Phase 1 - Research & Planning

NASA / Design Squad Challenge - “Touchdown” & “Roving on *Mars” Combination

1. Big Concept:

The goal of these challenges being put together is to design and build a shock-absorbing system that will protect a rover system when it lands on *Mars. (I am changing the landing to Mars because this planet is constantly brought up in my lessons/curriculum via a Mission Log project).

Materials to be used: (some are ones that I will personally add to it)

- corrugated cardboard body
- corrugated cardboard wheels
- sharpened round pencil
- ruler
- tape
- round candies (the
- hard, white, mint ones
- with a hole in the middle)
- plastic/paper drinking straws
- Scissors
- stiff paper or cardboard
- index cards
- Miniature marshmallows
- rubber bands
- plastic straws
- Repurposed bubble wrap
- Wooden sticks
- Bamboo q-tips
- **More will be added later on as the process of gathering materials begins...

2. Standards Covered:
    a. MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
    b. MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

c. MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
d. MS-PS2-2: Plan an investigation to provide evidence that a change in an object's motion depends on the sum of the forces on the object and the mass of the object.
e. MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

3. Types of Problem Solving & Declarative/Procedural Knowledge Needed:

Students will need to know the concepts of gravity, acceleration, types of energy and forces. They will also need to know how to take measurements using the metric system. They will need to be able to follow a step by step process after having written and picked a possible solution/design. For example, they should make connections to things such as how they will make the rover move once it safely lands, how will the wheels work and move, etc. Students may need to know Mars facts such as it's gravity/mass, atmosphere, etc. https://youtu.be/QnuLxzocuhY This video can give them ideas as to what their rover design could look like (just the concepts themselves, they obviously won't have the correct materials).

4. Objectives, ancillary concepts/content covered:

In the Touchdown portion of the challenge, it covers potential and kinetic energy, air resistance, acceleration due to gravity, and measurements for when they are dropping it from various heights. In the Rover part of the challenge it will cover friction, Newton's 2nd law, P & K energy and Measurements for how far their rover moves.

5. Possible Activities:

I would have the kids first off start with creating the space shuttle that will be carrying the rover. This way the size will accommodate the rover inside of it. I would also have the kids create a flapping door/ramp that would allow the rover to slide down onto Mars and begin roving.

This challenge would be perfect for 8th grade students in multiple different lessons that would cover different standards. I could have them

make and keep each model they make and we could use them to further discuss ideas such as friction, P & K energy and Newton's 2nd law.

6. Best Activity for My Classroom:

I am not sure what the BEST activity would be, but I believe that following the curriculum pacing and completing the challenge in separate parts could be beneficial. If the students were learning about Newton's second law first before air friction then they may build the rover first and test that out. Then the air shuttle may come later. Either way, I would want the two challenges to be pieced together at some point in the school year.

**On a side note, I might be able to start this project on my own and then when I get to my new home in July I could test out having an adult try and go through the challenge and I could practice going through the engineering and design process with him.