

Math and Units Tutorial for ESCI 409 Environmental Geology

Units:

mili (or m) indicates 1/1000 (one thousandth)

centi (or c) indicates 1/100 (one hundredth)

kilo (k) indicates 1000 (one thousand)

Mega (capital M) indicates 1,000,000 (one million)

Giga (capital G) indicates 1,000,000,000 (one billion)

Time (base unit is the second s, but year y is often used)

1 year = ~365 days = 365 x 24 hours = 365 x 24 x 60 min = 365 x 24 x 60 x 60 s

1 year = 8760 hours = 525,600 min = 31,536,000 s = 31.536 Ms (Megaseconds)

1 day = 24 hours = 1440 min = 86,400 s = 86.4 ks

Distance (base metric unit is the meter m)

1000 mm = 1 x 10³ mm = 1 m

100 cm = 1 x 10² cm = 1 m

1000 m = 1 x 10³ m = 1 km

100,000 cm = 1 x 10⁵ cm = 1 km

1,000,000 mm = 1 x 10⁶ mm = 1 km

Mass (base metric unit is the gram g)

1,000,000 mg = 1 x 10⁶ mg = 1000 g = 1 x 10³ g = 1 kg

1000 kg = 1 Mg = 1 metric tonne

Volume (for rectangular volumes is length times width times height)

1,000,000,000 m³ = 1 km³

Area (for rectangles is length times width)

1,000,000 m² = 1 km²

Velocity (distance per unit time)

$$1 \text{ km/s} = 1000 \text{ m/s}$$

Power is unit of work per unit time (Joules/s or Watts)

$$1000 \text{ MJ/s} = 1000 \text{ MW} = 1 \times 10^9 \text{ W} = 1,000,000,000 \text{ W}$$

General procedure for plugging numbers into formulas and extracting answers

- 1) Convert all values to the same units (i.e., if you want to solve in terms of m or m/s or m³/s, first convert all distance values to meters)
- 2) Cancel like units in the numerator and denominator (i.e., if you have m² in the numerator and m³ in the denominator, you will be left with 1 in the numerator divided by m¹ in the denominator... 1/m)
- 3) Divide and/or multiply coefficients (i.e., numbers in front of the units). Remember that $1 / 0.001 = 1000$ or $1 / 1 \times 10^{-6} = 1 \times 10^6$
- 4) Verify that your result make sense. If someone asks you the time that it takes for the Atlantic Ocean to open. You will expect this answer to be a fairly large number and you will also expect the units to be in time.

Example:

Calculate the time it has taken the Atlantic Ocean to open. Assume that Africa and South America are currently separated by 5000 km. Assume that the mid-Atlantic Ridge is and has been opening consistently at a rate of 33 mm/year. How many My old is the South Atlantic? Answer is in Keller.