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1. ***Identify the "Big" concept to be covered by the engineering design challenge:*** Students will plan and conduct an investigation to understand the effects of gravitational force on an object. They will work to reduce the impact of the gravitational force on an object by designing a device that resists the force.

2. ***Research appropriate learning standards associated with the topic:***

3-PS2-1. **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.**

3-PS2-2. **Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.**

3-5-ETS1-3. **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	**PS2.A: Forces and Motion** • The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)	**Patterns** • Patterns of change can be used to make predictions.

Science and Engineering Practices	Disciplinary Core Ideas
• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**ETS1.B: Developing Possible Solutions** • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

3. ***Identify and discuss the different types of problem solving and declarative/procedural knowledge needed:***

Declarative Knowledge: Students need to know what a force is. They need to know how to measure to the nearest inch using a yardstick. They need to know how to graph data in a table.

Procedural Knowledge: Students need to know that patterns can be observed and measured. They need to know that patterns of change can be used to make predictions (3-PS2-1), and they need to understand what the cause and effect relationship is within this investigation.

4. ***Explore objectives and ancillary concepts/content covered by the project:***

*Students will work collaboratively to design and test a craft that diminishes the impact of gravity on an object.

*Students will measure the impact of their shock-absorbing system from different heights and will test different solutions to determine which 'landing gear' best absorbs shock.

Ancillary concepts: Potential & kinetic energy, acceleration due to gravity, air resistance, measurement.

5. ***Identify possible activities:*** In my classroom this year, students completed an egg drop challenge. They dropped eggs from a second story in devices they created to protect the eggs from harm, but the activity was lacking in connection to a real-world problem, ancillary concepts listed above, and one final constraint: keeping an astronaut upright and in their 'cabin'.

6. ***Select the best activity for your classroom.*** Students will design and build a shock-absorbing system that will protect one 'astronaut' (marshmallow) when it lands.