

You will need to *carefully* follow the instructions in the lab manual to properly complete this worksheet. You may want to put one group member in charge of making sure no step is skipped while working in class.

**Tutorials:** Your instructor will advise you on when to complete these tutorials (before class, in class before data collection, in class after data collection, or after class).

1. The mass of a pencil is approximately 10 grams. How much does it weigh in Newtons? How much does it weigh in pounds ( $1 \text{ lb} \approx 4.4 \text{ N}$ )? **Show your work.** (*Think about whether or not your result makes sense!*)
  
2. Draw free-body diagrams of the hanging object directly on the picture below. Label each force and take care when drawing the length of each vector so that their relative sizes are approximately correct. Also draw a coordinate system next to the object. Next, use Newton's first law to develop an expression for the magnitude of the tension force in terms of the mass of the hanging system  $m$  and the free-fall acceleration  $g$ . **As always, show your work.**

Side View of Hanging Object



3. Under what circumstances is tension force acting on the object greater than its weight? When is the tension force less than its weight? **Explain.**