**Crash Barriers (Understanding Energy and Work)**

**Core Science Idea**: Mass and Height have an equal effect on the transformation from gravitational potential energy to kinetic energy when work is performed (Ep = mgh)

**Standards**:

SPI 0607.10.1 Distinguish among gravitational potential energy, elastic potential energy, and chemical potential energy.

SPI 0607.10.2 Interpret the relationship between potential and kinetic energy.

SPI 0607.10.3 Recognize that energy can be transformed from one type to another.

SPI 0607.10.4 Explain the Law of Conservation of Energy using data from a variety of energy transformations.

SPI 0707.11.4 Identify and explain how Newton’s laws of motion relate to the movement of objects.

SPI 0707.11.2 Determine the amount of force needed to do work using different simple machines

**Progression** (Storyline): This inquiry could be used in 6th Grade as an introductory lesson on gravitational potential energy or could be used at any point of this study to reinforce or correct ideas about potential energy. It could also be used in 7th Grade as an inquiry on force, mass, and acceleration.

**Science and Engineering Practices** (HOP):

**Anticipations**: Height will push the barrier further because the height will give the marble more force, two marbles will push the barrier further because the mass will make more force, two marbles and one book will move the barrier the same distance as two books and one marble.

**Lesson Flow**:

1. Setup
* Slide with deployed air bag, question on slide is: How do these things protest you? How do they absorb your energy if you crash?
* Slide with crash barriers at racetrack, question on slide is: How does this work to protect the driver?
1. Focus Question
* How does height and mass affect the way a crash barrier works?
1. Task Instructions
* You are going to construct a track from a piece of cardboard raised on books(s). Make a crash barrier from another piece of bent cardboard. Let’s investigate. Which crash barrier do you think will be pushed the farthest? One marble and one book, two marbles and one book, or one marble and two books.



* Make a prediction in your notebook. Please EXPLAIN your reasoning.
* Shoulder share, then Face share, ask 3 people to report out what their two partners said
* Data: In your notebook record the results from all three scenarios doing multiple trails and averaging each scenario separately. If time permits, you may do another scenario of your own choosing.
* Assessing and Advancing Questions: How many variable are you changing at a time? How many variables do Scientists change at a time? Why? Why did you report your data like that? Why are you using those units? What units do scientists use? What is that data showing you? Would this work in real life? Would you get these results in real life- Why or why not? What would make your results different? How does this compare to what you thought would happen?
1. Artifact: Organize your data into a table and write three sentences that state your results. Below this use the equation for Gravitational Potential Energy (Ep = mgh ) to prove your results are correct.
2. Structured Science Talk: Listen and compare with A/B groups. Be prepared to share your comparisons (Select and Sequence Chart)
3. Re-Answer Focus Question.
4. Exit Task: How has your thinking about potential energy changed because of this experience?