

PHYS 111

HOMEWORK #2

Due : 2 Sept. 2014

1. The sorts of estimates and order of magnitude problems covered in your text are often known as Fermi problems, named after the Univ. of Chicago physics professor Enrico Fermi who had a genius (for among many other things) estimating the answers to seemingly complicated questions. Your Fermi problem is : Estimate the number of vampires in Chicago.

Your solution must explicitly describe the assumptions you are making about the behavior of vampires, the data you are using, and the logic that leads to your result. Since there is no well defined answer to this question, your grade will depend solely on your logic and explanation. (If you have written more than two pages of explanation, that is likely too much.)

2. Estimate the mass of gas that you inhale during a night of sleeping. Estimate the mass of air you exhale. Why are these values different? How much mass loss will you experience during a typical sleep due to breathing alone? Again, state all assumptions clearly and show your logic.

3. A particle undergoes three successive displacements : a) 4.0 meters southwest, b) 5.0 meters east, c) 6.0 meters in a direction 60 degrees north of east. (Choose your coordinates such that the positive y axis represents due north and the positive x axis represents due east). Find :

- a) The components of each displacement
- b) The components of the resultant displacement

c) The magnitude and direction of the resultant displacement.

4. A room has dimensions of 10 ft x 12 ft x 14 ft. A fly starting at one corner ends up at the diametrically opposite corner. What is the magnitude of the displacement?

5. A boat can travel with a speed of 20 km/h in still water. If the boat is to travel directly across a river whose current has a speed of 12 km/hr, at what upstream angle must the boat head? Assume the boat needs to travel from the south to the north, and the current flows exactly from the east to the west.