Scientific Notation Homework Problems

1. Write the numbers 1 million, 1 billion, and 1 trillion as powers of 10.

2. According to the 2010 census the population of the United States in 2010 was 308,745,538. Write this number in scientific notation.

Without a calculator find the following.

3. $(4 \times 10^5) * (5 \times 10^{-4})$

4. $\dfrac{8 \times 10^{-3}}{4 \times 10^2}$

5. $(2 \times 10^6)^4$

6. 5% of 40 million

7. 16 hundred divided by 0.08

8. The radius of a hydrogen atom is 5.29×10^{-11} meters. Use the formula $V = \frac{4}{3}\pi r^3$ to find the volume of a hydrogen atom. (Go ahead and use a calculator for this one!)

9. The **Drake equation** states that:

$$N = R \cdot f_p \cdot n_e \cdot f_\ell \cdot f_i \cdot L$$

where N is the number of intelligent life forms in the visible universe, and

$R =$ the rate of star formation per year in the universe
$f_p =$ the fraction of those stars that have planets
$n_e =$ the average number of planets that can potentially support life per star that has planets
$f_\ell =$ the fraction of the above that actually go on to develop life at some point
$f_i =$ the fraction of the above that actually go on to develop intelligent life
$L =$ the length of time for which such intelligent species survive in years.

Suppose that we estimate the following values for the variables above: $R = 10^{12}$ stars per year, $f_p = 0.1$ (meaning only 1 tenth of stars have planets), $n_e = \frac{1}{1000}$ (1 out of 1000 planets can support life), $f_\ell = \frac{1}{100}$ (1 out of 100 planets that can support life have it), $f_i = \frac{1}{100}$ (1 out of 100 planets with life evolve intelligence), $L = 100,000$ (intelligent species survive 100,000 years on average (humans already have been around over 100,000 years)). Of course, these numbers are just wild guesses, but based on these guesses, calculate the number of intelligent species living in the visible universe. Hint: convert each number to a power of ten first.