods** are shown in green with a coniferous or non-coniferous tree shape printed over the top.
  - ✓ **Buildings** are marked by small black squares. However, some particular buildings have their own special symbols, such as churches and windmills. Any of these buildings can be useful landmarks, helping you to check your position on the map.
  - ✓ **Rivers and streams** are shown as blue lines. The width of the line is representative of the watercourse width (if the width of a river is more than 8 meters it is shown as two blue lines with a light blue area between). Rivers and streams can be extremely useful in determining your position on a map.
  - ✓ **Scale** tells you how much the land has been scaled down to fit on the paper. If the scale of a map is 1:50 000 then everything on the map will be 50 000 times smaller than it is in reality.
- **Understanding your map:** Grid lines explained Ordnance Survey maps are covered in a series of faint blue lines that make up a grid. The lines have numbers accompanying them that allow you to accurately pinpoint your location on a map. Once you have located where you are, the grid system makes it simple to give others (such as mountain rescue)

an accurate description of your location. This description, which will be a series of numbers, is known as a grid reference. but it also includes:-

- ✓ shape and orientation of site
- ✓ roads and railways
- ✓ existing buildings and structures services, including:
- ✓ drainage, sewerage, water, electricity and telecommunications lines
- ✓ geographical features
- ✓ heritage and cultural features
- ✓ structures, including: buildings, bridges, fabricated towers, fences and poles

3.2 Common symbols

The following table shows different type of symbols used in plan and site plan

Table 1.2 Agricultural, Electrical and plumbing symbols

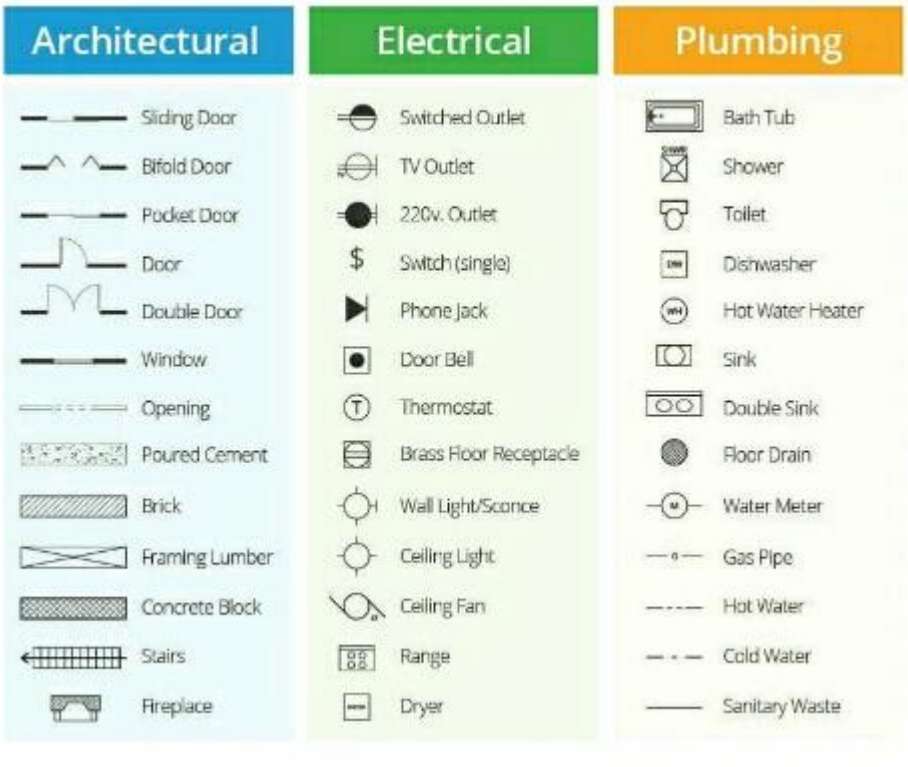
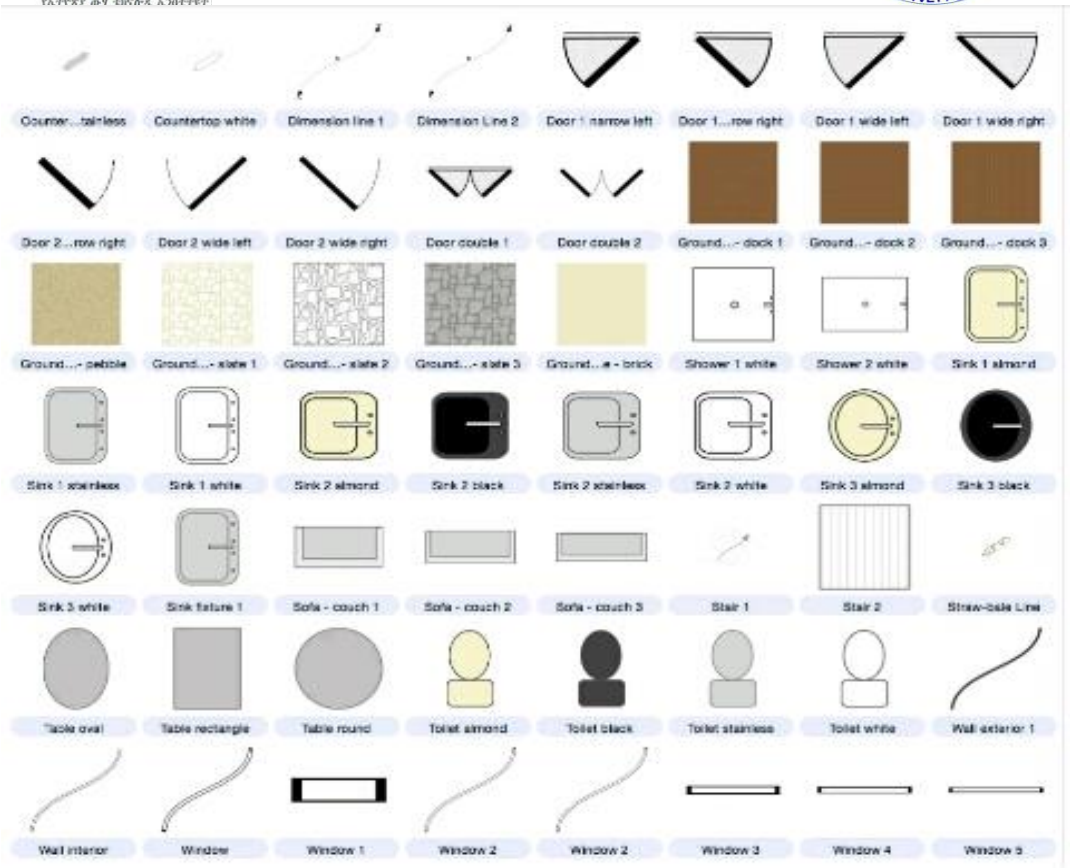
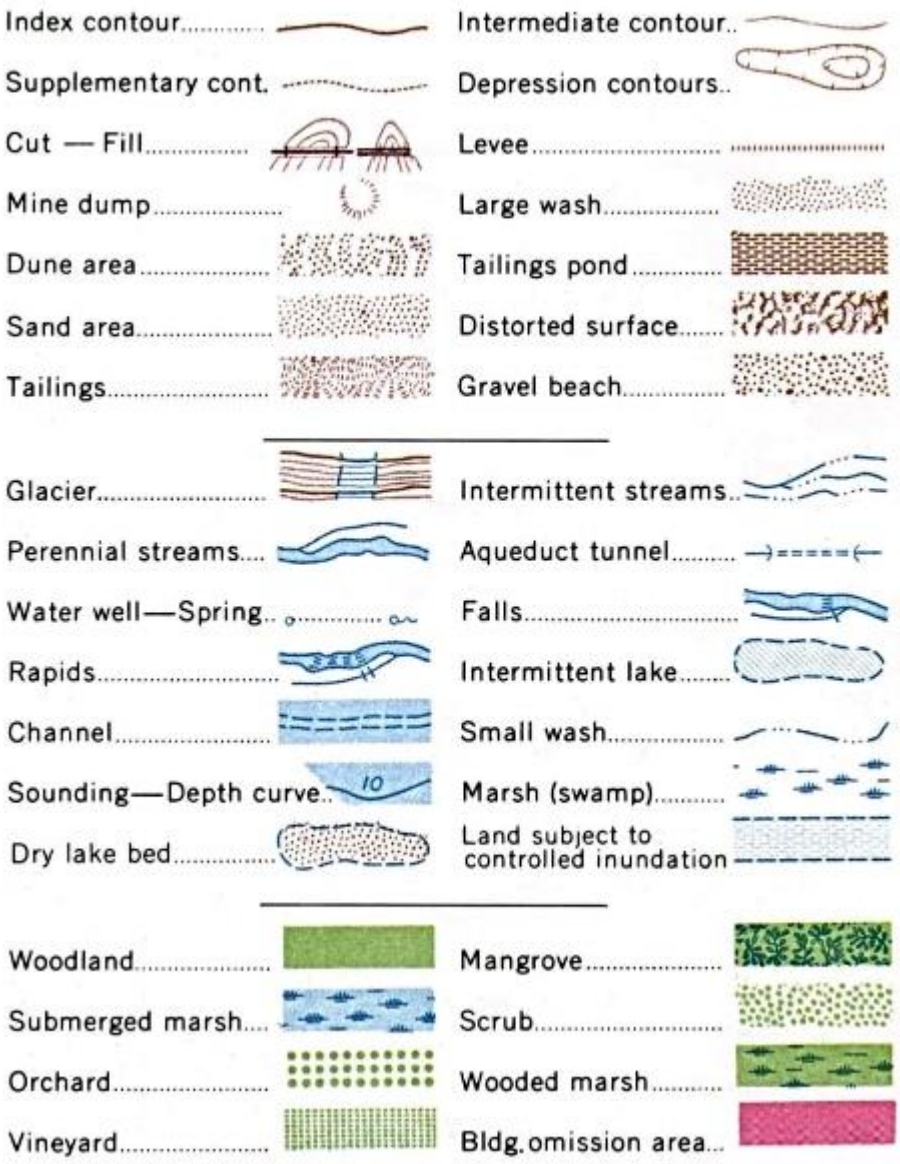


Table 1.3 Plan symbols



The various features shown on a map and plan are represented by conventional signs called Symbols. For example, colors can be used indicate a classification of roads.

Table 1.4 Map symbols



Self-Check 3	Written Test

Part: I choose the correct answers

1. _____one of the following is not the key features of map

A. Settlement C. Water body

B. Building D. cloud

2. Real world measurement can be taken from structures by simple measuring tape from the following distance except

a. Length

b. Height/depth

c. Thickness

d. Volume

3. Write at least five types of feature represent on map?

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page.

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

_____

2_____

_____

3_____

_____

4_____

_____

5_____

6_____

Score = _____

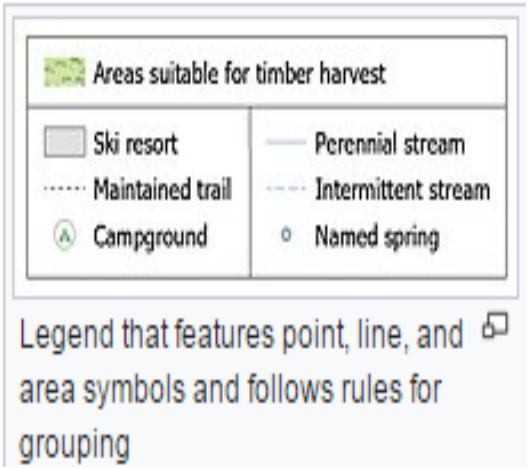
Rating: _____

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Information Sheet 4	Legend

Legend

- Legends explain how to interpret the map's symbols. Explanations of point, line, and area symbols can all be included in the legend. However, generally, the legend only includes explanations of symbols that are not already obvious. The legend may also give details about the variable being displayed, publication, or authorship. Often, the legend is critical to understanding a map, so it is important that legends are designed effectively. Using principles of gestalt, various sets of rules have been created for legend spacing, alignment, and grouping.
- Titles should be short and to the point. They typically include information about the location of the map and the subject of the map. The title should be an important part of the layout's visual hierarchy because the title tells people what the map is about.
- Scale is important to include on a map because it explains the size relationship between map features and the real world. Scale is commonly represented with a scale bar, a representative fraction, or a verbal scale.



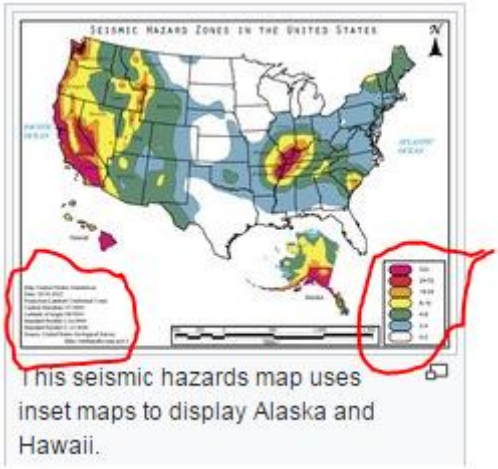


Figure 1.8 *Sample legend*

Self-Check 4	Written Test

Instruction I Answer the following questions accordingly

1. What is legend?
2. Explain its function?
3. Where do we use legend?
4. Explain its major advantages of legend?

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short answer

1. _____

_____

_____

2. _____

_____

_____

_____

3. _____

_____

4. _____

_____

_____

Information Sheet 5	Natural and manmade features on maps, plans and drawings

5.1 Natural and manmade features on maps, plans and drawings

- In remote and difficult terrain man-made features can often be rare. It's also possible a man-made feature, such as a log cabin, can be added or removed from the landscape. Since natural features don't change as quickly or easily as their man-made counterparts, being able to use them to navigate is essential.
- Interpreting the shape of the land on a map using contour lines is an extremely useful navigational tool. Looking at the lines and creating a mental picture of the landscape will allow you to plan a journey effectively.
- **Orange or brown** contour lines on maps join points of equal height above sea level together, and are usually measured in 5- or 10-metre height intervals.
- Natural and man-made features on maps, plans and drawings that should be identified from maps or drawings are:-
  - ✓ roads
  - ✓ railways
  - ✓ existing buildings and structures
  - ✓ services, including:
  - ✓ drainage, sewerage, water, electricity and telecommunications
  - ✓ types of structures, including: buildings, bridges, fences, pipelines and poles
  - ✓ cultural features and heritage features
  - ✓ settlement

Table natural and manmade features

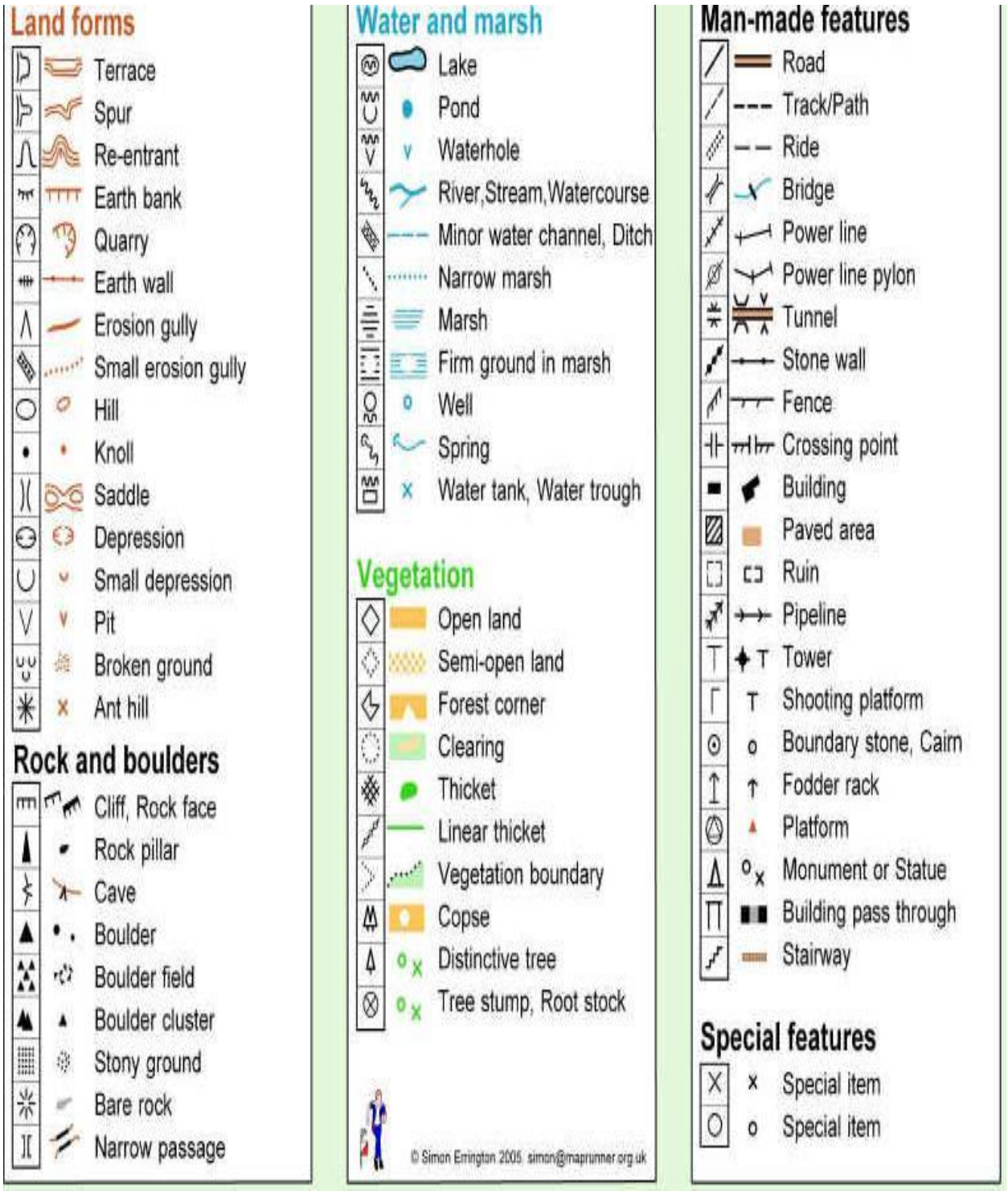


Table1.6 natural features


Linear Features
Major Road
Minor Road
Dirt Road
Vehicle Track
Large Path
Small Path
Indistinct Path
Narrow Ride
Wide Ride
Railway
Power Line
Stone Wall - high
Stone Wall - low
Stone Wall - ruined
Fence - high
Fence - low
Fence - ruined
Rock Features
Rocky Pit
Cave
Impassable Cliffs
Small Cliffs
Large Boulders
Small Boulders
Group of Boulders
Other Man-Made Features
Building
Ruin
Boulder Field
Tower/Mast
Small Tower
Cairn
Trig. Pillar
Landforms
Contours
Index Contours
Slope Line
Form Line
Steep Earth Bank
Earthwall
Erosion Gullys
Small Gullys
Knolls
Depressions
Pits
Platforms
Water Features
Lake
Ponds
Uncrossable River
Stream
Major Ditch/Drain
Minor Ditch/Drain
Narrow Marsh
Uncrossable Marsh
Crossable Marsh
Seasonal Marsh
Waterhole
Water Tank
Well
Special Water Feature
Vegetation
Cemetery
Stony Ground
Sandy Ground
Bare Rock
Open Land
Semi Open Land
Rough Open Land
Felled Area
Undergrowth: Walk
Undergrowth: Slow Run
Forest: Run
Forest: Slow Run
Forest: Walk
Forest: Impenetrable
Forest: Run Direction
Built-Up Area
Out of Bounds
Cultivated Land
Orchard

Self-Check 5	Written Test

Instruction I Answer the following questions accordingly

1. List natural and manmade feature on maps?
2. What is manmade feature?
3. Write the difference between natural and manmade features?

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1_____

_____

2_____

_____

3_____

_____

4_____

_____

5_____

6_____

Score = _____

Rating: _____

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Environmental Requirement

- Any legal requirement relating to health, safety or the environment and applicable to the Borrower, any Subsidiary or the Properties.
- All Laws and requirements relating to human, health, safety or protection of the environment or to emissions, discharges, releases or threatened releases of pollutants, contaminants, or Hazardous Materials in the environment (including, without limitation, ambient air, surface water, ground water, land surface or subsurface strata), or otherwise relating to the treatment, storage, disposal, transport or handling of any Hazardous Materials.
- Any applicable local, state or federal law, rule, regulation, permit, order, decision, determination or requirement relating in any way to Hazardous Materials or to health, safety or the environment.
- The following plan shows the interaction between pipe lines and sewerage lines. The pipe line is build to covey potable water where as the sewerage line which discharge waste and potable water. Therefore the plan should clearly address the two lines perfectly. And interpreted perfectly.

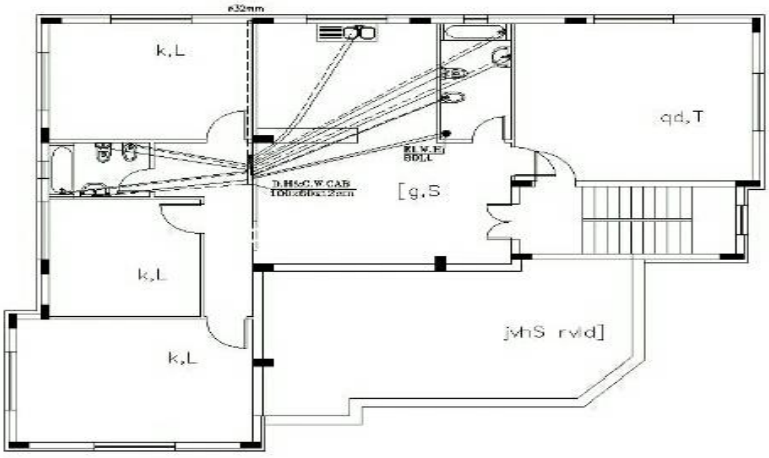


Figure 1.9 *Plan showing pipe line and drainage system*

Self-Check 6	Written Test

Instruction I Answer the following questions accordingly

1. Describe Environment requirement?

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short answer

1._____

_____

_____

_____

_____

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Operation Sheet- 1	Techniques of using and interpreting the of map

Techniques of reading and interpreting the view drawings

Step 1: identify the given map type

Step 2: identify all features on the map.

Step 3: write the selected feature symbol

Step 4: .write the selected feature name in legend part

Step5: identify the purpose of the given map

Step 6: use appropriate location of each feature

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1.Perform the following map interpretation

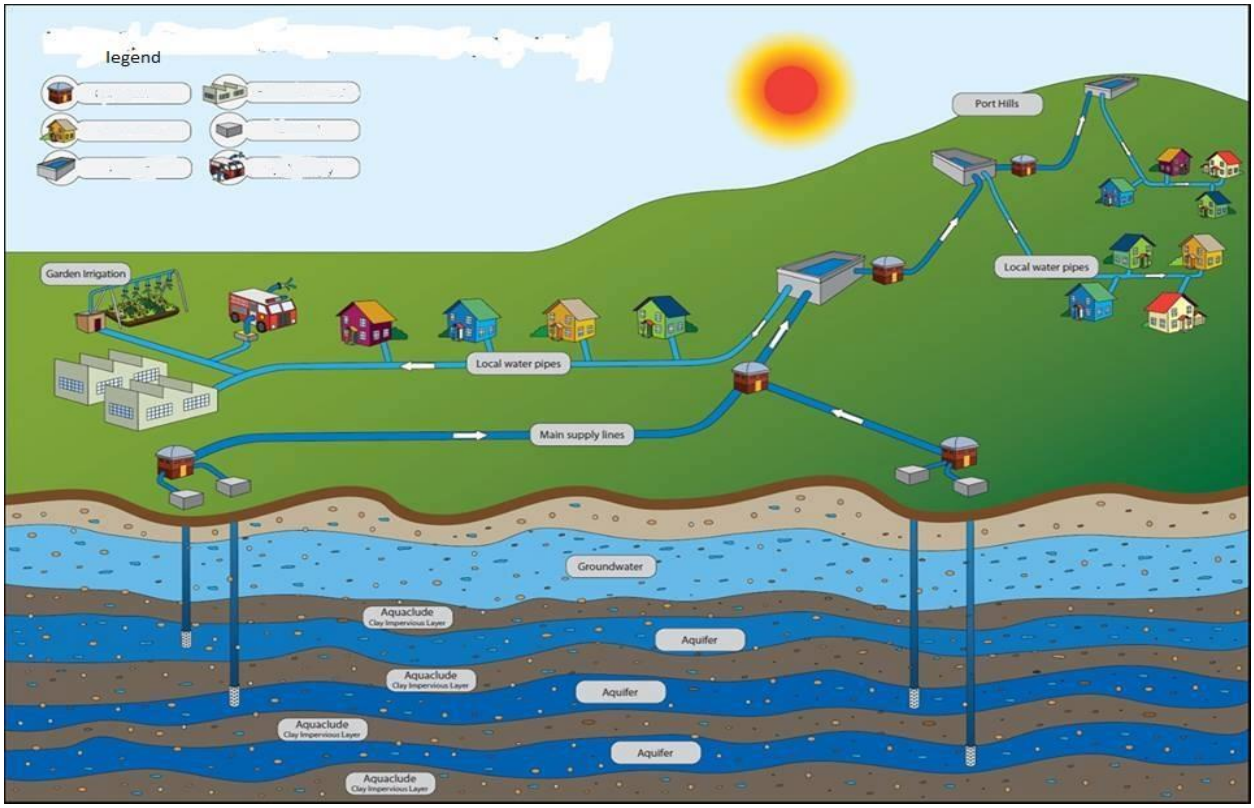


Figure 1.9 *map interpretation*

Instruction Sheet 2	Learning Guide #11: **Read and interpret engineering drawings and specifications**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

1. Identification of symbols, codes, legends and diagrammatic representations
2. Identification of job specification from drawing
3. Material specifications/finish and dimensions/ tolerances
4. Detail and assembly drawing
5. Interpreting and implementing Meetings outcomes
6. Specifications of particular maps and plans
7. Identifications of product, system, component and item represented by drawing

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Identify Symbols, codes, legends and diagrammatic representations in the drawing correctly with *relevant personnel*
- Identify Job specifications from drawings, notes and descriptions.
- Identify Standards of work, finishes and tolerances from the project specifications.
- Identify Material specifications/finish and dimensions/ tolerances as appropriate to field of employment.
- Identify Components, assemblies or objects as required.
- Relate Specifications to particular maps and plans and identify quality standards.
- Identify Types of details from works specifications and determined.
- Identify Product/system/component/item represented by the drawing correctly with relevant personnel

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the "Information Sheets 1- 6". Try to understand what are being discussed on pages 43, 52, 56, 63, 66 and 69

4. Accomplish the “Self-check 1, 2, 3, 4, 5 and 6” on pages 50, 54, 51, 64, 67 and 70
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheet” on page 72 and do the “LAP Test” on page 73.
7. After you accomplish operation sheets and LAP tests, ensure you have a formative assessment and get a satisfactory result; then proceed to the next LG.

Information Sheet 1	Identification of symbols, codes, legends and diagrammatic representations in the drawing

1.1 **Standards and codes**

- **Standards** are documents that describe the important features of a product, service or system.
- There are thousands of standards in use around the world. They cover everything from the simplest screw thread to the most complex information technology network.
- By applying standards, organizations can help to ensure that their products and services are consistent, compatible, safe and effective. Today, products are assembled from components made in different countries, and are then sold around the world, so standards are more important than ever.
- Two of the most important international agencies for standardization
  - ✓ International Organization for Standardization (ISO)
  - ✓ International Electro technical Commission (IEC).
- ISO and IEC standards are often adopted by countries as voluntary standards, or included in national rules and regulations.
- ***Drawing Standards*** are set of rules that govern how technical drawings are represented. It is used so that drawings convey the same meaning to everyone who reads them.
- Drawing standard stars from the paper size. There is different size of paper used for different drawing. Table 1.1 shows different paper size designated by ISO.
- The relation of papers are A0=2*A1=4*A2=8*A3=16*A4 o

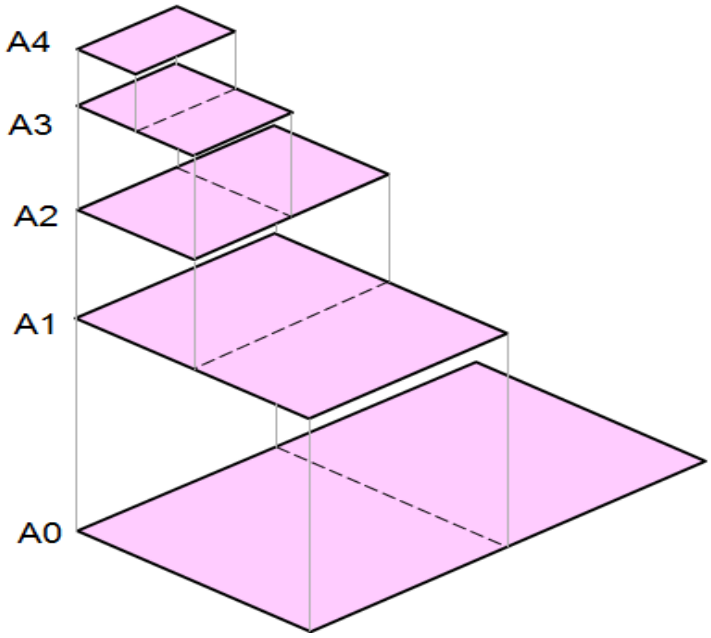
Table 2.1 *ISO standard of paper size*

Trimmed paper of a size A0 ~ A4.

Standard sheet size (**ISO**)

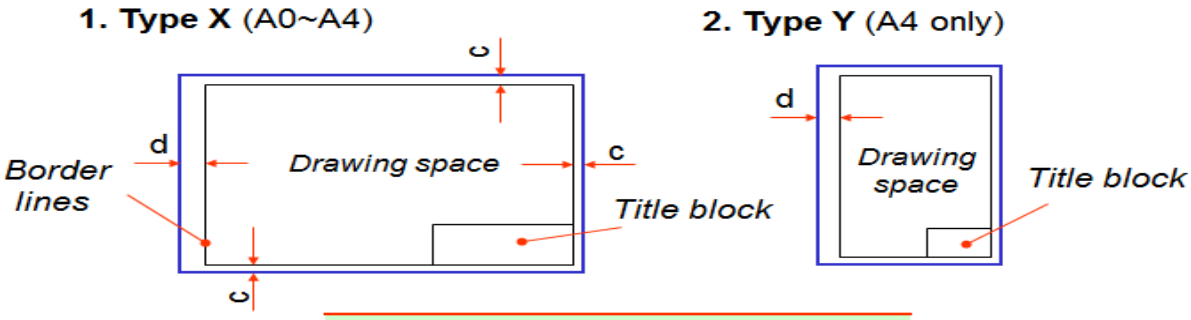
A4	210 x 297
A3	297 x 420
A2	420 x 594
A1	594 x 841
A0	841 x 1189

(Dimensions in millimeters)



- Orientation of the drawing is depends on paper size .See table 1.2

Table 2.2*Drawing orientation with respect to paper size*



Sheet size	c (min)	d (min)
A4	10	25
A3	10	25
A2	10	25
A1	20	25
A0	20	25

- **Drawing space:** It is the area in which the drawing fully drawn.
- **Title Block:** It is usually located on the bottom or lower right hand corner, contains all the information necessary to identify the **drawing** and to verify its validity.The **drawing title** and the **drawing** number are used for identification and filing purposes.

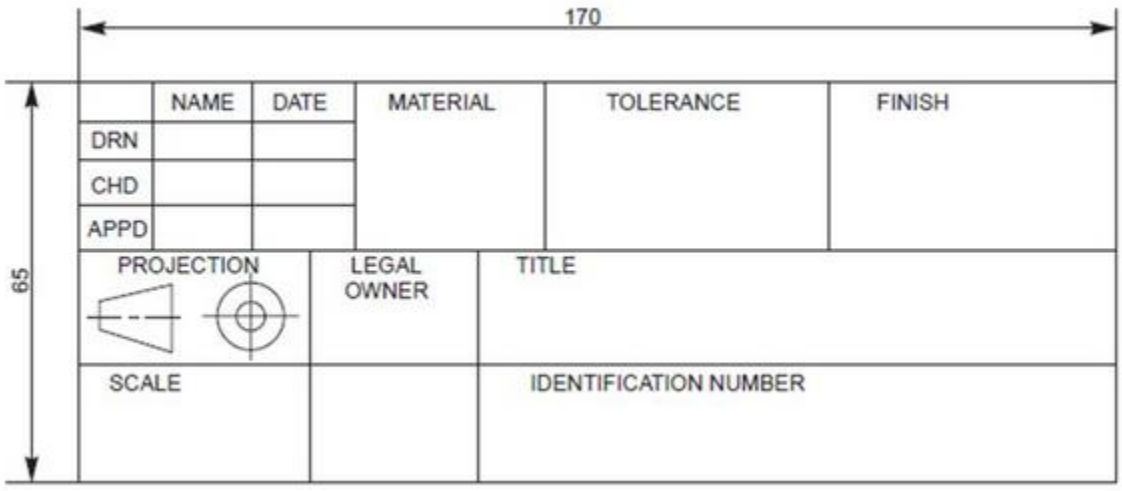


Figure 2.1 *Title block components and its dimension*

- The title block contains information
  - ✓ ***DRN*** *means drawn by which specifies name of the drawer and date of drawn*
  - ✓ ***CHD*** *means checked by which specifies name who check the drawing and checked date*
  - ✓ ***APD*** *means approved by which specifies Who approved the drawing and approved date*
  - ✓ ***MATERIAL*** *shows material type of the component*
  - ✓ ***TOLERANCE*** *is nominates the degree of allowable deviation dimension*
  - ✓ ***FINISH*** indicate tendency of finish
  - ✓ ***PROJECTION*** *shows angle of projection. It could be first angle or third angle.*

These two angles of projection shows the position of Top (T), Front (F) and Right side (RS). Figure1.2 shows first and third angle projection and designation symbol.

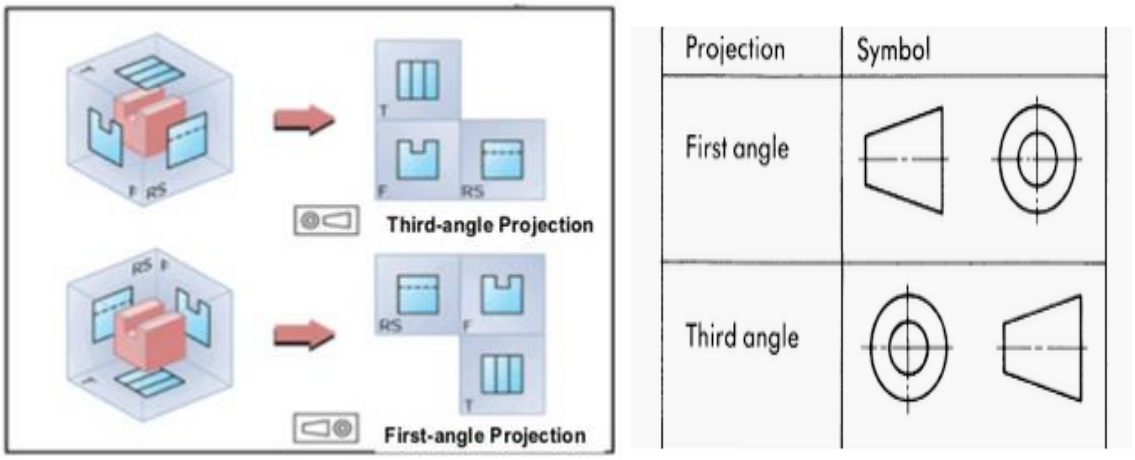


Figure 2.2 a) *first and third angle projection* ***b)*** *Symbol of first and third angle projection*

- ✓ ***LEGAL OWNER****: Specifies the name of the company's drawing owner*
- ✓ ***TITLE****: Specifies the title of the drawing*
- ✓ ***IDENTIFICRION NUMBER****: shows the specific number of the drawing*
- ✓ ***SCALE*** is the ratio of the linear dimension (length, size) of an element of an object shown in the drawing to the real linear dimension of the same element of the object (as shown on figure 1.3). SCALE 1:1 for full size

  SCALE **X**: 1 for ***enlargement*** scales (X > 1)

  SCALE 1: **X** for ***reduction*** scales (X < 1)

Dimension numbers shown in the drawing are correspond to "true size" of the object and they are independent of the scale used in creating that drawing.

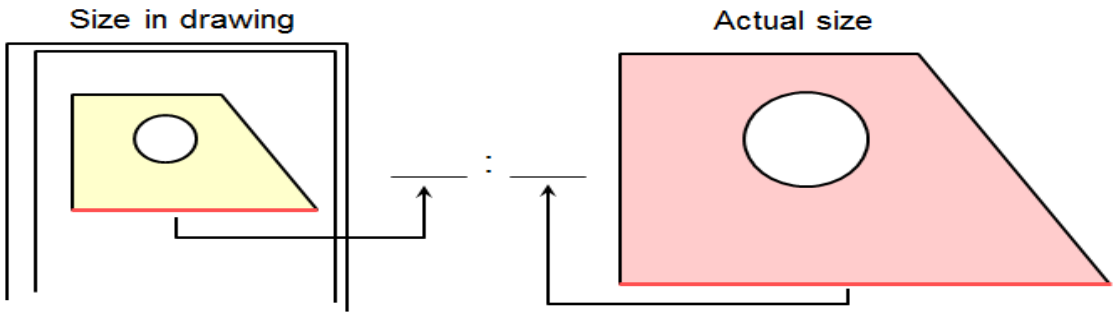


Figure 2.3 *Scale*

1. codes

- **Codes** are collections of laws and rules which provide correct procedures to maintain uniformity and safety.
- Important codes such as the Ontario Building Code and the National Building Code are available in the library
- The following table shows codes of drawing

Table 1.1 *drawing codes*

Code number	Contents
JIS Z 8311	***Sizes and Format of Drawings***
JIS Z 8312	***Line Conventions***
JIS Z 8313	***Lettering***
JIS Z 8314	***Scales***
JIS Z 8315	Projection methods
JIS Z 8316	Presentation of Views and Sections
JIS Z 8317	Dimensioning

2. Diagrammatic representation

- Diagram is a symbolic representation of information using visualization techniques. Diagrams have been used since ancient times, but became more prevalent during the Enlightenment. Sometimes, the technique uses a three-dimensional visualization which is then projected onto a two-dimensional surface. The word graph is sometimes used as a synonym for diagram**.**
- **Diagram types:**
  - ✓ ***Chart-like diagrams,*** which take a collection of items and relationships between them, and express them by giving each item a 2D position, while the relationships are expressed as connections between the items or overlaps between the items; examples of such techniques:

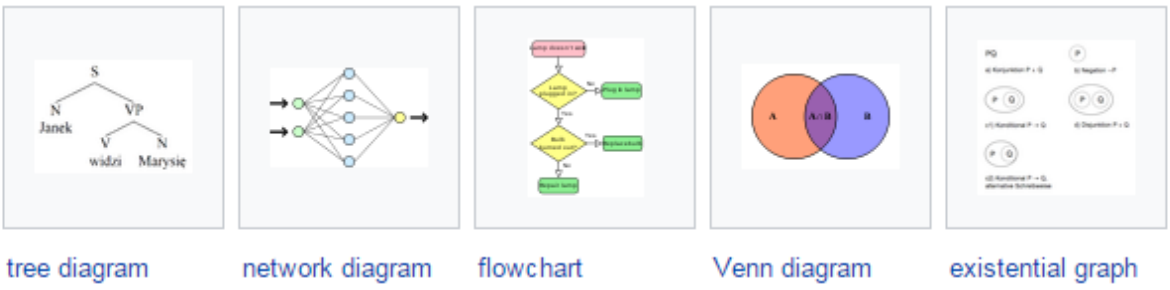


Figure 2.4 *chart like diagram*

- ✓ **Graph-**based diagrams; these display a relationship between two variables that take either discrete or a continuous ranges of values; examples

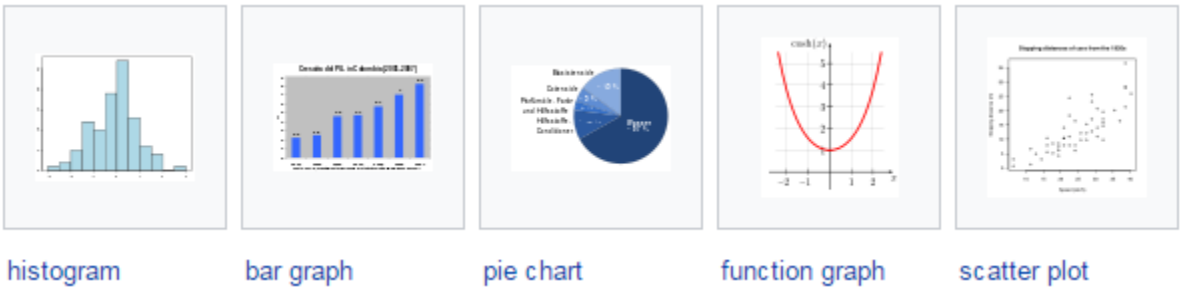


Figure 2.5 *graph diagram*

- ✓ **Schematics** and other types of diagrams, examples

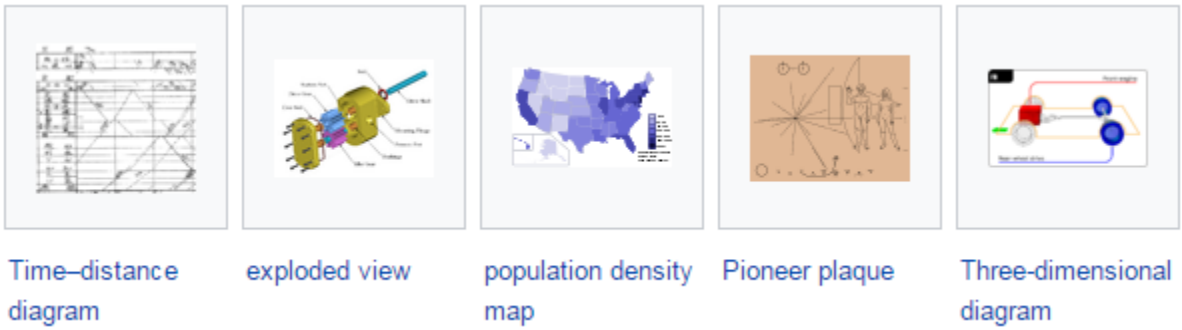


Figure 2.6 *Schematics diagram*

1.4 Legend or Symbols

- The legend, if used, is generally placed in the upper right-hand comer of a blueprint below the revision block. The legend is used to explain or define a symbol or special mark placed on a blueprint.
- A symbol may have more than one meaning. It should be noted that all symbols used are not from a single standard.
- The important thing is that you understand the meaning of the symbols on the drawing on which you are working. The legend will give you that meaning.

1.5 Bill of Material

- On a Drawing, the bill of material block contains a list of the parts and material used on or required by the print concerned. The block identifies parts and materials by stock number or other appropriate number and also lists the quantity used or required.
- The bill of material often contains a list of standard parts, known as a parts list or schedule. Many commonly used items, such as machine bolts, screws, fittings, and valves, have been standardized by the

Self-Check 1	Written Test

Instruction I: Answer the following questions accordingly

1. When you prepare drawing the dimension should be
    a. Accuracy
    b. Clearness
    c. Completeness
    d. Readability e. all
2. Write the information needed in any standard Title Block to the given drawing?

3. What is the purpose of dimensioning?

4. List types of lines?

5. Write the three basic element of engineering drawing?

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short answer Questions

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

Information Sheet 2	Identification of job specification from drawing

The drawing below shows open spanner with a full description of:

- Dimension
- shape and structure
- Material type
- By observing the technical drawing the technician understand the job description of the above open spanner drawing. It is able to understand
  - ✓ Which shape and structure going to manufacture
  - ✓ In what dimension
  - ✓ Material needed for manufacturing
- Generally any technical drawing able to understand job description of the part or assembly seen on the specific drawing.

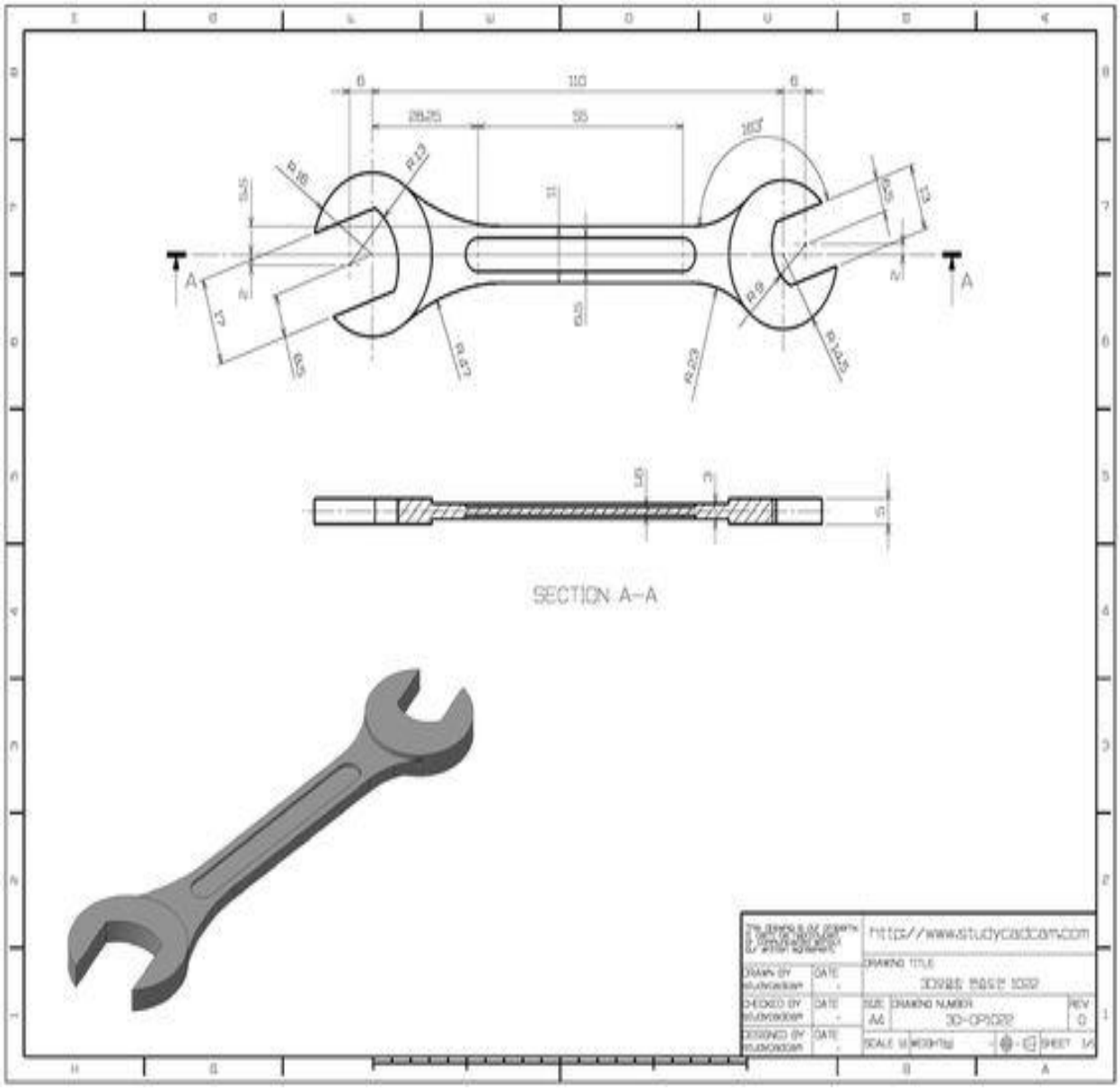


Figure 2.7 *Drawing showing*

Self-Check 2	Written Test

Instruction Answer the following questions accordingly

1. Write at least five specification and parameters shown on a standard drawing

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer

1. _____
   _____
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   ____

3.1 Material specification

- Means the description of the Material, including requirements, tolerances, shelf life, specifications, suppliers and safety data, which are set forth in Exhibit D.
- Materials including, but not limited to, written release specifications and testing instructions, as specified in the Master Batch Documentation or as otherwise mutually agreed upon in writing by the Parties
- The following table shows material specification of steel structure.

Table 2.1 *sample of material specification of steel structure*

No	Components		Specifications	Minimum yield strength	Applicable Design Code
1	Built –up (Plates)		ASTM A572 – Gr50 (or equivalent) <20mm	Fy = 34.5 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition
2	Hot Rolled	Angles	ASTM A-36 (or equivalent)	Fy = 24.5 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition
		Beams	ASTM A-36 (or equivalent)	Fy = 24.5 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition
3	Cold Form (Z275)	Galvanized (Z275)	ASTM A-653 (M) SS GR 50 (or equivalent.)	Fy = 34.5 kN/cm²	AISI – American Iron & Steel Institute – 2001 Edition
4	Roof panel		AZ150 Zinc Aluminum Base ASTM A792 Gr. 50	Fy = 34.5 kN/cm²	AISI – American Iron & Steel Institute – 2001 Edition
5	X-Bracing	Galvanized cable bracing	DIN 3066 (or equivalent)	Fy = 157 kN/cm²	ASCE –American Society of Civil Engineers Standards
6	Anchor bolts (Galvanized)		ASTM A36 (or equivalent)	Fy = 40.0 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition
7	High strength Bolts (Galvanized)		ASTM A325 Type 1 (or equivalent)	Ft = 30.3 kN/cm² Fu = 72 to 83 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition
8	Machine Bolts (Galvanized)		ASTM – A 307 (or equivalent)	Ft = 13.8 kN/cm² Fu = 41.0 kN/cm²	AISC – American Institute of Steel Construction – Latest Edition

3.2 Tolerance, finish and dimension

Dimension

- In a technical drawing, a basic dimension is a theoretically exact dimension, given from a datum to a feature of interest. In Geometric dimensioning and tolerance, basic dimensions are defined as a numerical value used to describe the theoretically exact size, profile, orientation or location of a feature or datum target.

    - ✓ **Geometric dimensioning** is a system for defining and communicating engineering tolerances. It uses a symbolic on engineering drawings and computer-generated three-dimensional solid models that explicitly describe nominal geometry and its allowable variation Dimensioning specifications define the nominal, as-modeled or as-intended geometry. One example is a basic dimension.

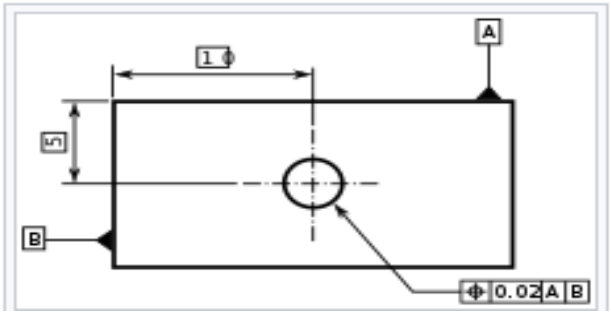

Figure 2.8 *Example of geometric dimensioning*

Tolerance

- It is the permissible limit or limits of variation in:

    - ✓ a physical dimension
    - ✓ a measured value or physical property of a material, manufactured object, system, or service (Physical property is any property that is measurable)
    - ✓ Other measured values (such as temperature, humidity, etc.)

- Dimensions, properties, or conditions may have some variation without significantly affecting functioning of systems, machines, structures, etc. A variation beyond the

tolerance (for example, a temperature that is too hot or too cold) is said to be noncompliant, rejected, or exceeding the tolerance.

- Mechanical component tolerance

  - ✓ Summary of basic size, fundamental deviation and IT grades compared to minimum and maximum sizes of the shaft and hole.
  - ✓ No machine can hold dimensions precisely to the nominal value, so there must be acceptable degrees of variation. If a part is manufactured, but has dimensions that are out of tolerance, it is not a usable part according to the design intent. Tolerances can be applied to any dimension. The commonly used terms are:

    - ***Basic size***: The nominal diameter of the shaft (or bolt) and the hole. This is, in general, the same for both components.
    - ***Lower deviation***: The difference between the minimum possible component size and the basic size.
    - ***Upper deviation***: The difference between the maximum possible component size and the basic size.
    - ***Fundamental deviation***: The minimum difference in size between a component and the basic size.

  - ✓ ***International Tolerance grade:*** This is a standardized measure of the maximum difference in size between the component and the basic size. For example, if a shaft with a nominal diameter of 10 mm is to have a sliding fit within a hole, the shaft might be specified with a tolerance range from 9.964 to 10 mm (i.e., a zero fundamental deviation, but a lower deviation of 0.036 mm) and the hole might be specified with a tolerance range from 10.04 mm to 10.076 mm (0.04 mm fundamental deviation and 0.076 mm upper deviation). This would provide a clearance fit of somewhere between 0.04 mm (largest shaft paired with the smallest hole, called the maximum material condition) and 0.112 mm (smallest shaft paired with the largest hole). In this case the size of the tolerance range for both the shaft and hole is chosen to be the same (0.036 mm), meaning that both components have the same International Tolerance grade but this need not be the case in general.

Finish

- Surface finish, also known as surface texture or surface topography, is the nature of a surface as defined by the three characteristics of lay, surface roughness, and waviness.
- It comprises the small, local deviations of a surface from the perfectly flat ideal (a true plane).
- Surface texture is one of the important factors that control friction and transfer layer formation during sliding.
- Considerable efforts have been made to study the influence of surface texture on friction and wear during sliding conditions.
- Surface textures can be isotropic or anisotropic. Sometimes, stick-slip friction phenomena can be observed during sliding, depending on surface texture.
- Each manufacturing process (such as the many kinds of machining) produces a surface texture. The process is usually optimized to ensure that the resulting texture is usable.
- If necessary, an additional process will be added to modify the initial texture.
- The latter process may be grinding (abrasive cutting), polishing, lapping, abrasive blasting, honing, electrical discharge machining (EDM), milling, lithography, industrial etching/chemical milling, laser texturing, or other processes.

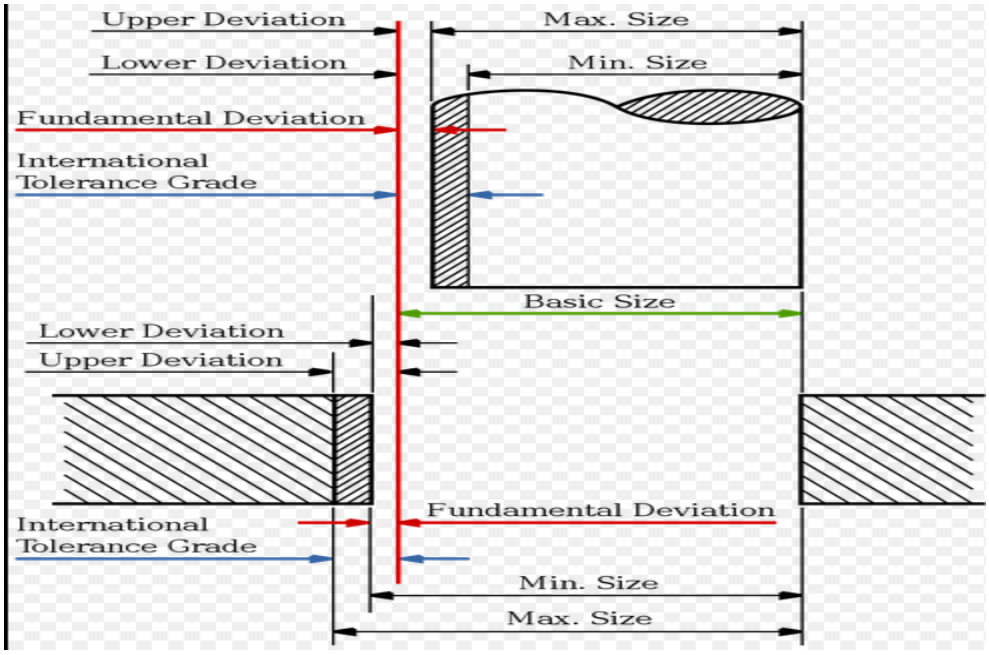

Figure 2.9 *Meaning of tolerance*

Self-Check 3	Written Test

Instruction I Answer the following questions accordingly

1. Define the following terms
   a) Material specification
   b) Tolerance
   c) Finish
   d) Dimension

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Information Sheet 4	Interpreting and implementing Meetings outcomes

Meeting outcomes

- Has the purpose of the meeting been identified as "discussing new communication strategies" when the real issue is trust between management a Key Points to take Away

  - ✓ A purpose statement should explain why the group is meeting.
  - ✓ A clear desired outcome statement defines a specific, tangible accomplishment.
  - ✓ A clear purpose and desired outcomes will help keep your meeting on track.

- To follow the parking lot situation through to resolution, a sample purpose statement might read:

Meeting Purpose: to identify the school's parking problems and their causes as the first step to improving parking.

Desired outcomes are a description of the specific accomplishments of the meeting -- tangible things that you want to have in your hand at the end of the meeting. In the parking lot example, the outcomes might be:

An agreed-on list of the problems with the parking

An agreed-on list of the causes of those problems

A list of next steps

Notice that the outcomes are nouns, not verbs. The final outcome is a "list," not "discussing." At the end of the meeting, you want to have a clear accomplishment -- a tangible thing in your hand.

Self-Check 4	Written Test

Instruction Give short answer

1. What is meeting outcome?

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

1. _____

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Information Sheet 5	Specifications of particular maps and plans

- The purpose of map specification remains the same: to provide a technical specification for contract mapping worldwide which modified as required by commissioning agencies and surveyors to particular needs of individual mapping projects.
- As far as possible, the products to be delivered are specified, not the survey methods to be used. This should assist commissioning agencies in selecting the scale, contour interval, and accuracies, map content and graphical or digital products which are necessary for the particular project, conscious that costs escalate rapidly with increasing scale, closer contour interval, higher accuracies and more detailed map content.
- It also permits surveyors to select the most timely and cost-effective combination of ground or aerial, conventional or innovative surveying techniques to meet the requirements both rapidly and economically**.**
- The final products may be hardcopy map transparencies, digital data for automated drafting, digital terrain models, or digital datasets for entry to geographic or land information systems. A slightly abbreviated version of the specification is printed below, and copies of the full specification, which includes notes for the guidance of users, may be purchased from the Royal Institution of Chartered Surveyors as printed documents, or as 5 1/4 inch diskettes for use with word processors, both in WordStar format and also as an ASCII file on the same diskette suitable for conversion to other word processing packages.

Self-Check 5	Written Test

Instruction I. Give short answer

1. What is specification particular maps

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Product

- In marketing, a product is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer.

System

- A **system** is a group of interacting or interrelated entities that form a unified whole.[1] A system is described by its spatial and temporal boundaries, surrounded and influenced by its environment, described by its structure and purpose and expressed in its functioning. Systems are the subjects of study of systems theory.

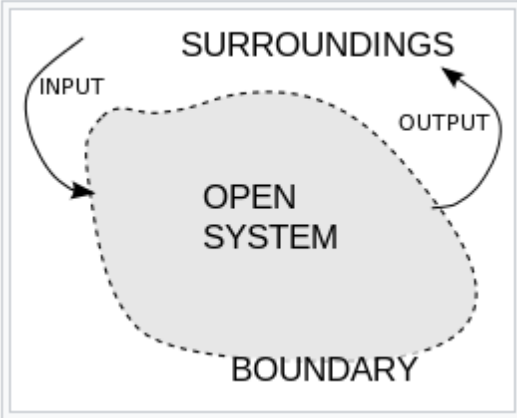

Figure 2.11 *model system*

Component

- Generic systems: System components, an entity with discrete structure, such as an assembly or software module, within a system considered at a particular level of analysis

➢ Electrical

- ✓ Component video, a type of analog video information that is transmitted or stored as two or more separate signals
- ✓ Electronic components, the constituents of electronic circuits
- ✓ Symmetrical components, in electrical engineering, analysis of unbalanced three-phase power systems

Self-Check 6	Written Test

Instruction Answer the following questions accordingly

1. Define the following terms
    a) Product
    b) System
    c) component

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Operation Sheet 1	Drawing Template and Title Block

Step 1: Set up your drawing paper on top of the drawing board.

Step 2: Use the drawing template format given to you by your teacher.

Step 3: Be sure to check the sharpness of your pencil lead. Use standard Sharpening for good aesthetic result of your work.

Step 4: Using the basic drawing instruments and materials, perform the drawing Task in the given following problems given in the Lap Test below.

Step 5: Use appropriate pencil lead in your drafting works.

Step 6: You may submit your finish work once you are true but should be within the Time specified for submission.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within3hr hour.

Task 1. Create the following drawing template and title block shown with the following dimensions

A. A4 size Landscape

B. A3 size Portrait

C. A3 size Landscape

Instruction Sheet 3	Learning Guide #12: Draw a map or plan

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Determination of requirement and purpose of drawing
- Identifying and collecting data for drawing
- Drawing requirements and time frame
- Identifying items to be manufactured and modified
- Tools and equipments, scale and abbreviation for simple map or plan
- Using features, real world measurements and field notes for drawing
- Assigning legend, symbols and abbreviations

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- Determine Requirements and purpose of drawing from customer and/or work specification and associated documents.
- Identify all data necessary to produce the drawing and collected
- Confirm Drawing requirements with relevant personnel and timeframes for completion is established
- Identify roduct/system/component/item to be manufactured/ modified
- Prepare a simple map or plan, including selecting tools and equipment and a workable scale, key and abbreviations.
- Take Real world measurements and record features on a drawing.
- Use Field notes and measures to draw a local area map.
- Locate Legend on project drawings, and symbols and correctly interpret abbreviation

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below

3. Read the information written in the “Information Sheets 1- 6”. Try to understand what are being discussed on pages76, 80, 83, 87, 91 and 94.
4. Accomplish the “Self-check 1, 2, 3, 4, 5 and 6” on pages 78, 81, 85, 87, 92 and 6
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheet” on page 102 and do the “LAP Test” on page 103
7. After you accomplish operation sheets and LAP tests, ensure you have a formative assessment and get a satisfactory result; then proceed to the next LG.

Information Sheet 1	Determination of requirement and purpose of drawing

Pupose of drawing

- In the first part I finished with this drawing of a relatively simple brick structure, which represents many of the fundamentals of technical drawing and is conveyed in a style which is generally agreed to be appropriate to the purpose.
- The purpose of technical drawing is principally to provide clear and accurate information for making, but in many disciplines the technical drawings also serve other purposes.
- For example if the subject is a theatre set, or one for a film or a television show, the designer's ground-plans become essential information used by almost all the other production departments.
- The set of drawings become a final 'blueprint' for the physical/spatial practicalities of the production including for example stage-management and costing. But as I also pointed out, the designer will often find that measured drawing is an essential tool for 'working out' the design even in a rough way during the early stages.
- Technical drawing allows efficient communication among engineers and can be kept as a record of the planning process. Since a picture is worth a thousand words, a technical drawing is a much more effective tool for engineers than a written plan.

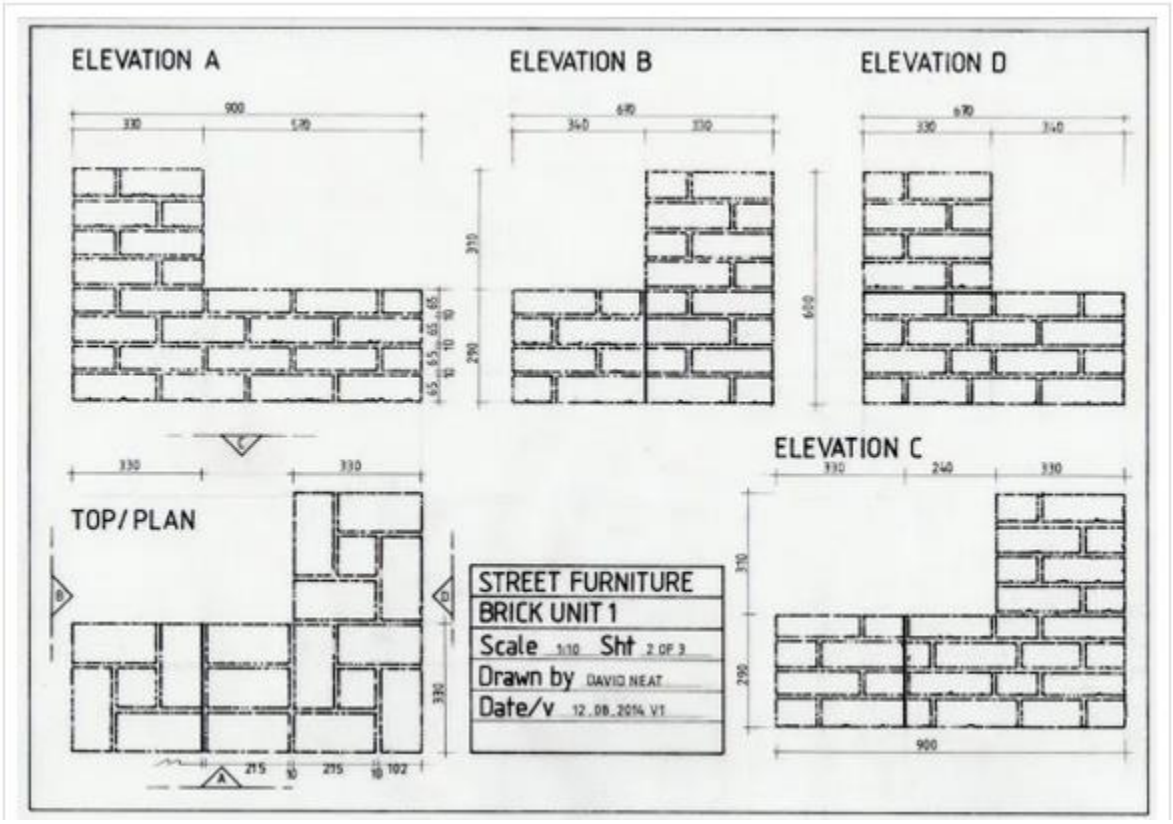

Figure 3.1 *Purpose of technical drawing*

Self-Check 1	Written Test

Instruction Give short answer

1. What is the purpose of drawing

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Information Sheet 2	Identifying and collecting data for drawing

Identifying and collecting data for drawing

Maps range from simple (e.g. points showing the locations of wells or springs) to complex (e.g. combining information on population, water scheme location and the number of users of each scheme to produce a map that shows the coverage by safe water schemes in an area).

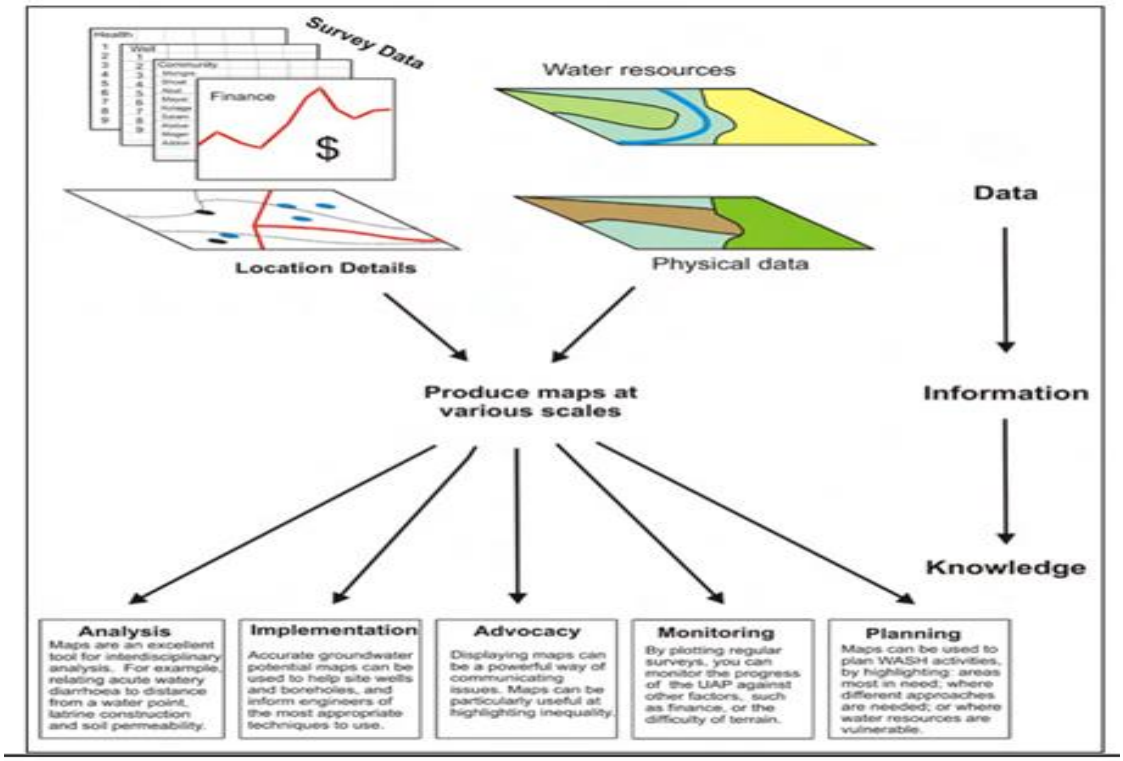

Figure 3.2*Maps Data identification and Collection process*

Data identification and Collection process Maps are not only useful for showing information about the physical world, but are also powerful ways of illustrating political and socio-economic data, and in integrating data from these different sectors.

Self-Check 2	Written Test

Instruction Give short answer

1. How to identify collect data for drawing

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Information Sheet 3	Drawing requirements and time frame

Drawing requirement

- Engineering drawings need to communicate information that is legally binding by providing a specification. Engineering drawings therefore need to met the following requirements:
  - ✓ Engineering drawings should be unambiguous and clear. For any part of a component there must be only one interpretation. If there is more than one interpretation or indeed there is doubt or fuzziness within the one interpretation, the drawing is incomplete because it will not be a true specification.
  - ✓ The drawing must be complete. The content of an engineering drawing must provide all the information for that stage of its manufacture.
  - ✓ There may be several drawings for several phases of manufacture, e.g. raw shape, bent shape and heat-treated. Although each drawing should be complete in its own right, it may rely on other drawings for complete specification, e.g. detailed drawings and assembly drawings.
  - ✓ The drawing must be suitable for duplication. A drawing is a specification which needs to be communicated. The information may be communicated electronically or in a hard copy format. The drawing needs to be of a suitable scale for duplicating and of a sufficient scale such that if is micro-copied it can be suitable magnified without loss of quality.
  - ✓ Drawings must be language-independent. Engineering drawings should not be dependent on any language. Words on a drawing should only be used within the title block or where information of a non-graphical form needs to be given. Thus, there is a trend within ISO to use symbol in place of words.
  - ✓ Drawings need to conform to standards. The 'highest' standards are the ISO ones that are applicable worldwide. Alternatively standards applicable within countries may be used. Company standards are often produced for very specific industries.

Time frame of drawing

- It is a period of time especially with respect to some action or project
- Time frame of the drawing is a period of time needed to complete a given drawing
- The three time frames are shown on figure 3.1

Figure 3.3 *Time frame*

Self-Check 3	Written Test

Instruction Give short answer

1. What is drawing requirement
2. What is time frame of a drawing

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Information Sheet 4	Identifying items to be manufactured and modified

Identifying items to be manufactured and modified

Manufacturing

- It is the production of products for use or sale using labor and machines, tools, chemical or biological processing or formulation and is the essence of secondary industry.
- The term may refer to a range of human activity from handicraft to high tech but is most commonly applied to industrial design, in which raw materials from primary industry are transformed into finished goods on a large scale. Such finished goods may be sold to other manufacturers for the production of other more complex products (such as aircraft, household appliances, furniture, sports equipment or automobiles
- Manufacturing engineering or manufacturing process are the steps through which raw materials are transformed into a final product.
- The manufacturing process begins with the product design, and materials specification from which the product is made. These materials are then modified through manufacturing processes to become the required part.

Modification

- It is a process of readjusting of parts in terms of shapes, size, physical property, Mechanical property and chemical property.

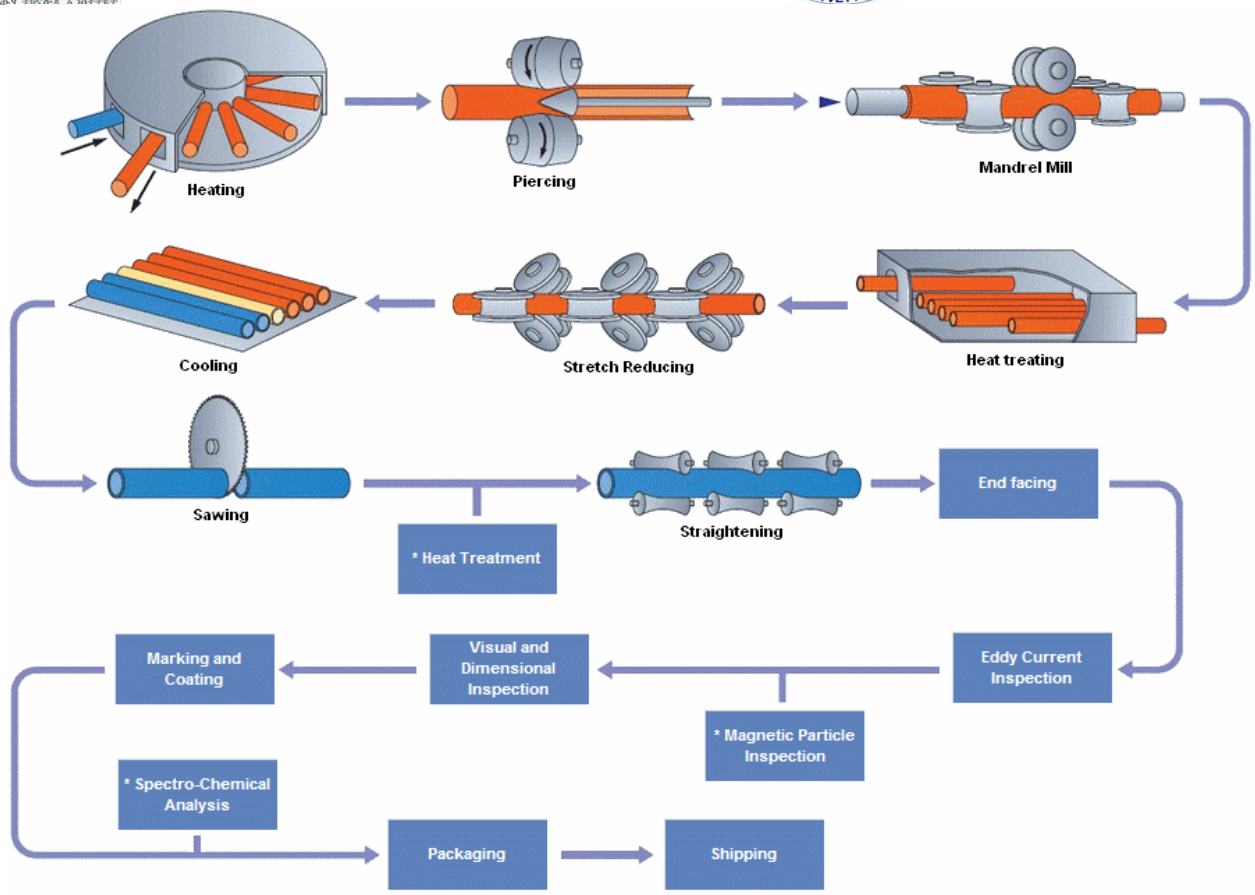

Figure 3.4 *Sample of manufacturing: steel pipe manufacturing*

Self-Check 4	Written Test

Instruction Give short answer

1. Define Manufacturing
2. Define modification

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Preparing workable scale, key and abbreviations

Scale is the ratio between the actual distance on the ground and the distance shown on the map. Large scale maps give more information than small scale maps.

- ✓ Ratio of the distance on the map to the distance on the ground
- ✓ Scale is a fraction
- ✓ Larger area covered means larger denominator
- ✓ Larger denominator means smaller fraction.
- ✓ **Expressing Scale:** There are two methods of expressing the scale of a map:
    - **Representative Fraction –** Map scale expresses the size relationship between the feature shown on a map and the same features on the earth's surface. Scale is generally expressed as a ratio or fraction such as 1:10 000 or 1/10 000 and in this form is known as the Representative Fraction or the RF of a map.
    - **Scale Bar or Linear Scale –** A method of measuring ground distances from a map is to use the scale bar or linear scale that is usually provided on most maps as illustrated

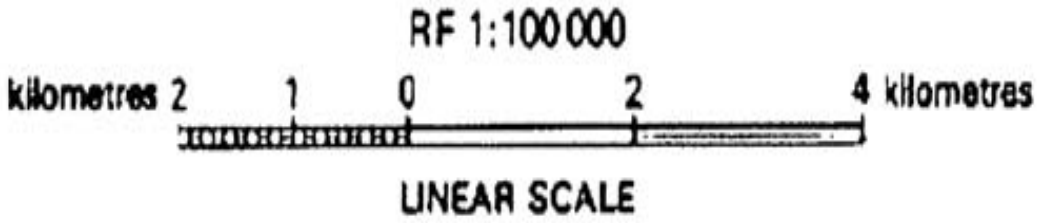

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Figure 3.5: Linear (graphic) Scale

Self-Check 5	Written Test

Instruction Give short answer

1. Define the following terms
    a) Scale
    b) Key
    c) Abbreviation
    d) legend

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Real world measurements on a drawing

- **Methods:** There are many ways of measuring distance on a map using dividers, a length of string, a rule, etc. Two simple methods using a strip of paper are described below:
  - ✓ **Measuring Straight Distance:** to measure the distance in a straight line between two points on a map, lay the straight edge of a piece of paper against the two points and mark the distance on the paper. Next, lay the paper along the linear scale with the right hand mark against one of the primary divisions and the left hand mark against the secondary divisions to the left. The total distance is zero, plus the distance to the left of the zero, the distance in Figure below is 600 meters.

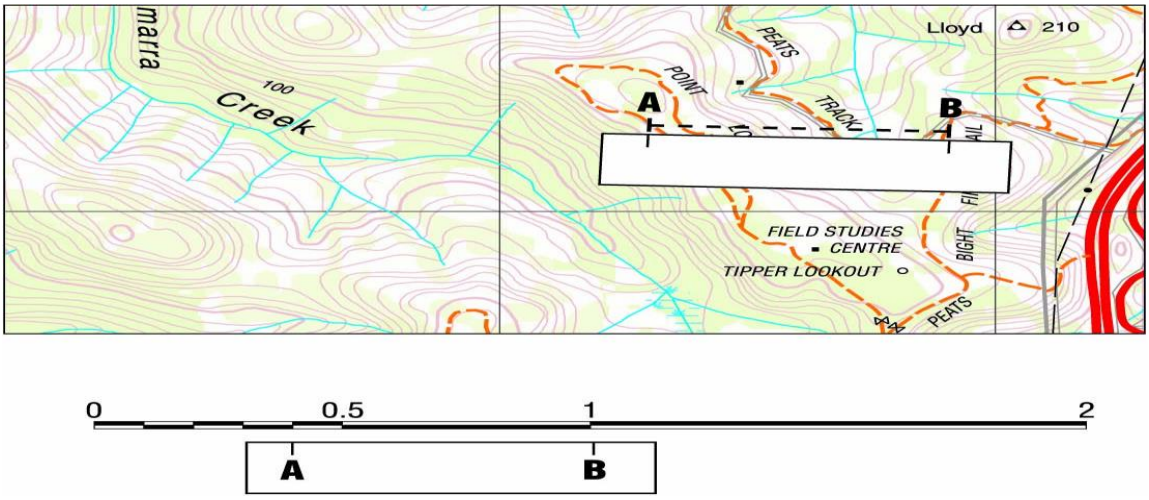

Figure 3.6*: *Measuring Straight Distance

  - ✓ **Measuring Distance Along a Road** – It is often necessary to measure a distance that is not straight, e.g. along a road. To calculate the distance from 'A' to 'B' consider the road as a number of straight, or nearly straight sections. Lay a piece of paper along the first section and mark it at 'A' and at the end of the straight section. Pivot the paper about the second mark until it lies along the second section. Mark the end of the second section and continue this method until 'B' is reached. The total distance by road is then recorded as a straight line on the piece of paper

and can read off against the linear scale. The distance in Figure below is 680 meters.

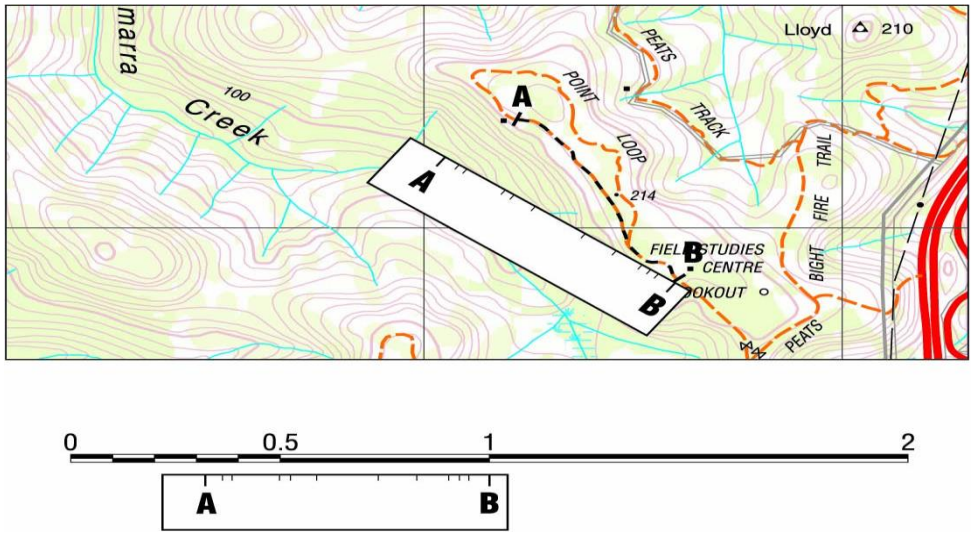

***Figure 3.7*:** Measuring Distance along a Road

- **Judging distance:** The four most common methods of judging distance are described below:
  - ✓ **Unit of Measure Method:** This involves taking a distance with which the viewer is familiar (e.g. the length of a football field or the length of a cricket pitch) as the unit and seeing how many units can be fitted in between the viewer and the object. This method is, however, of little use unless viewers can see all the ground between themselves and the object, nor is it useful for distances over 400 meters.
  - ✓ **Appearance Method:** In this case the viewer actually judges the distance to an object by comparing it with its surroundings. It takes practice to become proficient but under certain circumstances this method could prove extremely valuable.
  - ✓ **Bracketing Method:** The viewer decides on a minimum and maximum distance that the object is away and then takes the average between the two distances; e.g. it may be decided that a particular object is more than 200 meters away but less than 600 meters. Therefore the distance, in this case, is estimated to be 400 meters.
  - ✓ **Group Average Method** – This relies on having a team on hand. The team leader asks each member to estimate the distance to the object. The average of these

distances is then calculated. If team members are practiced in the skill of judging distances, this method is reasonably accurate

- **Real distance on map:** Maps are useful for more than just directions. They can also help you determine the distance between two (or more) places. The scales on a map can be different types, from words and ratios to pictorial. Decoding the scale is the key to determining your distance.

To know the exact distance on the ground we have to know the scale of the drawing if the real world measurement of rectangular physical object on the ground is 20m*25m with the given scale of 1:100 the paper distance can be calculated as

1/100*20= 0.2meter=200mm

1/100*25= 0.25meter=250mm

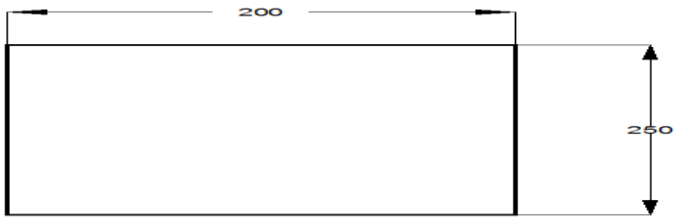

***Figure 3.8*:** sample of measuring Distance

To measure the distance on a map, If you haven't got a ruler, use the millimeter scale on your compass. On a map with a scale of 1:25 000 each millimeter is worth 25 meters, or on a 1:50 000 scale map each is worth 50 meters, and so on. You then need to measure your distance on the ground

- **Measuring distance** On a map, distances can be measured in two ways:
  - ✓ along a straight line or
  - ✓ Along a curved line.

Field notes

- **Field notes** refer to transcribed notes or the written account derived from data collected during observations and interviews. The notes are intended to be read as evidence that gives meaning and aids in the understanding of the phenomenon.
- One major disadvantage of taking field notes is that they are recorded by an observer and are thus subject to (a) memory and (b) possibly, the conscious or unconscious bias of the observer.

- Field notes are particularly valued in descriptive sciences such as ethnography, biology, geology, and archaeology, each of which have long traditions in this area.
- There are many styles of field notes, but all field notes generally consist of two parts:
  - ✓ descriptive in which the observer attempts to capture a word-picture of the setting, actions and conversations; and
  - ✓ Reflective in which the observer records thoughts, ideas, questions and concerns based on the observations and interviews.
- Field notes should be written as soon as possible after the observation and/or interviews.
- Field notes are used to "broaden your range of vision" and produce data that will be of use in later stages of the system design.
- ***FIELD DATA COLLECTION :***Field notes are the record of work done in the field. They consist of lengths, angles, areas, sketches, descriptions, and other data. They may be taken by hand, or can be computer-generated.
- ***TYPES OF NOTES***
  - ✓ ***TABULATIONS:*** Table of data, for differential leveling or profile leveling, taping or traverse data, etc.
  - ✓ ***DESCRIPTIONS*****:** Information about area, benchmarks, turning points, weather, survey party, etc.
  - ✓ ***DIAGRAMS:*** Sketch of the area, noting landmarks, roads and buildings, benchmarks, angles, and distances
- ***IMPORTANT POINTS TO REMEMBER ABOUT NOTES***
  - ✓ Always give the project name, location, and date. You can document and correlate surveys by time.
  - ✓ Indicate the weather conditions. Weather can point out errors made by the survey party, and errors due to poor visibility or high reflection, expansion by heat, or high wind, Temperature, Wind direction and Wind speed.
  - ✓ List the members of the crew on the survey and their duties. Party members are listed for documentation and future reference.

- ✓ Note the instruments used, their model and serial number. The instrument number is listed for documentation and to note accuracy, and for future reference if instrument errors are later discovered.

IMPORTANT POINTS TO REMEMBER ABOUT NOTES

- ✓ Use the Reinhardt system of lettering. Reinhardt lettering is used in drafting and engineering lettering, and is used for clarity and simplicity.
- ✓ Avoid crowding - Paper is cheap. Field books are assumed to be original. If a copy is made, the copy must be so marked, and is not admissible in court. Original notes are those taken in field with measurements.
- ✓ Put down what you read, do not selectively edit data in the field. Do not do calculations in your head; write them out for future reference.
- ✓ Write all notes in notebook, not on other paper for later transfer.
- ✓ NEVER erase recorded data on the data page. Erasures look like improper modifications have been made. If an error occurs, draw a single line through the improper part while allowing it to remain legible.
- ✓ VOID large areas if needed. There is less of a problem with erasures on the description, calculation, and sketch pages.
- ✓ Check your data for correctness before you leave the field. It is much easier to correct mistakes while at the site.

MEASUREMENTS

- ➢ Measurement is the process of comparing unknown magnitude of certain parameter with the known predefined standard of that parameter. For instance, if we have to measure the length of the wall, we measure it with the measuring tape that has predefined markings on it.
- ➢ It is specified by Value (Magnitude) number like 20,5.3.5 and so on and Unit like Meter, degree, calicoes
- ➢ **Principles of measurements**

- ✓ **Count or/sets:** No measurements are taken. The number of items required is considered. This is the case for items like basins, toilets, appliances etc. The number recorded.
- ✓ **Length:** Only one dimension is required. Length is used to calculate the quantities for items such as skirting, pipes, gutters etc. Linear measurement L/M
- ✓ **Area:** Two dimensions are required to calculate the area in square meters (m^2). Items measured in area include such things as carpet, tiles, glass, painting, brick walls, roof tiles etc.
- ✓ **Volume:** Three dimensions need to be taken to calculate volume. The unit for volume is cubic meters (m^3). The types of material measured by volume include, concrete, topsoil and excavations.
- ✓ **Weight :** Steelwork in a building is often measured in weight. They can be measured in number, m and then multiplied by a weight factor to give a quantity in tones (t). Some examples of materials measured by weight are; steel reinforcement, steel beams, columns etc.

Self-Check 6	Written Test

Instruction Give short answer

1. What are the methods of real world measurement?

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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Operation Sheet 1	Preparing free hand drawings

To prepare free hand drawings apply the following steps

Step 1: Set up your drawing paper on top of the drawing board.

Step 2: Use the drawing template format given to you by your teacher.

Step 3: Be sure to check the sharpness of your pencil lead. Use standard

Sharpening for good aesthetic result of your work

Step 4: Using the basic drawing instruments and materials, perform the drawing

Step 5: Use appropriate pencil lead in your drafting works.

Step 6: You may submit your finish work once you are true but should be

Within the time specified for submission

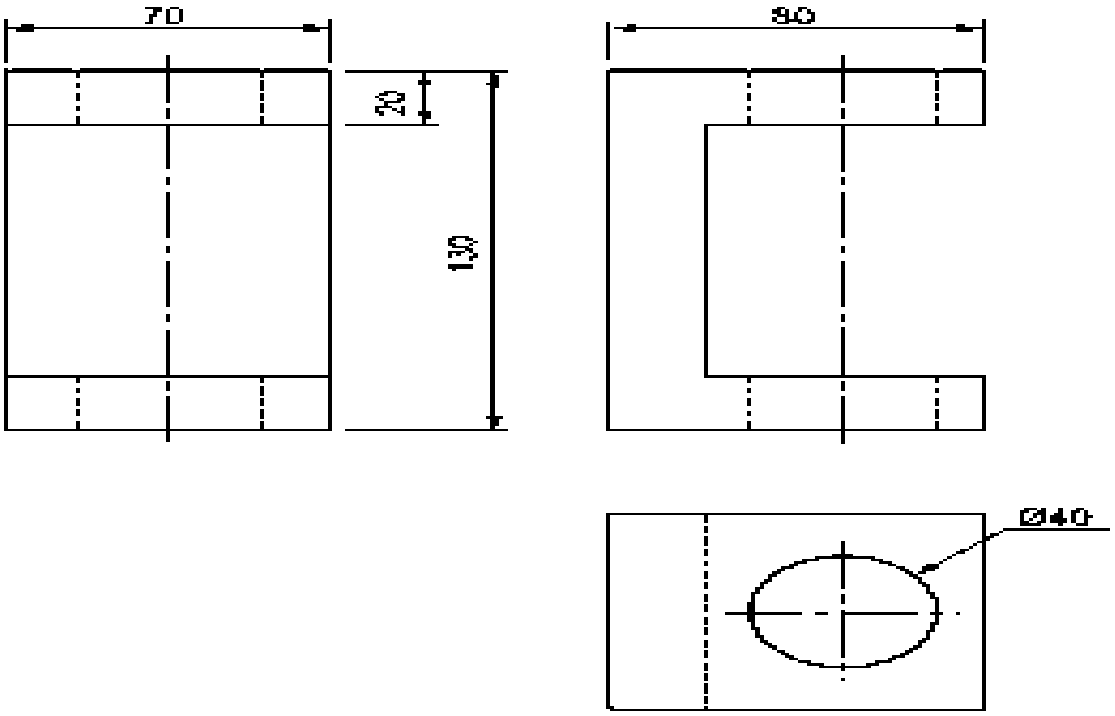
LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Task1.Perform free hand isometric view drawing from given three orthographic views. All dimensions are in mm**.**



Instruction Sheet 4	Learning Guide #13: Draw a map or plan

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

1. Drafting tools and equipment
2. Drafting principles and steps
3. Safety measures
4. Component and part list
5. Drawings and /or parts lists records
6. Ways to approve, copy, issued and store a completed drawing

This guide will also assist you to attain the learning outcome stated in the cover page.
Specifically, upon completion of this Learning Guide, you will be able to –

- *Select Drafting equipment* appropriate to the drawing method chosen.
- *Apply Drafting principles* to produce a drawing that is consistent with standard operating procedures within the enterprise
- Undertake all work safely measures to prescribed procedure.
- Receive approval of completed drawing in accordance with standard operating procedures.
- Identify components parts and organized by component type in accordance with organization/customer requirements.
- Complete drawings and/ or parts lists *records* in accordance with standard operating procedures.
- Copy and issue approved drawings and/or parts lists to relevant personnel in accordance with standard operating procedures.
- Store and catalogue approved drawings and/ or parts lists in accordance with standard operating procedures.

Learning Instructions:

1.Read the specific objectives of this Learning Guide.

2.Follow the instructions described below

3.Read the information written in the "Information Sheets 1- 4". Try to understand what are being discussed on pages 105, 111, 114 and 119.

4.Accomplish the "Self-check 1, 2, 3, and 4" on pages 109, 113, 117, and 120.

5.Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

6.If you earned a satisfactory evaluation proceed to “Operation sheet” on page xxx and do the “LAP Test” on page 123

7.After you accomplish operation sheets and LAP tests, ensure you have a formative assessment and get a satisfactory result; then proceed to the next LG.

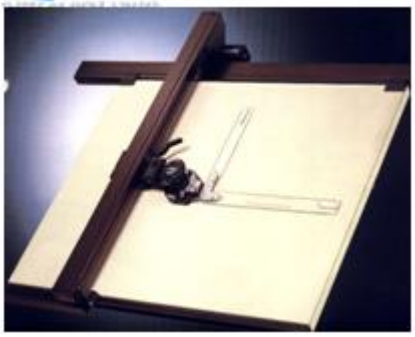
Information Sheet 1	Drafting tools and equipments

Tools and equipments

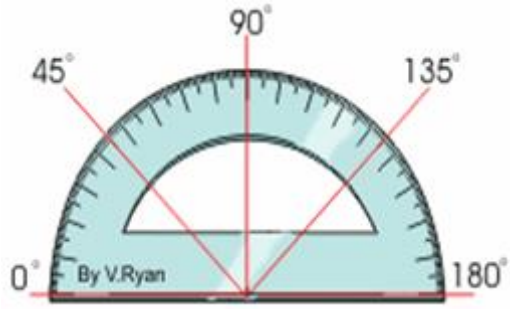
- Graphical representation of objects and structures is done using freehand, mechanical, or computer methods.
- **drafting board**

✓ Traditional drafting board is made of soft wood where the drawing paper can be attached on it.
✓ The left side at the end of the board is called working edge
✓ The working edge is made of a hard wood so that the t-square can easily being put on it.
✓ Modern board is user friendly where it has a stand that can be modify its height.

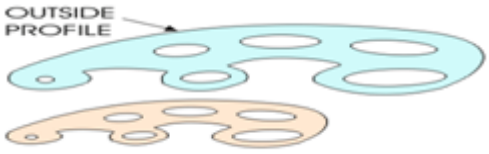
- **Protractor:** is used to measure angles. A typical protractor is a semi-circular piece of plastic with 180 degrees printed around its curve. This piece of equipment is not only used in graphics for constructing accurate drawings but is also used in subjects like Mathematics.
- **French curve:** is used to draw irregular curves.
- **Drawing Pencils:** Is a basic requirement of any graphics course. Ranging from 2B to 2H.This refers to the hardness of the pencil lead & sharp edge for longer and produces very fine lines.
- **Circle templates:** they are plastic with a number of accurate circles cut out.
- **Ellipse templates:** are similar to circle templates and these are useful for drawing ellipse / oval shapes accurately



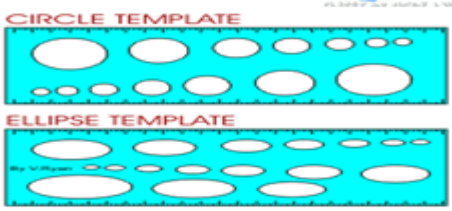
a) Drafting board



b) Protractor



c) French curve



d) Circle and ellipse template

Figure 4.1: *Drafting tools*

The following table shows different tools and equipments

Table 4.1 *Drafting tools and equipments*

	MEANING / FUNCTION	DRAWING
T SQUARE	*Used by draftsmen primarily as a guide for drawing horizontal lines on a drafting table. It may also guide a set square to draw vertical or diagonal lines.*	
FIXED T-SQUARE	*The head is fastened to the blade. It is used for ordinary works.*	
MOVABLE T- SQUARE	*It has one fixed and one adjustable head and use only for occasional drawing*	
REMOVABLE T- SQUARE	*It is designed for comport when carrying T- Square*	
COMPASS	*an instrument for drawing circles and arcs and measuring distances between points, consisting of two arms linked by a movable joint, one arm ending in a point and the other usually carrying a pencil or pen.*	
TRIANGULAR SCALE	*A drafting instrument that is triangular in cross section and has a different scale on each edge. Some edges have two*	

TRIANGLES	*A three-sided ruler typically has two equal sides which meet at a 90 degree angle joined to a third side at a 45 degree angle. Used to identify true bias lines or to square a corner.*	
DRAWING PAPER	*A **paper** specially prepared for the use of drawers (such as draftsmen or sketchers)*	
ERASER	*An object, typically a piece of soft rubber or plastic, used to clean dirt of something written.*	
PENCIL SHARPENER	*A pencil sharpener is a device for sharpening a pencil's writing point by shaving away its worn surface. Pencil sharpeners may be operated manually or by an electric motor.*	
DRAWING PENCIL	***HARD** – use for construction lines on technical drawing.* ***MEDIUM** – use for general use for technical drawing. The harder grades are for instrument drawings and the softer is for*	

DIVIDER	*Instrument for measuring, transferring, or marking off distances, consisting of two straight adjustable legs hinged together and ending in sharp points.*	
MASKING TAPE	*Drafting tape can also be used in Technical Drawing to help in keeping the paper well positioned. Leaving no residue behind.*	
ERASING SHIELD	*A thin plate (as of metal or celluloid) with holes usually of several sizes used to confine an erasure to a limited area.*	

Self-Check 1	Written Test

Instruction I: Answer the following the questions accordingly

1. _____is used to measure an angle?

   A. compass B. T-square C. protractor D. set-square

2. _____ is used to draw accurate angles

   A. compass B. T-square C. protractor D. set-square

3. list common types of drafting equipment?

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Answer Sheet

Score = _____

Rating: _____

Part: I Short Answer Questions

1. _____

_____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

Name of Trainee: _____Date: _____

Information Sheet 2	Drafting principles and steps

Drafting principles

- The process of producing engineering drawings, and the skill of producing them, is often referred to as technical drawing or drafting.
- Basics of engineering Drawing are:
  - ✓ Lines,
  - ✓ Signs,
  - ✓ Symbols.
- Engineering Drawing requires three essential skills:
  - ✓ The ability to draw any object by representing its lines and features in a clear and precise way leading to the understanding of the drawing and imagining what the object drawn looks like,
  - ✓ Knowledge of the used conventions to save time and convey the exact information,
  - ✓ The ability to work very accurately with all drawing instruments and convey the exact information.
  - ✓ to use the instruments drawing effectively,
  - ✓ Know the necessary geometrical constructions needed in engineering.
- The whole process of drafting should follow three drafts before it is ready to be presented before the authority. These drafts and their purposes are:-
  - ✓ **The first draft: -** Aims at the comprehensiveness and fullness of the facts.
  - ✓ **The second draft: -** Aims at the improving of the first draft by the correction of the form and the language by a considerable amount of trimming.
  - ✓ **The final draft: -** As the name suggests, it aims at giving a final touch and the finish up to make the document authoritative and able to convince.
- The process of drafting is generally governed by 4 principles:

- ✓ **Formation of outline in a satisfactory manner: -**"the draft is the skeleton of a document." This statement suggests that the prepared draft should be elaborate and should address all important issues. In a nutshell, a draft should be:
    - As detailed as possible
    - Not be vague
    - Able to fulfill the consideration of relevancy, content unity.
- ✓ **Emphasis on the arrangement of facts: –** A deep emphasis should be put on the manner in which the facts of the case are arranged. The facts should be arranged step by step to reflect an organized analysis of the problem.
- ✓ **Style and language: –** Style is an important factor for the transport of ideas. A clear presentation is an essential requirement for clear thinking. The style should be simple with the most appropriate use of legal terms that would convey the facts in a precise and simple manner.
- ✓ **Physical characteristics: –** The draft should be typed on standard quality paper (20 by 30 cm s) with margins of 4 cm s. at the top and left side and 2.5 to 4 cm s. on the right side and bottom.

Self-Check 2	Written Test

Instruction I: Answer the following questions accordingly

1. What is drafting
2. List the three basic element of engineering drawing
3. Write the purpose of drafting
4. Write the four basic principle of drafting

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1. _____

_____

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_____

2. _____

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3. _____

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4. _____

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_____

Information Sheet 3	Safety measures

Safety measures

- **Benefit of Safely work:** Working safely and hygiene can involve changes in how art materials are selected and how they are handled. Cleanliness and neatness in drawing work are very important requirements. Definitely the seal of excellence of any technical draftsman.
- **Drawing materials can be**: Toxic, can cause physical injury by inhalation, ingestion or by skin contact. They can be irritating, causing inflammation of the skin, eyes, mucous membranes or pain. The following procedures can be considered as safety measures to undertake work safely as standards
- Do not eat or drink from the work area (to avoid accidental ingestion).
- Familiarize yourself with substances that are dangerous.
- Hands should be kept clean at all times during work.
- Keep the work area clean and try to keep it in order.
- All drawing instruments should be kept clean with a cloth or towel.
- Identify the location of the extinguishers and the first aid box.
- Notify your boss of any health conditions or medications that may affect your work.
- Always have adequate ventilation.
- When using liquid drawing media such as ink try using those that are alcohol-based as they are less toxic.
- Never paint your body with markers or drawing inks. Body painting should be done with cosmetic colors.
- Always try to have a natural light entrance at your work place.
- When using the pencil sharpener, make sure your hands are clean and free from any trace of graphite.
- Never carry your work items into your mouth.
- If you suffer from allergies or have sensitive eyes, always try to protect your eye lenses.

- If you wear long hair, you should try to pick it up so it does not interfere with the process of drawing creation.

- Every 30 minutes try to rest your eyes for 10 minutes.
- Never support your elbows or body in the drawing project that is being carried out.
- Always try to make the entrance of natural light or the lamp you use to have a spotlight on the left
- Hazards: Drawing inks are generally water based but there are some solvents that generally contain solvents such as xylene so precautions should be taken.
- Permanent felt tip markers used in the design or graphic arts contain solvents. Xylene, is a highly toxic aromatic compound
- New markers often contain propyl alcohol which, although less toxic, is irritating to the eyes, nose and throat. The greatest risk of using permanent markers is the use of them at close range.
- The pencil should always be kept sharp and should be used properly. It should be kept away from the drawing sheet and other instruments.
- The ink containers and all working instruments should be kept at a reasonable distance from the technical drawing work being executed.
- The paper in which you work should always be on the left side of the board and if you are left hander, on the right side.
- Always keep your drawings protected in a cylinder or folder that prevents them from becoming soiled.
- As far as layout lines are concerned, always make sure that they are sharp and that they are never blurred.
- When the compass is used, the mine must always be sharpened.

Self-Check 3	Written Test

Instruction Answer the following questions accordingly

1. List safety precautions you must observe in any work area
2. List the procedures that can be considered as safety measures to undertake work safely as standards?
3. Fall injuries are not always caused by slipping on a wet surface.

A. true B. false

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

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

Information Sheet 4	Drawings and part lists records

Drawing and part list

- Part list of each part of the machine is identified on assembly drawing by the leader line and number, which are used in the detail drawing and in the bill of material.
- The height of the number may be approximately 5 mm and encircled by 9 mm diameter. Leader lines are drawn radically touching the respective parts.
- The bill of materials also shows the following:
  - (a) Number of parts
  - (b) Material of parts required for one unit
  - (c) Standard norm for
  - (d) Scale
  - (e) Method of projection
  - (f) Shop processes
  - (g) Name of the company
  - (h) Designed by, drawn by standard components and checked by
  - (I) Any special remark.

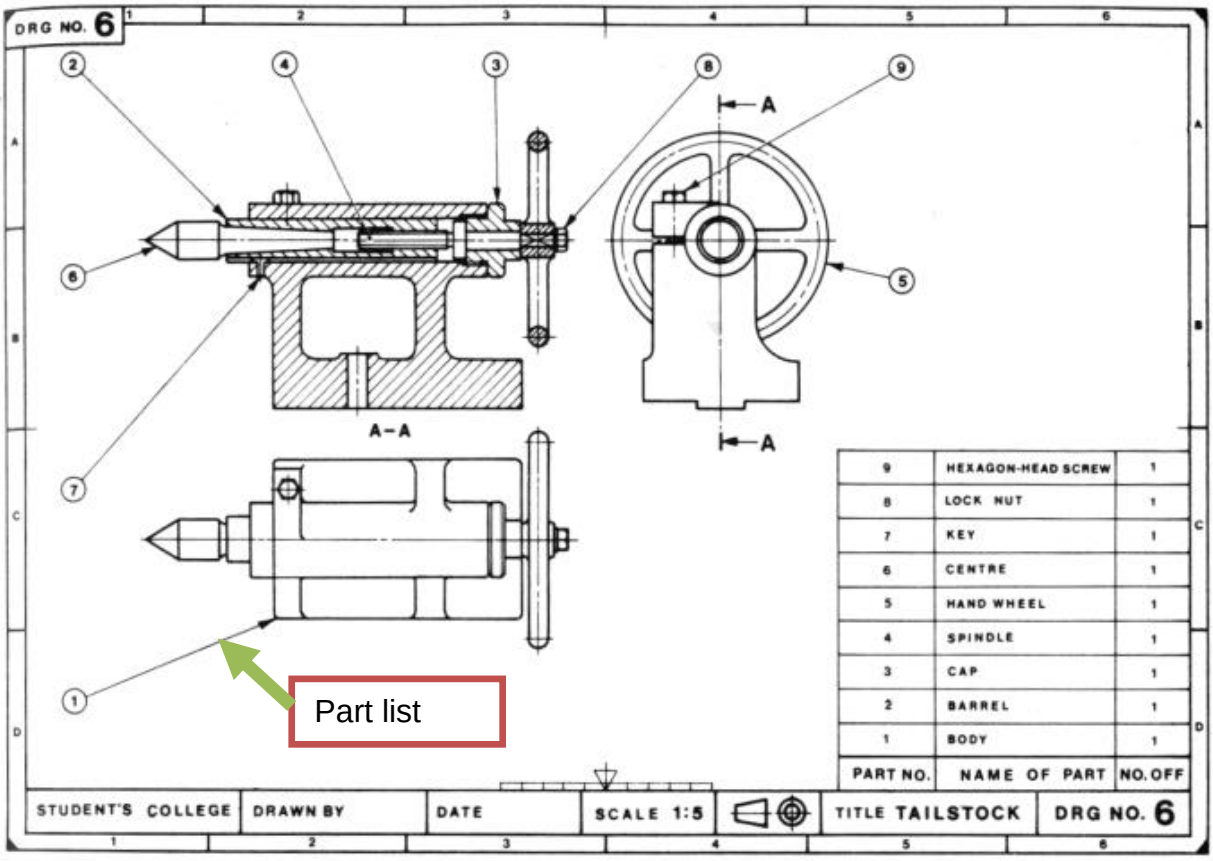

Figure 4.1 *Sample part list*

Self-Check 4	Written Test

Instruction Answer the following questions accordingly

1. List contain of part of part list (bill of material)

Note: Satisfactory rating - 10 points **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

1. _____

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Instruction Sheet 5	Learning Guide # 14: **Prepare for work**

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Work instruction
- Reading and interpreting job specification
- Selecting engineering drawing relevant to information required
- Checking and validating the latest version of map
- Checking to verify latest amendments to drawing of title panel of project documentation
- Identifying and checking correct equipment for safe use

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to: –

- Work instructions are identified, follow and used to determine job requirements
- Job specifications are read and interpreted
- Engineering drawings relevant to information required are selected
- The latest version of map, plan or drawing is checked and validated against job requirements or equipment..
- Amendments to *specifications* are checked to ensure currency of *information* and conveyed to others where appropriate
- Correct equipment for safe use is identified and checked

Learning Instructions:

1.Read the specific objectives of this Learning Guide.

2.Follow the instructions described below

3.Read the information written in the "Information Sheets 1- 4". Try to understand what are being discussed on pages 124, 128, 131 and 137

4.Accomplish the "Self-check 1, 2, 3, 4, 5 and 6" on pages 126, 129, 135, and 138.

5.Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information sheet:1	Work Instructions

Work instructions

- A Work Instruction is a document that provides specific instructions to carry out an Activity.
- This instruction is a step by step guide to perform a single instruction.
- A Work Instruction contains more detail than a Procedure and is only created if detailed step-by-step instructions are needed.
- Difference Between Work Instructions and Procedures is that:
  - ✓ Procedures describe: What is the activity is who performs it when it is performed.
  - ✓ Work instructions describe: How the activity is performed. Purpose of Work Instructions
- A work instruction is a tool provided to help someone to do a job correctly. This simple statement implies that the purpose of the work instruction is quality and that the target user is the worker.
- A work instruction – or work guide, job aid or standard operating procedure – describes in detail how an activity within a process (or procedure) is performed. Your work instruction should therefore be part of an overall process improvement plan. Work instructions, or SOPs, build and preserve the knowledge inside a company. When "how things are done" are passed on verbally, there is room for interpretation and human error. And knowledge about how to most efficiently perform a task is lost when said employee leaves the company and takes the knowledge with them.
- Good work instructions avoid all this:-
  - ✓ Work instructions reduce risk
  - ✓ Avoid errors
  - ✓ Save time**:**
- Good instruction look like

- ✓ It is clear
- ✓ It is accessible
- ✓ It is credible
- ✓ It is consistent
- ✓ It is short and simple

➢ steps to improve your work instructions:

STEP 1: Write a clear title

- ✓ **Give some context**: briefly, explain which process the task is part of.
- ✓ **Identify the owners:** briefly, explain who process owner is an who the task owner is
- ✓ **State the output:** briefly, explain what the output or purpose of the task is
- ✓ **The title must refer to the job**: A good example might be, "how to disinfect your hands".

STEP 2: Describe the purpose

STEP 3: Describe how to do it

STEP 4: Format for easy reading

STEP 5: Rewrite and simplify

STEP 6: Add references

STEP 7: Test with a colleague

Self-Check -1	Written Test

Part: I choose the correct answer

1._____ is a document that provides specific instructions to carry out an Activity

A) Procedure B) work instruction C) A&B D) all

2. _____ describes in detail how an activity within a process (or procedure) is performed.

A) Work instruction B) work guide C) operating procedure D) A&B

PART: II answer the following questions accordingly

1. What is work instruction?
2. Write the deference between work instruction and operating procedure?
3. List the characteristics of good work instructions?
4. Write the steps for preparing work instructions?

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer Sheet

Score = _____

Rating: _____

Part: I choose The Best Answers

1. _____
2. _____

Part: II Short Answer Questions

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4._____
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Name of Trainee: _____ Date: _____

Information sheet:2	reading and interpreting Job specifications

Job Specification

- A job specification outlines specific traits a person needs to do the job. Typically, that includes the qualifications, skills and personal traits you need to be successful.
- Usually, the job specification follows the job description, which describes the job itself and how that job fits within the company.
- Comparing the two, the description focuses more on-the_-job specifics_ while the specification focuses on the person filling the position.
- **Purpose of Job Specification**
  - ✓ Described on the basis of job description, job specification helps candidates analyze whether are eligible to apply for a particular job vacancy or not.
  - ✓ It helps recruiting team of an organization understand what level of qualifications, qualities and set of characteristics should be present in a candidate to make him or her eligible for the job opening.
  - ✓ Job Specification gives detailed information about any job including job responsibilities, desired technical and physical skills, conversational ability and much more.
- Job description includes basic job-related data that is useful to advertise a specific job and attract a pool of talent. It includes information such as job title, job location, reporting to and of employees, job summary, nature and objectives of a job, tasks and duties to be performed, working conditions, machines, tools and equipments to be used by a prospective worker and hazards involved in it.

Self-Check -2	Written Test

Part: I Answer the following questions

1._____ is a written statement of educational qualifications, specific qualities, level of experience, physical, emotional, technical and communication skills required to perform a job, responsibilities involved in a job and other unusual sensory demands.

A.) employee specifications B) a job specification C) A&B D) all

2. Job description and job specification are two integral parts of job analysis

A) True B) false

PART: II EXPLANATION

1. What is job specification?
2. Write the purpose of job specifications?
3. Discus the difference between job specifications and job description?

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer Sheet

Part: II Short Answer Questions

Score = _____

Rating: _____

1._____

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Name Of Trainee: _____ Date: _____

Information sheet:3	Selecting engineering drawing relevant to information required

Engineering drawings relevant to information required

Perspective projections: are drawings which attempt to replicate what the human eye actually sees when it views an object. There are three types of perspective projections: One point, Two-point and Three-point Projections

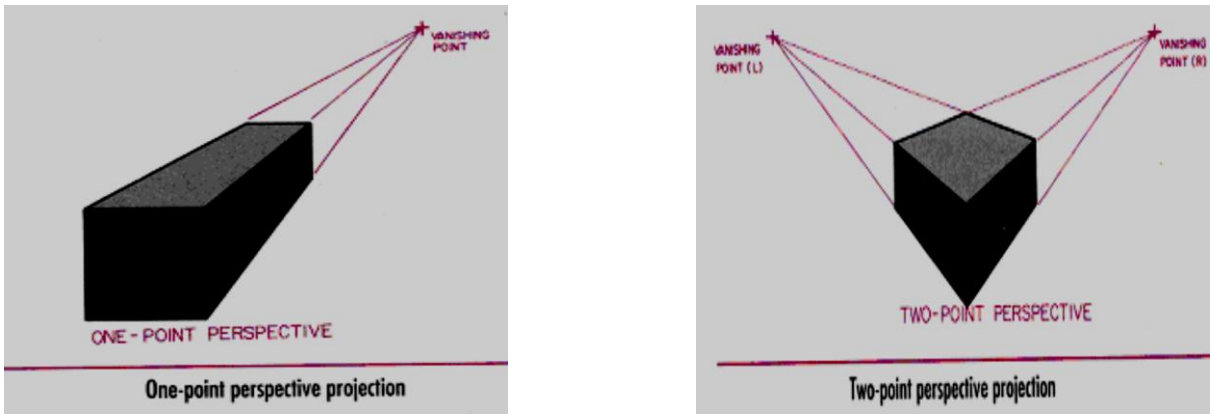


Figure 5.1 Perspective drawing

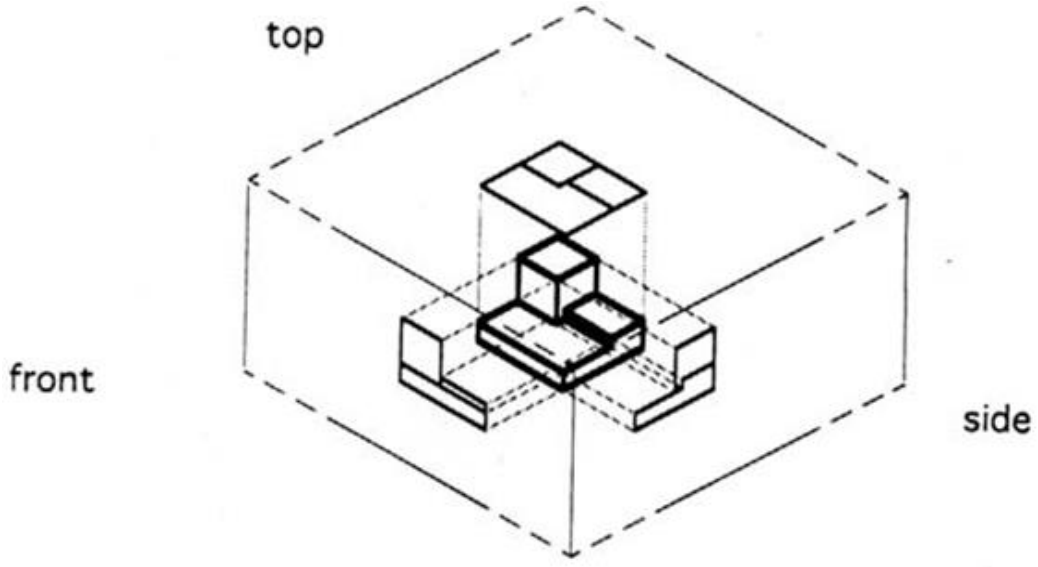


Figure 5.2: The block suspenede in the glass three phases

- **Pictorial Projections:** Pictorial sketches are a type of technical illustration that shows several faces of an object at once. Such sketches are used by any industry that designs, sells, manufactures repairs, installs or maintains a product.
  - ✓ **Axonometric Projection:** is a parallel projection technique used to create pictorial drawings of objects by rotating the object on an axis relative to a projection plane to create a pictorial view. Axonometric drawings are classified by the angles between the lines comprising the axonometric axes:

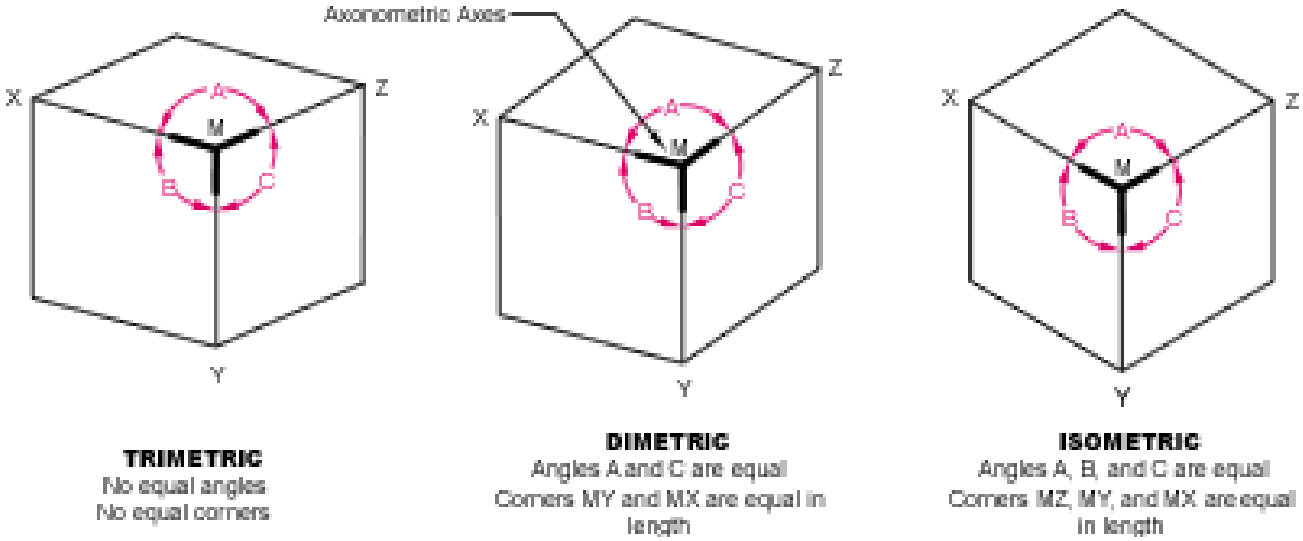
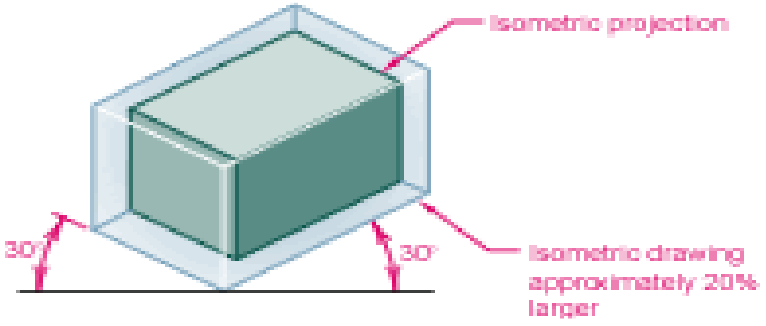


Figure 5.3 An Axonometric view with documentaion

  - ✓ **Isometric Projections** is created by rotating it 45 degrees about a vertical axis, and then tilted forward until the body diagonal of the cube (A-B) appears as a point in the front view. Isometric lines



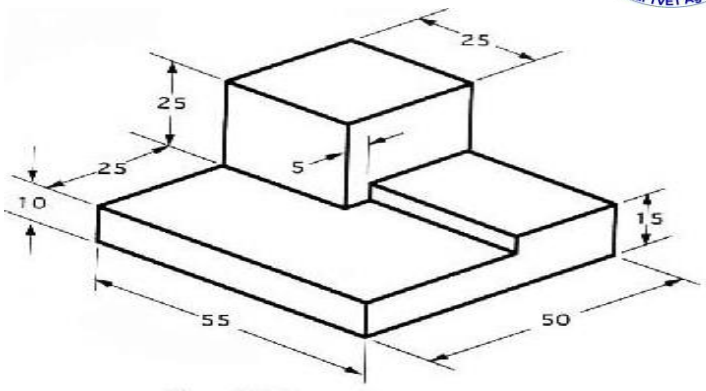


***Figure 5.4*:** An Isometric view with documentaion

- ✓ **Oblique projection** is easiest pictorial sketches to produce. Show the front view as if you were looking straight at it. Sides extend back from the front view. Sides shown with parallel lines that are generally drawn at 45 degrees to the front view.

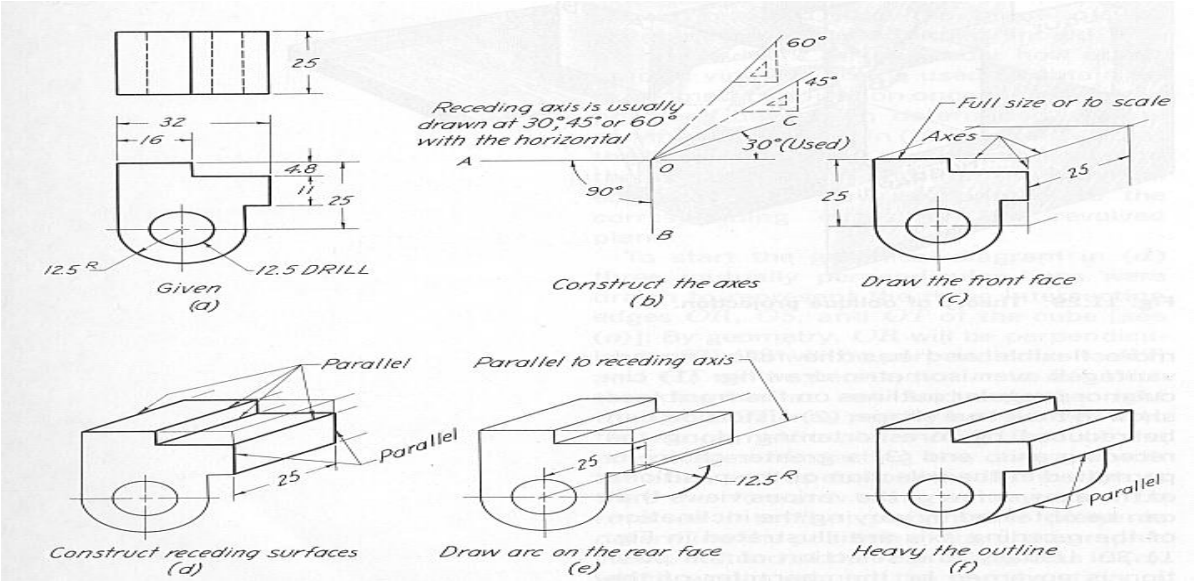


***Figure 5.5*:** An obleque view with documentaion

- ➢ **Orthographic Drawings** are two-dimensional drawings used to represent or describe a three-dimensional object. The orthographic views represent the exact shape of an object seen from one side at a time as you are looking perpendicularly to it without showing any depth to the object

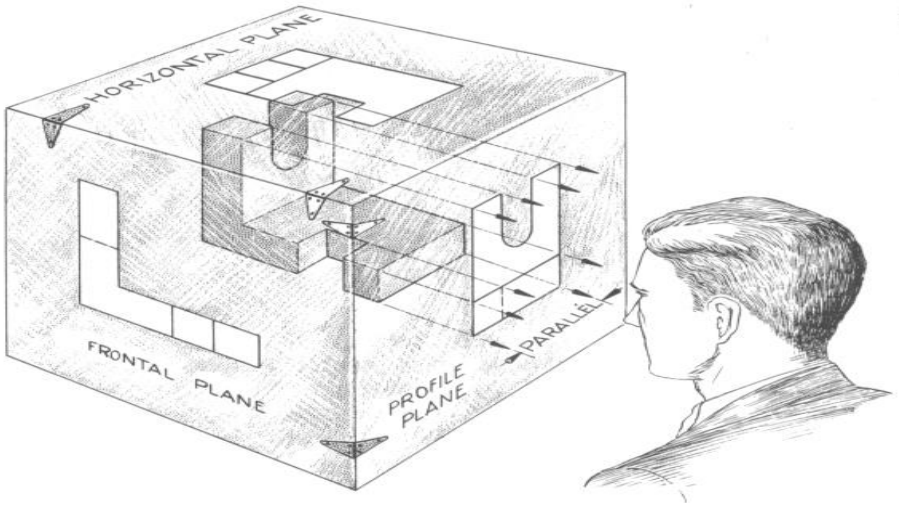


***Figure 5.6*:** Orthographic view projection

Primarily, three orthographic views (top, front, and right) adequately depict the necessary information to illustrate the object

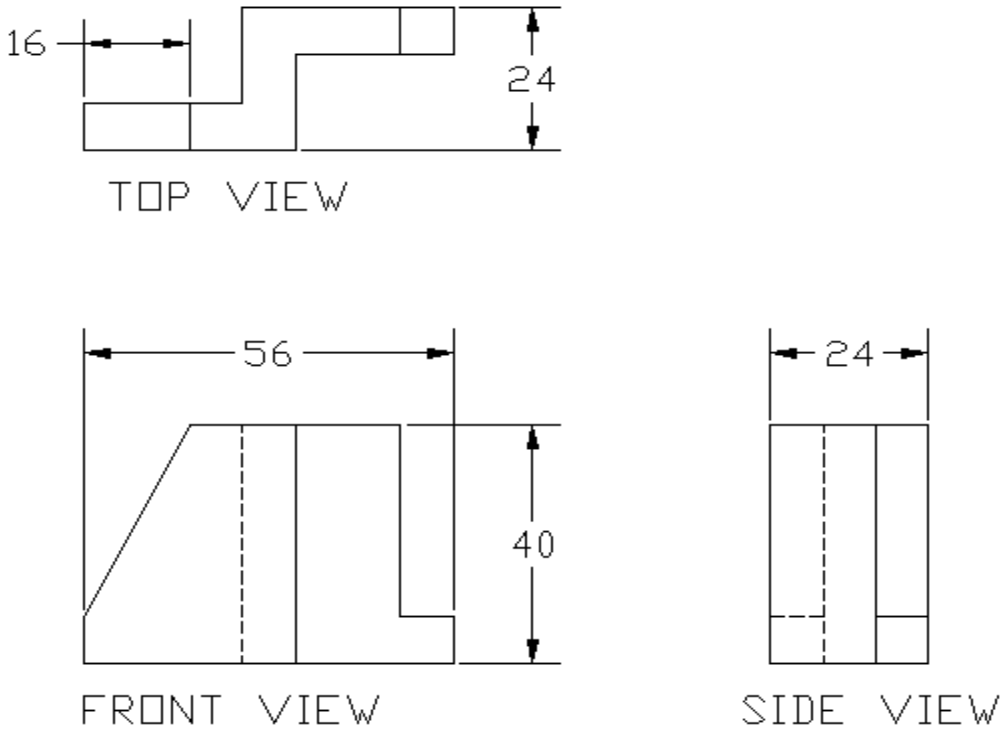


***Figure 5.7*:** Orthographic views

Self-Check -3	Written Test

Part: I Choose the Correct Answers

1._____ shows where the object is sliced or cut by the cutting plane line

a. Section lining
b. Plan
c. maps
d. elevation

2. _____are two-dimensional drawings used to represent or describe a three-dimensional object.

a. Axonometric
b. Isometric
c. Oblique
d. Orthographic view

3. An isometric view of an object is created by rotating it 45 degrees about a vertical axis, and then tilted forward until the body diagonal of the cube (A-B) appears as a point in the front view.

a. true
b. false

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer Sheet

Score = _____

Rating: _____

Part: I choose The Best Answers

1. _____
2 _____
3._____
4._____
5_____
_____
_____
_____

Name Of Trainee: _____ Date: _____

Information sheet:4	Checking and validating the latest version of map

Specification

Exact statement of the particular needs to be satisfied, or essential characteristics that a customer requires (in a good, material, method, process, service, system, or work) and which a vendor must deliver. Specifications are written usually in a manner that enables both parties (and/or an independent certifier) to measure the degree of conformance. They are, however, not the same as control limits (which allow fluctuations within a range), and conformance to them does not necessarily mean quality (which is a predictable degree of dependability and uniformity). Specifications are divided generally into two main categories:

- **Performance specifications:** conform to known customer requirements such as keeping a room's temperature within a specified range.
- **Technical specifications:** express the level of performance of the individual units, and are subdivided into (a) individual unit specifications which state boundaries (parameters) of the unit's performance consisting of a nominal (desired or mandated) value and tolerance (allowable departure from the nominal value, (b) acceptable quality level which states limits that are to be satisfied by most of the units, but a certain percentage of the units is allowed to exceed those limits, and (c) distribution specifications which define an acceptable statistical distribution (in terms of mean deviation and standard Deviation) for each unit, and are used by a producer to monitor its production processes. See also standard.

Self-Check -4	Written Test

Part: I Choose the Correct Answers

1._____ conforms to known customer requirements such as keeping a room's temperature within a specified range.

A. Performance specifications

B. Technical specifications

2_____ express the level of performance of the individual units,

A. Performance specifications

B. Technical specifications

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer Sheet

Score = _____

Rating: _____

Part: I choose The Best Answers

1. _____
2 _____
3._____
4._____
5_____
_____
_____
_____

Name of Trainee: _____ Date: _____

Instruction Sheet 6	Learning Guide #15 **Use maps and site plans to support work activities**

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Systems for managing maps and plans
- Relevant technologies used to gather, record and monitor map and plan data
- Identifying the function and key features of maps and site plans
- Orientation of sites
- Application of maps or plans to find identified features in the real world
- Access to site and from roadway
- Determination of distances and materials from plans and drawing
- Interpretation of dimension and scale on the drawing

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- Organization's *system for managing maps and plans* is applied.
- Relevant *technologies* used to gather record and monitor, map and plan data are applied.
- Function and *key features of maps and site plans* in the planning of work are identified.
- Key features of the site are identified and the *orientation of sites* is explained.
- A map or plan is followed to find identified features in the real world
- Access to site is gained and services, main features, contours and datum are identified
- Access from roadways to work site is identified and isolated.
- Materials and distances are determined from plans and drawings.
- Real world distances are calculated using maps and plans with a range of scales.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the "Information Sheets 1- 5". Try to understand what are being discussed on pages 142, 146,154, 160 and163.

   Accomplish the "Self-check 1, 2, 3, 4 and 5" on pages 146, 152, 158, 161, and 167

4. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet-1	systems for managing maps and plans

System for managing maps and plans

- Commonly maps would guide to identify and locate site specific structure. Cadastral topographic map are used for watershed planning.
- Resource map is drawn either on the ground or on the cadastral map directly to depict and describe the natural resource like forest, water bodies, different types of land..Then finally it transfer to scale chart appear

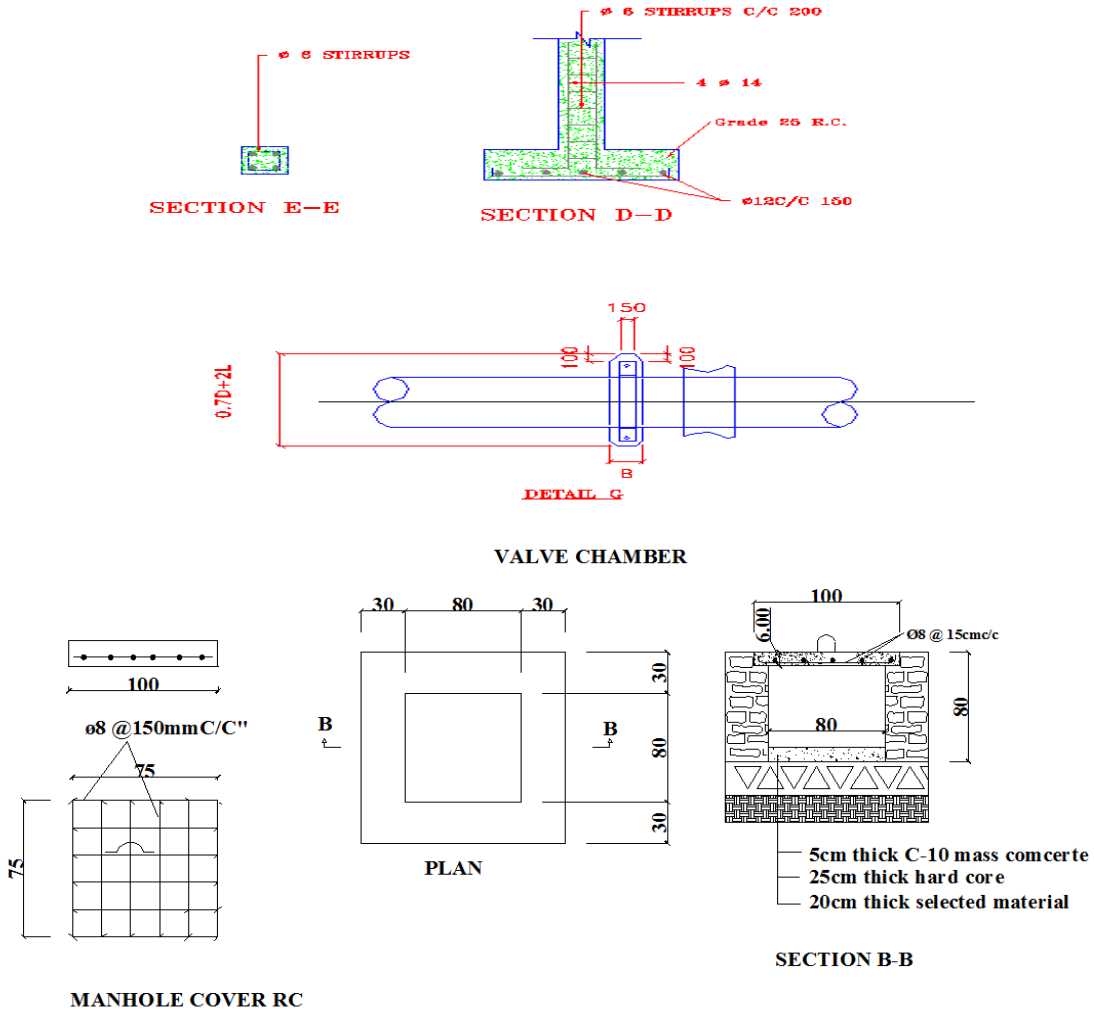


Figure 6.1 *Sectioned view*

- **Recent Feature interpretation** In remote and difficult terrain man-made features can often be rare. It's also possible a man-made feature, such as a log cabin, can be added or removed from the landscape. Since natural features don't change as quickly or easily as their man-made counterparts, being able to use them to navigate is essential.
- Interpreting the shape of the land on a map using contour lines is an extremely useful navigational tool. Looking at the lines and creating a mental picture of the landscape will allow you to plan a journey effectively. Orange or brown contour lines on maps join points of equal height above sea level together, and are usually measured in 5- or 10-metre height intervals.
- One of the easiest ways to convert contour lines into a mental picture is to imagine the lines as high tide marks left by the sea.. This can be surprising when you see the actual landscape and it contains features you haven't imagined since they don't appear on your map.
- **Key Indicator for Recent Map, plan and Drawings** Generally maps all have certain element that is important when you read them. These element allow you to understand what is being measured and how it is being measured
- **Check and Vitiating the various symbols and Legend in maps**

Utility symbol

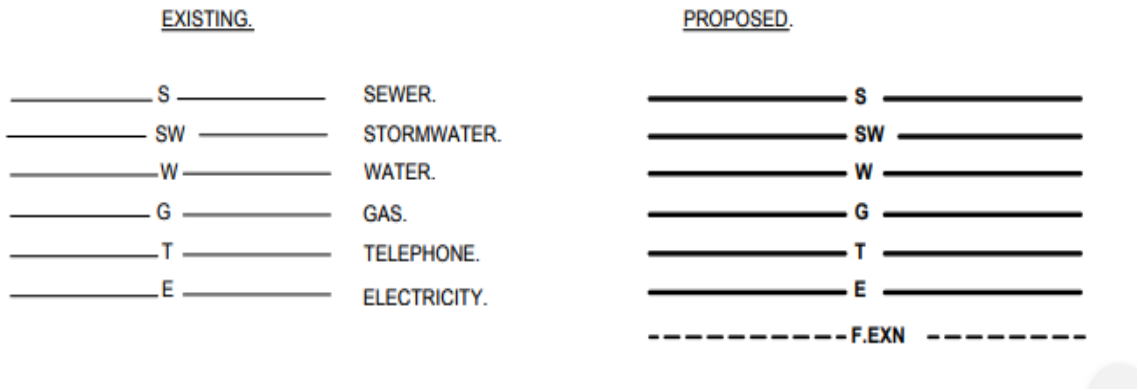


Figure 6.2 *Utility sym*

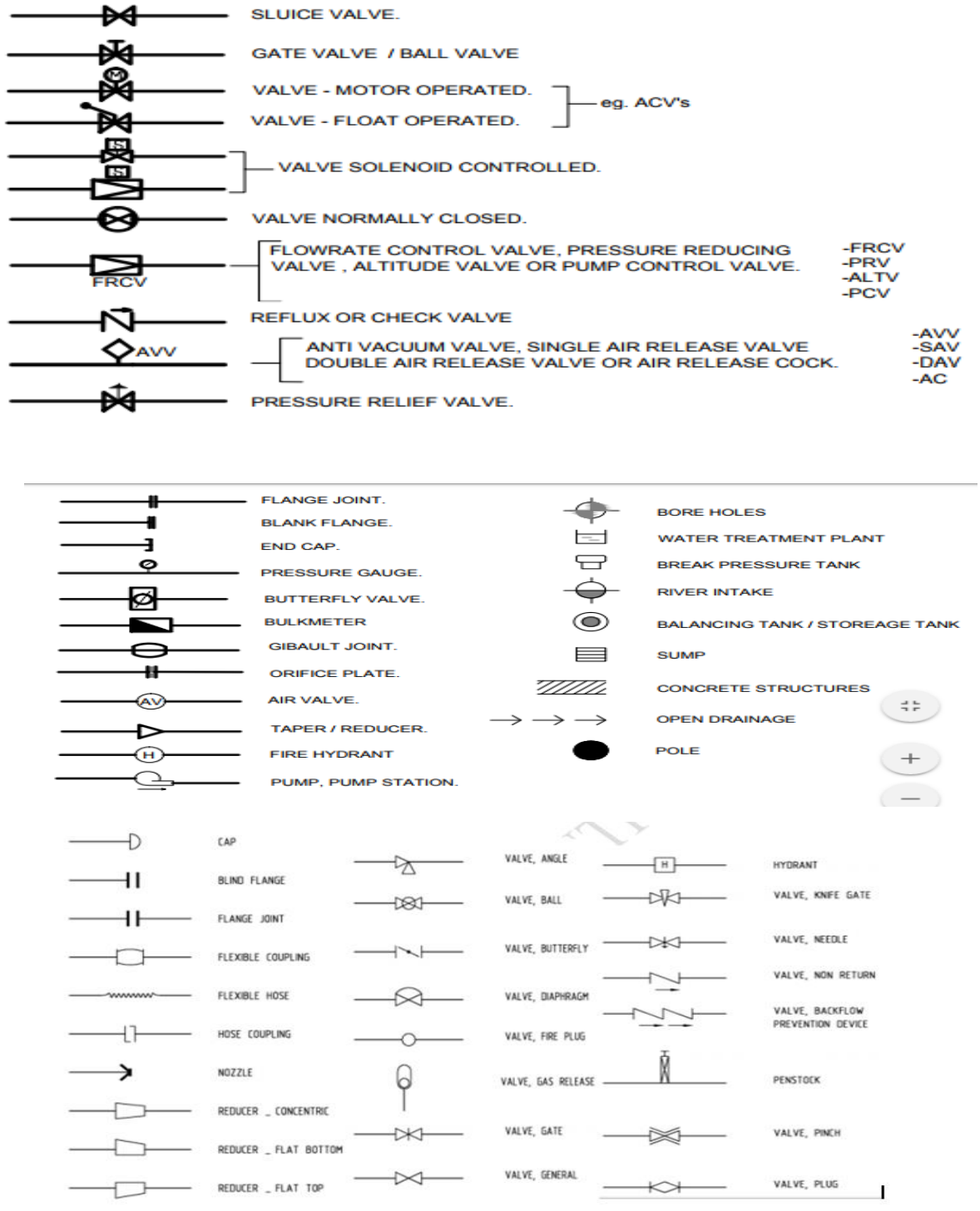


Figure 6.3 *General hydraulic symbols in bulk water supply and reticulation system*

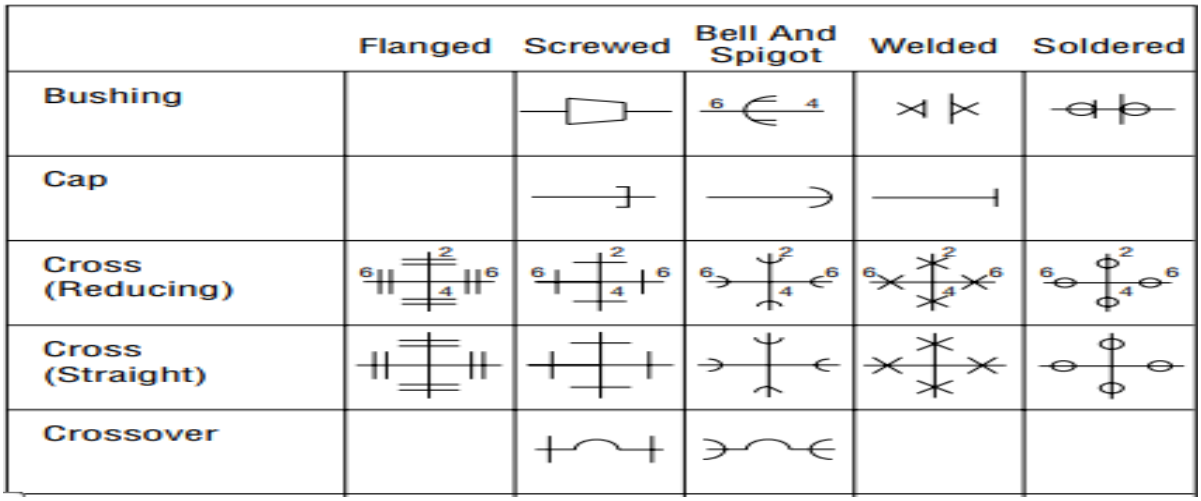


Figure 6.4 *Symbols for pipe fittings*

Self-Check 1	Written Test

Part I: choose the correct answer

1. shows where the object is sliced or cut by the cutting plane line
   A. Section lining
   B. plan
   C. maps
   D. elevation
2. When you prepare drawing the dimension should be
   A. Accuracy
   B. Clearness
   C. Completeness
   D. Readability

Part II Write Short note by recalling the information sheet covered

1. Write tools and equipment which used to free hand sketching of simple drawing.
2. What is the difference between scale and elevation
3. What is the difference between drawing board and title block
4. Define the word elevation ,drawing view and orientation of site

Answer sheet

Score = _____
Rating: _____

1._____
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2._____
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3_____
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4_____
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5._____
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Information Sheet-2	Relevant technologies used to gather, record and monitor map and plan data

Compasses

- There are many types of compasses suitable for use in map reading and navigation.
- Magnetic compasses are most commonly used although electronic compasses are also suitable. Although magnetic compasses may differ in shape and size, the principle of operation is essentially the same.
- In brief, they consist of a magnetized needle accurately balanced in a pivot point set in the centre of a non-ferrous or plastic box. A card, graduated in degrees, is usually fixed to the top of the needle with the 360° mark directly over the north point of the needle.
- Situated on the box of the compass is a datum point (north) and sometimes an aiming point or protrusion along the same line.

THE PRISMATIC COMPASS

- There are a considerable number of compasses which can be described as prismatic.
- The operation of these compasses is essentially the same regardless of brand.
- The boxes of the compasses are filled with liquid to dampen the movement of the card so that it rotates gently and comes to rest quickly.
- Also provided is a magnifying prism which enables the reader to read the bearing on the card with much more accuracy.
- Methods of using a prismatic compass by day are detailed below:
  - ✓ **To take a bearing:** Hold the compass in a steady position in both hands with the thumb through the ring, the lid vertical, and the prism turned over in the reading position.
  - ✓ Looking through the prism, line up the object with the hair line in the centre of the prism slot and read off the bearing on the card against the hair line.

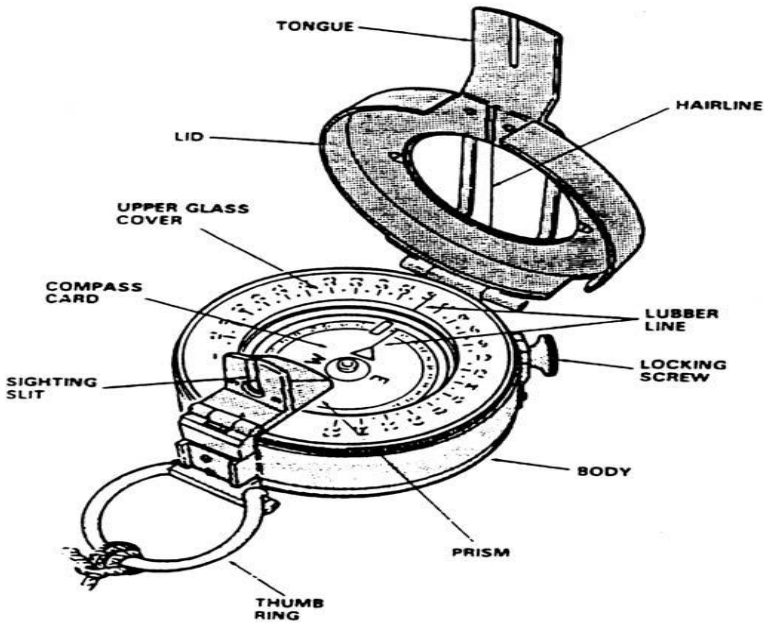

Figure 6.5: The Prismatic Compass

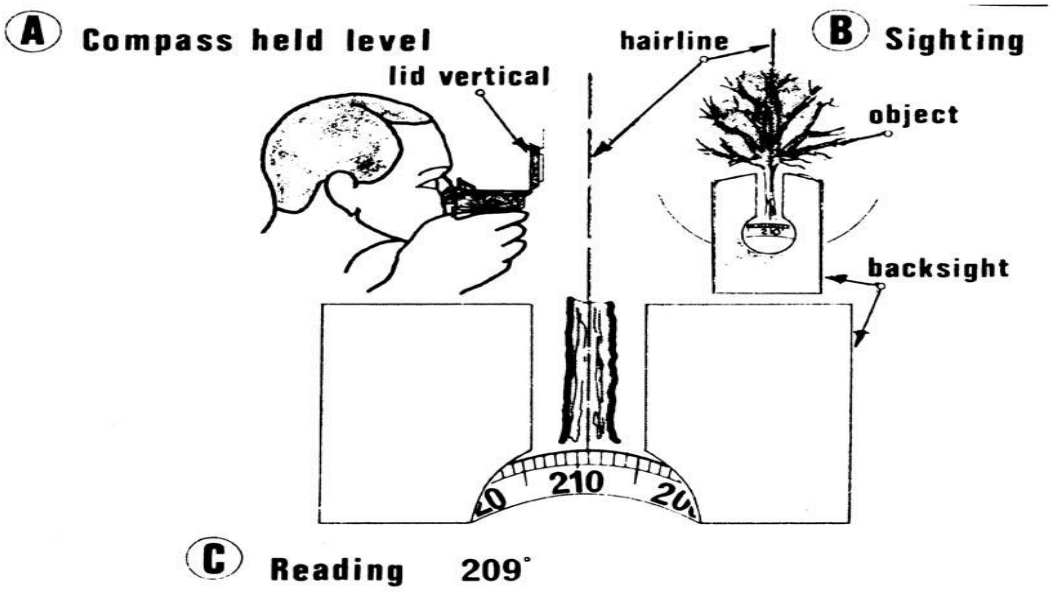

Figure 6.6 Taking a Bearing (Using the Prism)

- **To find the direction of a given bearing:** Looking through the prism turn the compass until the hair line cuts the given bearing and then note some object in the distance which is in line with the hair line. The object will be on the required bearing.

- **Using the compass without the prism:** Either of the above operations can be carried out without using the prism but with less accuracy. To take a bearing, open the compass out flat and line it up so that the tongue is directly in line with the object. The bearing is read from the inner circle on the compass against the lubber line. To find the direction of a bearing, turn the compass until the inner scale below the lubber line reads the given bearing. Rotate the body of the compass until the north point of the needle aligns with the north indicator on the glass cover. The tongue is then pointing in the required direction. To avoid errors, read with the eye vertically over the lubber line.
- **SETTING A PRISMATIC COMPASS FOR NIGHT MOVEMENT:** with the compass opened and held flat, loosen the locking screw and turn the glass cover to set the required bearing against the lubber line. With the glass cover relocked, the compass is then turned until the luminous point of the north point and the luminous strip on the cover coincide. The tongue will then point in the required direction. For very rough setting, the markings on the outside cover may be used instead of the markings on the compass card.
- **THE ORIENTEERING COMPASS** Although initially designed for the sport of orienteering, these compasses are now made in many models and are used widely throughout the world by armed forces and many other organizations as general purpose compasses.

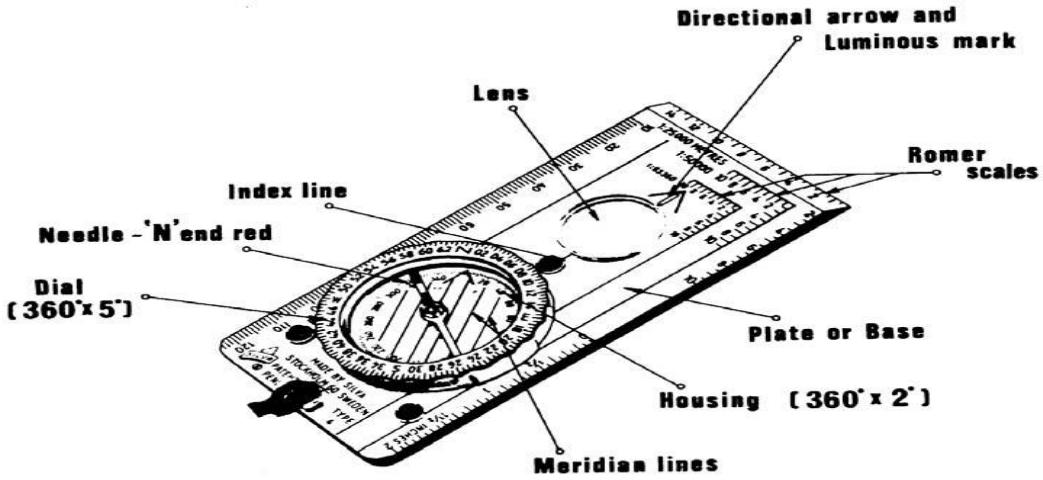

Figure 6.7 components a typical orienteering compass.

- **Taking a Grid Bearing –**

Self-Check 2	Written Test

- ✓ **Step 1 –** Place the long edge of the compass plate along the desired bearing making sure that the directional arrow on the compass plate points in the direction you wish to travel.
- ✓ **Step 2 –** Turn the compass housing so that the meridian lines are paralleled with the easting's on the map, and the north mark is pointed towards the top of the map.
- ✓ **Step 3 –** Read the grid bearing on the housing where the index line intersects it.

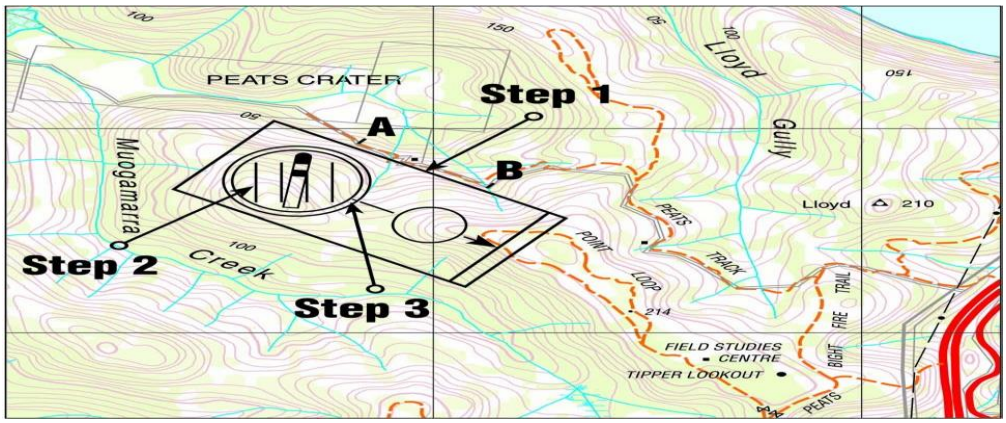

Figure 6.8 taking a Grid Bearing Using an Orienteering Compass

.

Part I: Answer the following questions accordingly

1. What is compass?
2. List types of compass?
3. Write the purpose of compass?

Answer sheet

Score = _____
Rating: _____

1._____

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2._____

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4_____

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5._____

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Information Sheet-3	Identifying the function and key features of maps and site plans

Documentation of Drawing System

An electronic archive will be maintained of all document released versions. The archive will be the responsibility of and can only be accessed by request to the Project Assistant. The PA will keep two archives, a PDF version held within Q-Pulse and MS-Word version held within a restricted archive directory.

Table 6.1 Document Front Page Approval Table

Prepared:	the author of the document
Approved:	the person who approves the document, e.g. a project engineer, systems engineer or commercial manager within the VPO or other company or organization
Released:	the person who releases the document, e.g. the Project Manager
Reviewed:	the person who (in some cases) reviews the document, normally the PS

New Drawing Issue and Approval Procedure

The drawing approval procedure is as follows:

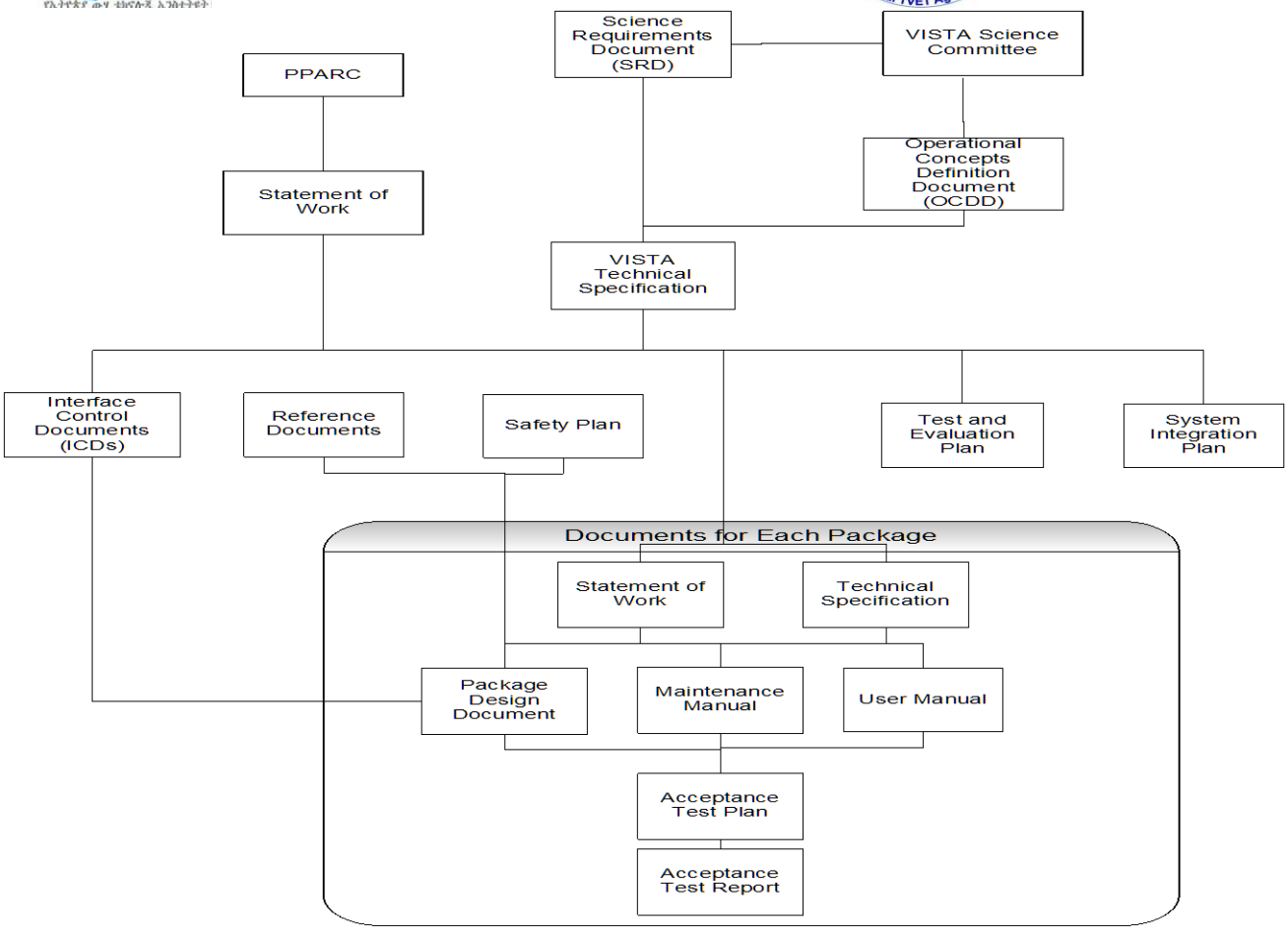
- Drawing numbers as required will be assigned by the project planner from a drawing database which is held separate from the documentation database.
- In accordance with Appendix A all drawings with the exception of interface control drawings will be numbered as such:
- The database will have a field to identify the origin of the drawing. This will form part CCC of the drawing number.
- Contractors supplying drawings to the project must comply with the VISTA drawing numbering system. Numbers will be allocated in blocks as required by the PA.
- The database will have a field to identify what the origin format of the drawing is i.e. ACAD, ProE, etc.

- The part of each drawing number GGGG will be allocated sequentially within each product code group DDDDD starting from 0001 regardless of whether that number has been used in the documentation database. Therefore it is entirely possible that a drawing and a document may appear to have almost identical numbers differing only in the identification of the document type.
- Example : VIS-DWG-ATC-01000-0001 and VIS-SPE-ATC-01000-0001
- Each drawing will have an approval/change record document associated with it. This document carries the same number as the drawing and will be circulated with the drawing for peer approval and should be signed and dated by the following personnel:

Drawn By:	The originator of the drawing
Checked By:	An appropriate person nominated to check the drawing
Approved By:	It be more than one person nominated to approve a drawing and are usually the Project System Engineer and an appropriate Project Engineer.
Released By:	This person nominated to release the drawing usually the Project Manager.

System Documentation

Throughout the progress of the project, many documents will be produced within each work package and within different disciplines. Although it is not possible to list in advance all the documents that will be produced, it is necessary to define what types of document will be produced.



Title Panels

A title panel (sometimes called a title block) is found on all drawings. It identifies which project the drawing is for and also gives some specific information about that particular drawing sheet. The title panel can be found at the bottom or the side (usually the right-hand side) of the drawing sheet.

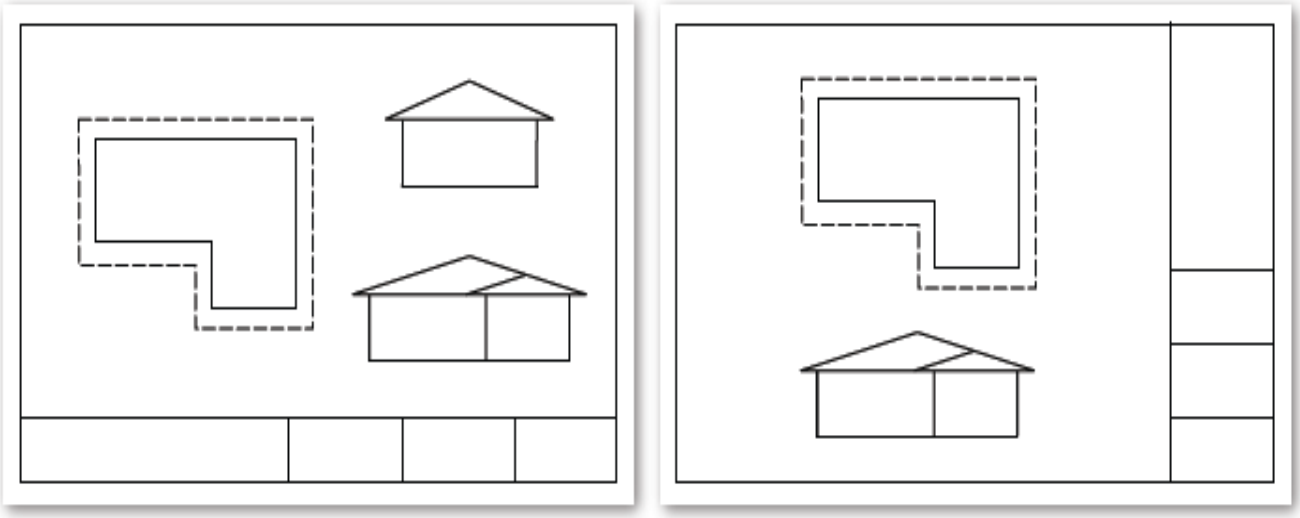


Figure 6.9: *Title panel*

Title Panel at the bottom of the sheet Title Panel at the right hand side of the sheet Where the title panel is located and what it looks like are decided by the drafting or architectural company. They will usually incorporate company styles, colors and logo. Employees creating drawings will be required to follow company procedures by inserting and completing the title block correctly.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. shows where the object is sliced or cut by the cutting plane line
   A. Section lining
   B. plan
   C. maps
   D. elevation
2. When you prepare drawing the dimension should be
   A. Accuracy
   B. Clearness
   C. Completeness
   D. Readability

Part II Write Short note by recalling the information sheet covered

1.Write tools and equipment which used to free hand sketching of simple drawing. (10 points)

2.What is the difference between scale and elevation (5pts)

3.What is the difference between drawing board and title block(5pts)

4.Define the word elevation ,drawing view and orientation of site (5pts)

Answer Sheet

1._____

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2._____

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4._____

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Information Sheet-4	Checking amendments to specifications to ensure currency of information and conveyed to others where appropriate

Amendments

An amendment is a change to a project that is decided after the drawings have been finalised. Amendments are sometimes called revisions. These changes could happen because the client requests them (for example, the client may want an extra window in the study) or because the builder realises something will work better if it's done slightly differently. Either way, they need to be shown on paper so that everyone knows about them, they are constructed correctly and there are no arguments later. So obviously it is important to use the latest version of the plans.

If this means that the building will vary from the way it was shown in the original contract documents, a written instruction will be issued by the architect/client and, if necessary, the drawings will be amended (changed) and re-issued.

Self-Check -4	Written Test

Directions: Choose the best answer

3. shows where the object is sliced or cut by the cutting plane line
   E. Section lining
   F. plan
   G. maps
   H. elevation
4. When you prepare drawing the dimension should be
   E. Accuracy
   F. Clearness
   G. Completeness
   H. Readability

Part II Write Short note by recalling the information sheet covered

5.Write tools and equipment which used to free hand sketching of simple drawing. (10 points)

6.What is the difference between scale and elevation (5pts)

7.What is the difference between drawing board and title block(5pts)

8.Define the word elevation ,drawing view and orientation of site (5pts)

Answer Sheet

1._____

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Information Sheet-5	Contours

Contours

Contours – The most common way of showing the shape of the ground on modern maps is by the use of contour lines. Contour lines give no visual illusion of relief and failure to recognize this, may cause difficulty in understanding their purpose.

(1) SIMPLE PRINCIPLE – The concept of a contour is very simple. It is an imaginary line drawn on a map, joining all places of equal height above a fixed datum line (usually sea level).

(2) CONTOUR HEIGHTS – On the map, each contour is drawn at a specific height above a fixed datum and the vertical distance represented by each is the same. The difference in height between contours is called the Vertical Interval (VI) or the Contour Interval and is shown in the marginal information on the map. It is from the height and spacing of contours that the shape of the ground is deduced and accurately calculated if necessary. Some contours have the height shown at intervals along their length. On most maps these heights are printed so that they read facing uphill. This allows the reader to determine the direction of high ground.

CONTOUR PATTERNS

Each topographical feature, such as a spur or a knoll, is represented by its own particular contour pattern. Important points to remember about contour patterns are:

a. contour lines close together indicate steep slopes;

b. contour lines far apart indicate gentle slopes;

c. evenly spaced contour lines indicate uniform slopes;

d. when the spacing of contour lines, reading from high to low, decreases, the slope is convex; and

e. when the spacing of contour lines, reading from high to low, increases, the slope is concave.

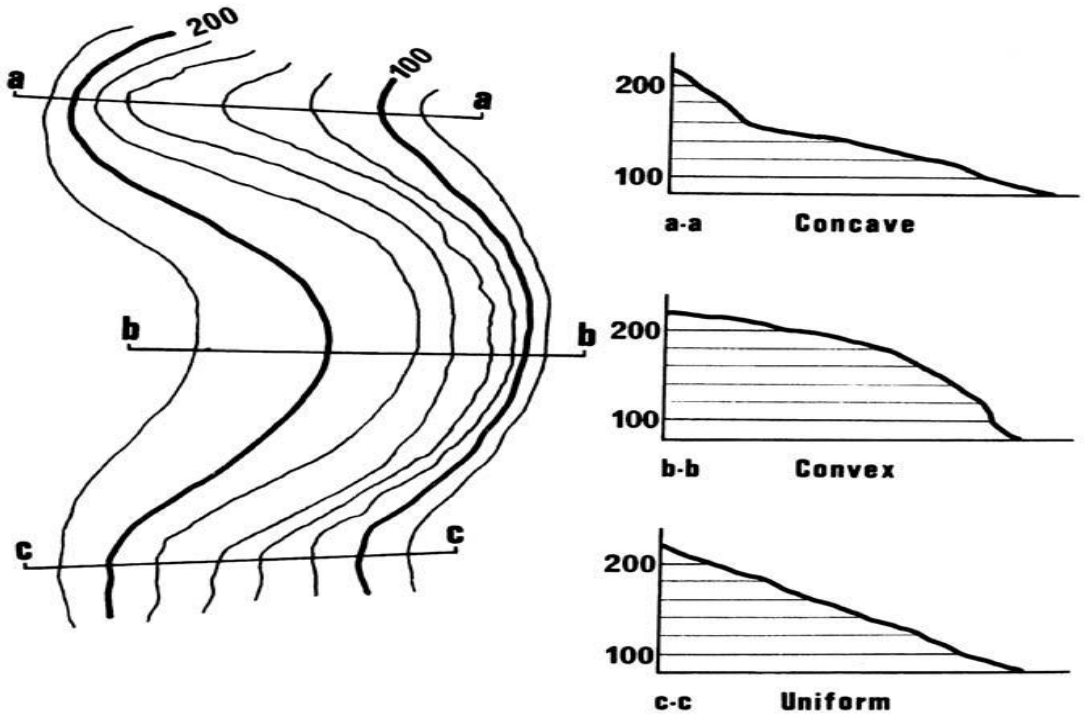


Figure6.10: *Contour Patterns*

A topographic map does not show landscape in the same way a photograph or a painting does. With practice, a map reader will be able to pick out small features, like streams or bridges, and learn to recognize symbols for many others which identify specific terrain. Hills and valleys are shown on the flat surface of a map by *brown* contour lines; these connect points of equal height throughout the area presented on the map. Lines are numbered to show the height of the ground in meters (or feet) above sea level. For example, a map reader following the course of a contour line would go neither uphill nor downhill but would stay on the same level. The drawing illustrates an imaginary hill which rises from sea level to 150 m; this is how it would appear on a map and how it would appear in cross section. Where lines are far apart, the ground slopes gently. Where they lie close together, the hill is steep. When lines are crowded, they show a cliff.

At the top of a large hill, the map may show a number, called a “spot location,” which represents the altitude of the crest.

The vertical distance between contour lines is called the “vertical interval” or “contour interval.” The horizontal distance between contours is called the “horizontal equivalent.”

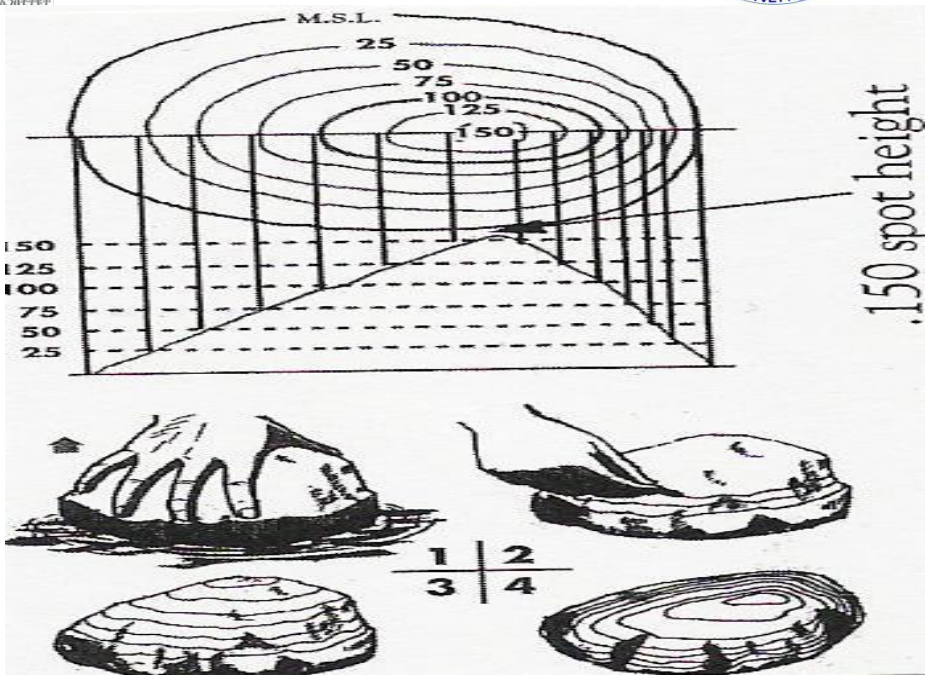


Figure6.11: *distance on contour*

REPRESENTATION OF HEIGHT

COMMON METHODS

Height without reference to shape is shown by fixing the height above sea level at selected points. Three common methods are described below in order of accuracy:

a. Bench Marks – These are the most precise heights and are usually permanent marks cut into stones built into walls, or, on the side of triangulation pillars. The height given is the height of the mark above sea level.

b. Trigonometrically (Trig) Stations – These are usually shown on maps and are normally defined on the ground by a mark in a concrete block under survey beacons.

c. Spot Elevations – These are less accurate heights and are not definite marks on the ground. They are selected to indicate the height of the ground at ruling points such as tops of hills. Their accuracy will vary, but are at least as accurate as contours. A contour line is drawn between points of the same height, so any single contour line will be at the same height all the way along its length. The height difference between separate contour lines is normally 5 meters, but it will be 10 meters in very hilly or mountainous areas. The map key will tell you the contour interval used.

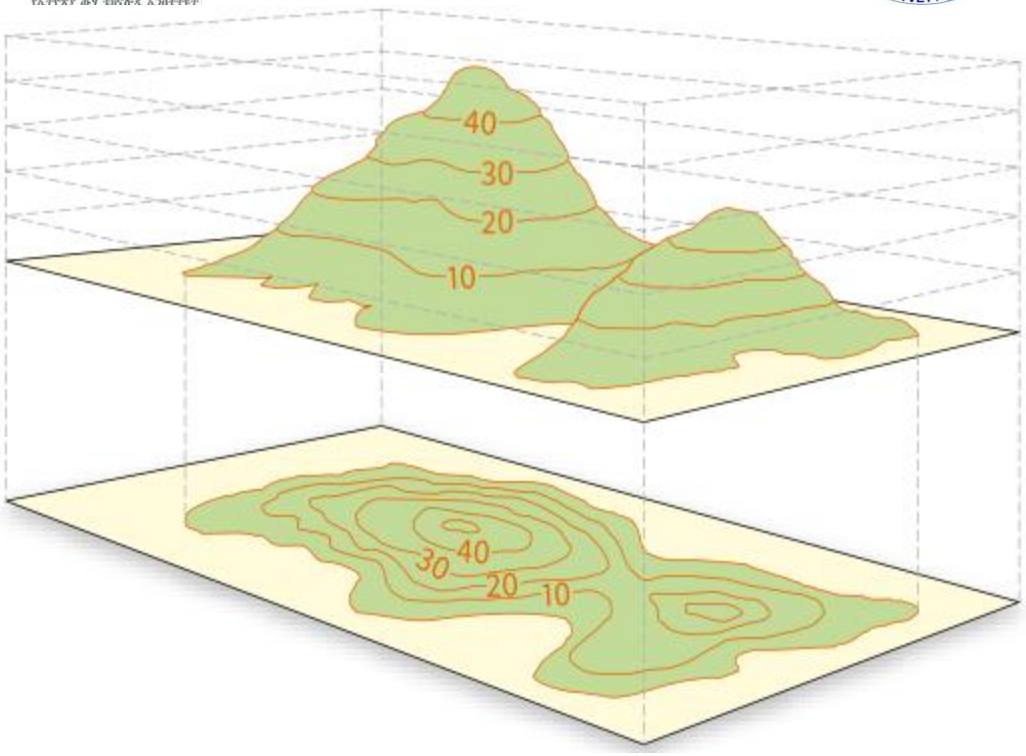


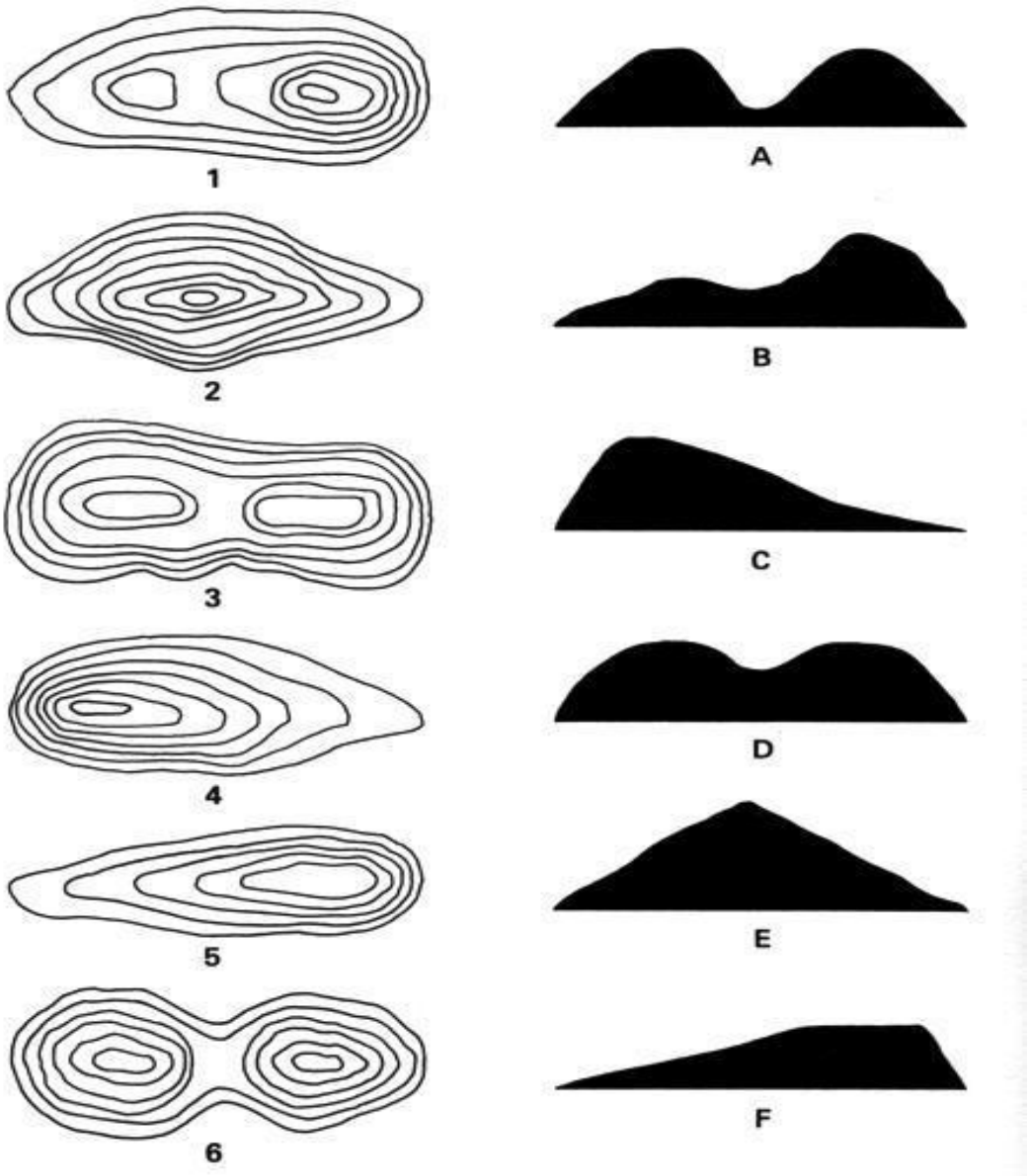
Figure6. 12: landscape and contour

The picture shown illustrates how a landscape can be converted into contour lines on a map. An easy way to understand and visualize contour lines is to think of them as high tide lines that would be left by the sea. As the water level drops it would leave a line every 10 meters on the landscape. These marks would be contour lines.

Self-Check -5	Written Test

Instruction I Answer the following questions accordingly

1. Match the contours on the left with the terrain on the right**.**



Answer Sheet

Score = _____
Rating: _____

1._____

2_____

3_____

4_____

5_____

6_____

Instruction Sheet: 7	Learning Guide #16: **Cleanup work area and maintain equipment**

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Cleaning, inspection and servicing equipments and work area
- Tagging and identifying faults unserviceable equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Equipment and work area are cleaned and inspected for serviceable condition in accordance with workplace procedures
- Unserviceable equipment is tagged and faults are identified in accordance with workplace procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the "Information Sheets 1and 2". Try to understand what are being discussed on pages 170 and 175.
4. Accomplish the "Self-check 1, 2, 3, 4, 5 and 6" on pages 173and 177
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information sheet:1	Cleaning, inspection and servicing equipments and work area

Cleaning Equipment and work area

- Drawing materials can be: Toxic, can cause physical injury by inhalation, ingestion or by skin contact. They can be irritating, causing inflammation of the skin, eyes, mucous membranes or pain. The following procedures can be considered as safety measures to undertake work safely as standards
  - ✓ Do not eat or drink from the work area (to avoid accidental ingestion).

    Familiarize yourself with substances that are dangerous.
  - ✓ Hands should be kept clean at all times during work.
  - ✓ Wash your hands thoroughly after working with baby oil, soap and water,
  - ✓ Keep the work area clean and try to keep it in order.
  - ✓ All drawing instruments should be kept clean with a cloth or towel.
  - ✓ Identify the location of the extinguishers and the first aid box.
  - ✓ Notify your boss of any health conditions or medications that may affect your work.
  - ✓ Always have adequate ventilation.
  - ✓ When using liquid drawing media such as ink try using those that are alcohol-based as they are less toxic.
  - ✓ Never paint your body with markers or drawing inks. Body painting should be done with cosmetic colors.
  - ✓ Try not to accept the measure.
  - ✓ Try to always keep the eraser free of ink and graphite.
  - ✓ Have a brush to wipe away any debris from the eraser.
  - ✓ Never deliver a project with small perforations caused by the use of the compass.
  - ✓ Always try to have a natural light entrance at your work place.

- ✓ When using the pencil sharpener, make sure your hands are clean and free from any trace of graphite.
- ✓ Never carry your work items into your mouth.
- ✓ Hand contact with the drawing sheet should be avoided.
- ✓ Rubbing or erasure should be done correctly with a soft eraser.
- ✓ If you suffer from allergies or have sensitive eyes, always try to protect your eye lenses.

- If you wear long hair, you should try to pick it up so it does not interfere with the process of drawing creation.
- Every 30 minutes try to rest your eyes for 10 minutes.
- Never leave glasses near the project being carried out.
- Try to have the least contact with the drawing in which you are working.
- Never support your elbows or body in the drawing project that is being carried out.
- Always try to make the entrance of natural light or the lamp you use to have a spotlight on the left.
- Hazards: Drawing inks are generally water based but there are some solvents that generally contain solvents such as xylene so precautions should be taken.
- Permanent felt tip markers used in the design or graphic arts contain solvents. Xylene, is a highly toxic aromatic compound
- New markers often contain propyl alcohol which, although less toxic, is irritating to the eyes, nose and throat. The greatest risk of using permanent markers is the use of them at close range.
- The pencil should always be kept sharp and should be used properly. It should be kept away from the drawing sheet and other instruments.
- The ink containers and all working instruments should be kept at a reasonable distance from the technical drawing work being executed.

- The paper in which you work should always be on the left side of the board and if you are left hander, on the right side.
- Always keep your drawings protected in a cylinder or folder that prevents them from becoming soiled.
- As far as layout lines are concerned, always make sure that they are sharp and that they are never blurred.
- When the compass is used, the mine must always be sharpened.
- Before submitting your project, look for a second opinion from a colleague who gives you his point of view regarding the hygiene of your drawing.

After finalizing your project, clean your work area, your instruments and always keep your area flawless.

Self-Check -1	Written Test

Part: I Choose the Correct Answers

1. _____can cause physical injury by inhalation, ingestion or by skin contact.

A. toxic B. hazard C. injury

2._____ can be irritating, causing inflammation of the skin, eyes, mucous membranes or pain.

A. toxic B. hazard C. injury

PART: II Fill the Blank Space

1. These colorful maps show lines that people use to divide countries and states. They also show major cities. _____
2. These maps show climate regions. _____
3. These maps show physical features on the Earth like rivers, mountains, and deserts_____

PART: III EXPLANATION

4. Distinguish between a map, plan and drawings
5. Name type of maps, plans and drawings
6. Write the role of drawing specifications

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer sheet

Score = _____

Rating: _____

Part: I choose the best answers

3. _____
4. _____

Part: III Fill the blank space

1. _____
2. _____
3. _____

Part: III Short Answer Questions

7. _____
   _____
   _____
   _____
   _____

2._____
_____
_____

Name Of Trainee: _____ Date: _____

Information sheet:2	Tagging and identifying faults unserviceable equipment

Tagging and Identifying faults unserviceable equipment

- Preventing the breakdown of a machine is much better than having to fix it after the event. A lot of time and money is spent on setting up an effective preventative maintenance schedule to avoid breakdowns.

- However, even with the best preventative maintenance program in the world, breakdowns will occur. When this happens qualified maintenance personnel are usually called in to make any repairs.

- The first step towards maintaining an effective preventative maintenance program is to have a running maintenance program and reporting procedures in place.

- An important part of any running maintenance program is identifying faults and using an appropriate sign system, called tagging, on faulty machines and equipment.

Tagging equipment

- When a machine breaks down or is faulty it must be locked out and tagged with a sign that can be easily seen by workers. This sign should be a clear warning to workers that the machine cannot be used until the necessary maintenance has been carried out.

- **Locking out** of equipment or machinery is the most effective way of preventing accidental operation while maintenance is carried out. Locking out is effective because it uses a "one key per lock" and "one lock per person" system.

  - ✓ If there is only one key per lock, the key has to be with the person carrying out the maintenance. Where more than one person is working on equipment or machinery a multi-lock system should be used. Each person must attach a 'personal' lock to the equipment or machine's multi-lock switch.

- ***Tagging :***There are two types of signs or **tags** used to warn workers that machines cannot be used:

  - ✓ **Danger** tags and

- ✓ **Out Of Service** or **Caution** tags.

These tags are used to indicate that the situation may constitute a hazard. They must be used in specified ways and whenever a machine or equipment has been identified as faulty or has broken down.

Self-Check -2	Written Test

Instruction I: Answer the following questions accordingly

1. What is the purpose of Tagging?
2. Write the two types of tagging types.
3. Explain tagging

Directions: Answer all the questions listed above. Use the Answer sheet provided in the next page

Answer Sheet

Score = _____

Rating: _____

1. _____
   _____
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2. .____
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3. .____
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Name of Trainee: _____ _____ Date: _____

Reference

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2. www.ordnanceservey .co.uk
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