Lab Quiz for PHY324

Q1: What experiment are you doing?

The Cavendish Experiment

Q2: Summarize the physics elements in this experiment.

The experiment focuses on the gravitational interaction between two masses. The masses are attached together by a wooden rod and are suspended from a wire. Then various other masses are placed nearby which creates a torque on the suspended masses due to their gravitational attraction to the nearby masses. This in turn causes the wire to twist.

Q3: Describe one major goal of the lab.

The goal of this lab is to measure the gravitational constant G using the aforementioned set up.

Q4: What do you measure directly in pursuit of the major goal described above?

There will be one key measurements taken in this lab using two distinct set ups. The two setups for this lab are as follows:

1. The two large lead balls are mounted and positioned fully clockwise on the balance.
2. The two large lead balls are mounted and positioned fully counterclockwise on the balance.

The key measurement will be the distance the oscillation of the projected beam within 45 minutes (or when equilibrium has been established). This will be tracked using a beam that is reflected off a mirror which is on the Cavendish balance. The motion of the projected beam be measured and tracked by computer software. Afterwards the balls will be removed and the equilibrium position for that system will be measured for 45 minutes using the same method outlined above.

Additionally: the mass of the lead balls, the radius of the lead balls, the distance between the mirror and the back of the box (w in the lab handout) will all be measured.

Q5: Outline how you get the answer to Q3 from the data collected as described in Q4. If you will graph data to achieve the goal in Q3 then explain what you will graph, what the trend-line will look like, and how it achieves the goal in Q3. Include any equations you will use to turn the data described in Q4 into the answer described in Q3.

We can use the no balls mounted equilibrium positions to determine the torsion constant in Eqn. 4, since this measurement will give us T (period of oscillation).

We can take the equilibrium of the motion of the projected beam (its axis of symmetry since it will have sinusoidal motion) and subtract this from the equilibrium of when there are no balls mounted. We can then find theta by taking the ratio of this difference with d and taking its sin inverse. Using this

theta, and measured R and w, we can obtain x using Eqn. 5. We can plug in Eqn. 4 and Eqn. 5 into Eqn. 3 along with the measured M to solve for G.

Q6: Your TA asked you a/some question(s) about the equipment. Write the question(s) and answer(s) here.

Q: What is the main source of error in this lab?

One main source of error is that we are not dealing with a perfectly uniform gravitational field. This is due to the fact that the mass surrounding the balls (i.e., the walls, the building etc.) are not of uniform density. This will then lead to a locally un-uniform gravitational field around the apparatus which will affect how the balls move due to the gravitational potential between them. This will also mean that equilibrium positions in this lab are not true equilibrium positions since the mass outside the system is not negligible and will contribute small changes in the gravitational field.