SYEN 1210. Introduction to Systems Engineering
Units Homework

1. Write $31.6\frac{g\cdot mm^2}{s^2}$ in the standard SI unit of energy using an exponent so that the leading digit occupies the ones place.

2. Correct the errors in the following expression, $5.2 s^{-1} Nm\, kg^{-2}$.

3. Reynold's number for flow in a pipe is calculated from the following quantities:

$\rho = 1000\frac{kg}{m^3}$ is the fluid's density
$\mu = 1\, mPa\cdot s$ is the fluid's viscosity
$D = 20\, cm$ is the pipe's diameter
$v = 10\frac{m}{s}$ is the average fluid velocity

The formula is $\Re = \frac{\rho v D}{\mu}$

Calculate Reynold's number and convert all units to base units ($1\, Pa = 1\frac{N}{m^2}$).
What do you observe about the resulting units?

Convert the result to US Customary units.

4. Convert $10\, kW\cdot h$ into base units. From there, convert it into a single unit. What quantity does this unit represent?

5. On a cloudless day, the power flux of sunlight is $\varphi = 1\frac{kW}{m^2}$. How much energy does $A = 10\, m^2$ receive in t = 1h? ($E = \varphi\, t\, A$)

If a car gets 40 miles per gallon of gasoline, and the energy density of gasoline is $E_D = 30\frac{MJ}{L}$, how far could a person drive on this hour of sunlight? (Divide 40 mpg by E_D to get miles per J, then multiply by the above sunlight energy.)