MEM12001B

Use comparison and basic measuring devices

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Unit Resource Manual

Manufacturing Skills Australia Courses

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Forward your comments to:

BlackLine Design

blakline@bigpond.net.au

Sydney, NSW 2000

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Aims of the Competency Unit:

The unit covers sorting items using basic comparison measuring equipment, and maintaining the equipment.

Measurements are conducted in a production environment or at a work station. The work is undertaken autonomously or as part of teamwork. All comparative measurements are undertaken to standard operating procedures and to regulatory and legislative requirements.

Unit Hours:

20 Hours

Prerequisites:

None.

Assessment:

The assessment to determine competency for this unit is based on all Skill Practice Exercises being completed with at least 90% of all answers to the questions and instructions being correct.

Elements and Performance Criteria

1.	Use comparison and/or basic measuring devices	1.1	Measuring devices are identified and used to undertake required comparisons or measurements using standard operating procedures
		1.2	Checking or sorting of items is undertaken using comparison and/or basic measuring device according to standard operating procedures
2.	Maintain comparison and/or basic measuring devices.	2.1	Basic care and storage is maintained to manufacturers' standards or standard operating procedures

Required Skills and Knowledge

Required skills include:

- using device in accordance with standard operating procedures
- storing and maintaining devices
- using basic numeracy skills for undertaking comparison measurements following oral instructions and written standard operating procedures

Required knowledge includes:

- use and application of various comparison or measurement devices
- procedures for the correct use of devices
- procedures for maintaining and storing devices
- hazards and control measures associated with conducting measurements, including housekeeping
- safe work practices and procedures

Lesson Program:

Unit hour unit and is divided into the following program.

Topic	Skill Practice Exercise
Topic 1 – Comparison:	MEM12001-SP-0101 to MEM12001-SP-0106
Topic 2 – Graded Linear Measuring Devices:	MEM12001-SP-201 to MEM12001-SP-0204
Topic 3 – Non-Graded Linear Measuring Devices:	MEM12001-SP-301 to MEM12001-SP-030
Topic 4 – Comparison measuring devices:	MEM12001-SP-401 to MEM12001-SP-040

Contents:

Topic 1 – Comparison:

Required Skills:

- Verify all measuring devices before use.
- Carry out simple calculations.
- Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents.

Required Knowledge:

- Measurement techniques.
- Safe work practices and procedures.

Introduction:

Comparison is the examination of two or more items to establish similarities and dissimilarities while measurement is the number is in reference to some standard measurement (meter or kilogram). Measuring devices are seldom used when comparing. Comparison will not give the distance which can only be ascertained by estimation (approximate size) or measurement (exact size).

Tutorial Exercise MEM12001-TU-01:

For each of the following pairs of lengths, and compare which is the greater length?

a) 6.5 cm and 78 mm
b) 3.8 m and 370 cm

Solution:

To compare 6.5 cm to 78 mm the 6.5 cm must be converted to mm.

6.5 x 10 = 65 mm

Therefore 78 mm is greater than 65 mm

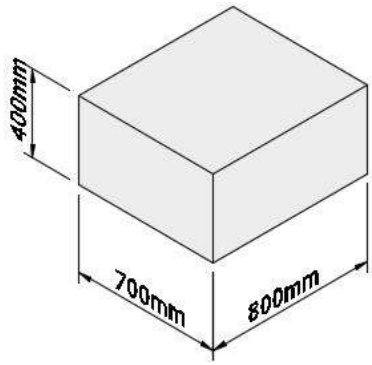
To compare 3.8 m to 390 cm the 3.8 m must be converted to cm.

3.8 x 100 = 380 cm

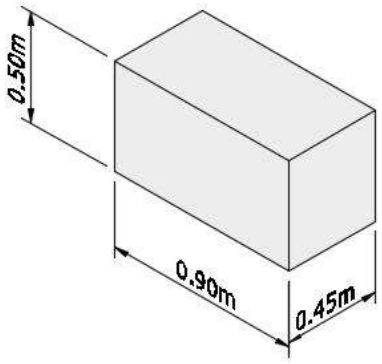
Therefore 390 cm is longer than 380 cm

Tutorial Exercise MEM12001-TU-02:

Compare the two boxes below to determine which one carries the most fluid.



Box A



Box B

Solution:

Calculate the volume of each box = L x H x W

First change the dimensions to the same units (m)

Box A: L = 700/1000 = 0.7m; H = 800/1000 = 0.8m; W = 400/1000 = 0.4m

Box A = 0.7 x 0.8 x 0.4 = 0.224 m^3

Box B = 0.9 x 0.45 x 0.50 = 0.2025 m^3

∴ Box A has the larger volume so will carry the most fluid.

Comparison of Lengths:

In order to compare lengths (or distances), it is essential that they are expressed in the same units, i.e. millimetres (mm) or meters (m).

The simplest method for starting to compare lengths of two or more objects is by observation by placing them side-by-side. Not only the length can be compared but also other attributes such as texture, colour or shape.

Workers can describe the length using words such as longer, longest, shorter, shortest, thick, thicker, thickest, wide, wider and width depending on the attribute they are comparing. Depending on the object being compared, the language may differ; in the case of a building the height could be expressed as height, higher, tall or taller. In the case of a tree words such as thin or thinner while words such as more extensive, less extensive, broad or broader for a river.

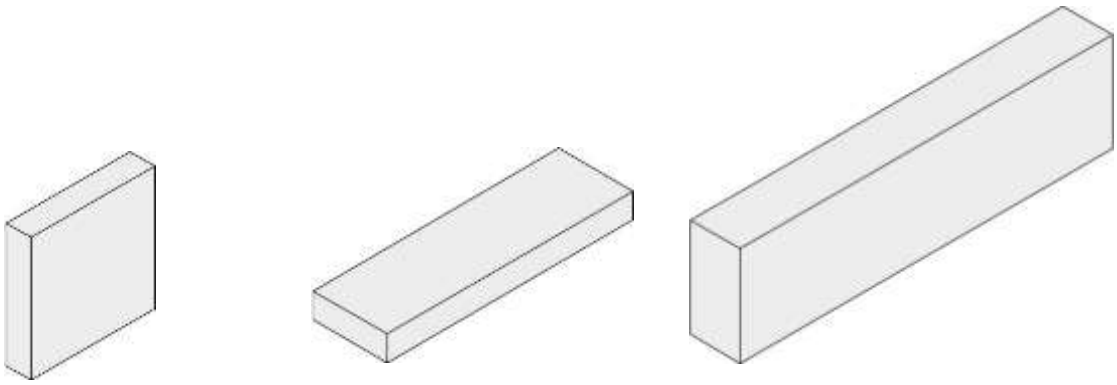


Figure 1. 1

Figure 1. 1 shows three different workpieces of metal; Workpiece A is taller than B or C while Workpiece C is the longest while comparing A to B, Workpiece B is longer. In the examples the three sizes of each workpiece can be compared to each other, all differ.

Terms relating to comparing length are, long, longer, longest, wide, wider, width, high, height, higher, highest, deep, deeper, deepest, thick, thicker, thickest.

Comparison of Angle:

The units of measurement used in conjunction with angles are degrees, radians and grads. Angles are measured using a protractor. There are three types of angles, acute which is between 0° and 90°, obtuse which is between 90° and 180°, and a straight angle which is exactly 180°. Acute angles are "sharp" angles while obtuse are "blunt" angles.

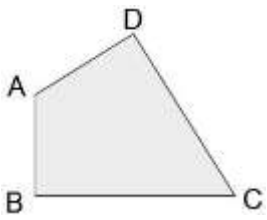


Figure 1. 2

Figure 1. 2 shows a gusset plate for a structural steel tower and has 4 corners marked A, B, C & D. Corner A is an obtuse angle and is blunter than corners B, C, or D. Corner C is an acute angle and is therefore smaller than corners A, B or D. Corners B & D appear to be similar or the same and are right angles or one edge is perpendicular to the second.

Words used when comparing angles are larger or smaller, shorter or blunter, greater or lesser.

Comparison of Temperature:

Most people think temperature in terms of degree Celsius and degrees Fahrenheit but in reality there are six other temperature scales, those being Kelvin, Rankine, Delisle, Newton, Réaumur and Rømer. As a comparison, water freezes at 0° Celsius, 32° Fahrenheit, 273.15° Kelvin, 491.67° Rankine, 150° Delisle, 0° Newton, 0°Réaumur and 7.5° Rømer.

Without using a thermometer, the only way to determine temperature difference depends on the materials being compared. If water was being heated expressions such as tepid, mild, warm hot or boiling could be used while metals could use colour terms such as hot, red-hot, white-hot and melting.

The most common use of temperature comparison is when one walks from an air-conditioned building to the outside environment. By comparison it is either too hot or too cold but the comparison is easy to make.

Charts and graphs can also be used for comparing different scales of temperature degrees as shown in

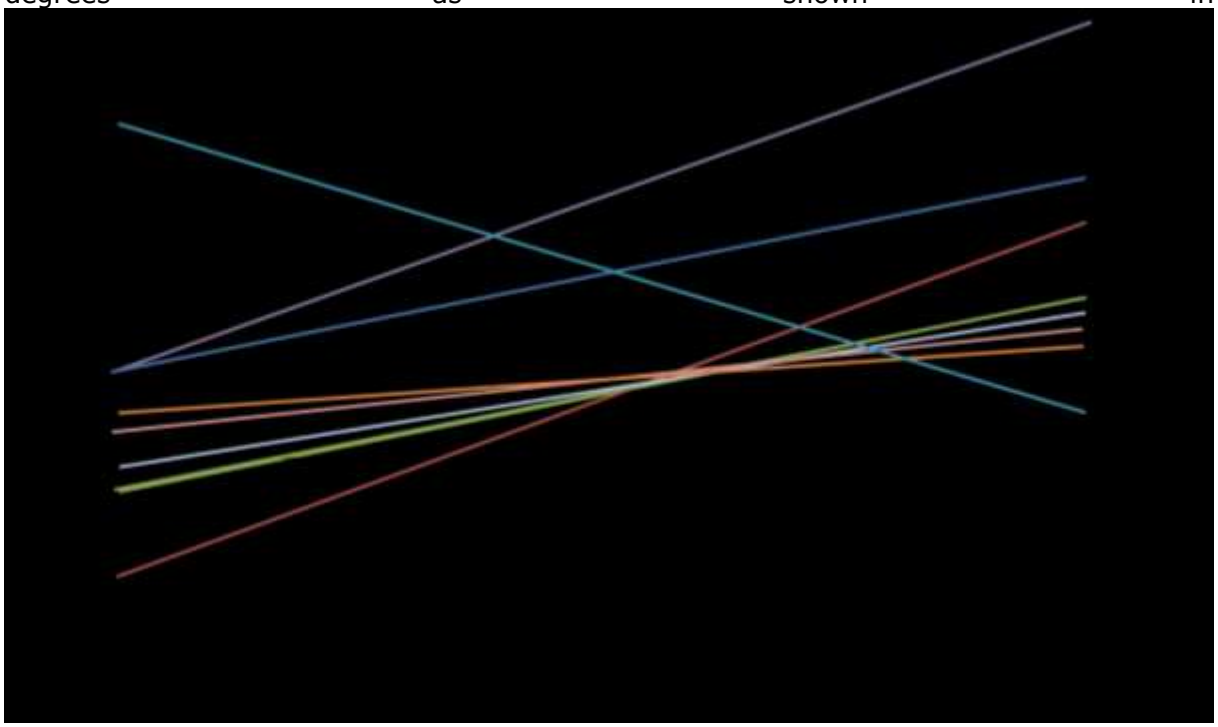


Figure 1. 3 Comparison of Temperature Scales. By reading across the graph similar temperatures can be compared using the different scales.

Terms relating to comparing temperature are, low, lower, high, higher.

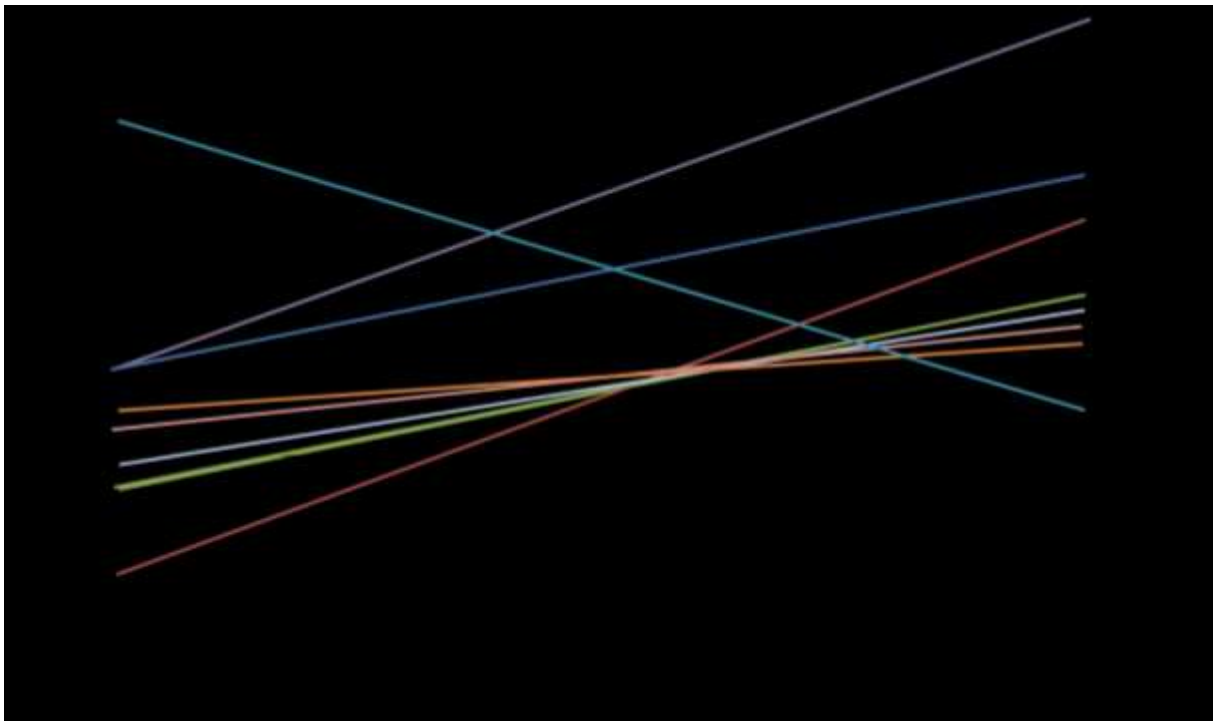


Figure 1. 3 Comparison of Temperature Scales

Comparison of Pressure:

Pressure (P) is defined as the amount of force (F) acting per unit area (A). The mathematical equation for pressure can be written as:

P= F/A.

Typical measurement units are BAR, Pa (Pascal), InHg (Inches of Mercury) and InH_2O (Inches of Water)

Pressure is present all around us; in medical terms high blood pressure can lead to a heart attack or stroke and also affect the kidneys. A typical blood pressure reading is 120/80mmHg.

Atmospheric or barometric pressure is the pressure exerted by the weight of air in the atmosphere of Earth. In most circumstances atmospheric pressure is closely approximated by the hydrostatic pressure caused by the weight of air above the measurement point. The average sea-level pressure is 1013.25 mbar.

All matter is made up of tiny particles called atoms. The forces that exist in fluids are caused by the mass and velocity of these atoms making up a fluid. The pressure exerted by a static fluid depends only upon the depth of the fluid, the density of the fluid, and the acceleration of gravity.

Vapour pressure (or equilibrium vapour pressure) is the pressure (at a given temperature) that is exerted by a gas in equilibrium with either a solid or liquid that is in a closed container. The equilibrium vapour pressure is an indication of a liquid's evaporation rate. Vapour pressures increase with temperature. The vapour pressure is an indication of a liquid's evaporation rate.

In engineering high pressure can rupture pipes and fittings if the pressure becomes excessive. Pipes carrying the same fluid at the same pressure can be compared be sight and feel; flexible pipes may expand under excessive pressure while the pipes may feel hotter.

Terms relating to comparing pressure are, low, lower, high, higher.

Comparison of Weight:

In engineering, the weight of an object is usually taken to be the force on the object due to gravity. The weight (W) of an object is calculated as the mass of the object (m) multiplied by the magnitude of the local gravitational acceleration (g) and is expressed as:

$$W=mg$$

The SI unit of weight is the same as that of force: the newton (N) – a derived unit which can also be expressed in SI base units as kg·m/s2 (kilograms times meters per second squared).

In commercial and everyday use, the term "weight" is usually used to mean mass, and the verb "to weigh" means "to determine the mass of" or "to have a mass of". Used in this sense, the proper SI unit is the kilogram (kg).

Gross weight is a term that is generally found in commerce or trade applications, and refers to the total weight of a product and its packaging. Conversely, net weight refers to the weight of the product alone, discounting the weight of its container or packaging; and tare weight is the weight of the packaging alone.

The only way to determine the weight of an object is to weigh it using scales. Objects made of the same material can be compared by observation however a 500 mm x 500 mm x 500 mm block of aluminium weighs 320 kg, while the same object in lead is 1,418 kg and gold would be 2,415 kg.

Terms relating to comparing weights are, light, lighter, lightest, heavy, heavier and heaviest.

Comparison of Voltage:

Voltage, or electromotive force, is the potential difference in charge between two points in an electrical field. In other words, voltage is the "energy per unit charge" and is identified by the unit V.

Current is the rate at which electric charge flows past a point in a circuit. In other words, current is the rate of flow of electric charge and is identified by the unit A (amps).

Voltage can be compared using a comparator which is a circuit that accepts two voltages, V_1 and V_2 and outputs zero volts if V_1 is greater than V_2 or outputs a positive voltage level if V_2 is greater than V_1.

Terms relating to comparing voltage are, low, lower, high, higher.

Comparison of Resistance:

Resistance is a force that acts to stop the progress of something or make it slower. Typical examples are electrical resistance, gasses and fluids in a pipeline, friction between two surfaces in motion.

In electrical industry, resistance is the opposition that a substance offers to the flow of electric current. It is represented by the uppercase letter R. The standard unit of resistance is the ohm, sometimes written out as a word, and sometimes symbolized by the uppercase Greek letter omega (Ω).

In hydraulic engineering resistance to flow is called viscosity which is the amount of internal friction or resistance to flow. Water, for instance, is less viscous than honey, which explains why water flows more easily than honey. Resistance is also caused through shape and drag. Fluids and gasses experience a resistance or drag due to the viscous force of the substance motion against the pipe's surface. Another source of resistance is pressure drag, which is due to a phenomenon known as flow separation. This happens when there is an abrupt change in the shape of the moving object, and the fluid is unable to make a sudden change in flow direction and stay with the boundary.

In a theoretical situation, given a pipeline of infinite length with an infinite number of components while fluid is forced into one end, the resistance built up inside the pipe can result in no fluid coming out the other end.

Terms relating to comparing resistance are, low, lower, lowest, high, higher and highest.

Skill Practice Exercises:

Skill Practice Exercise MEM12001-SP-0101.

Compare the containers shown in Figure 1. 4 and Figure 1. 5 and then select the simplest shape to be developed and constructed.

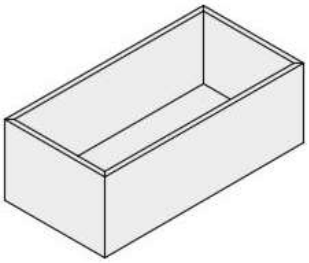


Figure 1. 4 – Rectangular Container

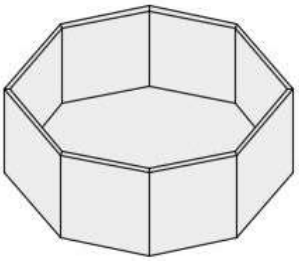


Figure 1. 5- 9 Sided Container

Skill Practice Exercise MEM12001-SP-0102.

Compare the 3 mild steel bars below and determine which bar is the longest.

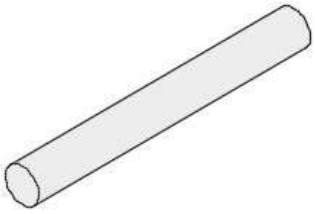


Figure 1. 6 – Large Diameter

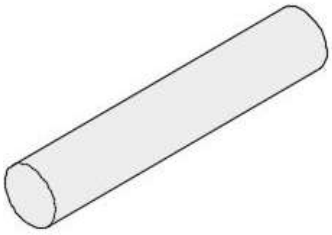


Figure 1. 7 – Medium Diameter

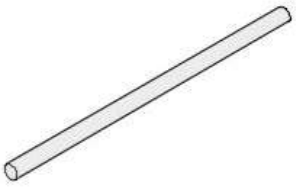


Figure 1. 8 – Small Diameter

Skill Practice Exercise MEM12001-SP-0103.

Compare the angles of the corners and lengths of each side of the pentagonal shape and determine the corner with the largest angle and longest side.