Assignment II, PHYS 101 (Introductory Physics I)
Fall 2020
Due via pdf upload to OAKS prior to Thursday, September 3rd at 9:25 AM

This will be the first "regular" homework assignment of the semester. For this, and all other homework assignments, please turn in your solutions with all supporting work; answers without supporting work will not earn credit.

You do not need to upload the sheet with the questions on it, but please clearly number your problems and circle or box your final answers.

I encourage you to collaborate with classmates to discuss how to approach a particular question, but the mathematical steps to generate your final answer on your submitted work should be your own. If I see the same simple mistake on multiple homework assignments, I will take off more points for that error than I normally would.

Please include *words* in your answers. When you get answer keys back from me, you'll see that there are explanations, ideas, commentary, and thought processes included – not just a set of equations one after another.

Finally, please ensure that all numerical answers have units. As always, if you have questions feel free to email me.

1. It turns out that we use some extremely large and extremely small numbers when doing Physics, so scientific notation is a must. This first problem is just to help make sure that you know how to use your calculator properly. Unfortunately, every calculator is a bit different. Here is a youtube link to a (somewhat snarky) teacher explaining how to do scientific notation on a few different calculator models. If you are concerned that you might not know how to use your calculator properly, please ask for help! It is far better to get this ironed out now than continuously losing problems on your homework for a full year. As a check, when you compute $\frac{3.07\times10^{4}}{6.20\times10^{-3}}$ you should obtain 4.95×10^{6}.
   a) Compute $(3.24 \times 10^{21})(5.28 \times 10^{13})$.
   b) Compute $-(2.35 \times 10^{8})(1.38 \times 10^{-19})$.
   c) Compute $\frac{6.626\times10^{-34}}{9.11\times10^{-31}}$
   d) Compute $[-3(2.35 \times 10^{3})^{4}]$
   e) Compute $6.67 \times 10^{-11}\left(\frac{1.67\times10^{-27}}{(3\times10^{8})^{2}}\right)$
   f) Compute $\left(\frac{3.6\times10^{6}}{1.26\times10^{-6}}\right)^{-2/3}$
2. The volume of a cylinder (in case you forgot or were never told) is $\pi r^2 H$ where r is the radius of the cylinder and H is the height. If a right circular cylinder has a radius of 1.25 *inches* and a height of 18 *inches*, what is its volume *in cubic centimeters*? Note – 1 cubic centimeter (sometimes called a cc for short) is a volume that is 1 cm x 1 cm x 1 cm.

3. The Earth is (approximately) spherical in shape, with a radius of about 6.37 Mm (megameters). The surface area of a sphere is $4\pi r^2$. What is the surface area of the Earth in square nanometers?

4. The statue of liberty has an approximate mass of about 200000 kg.

   a) The approximate mass of a penny is 2.5 grams. How much money would you have if you had the mass of the statue of liberty in pennies?

   b) The approximate mass of a quarter is 5.670 grams. How much money would you have if you had the mass of the statue of liberty in quarters?

   c) The hope diamond is worth approximately 350 million dollars. The approximate mass of a dollar coin is 8.100 grams. If you had the statue of liberty's mass in dollar coins, could you afford to buy the hope diamond at its appraised value? (Justify your answer with a computation).

5. Vector $\vec{A}$ has components $A_x = 3.24\text{m}$ and $A_y = 2.53\text{m}$. Vector $\vec{B}$ has components $B_x = -1.84\text{m}$ and $B_y = 1.53\text{m}$. Vector $\vec{C}$ is defined as $\vec{A} + \vec{B}$; vector $\vec{D}$ is defined as $2\vec{A} + 3\vec{B}$; and vector $\vec{E}$ is defined as $-2\vec{A} - \vec{B}$.

   a) Find the components of vector $\vec{C}$.

   b) Find the components of vector $\vec{D}$.

   c) Which vector ($\vec{A}$, $\vec{B}$, $\vec{C}$, $\vec{D}$, or $\vec{E}$) has the greatest magnitude? (aka which vector is longest? Justify your answer with a calculation)

   d) If $\vec{A} + \vec{E} + \vec{F}$ add up to a vector that has zero in both components, what are the components and magnitude of $\vec{F}$?

6. Vector $\vec{P}$ has a magnitude of 57.4 m/s and points at an angle 37° below the x-axis. (In other words, if the tail of the vector is at the origin, the tip of the vector can be found by going 37° clockwise from the positive x axis).

   a) What are the x and y components of $\vec{P}$?

   b) If vector P was added to another vector $\vec{M}$ that had components $M_x = 0\text{m/s}$ and $M_y = -30\text{m/s}$, what would be the length (aka magnitude) of the combined vector $\vec{P} + \vec{M}$?