CC **Topic I**

Introduction to Earth's Changing Environment

I. **Earth Science** - study of the earth, and the universe around it
   A. Branches (careers) in Earth Science
      1. Geology - study of the earth itself... its origin, history, structure, and processes
      2. Astronomy - study of the solar system and the stars (universe)
      3. Meteorology - study of atmospheric conditions (weather/climate)
      4. Oceanography - study of the oceans... their waves, tides, and currents

II. Describing things in science
   A. Observation – occurs through interaction of the **senses**
      ex. the shirt is green
      1. instruments – devices that extend the normal range of our senses (still are observations)

   B. Inference – an **interpretation** of observations (figure out in your head)

III. Classification
   A. Grouping of things based on observed properties
      1. makes order out of chaos

IV. Measurement –comparing an object to a known standard
   A. it expresses an observation with greater **precision**

   B. 3 dimensional quantities
      1. length - a distance
      2. mass - quantity of matter
      3. time - how long it take

   C. Many measurements combine these dimensions
      1. volume
      2. density see Ref. Tables ... p. 1
      3. gradient see Ref. Tables ... p. 1

   D. When doing calculations, you **MUST** include the units (labels)
      ex. volume = lwh
      10cm x 5cm x 2 cm = 100 cm^3

E. 3 important words:

word	definition	how found	units
1. MASS	quantity of matter	triple beam balance	grams
2. VOLUME	space something takes up	lwh or graduated cylinder	cm^3 or ml
3. WEIGHT	pull of earth's gravity for an object	spring scale	pounds (or newtons)

V. Percent deviation (percent error)

A. A way of calculating how far a **measured** value is off from the ***accepted*** value.

B. Use equation:

$$\text{dev.}(\%) = \frac{\text{difference from accepted value}}{\text{accepted value}} \times 100$$

sample:

If the measured value is 24 cm and the accepted value is 25 cm, what is the percent deviation?

$$\text{dev.}(\%) = \frac{\text{dif. from a.v.}}{\text{a.v.}} \times 100 \qquad \text{dev.}(\%) = \frac{25\text{cm} - 24\text{cm}}{25\text{cm}} \times 100 \qquad \text{dev.}(\%) = 4\%$$

B. Sometimes, **YOU** must get the accepted value from the Ref. Tables.

VI. Density - how tightly packed (concentrated) the matter of a substance is

A. Comparing 2 "rocks"

1. **Real** rock = **tightly** packed = **high** density
2. **Fake** styrofoam rock = **loosely** packed = **low** density

B. See equation . . . Ref. Tables ... p.1

$$\text{Density} = \frac{m}{V}$$

mass = quantity of matter

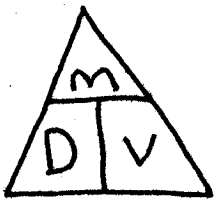
volume = the space it takes up

sample:

If an object's mass is 25g and its volume is 10 cm^3, what is its density?

$d = \frac{m}{v}$ $d = \frac{25g}{10\ cm^3}$ $d = 2.5\ g/cm^3$

MUST include units

C. 

- used to find **one** unknown in density equation

C. Factors affecting density

1. Temperature – when most things get **hot**, they expand, becoming **less tightly packed**, and their density **decreases.**

(opposite is true when they get **cold**...they **contract** and density **increases**)

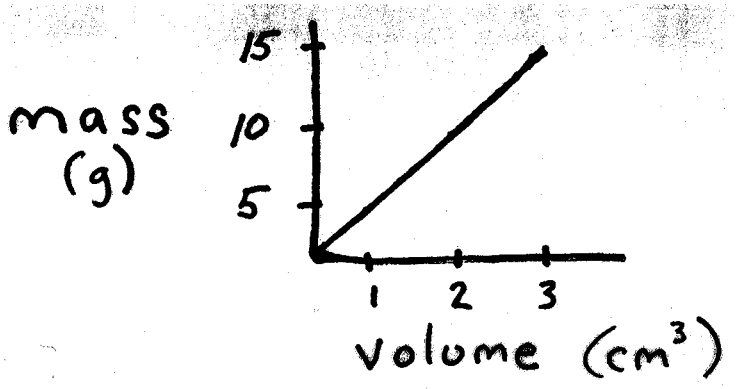
2. Pressure – squeezing things makes them compress, making them become more tightly packed, and their density increases.

(opposite is true when they **expand**... their density **decreases**)

N O T E: Cutting an object in half (or ANY size piece) will **NOT** affect its density. . . each piece will have the same density as the original!!

D. Density shown on a graph

1. Compares mass and volume of a substance.



Any two coordinates from the graph will yield the same density (when they are divided using the equation m/v .)

1. The **steeper** the graph line, the **greater** the density it represents.

VII. Flotation

A. If the density of an object is LESS than the density of the liquid it is immersed in, then that object will FLOAT.

1. The lower the density, the higher it will float.

B. Density of water is 1g/ml (Ref. Tables ... p.1), so...

- a density > 1 will sink in water
- a density < 1 will float in water
- a density = 1 will suspend within the water

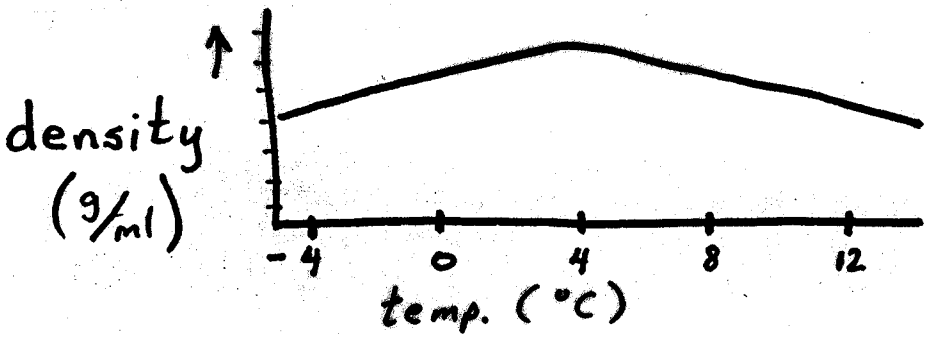
VIII. Phases (states) of matter (on earth)

(except for water):

A. solid	-	most dense	-	coldest
B. liquid	-	medium dense	-	medium
C. gas	-	least dense	-	hottest

1. Exception is water . . . reaches its maximum density at **4 ^{o}C**

a) all other temperature water (or ice) is ***less*** **dense**



b) Any **4 ^{o}C** water (the heaviest) will be at the **bottom** of the lake

c) This is why ice floats . . . is less dense (at 0 ^{o}C) than the surrounding water

IX. The Changing Environment

A. Environment is always changing

1. the change is called an **event**
   a) instantaneous (fast) - lightning
   b) long-term - erosion of a mountain (hardest to measure)

B. Frames of reference – change is described in comparison to:
   1. time
   2. space (value)

C. Rate of change Ref. Tables ... p. 1
   1. Tells how quickly a change occurs

      sample:
      If the temperature drops from 75°F to 65°F in 20 minutes, what is the rate of change?

$$\text{rate of change} = \frac{\text{change in value}}{\text{time}}$$

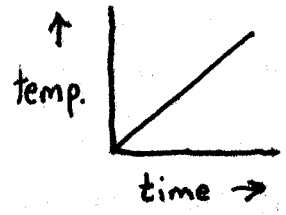
$$\text{rate of change} = \frac{75^\circ F - 65^\circ F}{20 \text{ min}}$$

$$\text{rate of change} = 0.5 \, ^\circ F/\text{min}.$$

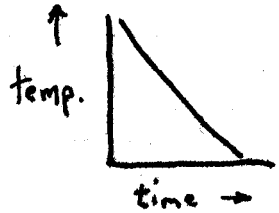
X. Graphing
   A. Shows relationship between 2 (or more) variables
      1. Independent variable – will NOT change due to experiment
         ex. time
         a) the **X-axis** (horizontal)
      2. Dependent variable – changes from experiment to experiment
         ex. temperature
         a) the **Y-axis** (vertical)

   B. Plotting points
      1. set up the scales (numbers) on the X and Y axis (if not given already)
         NOTE: The intersection of the X and Y axis need not be 0,0
         a) use the data (numbers) in data table as a guide
            NOTE: Always **LABEL** your X and Y axis
            NOTE: Your scale should make use of as much of the graph paper as possible.
      2. Make a dot (plot) where the two numbers intersect for each pair in the data table.
      3. Connect the plots with a line
         a) Sometimes the line will be straight, other times it will be curved.
         b) You may extend the line beyond the plots. This is often done to make predictions.

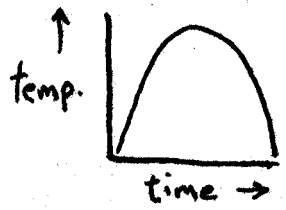
C. Understanding graph relationships

1. 

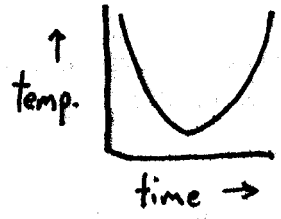
warmer as time goes on
(a **direct** relationship)

2. 

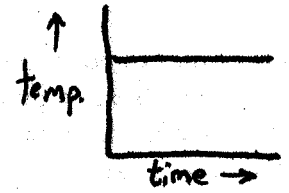
Colder as time goes on
(an **indirect** relationship)

3. 

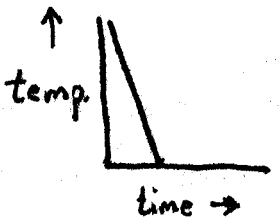
warms first, then cools

4. 

cools first, then warms

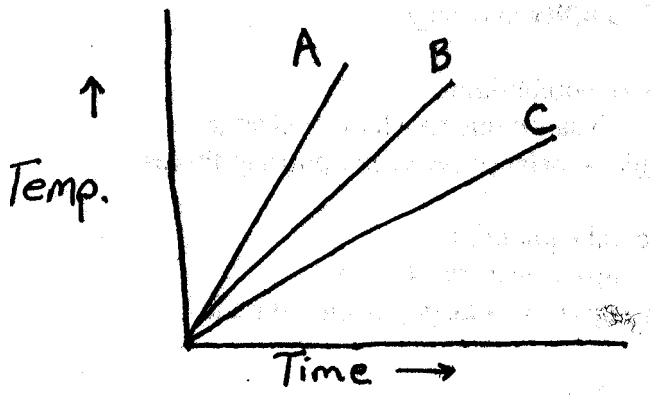
5. 

no change as time goes on

6. 

a RAPID change (drop) since line is steep

D. Several plots on one graph



XI. Cyclic changes (most earth changes are cyclic)

A. Occur in some orderly fashion that repeats regularly
ex. moon phases, eclipses, atmospheric carbon dioxide

1. **predictions** - can be best made if a change is
   a) cyclic (repeating)
   b) observed over a long period of time.

B. Can be considered a cyclic change if the event occurs at regular intervals EVEN IF the **intensity** (strength) of the event changes from time to time.
ex. ocean tides (caused by moon and sun gravity)
sunspot cycle
hurricane season

XII. Noncyclic changes

A. Random events, such as meteorite hits, thunderstorms, and volcanic eruptions.
1. Can not be easily predicted well in advance.

XIII. Energy

A. **ALL** changes involve a flow of energy from one point in the environment to another.
1. **Interface** - a **boundary** between regions of different properties
ex. air/land, air/water, water/land
   a) energy "flows" across this interface

XIV. Equilibrium

A. A state of **stability** in change

B. Two types of equilibrium
   1. Static - balance due to a lack of change
   2. Dynamic - balance between opposing forces

C. Environmental equilibrium
   1) Easy to upset on a **small** scale.
   2) Hard to upset on a **large**, or **global** scale

XV. Natural resources

A. materials and energy found in the environment
   1. societies are always in conflict over their ownership and use (vs preservation)

XVI. **Pollution** - concentration of any substance OR form of energy that reaches a proportion (amount) that adversely affects man or other life. (is bad for)

A. Causes of pollution

   1. natural events (volcanoes, pollen, dust storms)
   2. technology (all technology has **trade-offs**... good for bad)