Homework 0

Vector Review (Ungraded)

Due: Friday, September 3

1. A proton is at rest at a location $\vec{r} = (-2 \text{ m})\hat{x} + (4 \text{ m})\hat{y}$.
   (a) What is the distance between the proton and the origin?
   (b) What is the unit vector expressing the direction from the origin to the proton?

2. In a certain coordinate system, a hydrogen atom is at a location $\vec{r}_H =< 2, 4, -1 >$ meters, relative to the origin. A nearby oxygen atom is located at $\vec{r}_O =< 0, -1, 3 >$ meters, relative to the same origin. What is the position of the hydrogen atom relative to the oxygen atom?

3. Relative to the origin, a neutron is located at the position $\vec{r}_n = (-1 \text{ cm})\hat{x} + (3 \text{ cm})\hat{z}$. Relative to this neutron, a proton is at location $\vec{r}_p = (2 \text{ cm})\hat{x} - (4 \text{ cm})\hat{y}$. What is the location of the proton relative to the origin?

4. A muon is traveling with velocity of $\vec{v} =< 3 \times 10^7, -4 \times 10^7, 0 >$ m/s.
   (a) What is the muon's speed?
   (b) What is the unit vector describing the direction of the muon's velocity?
   (c) What angle does the muon's velocity make, relative to the positive x direction?