

PRACTICE WITH METRIC PREFIXES (and significant figures)

Remember: you will need to be able to do these *without* looking at notes.

1. Which is longer: a second or a nanoyear? Figure out which one is longer and then give your answer in the form of: "There are X (of the shorter things) in one (longer thing)" (as in "there are 100 centimeters in a meter" or "there are seven days in a week").
2. A satellite in orbit travels 1.0 centimeter in approximately 1.22 nanoseconds. What is the speed of the satellite in meters per second?
3. The radio signal for KGRG FM oscillates at a frequency of 89.9 megahertz. One hertz is one cycle per second. What is the amount of time between oscillations of KGRG? (Answer in metric units with an appropriate prefix, such as "5.2 milliseconds" or whatever the answer may be.)
4. There are  $3.1 \times 10^{16}$  m in a parsec. There are 1609 meters in a mile. How long is a parsec in teramiles? (Technically prefixes such as "tera" or "giga" belong with metric units, but the use of these prefixes with other units is becoming increasingly common.)
5. A metal sphere has a radius of 1.3  $\mu\text{m}$ . It has a mass of 25 pg. Density is mass divided by volume and the volume of a sphere is  $(4/3)$  times  $\pi$  times the cube of the radius. What is the density of the sphere? (Answer in kilograms per cubic meter.)

Answers:

1. A second is longer than a nanoyear. There are about 32 nanoyears in a second.
2. The speed of the satellite is  $8.2 \times 10^6$  m/s, 8,200 km/s, or 8.2 Mm/s. (There are only two significant figures in the distance in the question, so there should only be two in the answer.)
3. There are 89.9 million oscillations every second, so the time between seconds is one second divided by that number, or about 11.1 nanoseconds. (Notice: three significant figures.)
4. One parsec is  $1.9 \times 10^{13}$  miles which is 19 teramiles.
5. You should find that the volume of the sphere is about  $9.2 \times 10^{-18}$  cubic meters. This gives us a density of  $2700 \text{ kg/m}^3$  or  $2.7 \times 10^3 \text{ kg/m}^3$  which happens to be the density of aluminum.