OUT OF RANGE
NAME_____   DATE_____

PERIOD_____   Estimating Out of Range Measurements

 There are certain measurements that are out of our range, that we can't easily
measure. But we CAN estimate the values by making several assumptions.

 Example: How many leaves are on a tree? First, assume that the tree is a cube,
perhaps 10 meters on a side. That means the tree has a volume of 10m X 10mX
10m=1000 meters
cubed.
 Now suppose that there are leaves evenly distributed all over the tree and that ten
leaves end to end are about 1 meter. That means that each cubic meter has 10 leaves X 10
leaves X
10 leaves=1000 leaves per cubic meter.
 So now the number of leaves on the tree is:
 1000 leaves X 1000 m3 = 1 X 10^6 leaves
  m3

ESTIMATE answers for the following problems. You need to show and check all your
assumptions.

1) Numbers of hairs on your head: (Hint: estimate the number of hairs per square
centimeter and
the area of your head)
 *my head: 100 hrs/ cm^2 * 12cm * 20 cm = 24000 hairs/head*

2) Times your heart beats in a lifetime.
  *Beat: 80 beats/min * 60 min/hr*24hr/day*365 day/yr* 85 yrs/life = 3.5 billion beats
(3.5*10^9 beats)*

3) Time you spend in school total in life:
 3600 sec/hr 7 hrs/day * 183 days/yr * 13 yrs = 1.6 * 10^4 hrs = 6*10^7 sec*

**4) Weight of the whole earth's atmosphere: (Earth has 6371 km radius, 4 mile high air)
 *AIR: density = 1.29 kg/m^3 * (4*pi* (6371,000 m$)^2$) * 4miles*1,600m/1mile*
                                                            *=4.2 * 10^{18} kg*
*or AIR = 14.7 lb/in^2 * (4 * pi * (6,371,000 m * 39.37 in/m $)^2$) = 1.16 * 10^{19} lbs*

**5) Number of atoms in the earth (made mostly of carbon, 6371 km radius)
 *5.9 * 10^{24} kg/ earth * 1000grams/kg* 1 mole C/ 12 g * 6.02 * 10^{23} atoms/mole*
                                                    = 3 10^{50} atoms/earth*

7) Grains of sand on a typical beach
 *50 grains/in * 50 grains/in * 12 in/ft* 12 in/ft * 50 ft/beach* 1000 ft/beach*
$$= 1.5 * 10^9 \text{ grains/beach} = 1.5 \text{ billion grains}$$

8) Number of blades of grass on a soccer/field hockey field
 *20 blades/in * 20 blades/in * 12in/ft *12 in/ft * 100 ft/field * 50 ft/field*
$$= 2.9 * 10^8 \text{ blades/field}$$

9) Volume of ice cream eaten by the total population of town in a year.

*20% people/people * .5 gal/week*52 week/yr= 73, 000 gal/yr*

10) Amount of liquid our school can hold:
 *10 m * 20m * 4 m/ classroom * (8 classroom/hall* 8 hall/school) * 100*
*cm/m*100cm/m*100cm/m * 1ml/cm³ = 5.1 * 10¹⁰ ml = 5.1 * 10⁷ liters =1,300,000 gal*

11) Speed of a butterfly
 *30 cm/1 sec * 1ft/30 cm * 1 mile/ 5280 ft * 60 sec/1 min*60 min/1hr = .7 miles/hr*

12) Distance traveled per evening in a rocking chair.
 *2 ft/rock * 1 rock/sec* 60 sec/min*60min/hr*3 hrs/evening= 21,600 ft/evening = 4miles/evening*

TIME: Using convenient units such as minutes, hours, days, or years, estimate the lifetime
of each of the objects below. rank them in order from smallest to largest. Then find the approximate value in SECONDS for each one.

human   baseball game

dog   lightning flash

sea turtle   firefly flash

sun   a road's yellow line

flea   a pencil