**Chapter 1: Measurement**

Measurement is widely used in business and industry, in science and technology, in manufacturing and engineering, as well as in many aspects of daily living.

Measurement gives a number to a particular characteristic of a person, an object or a concept. When measurements are made, they are expressed quantitatively as numbers. This, therefore, entails the study of the standard u8nits of measure and the proficient use of measuring devices.

Ancient people made use of counting to measure objects and distances. Now, modern technology makes possible the use of measuring devices such as counters, scales, meters, transits, spectroscopes, and the like.

**1.1: The History of Measurement**

The idea of measurement dates back to the ancient civilizations of Egypt, Babylonia and China. Through trade and conquest, systems of measurements spread to other parts of the world.

**The Ancient System**

The ancient system of measurement makes use of body parts.  
The basic units used by the early Egyptians are:

*Cubit:* the length of the distance from the elbow to the extend fingertip  
*Digit:* the subdivisions of the cubit, supposed to be a finger’s breadth  
*Small span/large span:* the length of the distance covered with the palms of the hand.

The basic unit used by the early Babylonians is:

*Mina: the earliest known unit of weight.*

The basic units used by the early Greeks are:

*Finger:* the basic unit of length  
*Olympic cubit:* the equivalent of twenty four fingers  
*Talent:* the basic unit of weight  
*Metrites:* the basic unit of liquid measure

The Chinese system of measurement employed parts of the body, such as the distance from the pulse to the base of the thumb.

*Shih/Tan:* the basic units of weight  
*Chih/Chang:*  the basic units of length

The standard measure for grain included its *weight* and its *pitch* when struck. This gives the reason why the inclusion of the acoustic dimension is its unique characteristic. Another characteristic of the Chinese measure is the use of the *decimal notation.*

**The Medieval System**

The medieval system of measurement was an offshoot of the Roman system which was a mixture of the Babylonian, the Egyptian and the Chinese systems.

*Libra:* the medieval unit of weight  
*Roman mile:* the unit of measure for distance with varying number of feet and yards.  
*pinte:* the basic unit of liquid measure  
*quart:* the unit of dry measure similar to the modern English quart.

**The English System**

The English system used by Great Britain and its colonies:  
 *inch:* length of 3 barley corns  
 *foot:* length equivalent to 12 inches  
 *yard:* the standard unit of length divided into 3 feet  
 *perch:*  equivalent to 5.5 yards  
 *acre:* 4 rods wide by 40 rods long  
 *furlong:*  standardized as one-eighth of a mile  
 *English Pound:*  a troy weight  
 *avoirdupois:*  used for goods that had to be weighed  
 stone: a multiple of the English pound

**The Metric System**

The metric system came about as a result of the French Revolution. By 1799, a new law in France defined the standard units of measure.

*Meter:* for length  
 *gram:* for weight  
 *liter:* for liquid volume  
 *are:* for area  
 *stere:*  for volume

**The International System**

The *Systeme International d’ Unites* (SI) was extablished in October 1960 by the 11th General Conference on Weights and Measures in Paris.  
 *meter:  
 kilogram:  
 second:  
 ampere:*

**1.2: Measures and Measuring Devices**

The results of measuring are merely near approximations since measurements a re not always exact. There is often a relative error involved.  
 Accuracy of measurements depends on two factors:  
 1. The skill of the person doing the measuring; and  
 2. The precision of the instrument used in measuring.  
 The first factor can easily be developed through constant practice while the second factor is totally dependent upon the measuring device.  
 As noted from the development of measurements as well as observed from daily life activities, different quantities require different units of measure and different measuring devices.  
 Originally, our forefathers made use of their body parts to measure lengths and distances. Unfortunately, these nonstandard units proved inconvenient, paving the way for standardized units like the metric system or *Systeme International d’ Unites* (SI). This system of measurement is the one commonly used by most countries today.

**1.2.1: Measure of Length**

The fundamental unit of length in the metric system is the *meter*. It is a decimal system for measurement where multiples and fractions of the basic unit(meter) correspond to powers of ten.

**TEST YOURSELF  
 Choose the most realistic unit of measure for each.**

1. Length of a ballpen
2. Width of a blackboard
3. Thickness of a notebook
4. Length of a pair of pants
5. Height of a tree
6. Height of a 12 year old boy
7. Length of a curtain material
8. Width of a street
9. Diameter of a 5c coin
10. Thickness of a glass

**Convert the following. (Use the metric converter.)**

1. 2km to m = **2000 m**
2. 354 cm to m = **3.54 m**
3. 7.15 m to cm = **715 cm**
4. 275 dm to m = **27.5 m**
5. 80 mm to m = **0.08 m**
6. 2650 m to km = **2.65 km**
7. 0.09 m to mm = **90 mm**
8. 8.75 m to km = **0.00875 km**
9. 60.8 km to m = **60,800 m**
10. 4585 cm to m = **45.85 m**

**PROBLEMS**

1. **A boy ran a distance of 5.8 kilometers . How many meters did he run?**
   1. **5.8 x 1000 = 5,800 meters**
2. **A car traveled a distance of 23.6 kilometers. How many meters did the car travel?**
   1. **23.6 x 1000 = 23,600 meters**
3. **A piece of wood is 470 centimeters long. How long is it in meters?**
   1. **470 x 0.01 = 4.7 meters**
4. **Loida walked 204 meters to her classmate’s house and together they walked 523 meters to school. How many kilometers was covered by Loida alone?**
   1. **204 x 0.001 = 0.204 kilometers**
5. **Ben traveled a distance of 126 kilometers in 2 ½ hours. How many meters did Ben travel? How many minutes did it take him to travel 126 kilometers?**
   1. **126 x 1000 = 126,000 meters.**
   2. **(2 x 60) + (60/2) = 120 + 30 = 150 minutes.**
6. **Jose walks 378 meters while Rene walks 0.67 kilometer. What is the difference between the distances they walked in centimeters?**
   1. **((0.67 x 1000) - 378) x 100 = (670 - 378) x 100 = 29,200 centimeters**
7. **A book is 48 millimeters thick. How thick is the book in centimeters?**
   1. **48 x 0.1 = 4.8 centimeters.**
8. **Luisa needs 2.3 meters of cloth for her project. How many decimeters of cloth does she need?**
   1. **2.3 x 10 = 23 decimeters.**