GS331 In-Class Exercise
Introduction to Scientific Inquiry and Data Analysis

c:wou:ocean:quantex.wpd

KEY

Introduction

Earth Science employs the scientific method via qualitative and quantitative observation, the collection of data, hypothesis formulation / testing, and hypothesis modification. This lab exercise provides a basic introduction to quantitative observation and analysis.

Part 1 - Unit Conversion

Using the attached metric and English measurement unit conversion tables, complete the following conversions. SHOW ALL OF YOUR MATH WORK IN THE SPACE PROVIDED.

2.05 m = 205 cm $2.05\,m \left(\frac{100\,cm}{1\,m}\right) = 205\,cm$

1.50 m = 1500 mm $1.5\,m \left(\frac{1000\,mm}{1\,m}\right) = 1500\,mm$

5.4 g = 5400 mg $5.4\,g \left(\frac{1000\,mg}{1\,g}\right) = 5400\,mg$

6.8 m = 0.0068 km $6.8\,m \left(\frac{1\,km}{1000\,m}\right) = 0.0068\,m$

4214.6 cm = 42.15 m $4214.6\,cm \left(\frac{1\,m}{100\,cm}\right) = 42.15\,m$

321.5 g = 0.3215 kg $321.5\,g \left(\frac{1\,kg}{1000\,g}\right) = 0.3215\,kg$

1 in = 2.54 cm

1 m = 3.28 ft

1 mi = 1.61 km $1\,mi \left(\frac{1\,km}{0.62\,mi}\right) = 1.61\,km$

123.4 mi = 199 km $123.4\,mi \left(\frac{1\,km}{0.62\,mi}\right) = 199$

1234 km = 765 mi $1234\,km \left(\frac{0.62\,mi}{1\,km}\right) = 765\,mi$

1054 lb = 479 kg $1054\,lb \left(\frac{1\,kg}{2.2\,lb}\right) = 479\,kg$

2×10^5 in = 3.17 mi $(2 \times 10^5\,in) \left(\frac{1\,mi}{63,360\,in}\right) =$

2×10^9 ft = 3.8×10^5 mi $2 \times 10^9\,ft \left(\frac{1\,mi}{5280\,ft}\right) =$

126,765,000 ft = 38636.1 km 3.8×10^5 mi.
$(126,765,000\,ft) \left(\frac{1\,km}{3281\,ft}\right) = 38636.1$

72° C = 161.6 °F
$\left(\frac{9}{5}\right)(72°C) + 32° = 161.6°F$

8° F = −13.3 °C
$\frac{5}{9}(8°F - 32) = -13.3°C$

0°C = 212 °F

212°F = 100 °C

5.7×10^{45} sec = 1.81×10^{38} years
$5.7 \times 10^{45}\,sec \left(\frac{1\,yr}{3.15 \times 10^7\,sec}\right) = 1.81 \times 10^{38}\,yr$

9.8×10^{20} days = 2.68×10^{18} years
$9.8 \times 10^{20}\,day \left(\frac{1\,yr}{365.25\,day}\right) = 2.68 \times 10^{18}\,yr$

2.0×10^{31} in = 5.1×10^{26} km
$2.0 \times 10^{31}\,in \left(\frac{1\,km}{39370\,in}\right) = 5.1 \times 10^{26}\,km$

If 1 inch equals 2000 ft on a map; points A and B are 7.8 inches apart on the map. How far apart are points A and B on the ground in feet? Now how about in miles?

$(7.8\,in) \left(\frac{2000\,ft}{1\,in}\right) = 15600\,ft$

$15,600\,ft \left(\frac{1\,mi}{5280\,ft}\right) = 2.95\,mi$

Part 2. Solving Equations

A. The density of a substance is defined by it's mass divided by it's volume. The equation has the following form:

$$D = M / V$$

where D is density in gm/cm^3, M = mass in grams, and V is volume in cm^3

1. You measure the mass of a substance as 2356 gm. It's volume is 534 cm^3, calculate it's density in gm/cm^3. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$D = \frac{M}{V} = \frac{2356\ gm}{534\ cm^3} = 4.41\ gm/cm^3$$

2. The density of a substance is 9.8 gm/cm^3. If you had a volume of 3.8 cm^3 of the substance, what would be the corresponding mass in grams? Hint: Rearrange the density equation to solve for mass. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$D = \frac{M}{V} \cdot V \Rightarrow D \cdot V = M = \left(9.8\frac{gm}{cm^3}\right)(3.8\ cm^3) = 37.24\ gm$$

3. The density of a substance is 2.5 gm/cm^3 and you possess 15.3 grams of that material. What will be it's corresponding volume in cm^3. Hint: Rearrange the density equation to solve for mass. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$V \cdot D = \frac{M}{V} \cdot V \Rightarrow \frac{V \cdot D}{D} = \frac{M}{D} \Rightarrow V = \frac{M}{D} \Rightarrow \frac{15.3\ g}{2.5\ gm/cm^3} \Rightarrow 6.12\ cm^3$$

B. The velocity of moving objects (for example your car while driving) is measure as a rate of motion, according to the following equation:

$$V = d / t$$

where V is velocity (m/sec), d is distance (m), and t is time (sec).

4. You drive your car between two cities that are 123 miles apart. It takes you 4 hours to get there. Calculate your average velocity in mi/hr. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$V = \frac{d}{t} = \frac{123\ mi}{4\ hr} = 30.75\ mi/hr$$

5. Using the velocity you caculated in 4 above, what was your velocity in m/sec? Hint: you will have to use a distance and time conversion factor. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$\left(30.75\frac{mi}{hr}\right)\left(\frac{1\ hr}{60\ min}\right)\left(\frac{1\ min}{60\ sec}\right)\left(\frac{1.61 \times 10^3\ m}{1\ mi}\right) = 13.8\ M/sec$$

6. You are driving a car at a velocity of 10 m/sec for a distance of 12 km. How long did it take you to get there? Answer in hours. SHOW THE FORMULA AND ALL OF YOUR MATH WORK!

$$t \cdot V = \frac{d}{t} \cdot t \Rightarrow \frac{t \cdot V}{V} = \frac{d}{V} \Rightarrow t = \frac{d}{V} \quad \frac{(12\ km)(1000\ m/km)}{2\ (10\ m/sec)(3600\ sec/hr)} = \frac{1200\ m}{36000\ m/hr} = 0.03\ hr$$