Measurement: Comparison to a standard

Cubit

A cubit is a unit of linear measure, from the elbow to the tip of the longest finger of a man. This unit is commonl converted to 0.46 meters or 18 inches, although that varies with height of the man doing the measurement. There is also cubit that is longer than a regular cubit by a handbreadth. (Ezekiel 43:13)

Yard -

Foot -

Qualities of a good standard:

-

-

-

Why do we need a standard "standard"?

The M.K.S. system of units is used in science:

Meter - m - how far light travels in 1/299792458 s

Kilogram - kg - the mass of a platinum-iridium cylinder.

Second - s - defined in terms of the frequency of a particular radiation

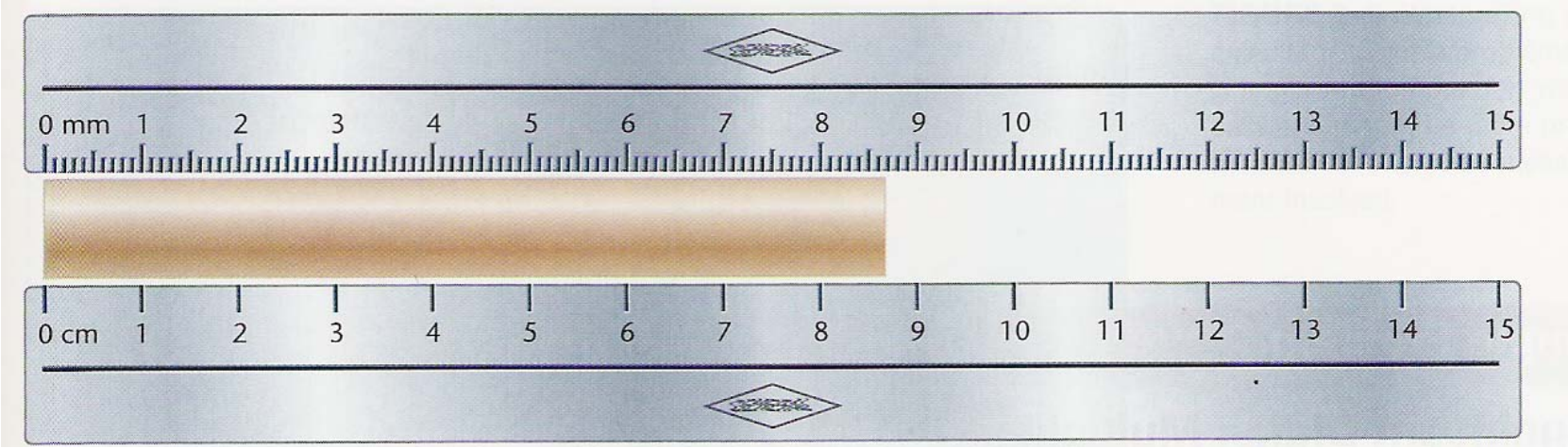

CUBIT
HAND
FOOT
PACE

FIGURE 2–1 The Metric Conversion Act became law in the United States in 1975.

Significant Digits

All measurements are made to some limited accuracy.
We record ONE AND ONLY ONE estimated digit.

The number of digits depends upon the measuring instrument being used as well as the magnitude of the measurement itself



http://ionaphysics.org/ntnujava/ruler/vernier.html

Zeroes:

Nonzero digits are always significant.
Zeroes between nonzero digits are always significant.
Leading zeroes are never significant.
Trailing zeroes are significant ONLY if the decimal point is explicit.

Doing Arithmetic

When doing arithmetic with measured quantities, the answer can never be more precise than the least precise measurement.

+- answer has as many decimal places as the measurement with the fewest number of decimal places.

X / answer has as many significant digits as the measurement with the fewest number of significant digits.

Problem:
What is the area of a rectangular field 125.4 m long and 5.3 m wide? (area = length x width)

What is the perimeter of that field?

Fundamental Units and derived units

Fundamental Units

Meter, Kilogram Second, kelvin, mole, ampere, candella

Any other units are derived: m^2 , m/s, m/s^2, and so on

Solve the following problems. Write your answer

6. a. 5×10^{-7} kg + 3×10^{-7} kg

b. 4×10^{-3} kg + 3×10^{-3} kg

c. 1.66×10^{-19} kg + 2.30×10^{-19} kg

d. 7.2×10^{-12} kg − 2.6×10^{-12} kg

7. a. 6×10^{-8} m^2 − 4×10^{-8} m^2

b. 3.8×10^{-12} m^2 − 1.90×10^{-11} m^2

c. 5.8×10^{-9} m^2 − 2.8×10^{-9} m^2

d. 2.26×10^{-18} m^2 − 1.8×10^{-18} m^2

8. a. 5.0×10^{-7} mg + 4×10^{-8} mg

b. 6.0×10^{-3} mg + 2×10^{-4} mg

c. 3.0×10^{-2} pg − 2×10^{-6} ng

d. 8.2 km − 3×10^{2} m

Homework page 22
6 a,b,c,d
#7 a,b,c,d

Page 23
#9 a,b,c,d
10 a,b,c,d

Find the value of each of the following quantities.

9. a. $(2 \times 10^{4}\ \text{m})(4 \times 10^{8}\ \text{m})$

b. $(3 \times 10^{4}\ \text{m})(2 \times 10^{6}\ \text{m})$

c. $(6 \times 10^{-4}\ \text{m})(5 \times 10^{-8}\ \text{m})$

d. $(2.5 \times 10^{-7}\ \text{m})(2.5 \times 10^{16}\ \text{m})$

10. a. $\dfrac{6 \times 10^{8}\ \text{kg}}{2 \times 10^{4}\ \text{m}^3}$

b. $\dfrac{6 \times 10^{8}\ \text{kg}}{2 \times 10^{-4}\ \text{m}^3}$

c. $\dfrac{6 \times 10^{-8}\ \text{m}}{2 \times 10^{4}\ \text{s}}$

d. $\dfrac{6 \times 10^{-8}\ \text{m}}{2 \times 10^{-4}\ \text{s}}$

11. a. $\dfrac{(3 \times 10^{4}\ \text{kg})(4 \times 10^{4}\ \text{m})}{6 \times 10^{4}\ \text{s}}$

b. $\dfrac{(2.5 \times 10^{6}\ \text{kg})(6 \times 10^{4}\ \text{m})}{5 \times 10^{-2}\ \text{s}^2}$

12. a. $(4 \times 10^{3}\ \text{mg})(5 \times 10^{4}\ \text{kg})$

b. $(6.5 \times 10^{-2}\ \text{m})(4.0 \times 10^{3}\ \text{km})$

c. $(2 \times 10^{3}\ \text{ms})(5 \times 10^{-2}\ \text{ns})$

13. a. $\dfrac{2.8 \times 10^{-2}\ \text{mg}}{2.0 \times 10^{4}\ \text{g}}$