**Constructing Parachutes Lesson Plan**

Grade Level: 6

**Massachusetts Science Standards (based on Next Generation Science Standards):
Grade 6: Technology/Engineering***MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit possible solutions.\**

*MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution. [Clarification Statement: Examples of intended users can include students, parents, teachers, manufacturing personnel, engineers, and customers.]*

**Grade 6: Materials, Tools and Manufacturing**

*MS-ETS2-2(MA). Given a design task, select appropriate materials based on specific properties needed in the construction of a solution. [Clarification Statement: Examples of materials can include metals, plastics, wood, and ceramics.]*

*MS-ETS2-4(MA). Analyze the shape, form, size and materials of a designed object to infer the function for which it was designed.*

**Purpose**This lesson plan spans several days and its purpose is to give students the opportunity to put the Engineering Design Process into practice. Students will explore how parachutes are used to slow moving objects. They will work in their “engineering teams” to design and build a parachute out of everyday items. They will test their parachute, collect data, evaluate the results and present the results to the class with an eye to how they would redesign their parachute to better meet the goal.

**Student Learning Objective:**During this lesson, students will use the Engineering Design Process as they:

* Design and construct a parachute
* Test and refine their designs
* Communicate their design process and results.

**Resources/Materials:**

* Video – Bayer Corporation – Making Sense of Science : *How Does a Parachute Work?*(<http://www.watchknowlearn.org/Video.aspx?VideoID=32820&CategoryID=468>)
* Parachute Article by Chris Woodward (taken from *Explain That Stuff* website)
* Constructing Parachutes student worksheet
* Materials to construct parachutes include: plastic grocery store bags, small garbage bags, tin foil, copy paper, coffee filters, newspaper, twine, string, masking tape, small plastic army figures, metal washers, scissors, and ruler.
* Meter stick and target for parachutes to land.

**Lesson Procedure:**

1. Review the phases of the Engineering Design Process with students. This should not be the first time they’ve seen it or practiced it.

2. Give a quick synopsis to students of what they’ll be building. Tell them more details will follow, but first they need to understand the underlying science in order to construct a viable parachute. Play the video,
*How Does a Parachute Work?* After this, give students the Parachute Article to read and discuss in their science groups.
4.Pass out the Constructing Parachutes student worksheet. Review the goal of the engineering project, as well as the constraints students will have in constructing their parachutes and the materials that will be available to them. Students must construct their own working parachute from the materials available that can carry one plastic army soldier to the ground from a height of 2 meters. The parachute has to hit a target 10 centimeters in diameter with the slowest rate of descent. The parachute that can hit the target with the slowest rate of descent is the winner. Also be sure to review the data collection process and how students will enter their data into iSense through Contribution keys.

5. Give students time to brainstorm, plan, design, construct and test their parachutes. When they are satisfied with their parachute, students should test their parachutes at the official test site. The drop height should be measured from the bottom the toy army soldier’s feet. The teacher will serve as the dropper. The target can be made on the ground with tape, string or a paper plate. Teams will collect data from four test drops.

6. Data to be collected from each test and entered into a table on student worksheet includes includes: drop height (2 meters for each test), drop time (seconds), and distance landed from target (cm). Once all data has been collected, students will calculate the velocity (meters/second) for teach test, as well as the average drop height (2 meters), drop time, velocity and distance landed from target. Students will enter this data into iSense.

7. Teams will complete an evaluation/reflection worksheet, and present their findings to the class.
 **Assessment**

The evaluation/reflection worksheet will be used as an assessment as it will reflect what students learned.