In Class Activity Plan
Week six: Becoming Quantitative with Energy

120 min **Investigating Energy Conservation (Word, Pdf)**

PURPOSE: Introduce equations for E_g and E_k, opportunity to design experiment

Teaching Notes:

- You should whiteboard after the first page (making pie charts).
  - Goals here will be to push them towards the answers to the questions on page 2.
  - Suggest energy at the top should be proportional to both mass and height.
- For many students this will be the first time they have ever had to design their own experiment. So this lab will both take a long time, and be difficult for some students.
  - The proposal must have a model associated with it, and must identify what measures are going to be made and how the data is going to be analyzed.
  - Also, the teacher must be very good at evaluating experiments on the fly. They may think of things that would work, but we haven't thought of before.
- Possible experiments:
  - Drop the ball from different heights and record the speed at the bottom. They can then make a graph of E_{Ig} and E_k and get a linear fit.
  - Also a possibility of rolling things on rails and measuring speeds.

20min **Whiteboard – Investigating Energy Conservation**

PURPOSE: Share experimental designs and results for equations for E_g and E_k

Video Example: (Whiteboarding)

1) What did you learn?
2) What rules can you make?
3) What questions do you still have?

45min **Board Meeting**

PURPOSE: Compare experimental designs and results for E_g and E_k, reach consensus about how to calculate Energies.

Video Examples: (Discussion1, Discussion2, Discussion3)

- Need to define system (Schema)
- Use pie charts to help you determine what needs to be measured
- Strategy 1
  - $E_{Igo} - E_{Igf}$
  - Plot E_k vs. v

        - Fit a curve in Excel
    - Strategy 2
        - $E_{Igo} = ma_gh$
        - $E_{kf} = m\,(\Delta v/\Delta t)(\,\tfrac{1}{2}a_g(\Delta t^2))$
        - $E_{kf} = m\,(\Delta v/\Delta t)(\,\tfrac{1}{2}(\Delta v/\Delta t)(\Delta t^2))$
        - $E_k = \tfrac{1}{2}mv^2$
        - Must be supported by data!
    - Energy Pie Charts are a representation of the Equation of Everything (energy conservation)

20 min **Whiteboard - 1-d problem using both kinematics and energy conservation**
PURPOSE: Compare and contrast strategies for making calculations on constant a model using kinematics and energy;
Problem:
Cubs fan throws his hat straight into the air at 7m/s.

10 min **Board Meeting**
PURPOSE: Show how basic constant a models obey energy conservation and give same results.
Emphasize energy as an easy approach that works well in some situations.

60 min **Whiteboard - Redo 2-d problems they've already done now using energy &/or additional problems**
Energy Pie Chart Problems (Word, Pdf)
Energy Problems for Practice (Word, Pdf)
Video Examples: (Whiteboarding, Discussion)
Note: These are often done, but not discussed in a board meeting since they have done them previously.