FLINN SCIENTIFIC

Name____

Engineering Worksheet

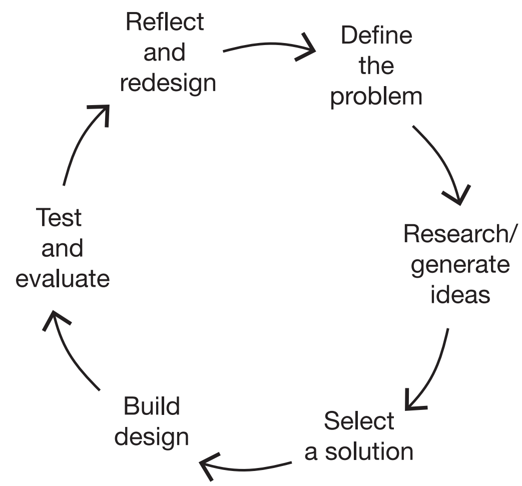

Figure 4. Engineering Process

1. Define the problem: What is the goal of your parachute design?

2. Research/generate ideas: Using what was found in the *Introductory Activity*, name some factors that influence the speed of a parachute in free fall. What caused the parachute to fall more slowly?

3. Research/generate ideas: Parachute canopies can be made out of many different types of materials. Brainstorm various everyday materials that can be used in the design of your parachute. What materials do you believe will work best? Why?

4. Select a solution: Below, detail the design plan for your parachute. Include materials used, estimated measurements, and your reasoning for each design decision. For instance, how will the canopy size chosen benefit your design? What shape will your canopy be?

5. Build your design: Draw and label a sketch of the final design.

6. Reflect and redesign: What modifications were made to your design for the final test?

Egg-streme Parachuting Worksheet

Data Tables

Table 1. Introductory activity

Variable	Alteration	Observations
Canopy size	Constructed canopies of two different sizes: 15 cm × 15 cm 30 cm × 30 cm	

Table 2. Design challenge

Trial	Mass, Kg	Fall distance, *m*	Drop Time, *s*	Average Velocity, m/s	Egg Observations
1					
2					

Table 3. Surface area vs. acceleration

Trial	Surface Area of Canopy, cm^2	Average Acceleration, m/s^2	Drag, N
1			
2			

Table 4. Class data

Group	Trial	Surface Area of Canopy, cm^2	Average Acceleration, m/s^2	Drag, N
1	1			
	2			
2	1			
	2			
3	1			
	2			
4	1			
	2			
5	1			
	2			
6	1			
	2			
7	1			
	2			
8	1			
	2			
9	1			
	2			
10	1			
	2			
11	1			
	2			
12	1			
	2			
13	1			
	2			
14	1			
	2			
15	1			
	2			

Post-Lab Questions

1. Calculate the average velocity of the egg for each trial. Record in Data Table 2.
2. Calculate the surface area of the parachute canopy for each trial using Equation 1 or Equation 2 from page 1. Record in Data Table 3.
3. Calculate the average acceleration of the egg for each trial using the equation below. Record in Data Table 3.

$$a = 2d / t^2 \qquad \textit{Equation 4}$$

where a = acceleration
d = distance, meters
t = time, seconds

4. Calculate the force due to drag on the system for each trial using Newton's second law. Record the values in Data Table 3.
5. Add data from Data Table 3 to the Class Data Table 4. When complete, one member will graph the data with surface area on the *y*-axis and acceleration on the *x*-axis. The other will graph surface area on the *y*-axis and drag on the *x*-axis. Clearly label each axis – don't forget units! *Note:* graph the absolute values for acceleration and drag.

6. Describe the relationship between the surface area of the canopy to both the acceleration of the egg and drag produced.
7. What variables in the parachute's design, other than surface area, could have influenced the overall acceleration during free fall?