



The following problems involve the multiplication and division of numbers expressed in Scientific Notation. Report all answers to two significant figures. For example:

$$1.34 \times 10^8 \times 4.5 \times 10^6 = (1.34 \times 4.5) \times 10^{(8+6)}$$

$$= 6.03 \times 10^{14}$$

To 2 significant figures this becomes... 6.0×10^{14}

$$3.45 \times 10^{-5} / 2.1 \times 10^6 = (3.45/2.1) \times 10^{(-5 - (6))}$$

$$= 1.643 \times 10^{-11}$$

To 2 significant figures this becomes... 1.6×10^{-11}

- 1) Number of nuclear particles in the sun: 2.0×10^{33} grams / 1.7×10^{-24} grams/particle
- 2) Number of stars in the visible universe: 2.0×10^{11} stars/galaxy x 8.0×10^{10} galaxies
- 3) Age of universe in seconds: 1.4×10^{10} years x 3.156×10^7 seconds/year
- 4) Number of electron orbits in one year: $(3.1 \times 10^7$ seconds/year) / $(2.4 \times 10^{-24}$ seconds/orbit)
- 5) Energy carried by visible light: $(6.6 \times 10^{-27}$ ergs/cycle) x 5×10^{14} cycles
- 6) Lengthening of Earth day in 1 billion years: $(1.0 \times 10^9$ years) x 1.5×10^{-5} sec/year
- 7) Tons of TNT needed to make crater 100 km across: 4.0×10^{13} x $(1.0 \times 10^{15}) / (4.2 \times 10^{16})$
- 8) Average density of the Sun: 1.9×10^{33} grams / 1.4×10^{33} cm³
- 9) Number of sun-like stars within 300 light years: $(2.0 \times 10^{-3}$ stars) x 4.0×10^6 cubic light-yr
- 10) Density of the Orion Nebula: $(3.0 \times 10^2$ x 2.0×10^{33} grams) / $(5.4 \times 10^{56}$ cm³)

Answer Key:

- 1) Number of nuclear particles in the sun: 2.0×10^{33} grams / 1.7×10^{-24} grams/particle
 1.2×10^{57} particles (protons and neutrons)
- 2) Number of stars in the visible universe: 2.0×10^{11} stars/galaxy x 8.0×10^{10} galaxies
 1.6×10^{22} stars
- 3) Age of universe in seconds: 1.4×10^{10} years x 3.156×10^7 seconds/year
 4.4×10^{17} seconds
- 4) Number of electron orbits in one year: $(3.1 \times 10^7 \text{ seconds/year}) / (2.4 \times 10^{-24} \text{ seconds/orbit})$
 1.3×10^{31} orbits of the electron around the nucleus
- 5) Energy carried by visible light: $(6.6 \times 10^{-27} \text{ ergs/cycle}) \times 5 \times 10^{14}$ cycles
 3.3×10^{-12} ergs
- 6) Lengthening of Earth day in 1 billion years: $(1.0 \times 10^9 \text{ years}) \times 1.5 \times 10^{-5} \text{ sec/year}$
 1.5×10^4 seconds or 4.2 hours longer
- 7) Tons of TNT needed to make crater 100 km across: $4.0 \times 10^{13} \times (1.0 \times 10^{15}) / (4.2 \times 10^{16})$
 9.5×10^{11} tons of TNT (equals 950,000 hydrogen bombs!)
- 8) Average density of the Sun: 1.9×10^{33} grams / $1.4 \times 10^{33} \text{ cm}^3$
1.4 grams/cm³
- 9) Number of sun-like stars within 300 light years: $(2.0 \times 10^{-3} \text{ stars}) \times 4.0 \times 10^6 \text{ cubic light-lys}$
 8.0×10^3 stars like the sun.
- 10) Density of the Orion Nebula: $(3.0 \times 10^2 \times 2.0 \times 10^{33} \text{ grams}) / (5.4 \times 10^{56} \text{ cm}^3)$
 1.1×10^{-21} grams/cm³