

## Some Questions that Challenge. Grades six and above

See NO 13 for definitions of exa, peta, nano, pico, femto atto, zept etc.

Definition of **Angstrom** ÅAn **Angstrom** Å is a unit of length equal to  $10^{-10}$  meters

1. Which is bigger a nanometer or an Angstrom? Answer: \_\_\_\_\_
2. Which is bigger a picometer or femtometer? Answer: \_\_\_\_\_
3. Which is bigger a zeptometer or attometer? Answer \_\_\_\_\_
4. Which is bigger a exameter or petameter? Answer: \_\_\_\_\_
5. True or False Å = 100 picometres Answer: \_\_\_\_\_

**Order of Magnitude:** The number of times we would have to multiple or divide by 10 to convert one size to the other. Comparing numbers of widely different size we use **Ratios!**

Examples: Determine the order of magnitude difference in the sizes of the radii for:

- (a) The solar system ( $10^{12}$  meter) compared with Earth ( $10^7$  meter)
- (b) Protons ( $10^{-15}$  meter) compared with Milky Way ( $10^{21}$  meter)
- (c) Atoms ( $10^{-10}$  meter) compared with neutrons ( $10^{-15}$  meter)

Answer:

- (a)  $10^{12}$  meter/ $10^7$  meter =  $10^5$  Order 5 larger Solar system than Earth (b)  $10^{21}$  meter/ $10^{-15}$  meter =  $10^{36}$  Order 36 larger Milky Way than Protons  
 (c)  $10^{-10}$  meter/ $10^{-15}$  meter =  $10^5$  order 5 larger Atoms than neutrons

For each of the following pairs, determine the order of magnitude difference:

6. The radius of the sun ( $10^9$  meters) and the radius of the Milky Way ( $10^{21}$  meters) Ans: \_\_\_\_\_
7. The radius of a hydrogen atom ( $10^{-11}$  meter) and the radius of a proton ( $10^{-15}$  meter) Ans: \_\_\_\_\_
8. How many orders of magnitude greater is a kilometer than a meter? Than a millimeter? Ans: \_\_\_\_\_
9. An ant is roughly  $10^{-3}$  meter in length and the average human roughly one meter. How many times longer is a human than an ant? Ans: \_\_\_\_\_
10. A millimeter and a gigameter Ans: \_\_\_\_\_