Quiz 2 - Units

Math 1030 - Dylan Zwick's Class

Fall 2007

Name: Solutions

Here are some unit conversions you might need

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
12 months = 1 year
12 inches = 1 foot
201 meters = 1 furlong
149,598,000,000 meters = 1 astronomical unit
2.204 pounds = 1 kilogram

1. **Simple Conversions**

(a) *2 points* - How many seconds are in a week?

$$1\ \text{week}\left(\frac{7\ \text{days}}{1\ \text{week}}\right)\left(\frac{24\ \text{hours}}{1\ \text{day}}\right)\left(\frac{60\ \text{min}}{1\ \text{hour}}\right)\left(\frac{60\ \text{sec}}{1\ \text{min}}\right) = \boxed{604,800\ \text{s}}$$

(b) *2 points* - How many cubic inches (in^3) are there in a cubic foot (ft^3)? *Note* - The exam originally had a typo that said square inches and square foot.

$$1\ ft^3\left(\frac{12\ in}{1\ ft}\right)\left(\frac{12\ in}{1\ ft}\right)\left(\frac{12\ in}{1\ ft}\right) = \boxed{1,728\ in^3}$$

(c) *2 points* - How many furlongs are in an astronomical unit?

$$1\ au\left(\frac{149,598,000,000\ m}{1\ au}\right)\left(\frac{1\ \text{furlong}}{201\ m}\right) = \boxed{743,647,101\ \text{furlongs}}$$

2. **Fundamental and Derived Units**

4 points - For each of the following units place them in the appropriate list. The lists are fundamental units and derived units.

{ time, speed, distance, mass, power, energy, acceleration, density, volume, temperature }

Fundamental Units	**Derived Units**
time	speed
distance	power
mass	energy
temperature	acceleration
	density
	volume

3. **Temperature**

The formulas to convert from Celsius to Fahrenheit, and from Celsius to Kelvin are:

$$F = \frac{9}{5}C + 32 \qquad K = C + 273$$

(a) *2 points* - What is the Celsius temperature of "body temperature", which is 98.6° Fahrenheit?

$98.6 = \frac{9}{5}C + 32$

$\Rightarrow \frac{5}{9}(98.6 - 32) = C$

$C = 37°\text{Celsius}$

(b) *1 point* - What is the Kelvin temperature of "body temperature"?

$k = C + 273$

$k = 37 + 273 = 310\,k$

(c) *3 points* - At what temperature do the Fahrenheit and Celsius scales have the same value?

Call the equal value x. If both scales read the same x must satisfy:

$x = \frac{9}{5}x + 32$

$\Rightarrow -\frac{4}{5}x = 32 \Rightarrow x = -\frac{5}{4}(32) = -40$

4. **Compound Conversion Problem**

A person spends \$65 per month on gasoline. Gas costs \$3.15/*gallon*, and the person's car gets 36 miles to the gallon. Each gallon releases 19 pounds of carbon dioxide into the atmosphere when used.

(a) *4 points* - How far does the person drive in one year?

$$\text{Money spent on gas in a year} = \left(\$65/\text{month}\right)\left(12\ \text{months}/\text{year}\right)$$
$$= \$780/\text{year}$$

$$\text{Gallons of gas used in a year} = \frac{\$780/\text{year}}{\$3.15/\text{gallon}}$$
$$= 247.62\ \text{gal}/\text{year}$$

$$\text{Distance traveled} = \left(\frac{247.62\ \text{gal}}{\text{year}}\right)\left(\frac{36\ \text{miles}}{1\ \text{gal}}\right) \approx \boxed{8,914\ \frac{\text{miles}}{\text{year}}}$$

(b) *4 points* - How many pounds of carbon dioxide does the person release into the atmosphere in one year?

Each gallon releases 19 lbs CO_2, so as the person uses 247.62 gal/year he or she releases:

$$\left(\frac{247.62\ \text{gal}}{\text{year}}\right)\left(\frac{19\ \text{lbs}\ CO_2}{1\ \text{gal}}\right) \approx \boxed{\frac{4,705\ \text{lbs}\ CO_2}{\text{year}}}$$