## Egg Drop Prediction Paper – Summative

- I. Title
- II. Purpose
- III. Background information
  - a. A discussion of the physics issues involved in the drop, including a discussion of the forces and energy changes during the fall and during impact. (See "Putting the background together" for specifics)
  - b. Your original sketch and design analysis.
  - c. Your revised design analysis, including documentation of any changes made to your design, if design was revised
- IV. Presentation of test data (remember all graphs should be titled, axis are labeled, units are included.)
  - a. d vs t graph (for drop with fully weighted egg)
  - b. v vs t graph (for drop with fully weighted egg)
  - c. a vs t graph (for drop with fully weighted egg)
  - d. drag coefficient graphs and charts
  - e. a table of the following values:
    - mass of empty vehicle
    - mass of "crash test" egg
    - weight of loaded vehicle
    - formula for force of air resistance
    - drag coefficient
    - air resistance at terminal velocity
    - predicted terminal velocity (must show calculation)
    - time then impact begins **and** time when vehicle "settles"
    - duration of the impact
    - maximum velocity just before impact
    - did the vehicle reach terminal velocity or predicted terminal velocity?
    - maximum acceleration during impact
    - maximum force on the egg during impact (use the mass of the test egg in your calculation) (**must show calculation**)
    - height of bounce (if any)
    - average acceleration during fall
    - Max GPE just before the drop **and** max KE just before impact (**Must show calculations**) – **Bonus for Graphs of GPE and KE**
    - Momentum just before **and** just after impact
    - Average Force during impact
  - f. Extra Credit:
    - Graph of  $F_{Air}$  vs. t for the test run (use model of air resistance)
    - Work against Air Resistance during the fall.

- V. Analysis of the data
  - a. Discussion of how each design component should lead to desired results.
  - b. What do the graphs tell you how do you know that?
    - Consider what you know about graph analysis what do the respective shapes of the graphs indicate?
    - ✓ Do the graphs correlate well with the video? (Feel free to discuss and refer to your video but **DO NOT** paste it into your report.)
  - c. Do your numbers support what you know about the physics of a free fall? About conservation of energy? About impulse and momentum? Discuss and support your statements.
  - d. Does the data match your design intent?
- VI. "Conclusion" statement will there be a successful launch and landing? How do the numbers, etc., allow you to predict a probable outcome? What is that probable outcome? Explain your reasoning including summarizing statements of 'why'
- VII. Share a Google folder with me (or provide directly through USB drive) the following:
  - a. Every video of test drops. If you only analyzed 1 of each type, indicate which video you analyzed.
  - b. Saved Tracker or Video Analysis files
  - c. Screenshots
  - d. Share with me your data tables and any Google Sheets docs used or Desmos docs.