From Potential to Kinetic: The Journey of a Rubber Band Rocket

Grade Level: Suitable for 2nd to 5th Grade

Objective:

- Students will understand the concepts of potential and kinetic energy.
- Students will explore how changes in design affect the flight of a rubber band rocket.
- Students will engage in the engineering design process to create and optimize their rubber band rockets.

Standards:

- **NGSS 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.
- **NGSS 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.
- **NGSS 4-PS3-4:** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Materials:

- Duct tape
- Masking tape
- Paper towel rolls
- Rubber bands
- Construction paper or cardstock for fins
- Scissors
- Ruler

Procedure:

1. **Introduction to Energy Concepts (10 minutes):**
    - Introduce potential and kinetic energy. Discuss how energy can be stored and transformed from one type to another.
2. **Design Options Introduction (5 minutes):**
    - Explain the two design options:

        - **Option A:** Provide students with a base design for their rocket. Here is a video link that shows how to make the rubber band rocket: Rubber Band Rocket Video Link
        - **Option B:** Give students the materials and let them create their own designs.
    - Divide students into groups according to their preferred option.
3. **Building the Rockets (30 minutes):**
    - For both options, provide materials and guide students through the construction of their rubber band rockets. For Option A, demonstrate step-by-step construction. For Option B, allow students to experiment with their own designs.
    - Discuss how the rubber band's tension acts as potential energy.
4. **Testing and Modification (20 minutes):**
    - Allow groups to test their rockets by launching them in a safe outdoor or gym area. Students should measure the distance traveled and note the flight stability.
    - Encourage students to modify their rockets based on their observations.
5. **Discussion and Reflection (15 minutes):**
    - Reconvene the class and discuss the outcomes. Use the guiding questions to facilitate discussion:
        - What happens to the rocket when you pull the rubber band further?
        - How does the angle of launch affect the rocket's flight?
        - What design changes helped improve the rocket's performance?

Guiding Questions:

- What modifications did you make to improve your rocket's performance?
- How did changes in the rubber band's tension affect the distance your rocket traveled?

Conclusions:

- Students should conclude that increasing the tension in the rubber band increases the potential energy, which when released, transforms into kinetic energy, propelling the rocket further.
- They should also observe that the design of the rocket, including the placement and size of fins, affects its stability and flight path.

Assessment:

- **Performance Assessment:** Evaluate each group's ability to apply the concepts of potential and kinetic energy based on the design and performance of their rockets.
- **Reflection Journal:** Have students write a reflection on what they learned about energy transformation and the engineering design process.

Extensions:

- **Creative Design Challenge:** Invite students to decorate their rockets and hold a competition for the most creative design.
- **Parachute Addition:** Challenge students to add a parachute to their rocket that deploys after launch, integrating lessons on air resistance.
- **Video Analysis:** Record the rocket launches and analyze the videos to visually demonstrate the energy transformation and discuss improvements.