Skill Drill 2

These exercises should help you build up your speed and comfort level in using and converting units, and in making rough estimates of the sizes of things. Continue to use the calculating and estimating skills discussed in Review 1. Space is provided for your work. Frequently check yourself by turning over a page and looking at the solution.

1. Answer the following questions without looking up any conversion factors.

(a) How many mm in a km?

(b) How big is 1 μm (also called a "micron") in meters and, approximately, in inches?

(c) A mile is about 1000 paces (double steps). Roughly how many meters are in a pace?

(d) What is the size measured in angstroms (10^{-10} m) of a 500 nm wavelength of light?

2. Make an estimate (1 significant figure) of your age in seconds. Use information such as the number of seconds in an hour, hours in a day etc.

3. Make an estimate of how many ordinary bricks would go into a brick wall 1 ft thick, 5 ft high, and 1 mile long.

4. If people formed a human chain by holding hands, roughly how many people would it take to span your state?

5. Think of how big a box you could just barely squeeze into, i.e., a box with approximately your body volume. (a) How many cubic cm (cm^3) does it contain? (b) How many liters? (c) How much water (in kg) would it contain?

6. Density is the amount of mass of a body divided by its volume. A liter of water has 1 kg of mass. What is the density of water in g/m^3?

7. Approximately how long would it take (in seconds) for a light beam (speed = 3×10^8 m/s) to cross an atomic nucleus (diameter approximately 10^{-15} m, also called a "femtometer")? (This may be about as small an interval of time as has any physical meaning.)

8. Calculate how much a U.S. dollar is worth in French francs using this information: \$1 = £0.529 (British pounds), £1 = 2.96 DM (German deutsche marks), and 1 DM = 3.35 F (French francs).

9. How fast is a mi/hr in m/s? First make an estimate, then convert units using this information: 5280 ft in a mile, 3.28 ft in a meter, 60 s in a minute, and 60 min in an hour.

10. Express atmospheric pressure in newtons per square meter (N/m^2) given these conversions: atmospheric pressure = 14.7 lb/in^2, 2.54 cm = 1 inch, 1 N = 0.225 lb. (Note: 1 N/m^2 is called a pascal, Pa.)

11. You are going 50 km/hr in your car when you suddenly see a stalled car in your path. If the time it takes before you begin applying the brake pedal (reaction time) is 0.50 s, how far has your car gone during this interval in meters, and in feet? (3.28 ft per meter.)

12. A watt (W) is a unit of power (rate of energy usage). (a) How many 1 kW baseboard heaters can be run by the output of a 200 MW nuclear power plant? (b) What is the equivalent horsepower? (1 hp =746 W.)