Units

- **Unit Conversion – Factor-Label method**
- **SI Units**
- **Unit Math**

If you're driving at 60 mph, how many miles do you go every minute?

A method for switching units, based on <u>two</u> ideas:

#1 If A = B, then $\dfrac{A}{B} = 1$

#2 A * 1 = A

#1 Since 1 hour= 60 minutes

#2

$$\frac{1 \text{ hour}}{60 \text{ minutes}} = 1$$

$$\frac{60 \text{ miles}}{\text{hour}} \left| \frac{1 \text{ hour}}{60 \text{ minutes}} \right. = \frac{1 \text{ mile}}{1 \text{ minute}}$$

Example 1

Convert 55miles per hour to meters/sec.

$$\frac{55\text{miles}}{\text{hour}} \qquad = 24.6 \, \frac{\text{meters}}{\text{sec}}$$

Example 2

The United States uses 19 million barrels of oil a day. What is our average power used from oil expressed in Joule/sec (Watts)?

$$\frac{19 \times 10^6 \text{ BOE}}{\text{day}}$$

$$= \text{Watts} = 1.34 \times 10^{12} \frac{\text{Joules}}{\text{sec}}$$

1.   The circumference of the earth's orbit around the sun is 292 million miles. Use the factor-label method to determine the average speed of the earth in meters per second.

2.   The US used 137 billion barrels of gasoline in 2014. There are 42 gallons in a barrel. Use the factor label method to determine our use rate in gallons per minute.

3.   A grande Starbuck mocha (no whip and 2% milk) has 290 Calories in it. Let's say you wanted to live off nothing but mochas and you drank three of them a day.   Use the factor-label method to determine your energy intake in Joules/second (Watts).

You're asked on the 1150 final exam to calculate the moment of inertia of an turbine blade. You're panicked because you don't have a clue what I mean by moment of inertia but you do remember the units for moment of inertia are kg-meter^2.

What is a possible valid formula for this value?

A) $7/5 \ MR^2$ B) $5/8 \ M/R^2$

C) $2/3 \ M^2/t^2$ D) $9/5 \ MR$

E) None of the above are correct

Here M = mass, R = radius of the sphere and
t = time of rotation

The units for x are meters(m). Units for t are seconds(s). The units for K are s/m³. Which of the following equations might be right?

A) $K = 3.0 \; x/t$

B) $K = 0.25 \; x^3/t$

C) $K = 3.14 \; t/x^3$

D) $K = 6.0 \; t^3/x^3$

In a homework problem, you are asked to calculate the height of a physics teacher. What would be a reasonable answer?

A) 0.9 meters

B) 1.9 meters

C) 3.2 meters

D) 6.8 meters

What would be a reasonable answer for the width of Prof Carter's thumb?

A) 2 millimeters

B) 2 centimeters

C) 2 meters

D) 2 kilometers

What would be a reasonable answer for the width of violin string?

A) 2 millimeters

B) 2 centimeters

C) 2 meters

D) 2 kilometers

What a good guess at the distance between COD and Buckingham Fountain down by the lake?

A) 10 kilometers

B) 20 kilometers

C) 40 kilometers

D) 100 kilometers

E) 200 kilometers

The country of Niger mines and refines a type of uranium called "yellow cake". They make about **3000 tons** per year.   Because yellow cake is used in making nuclear weapons, it's distribution is monitored closely by the world's governments. How much yellow cake do you think you could divert from Niger before someone (e.g. the CIA) noticed?

A) 0.5 ton

B) 3 tons

C) 10 tons

D) 500 tons

E) 1000 tons