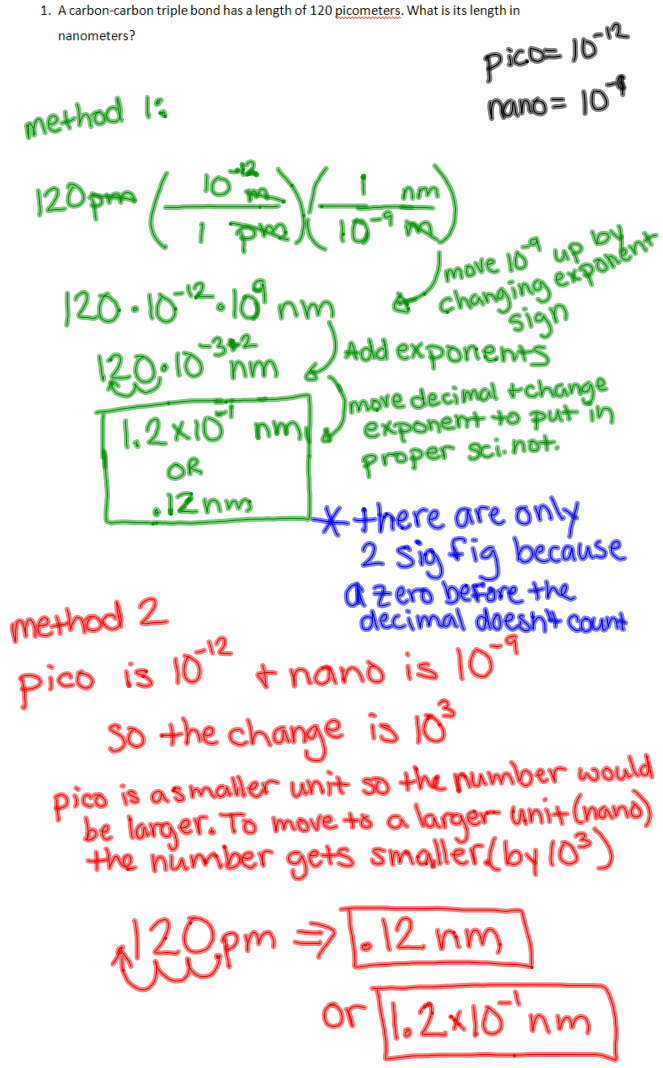
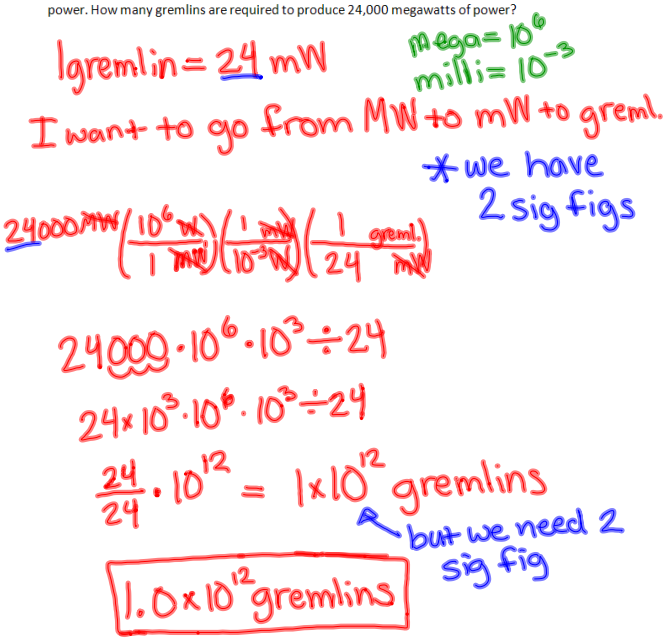
# Physics Problem Set 1 Solutions

1. A carbon-carbon triple bond has a length of 120 picometers. What is its length in nanometers?




2. A gremlin is a tiny mythical creature often blamed for mechanical failures. Suppose for a moment that a shrewd physicist catches one such gremlin and makes it work for her instead of against her. She determines that the gremlin can produce 24 milliwatts of power. How many gremlins are required to produce 24,000 megawatts of power?



3. An electron can tunnel through an energy barrier with probability 0.0000000000375. (This is a concept used in quantum mechanics.) Express this probability in scientific notation.

$0.00000000000375$

moved 11 spaces

$\boxed{3.75 \times 10^{-11}}$

4. Light travels at $3.0\times10^{8}$ m/s in a vacuum. Find its speed in furlongs per fortnight. There are roughly 201 meters in a furlong, and a fortnight is equal to 14 days.

2 sig figs

$$3.0\times10^{8}\ \frac{m}{s}\left(\frac{1\ \text{furlong}}{201\ m}\right)\left(\frac{60\ s}{1\ min}\right)\left(\frac{60\ min}{1\ hr}\right)\left(\frac{24\ hr}{1\ day}\right)\left(\frac{14\ day}{1\ \text{fortnight}}\right)$$

$$\frac{3.0\times10^{8}\cdot60\cdot60\cdot24\cdot14}{201}\ \frac{\text{furlong}}{\text{fortnight}}$$

$$\frac{3.6\times10^{14}}{201}$$

$\boxed{1.8\times10^{12}\ \text{furlong/fortnight}}$

5. Multiply $3.65\times10^{23}$ by $4.12\times10^{154}$ by $1.11\times10^{-11}$ and express the answer in scientific notation.

$3.65\times10^{23}\cdot4.12\times10^{154}\cdot1.11\times10^{-11}$

$(3.65)(4.12)(1.11)\times10^{23+154-11}$

$16.692\times10^{166+1}$

$1.67\times10^{167}$

3 sig figs!

6. Evaluate $(5.7\times10^{6}\ \text{kg})\times(6.3\times10^{-2}\ \text{m/s}^2)$ and express the answer in scientific notation.

$(5.7)(6.3)\times10^{6-2}\ \text{kg}\cdot\frac{\text{m}}{\text{s}^2}$

$35.91\times10^{4+1}\ \frac{\text{kg m}}{\text{s}^2}$

$3.6\times10^{5}\ \frac{\text{kg m}}{\text{s}^2}$

2 sig fig

7. Evaluate $(4.9\times10^{-8})\ /\ (7.0\times10^{-3})$. Express the answer in scientific notation

$\frac{4.9\times10^{-8}}{7.0\times10^{-3}}=\frac{4.9}{7}\times10^{-8+3}$

← sign of exponent changes when moved to numer.

$.7\times10^{-5-1}$

$7\times10^{-6}$

but 2 sig fig

$7.0\times10^{-6}$

8. A $3.70\times10^{6}$ kg piece splits off an iceberg of mass of $5.96\times10^{7}$ kg. Calculate the mass of the remaining iceberg and express the answer in scientific notation.

$5.96\times10^{7}\text{kg} - 3.70\times10^{6+1}\text{kg}$ we need same exponent!

$5.96\times10^{7} - .370\times10^{7}$

$(5.96-.370)\times10^{7}$ but our most precise figure is the thousandth place, so we need another sig fig.

$5.59\times10^{7}$

$\boxed{5.590\times10^{7}\text{ kg}}$

9. The silicon chip in a microelectronic component has a mass of $1.37\times10^{-3}$ kg. To complete the wiring, $6.79\times10^{-5}$ kg of solder is added to the chip. Compute the final mass of the circuit.

$1.37\times10^{-3-2} + 6.79\times10^{-5}$

$137\times10^{-5} + 6.79\times10^{-5}$ significant to hundredths place

$143.79\times10^{-5+2}$

$\boxed{1.4379\times10^{-3}\text{ kg}}$

10. An auto transport truck has a mass of $2.50\times10^{4}$ kg. A car has a mass of $1.31\times10^{3}$ kg. The car is loaded onto the truck. What is their total mass?

$2.50\times10^{4} + 1.31\times10^{3+1}$

$2.50\times10^{4} + .131\times10^{4}$ significant to thousandths place

$\boxed{2.631\times10^{4}\text{ kg}}$