Physics 113/213 **Energy Conservation: Lab Paper Checklist** Fall (12) 2018

Abstract (no longer than half a page):

1) Clear, concise summary of the experiment (including how the air track works, how the final speed is measured, what is varied between different runs).

2) Statement of how many different experiments were performed and, of these, how many agree/disagree, within exp. uncertainty, with E-conservation. If you have some disagreement, give a one-line comment on what might be causing this.

Introduction:

1) Why are conservation laws important in physics?

2) Give some history of the idea of energy conservation.

3) Discuss difficulties with this type of measurement (can we really achieve zero-friction?).

4) Must include reference(s) ... should avoid direct quotes from any source.

Theory:

1) Give energy conservation in equation form and the equations we are using to test this.

2) Expressions for uncertainty in computed values of U_{sys} and K_{sys} (with proper reference).

3) Equations must be numbered and all variables must be defined.

4) Cannot have a list of equations ... each equation is considered part of a sentence.

5) NO direct copying or close paraphrasing from the theory section of the lab instructions.

Apparatus:

1) Diagram or annotated photograph of the set up, with a Figure caption. NO copying of figures from the lab instructions or the internet.

2) Begin with reference to your figure of the setup and explain of how the main parts work.

3) Discuss why we use the uncertainty in the glider length measurement to determine the uncertainty in our speed measurements.

4) Discuss why the track must be level, why the string must be parallel to the track, why you place the photogate where you do.

5) Brief explanation of how data is taken.

6) This section must include all experimental measurement uncertainties.

7) NO step-by-step description of the procedure, i.e., DO NOT include statements like: "we cut two meters of string and tied one end to the aluminum ball and tied the other end to ...".

Results:

1) Must start with text describing in some detail what is included in the data table(s).

2) Well formatted data tables that include units (with column/row descriptor) and measurement uncertainty as appropriate (at head of column/row if same for all entries), and proper number of significant digits displayed.

3) It is best to have a separate Data and Calculated Results table. There must be text explaining how the data was used to compute the final results and final uncertainty, with reference to the appropriate equations from the Theory Section.

4) You don't need to include all four speed measurements in your data table, just include the average and say that it is obtained from four separate runs. Also, you don't need to include h_i and h_f in your data table, just give h with an uncertainty.

5) You do not need to include the glider "turn-on/turn-off" table, just give your final $L \pm \sigma_L$.

6) If you consistently "lose" kinetic energy you should compute an average friction force in the system.

7) No discussion of how "good" the results are here ... this all must be in the next section.

Discussion:

1) Start by identifying which data sets agree/disagree, within uncertainty, with energy conservation.

2) Discuss the size of the uncertainties and identify the largest contributor(s) to the final uncertainties.

3) Discuss any systematic trends observed in the data (e.g., was K always a bit larger/smaller than U?).

4) Discuss any assumptions made about the setup (e.g., the track is perfectly flat, the buoyancy force supporting the glider is the same everywhere along the track, the string does not stretch, etc.)

5) Suggest how this experiment might be improved to give a better test of E-conservation.

References:

1) Should include a reference to the textbook for general theory.

2) Must include two separate entries for the lab manual ... one for the exp. instructions and one for the Data Analysis section ... appropriate format: "Some Notes on Data Analysis", in Physics 113/213 Laboratory Manual, Hiram College Physics Dept. (2016).

3) The references MUST be cited in the text in appropriate locations. You can use either numbers, as in [1], [2], etc., or abbreviated citations such as (Lindenfeld and Brahmia, 2011) or (Moore, 2016).