Assignment #7

Due on Monday, September 30, 2013

Read Section 1.3 on *Real World Measurements: Dealing with Units,* on pages 41–57 in the text.

Do the following problems

1. An **astronomical unit**, denoted AU, is the average center–to–center distance from Earth to Sun. Modern measurements have established the value of the AU to be about 9.2967×10^7 miles. It takes about 8 minutes for the Sun's light to reach Earth. Use this to estimate the speed of light in meters per second. (A mile is $1,609$ meters).

2. The following equation relate the temperature scales for Celsius with that of Fahrenheit
$$F = (9/5)C + 32,$$
where C denotes the temperature in degrees Celsius and F the temperature in degrees Fahrenheit.

   (a) Write an expression for obtaining C in terms of F.

   (b) Is there a temperature whose degrees measured in Fahrenheit is equal to its degrees measured in Celsius? If so, find it.

3. Newton's Second Law of Motion states that the total force, F, acting on a moving body on a given direction is proportional to the acceleration, a, of the object in the direction of motion. The constant of proportionality is the mass, m, of the object.

   (a) Write an expression that relates F to a.

   (b) If mass is measured in kilograms and the acceleration is measured in meters per second squared, how is force measured in terms of those units?

   (c) Write an expression for computing the mass of a moving object in terms of the force acting on the object and its acceleration. If the force is measured in newtons, what is one kilogram in terms of newtons, meters and seconds?

4. Charle's law for gases states that if the pressure remains constant, then the relationship between the volume V (in cm^3) that a gas occupies and its temperature T in degrees Celsius is given by

$$V = V_o\left(1 + \frac{T}{273}\right).$$

   (a) What does V_o represent?

   (b) What increase in temperature corresponds to an increase in volume from V_o to $2V_o$?

5. Assume that the length, L, of skid marks of a car's tires (when brakes are applied) is proportional to the square of the speed v of the car.

   (a) Write an expression relating L to v.

   (b) If skid marks of 20 ft are produced at 30 mph, how fast would the car be going if the same car produced skid marks of 80 ft?