

Some Questions that Challenge. Grades six and above

Definition of **Angstrom** Å

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

1. Which is bigger a nanometer or an Angstrom? Answer: _____

Answer: nanometer

2. Which is bigger a picometer or femtometer? Answer: _____

Answer: picometer

3. Which is bigger a zeptometer or attometer? Answer _____

Answer: attometer

4. Which is bigger a exameter or petameter? Answer: _____

Answer: exameter

5. True or False Å = 100 picometres Answer: _____

Answer: True

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: _____

Answers (a) order 12

7. The radius of a hydrogen atom (10^{-11} meter) and the radius of a proton (10^{-15} meter)

Ans: _____

Answer order 4

8. How many orders of magnitude greater is a kilometer than a meter? Than a millimeter?

Ans: _____

Answer: Kilometer to meter order 3 and kilometer to millimeter order 6

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: _____

Answer: 10^0 meter/ 10^{-3} meter = 10^3 **Order 3** A human is of order 3 larger than an ant.

10. A millimeter and a gigameter

Ans: _____

Answers: A millimeter and a gigameter $10^9/10^{-3} = 10^{12}$ **Order 12**

See page SI METRIC PREFIXES No 13 for definitions of exa, peta, nano, pico, femto, atto, zept etc.