Science & Measurement

A. The Science of Nature

* 1. Science is the total collection of knowledge gained by man's observation of the "physical" universe.

2. Science tries to answer the questions how and what (not why).

B. Two main types of science

1. Pure science – attempts to gain new knowledge; discoveries; research.

2. Applied science (technology) is the use of science in practical ways.

C. Physical Science

1. Physics – study of energy & motion.

2. Chemistry – study of matter and the changes it undergoes.

3. Earth Science – study of the Earth in general.

a. Geology & Geophysics

b. Hydrology & Oceanology

c. Meteorology & Climatology

4. Astronomy – study of matters beyond earth

a. Cosmology

b. Astrophysics

D. Limitations of Science

1. Cannot make value judgments.

2. Cannot prove a universal negative.

3. It is as limited as our instruments.

E. Scientific Statements

1. Facts – observable and indisputable.

2. Data – information gained from experimentation.

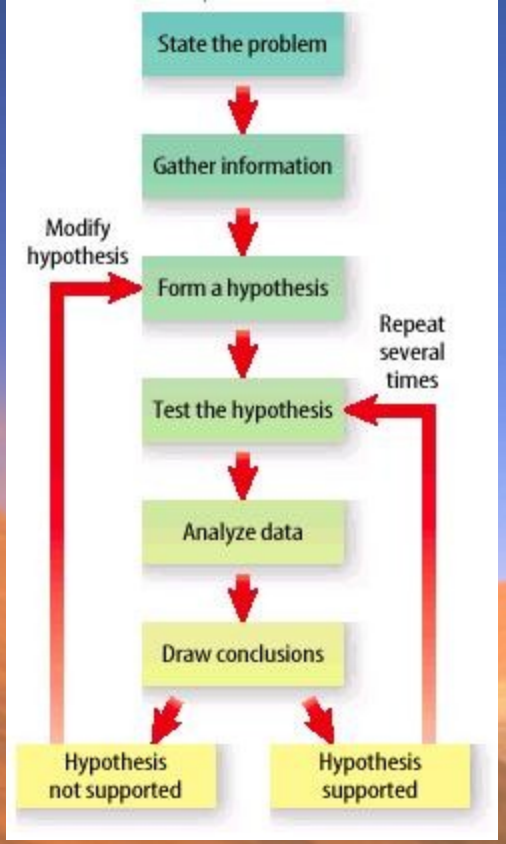
3. Laws – statements that describe patterns in nature with no known exceptions.

4. Theories – explanations based on evidence (may be wrong).

5. Models – man-made ideas to help us visualize scientific concepts.

F. The Scientific Method

1. Identify the problem (in the form of a question).
2. Gather information by research.
3. Form a hypothesis (an educated guess).
4. Experimentation.
5. Analyze data & make conclusions.
6. Make predictions.



G. Scientific Experimentation

1. An experiment is a controlled test.

2. Only one variable should be changed at a time.

   a. Manipulated (independent) – changed by the experimenter.

   b. Responding (dependent) – the effect.

3. Constants do not change.
4. Controlled variables are those which could change, but are not allowed to.
5. Two parts to an experiment:
    a. Control group – normal conditions.
    b. Experimental group(s) – variables are changed.
6. Prediction is the goal of experiments.

H. SI - International System of Units

1. Based on multiples of 10
2. Common metric prefixes:
   a. mega- (M) 1 000 000 x
   b. kilo- (k) 1 000 x
   c. hecto- (h) 100 x
   d. deka- (da) 10 x
   e. deci- (d) 0.1 x (1/10)
   f. centi- (c) 0.01 x (1/100)
   g. milli- (m) 0.001 x (1/1000)
   h. micro- (u) 0.000 001 x

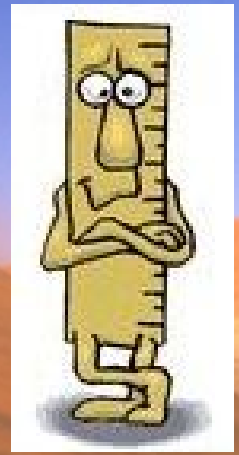
I. Types of Measurements

1. Length

a. The distance from one point to another point.

b. Base unit is the meter (m).

c. Tool is the metric ruler.



2. Volume

a. The amount of space a substance occupies.

b. Base unit is the liter (L).

c. Tools: metric ruler for regular solids or graduated cylinder for liquids.

3. Mass

a. The amount of matter in a sub

b. Base unit - kilogram (kg).

c. Tool is the balance.

4. Weight

a. A measure of gravitational force on an object.

b. Unit is the newton (N).

c. Tool is the scale.

5. Time
    a. How long an event takes to occur.
    b. Unit is the second (s).
    c. Tool is the clock (stopwatch).
6. Pressure
    a. The amount of force exerted per unit area.
    b. SI unit is the Pascal (Pa).
    c. Tool is the manometer/ barometer.