

Rocket Sled

Objective:

Students will learn about Newton's Third Law of Motion, which states that for every action, there is an equal and opposite reaction. By participating in this activity, they will observe how throwing a sandbag off a skateboard causes them to move in the opposite direction.

Materials:

- 1 skateboard per student
 - 5 small sandbags (or bean bags) per student
 - Runners to protect the floor in case sandbags leak
 - Tape or markers to mark start and finish lines
 - Stopwatch (optional)
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Preparation:

1. Set up a designated area where students can safely perform the activity. Make sure the floor is clear of obstacles.
 2. Have each student sit on a skateboard with five sandbags (one at a time) in their lap.
 3. Mark a starting line and a finish line at the opposite end of the area.
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Activity Timeline:

25 minutes per rotation. 5 rotations. 5 minutes between rotations. 27-30 students per rotation.

2 minutes: Introduction – Newton's Third Law

20 minutes: Students take turns on skateboards.

3 minutes: Discuss observations.

Activity Instructions:

1. **Introduction to Newton's Third Law:**

- Start by explaining Newton's Third Law of Motion: "For every action, there is an equal and opposite reaction."
 - Give an example: "If you push against a wall, the wall pushes back on you just as hard, but in the opposite direction. This is how rocket engines work too—they push gas out one way, and the rocket moves the other way."
2. **Set-Up:**
- Each student will sit on a skateboard and hold five sandbags in their lap.
 - Explain that the goal is to move across the floor by throwing one sandbag at a time off their lap.
3. **How It Works:**
- **Action:** When the student throws a sandbag in one direction, it pushes off their lap.
 - **Reaction:** According to Newton's Third Law, the opposite reaction is that the skateboard will move in the other direction.
 - Make sure students understand that they should only throw one sandbag at a time, as the force they create will move them in the opposite direction.
4. **Safety Reminder:**
- Make sure students are sitting safely on the skateboard and not standing.
 - Remind them to throw the sandbag gently and in control, so no one gets hurt.
5. **Let's Begin:**
- At the start line, each student will sit on the skateboard with all five sandbags in their lap.
 - When you say "Go," the students will throw one sandbag at a time onto the floor in front of them, using the action of the sandbag being thrown to propel them backward.
 - After each throw, students will stop for a moment, check if they are moving, and get ready for the next throw.
6. **Repeat:**
- Students should continue to throw the sandbags one by one until they've thrown all five and moved as far as possible across the floor.
7. **Optional Challenge:**
- You can time how long it takes students to reach the finish line after all the sandbags are thrown. Then, have them try again to see if they can improve their time!
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Discussion Questions:

- **How did throwing the sandbags make you move?**
- **Did you notice how your movement speed changed with each throw? Why do you think that happened?**
- **What do you think would happen if you threw the sandbag harder or lighter?**

Conclusion:

- Recap the activity by discussing how Newton's Third Law of Motion worked in this experiment. The action of throwing the sandbags caused an opposite reaction that moved them across the floor.
- Encourage students to think of other examples of Newton's Third Law in their daily lives, like jumping off a swing or riding a skateboard.
- When a rocket ignites, the fuel burns and makes huge amounts of hot gases that expand and shoot out the back of the rocket. As the gases thrust downward, the rocket is pushed upward.

Safety Note: Ensure students are wearing appropriate footwear to prevent slipping, and always supervise the activity to ensure safety.

Notes: Keep an eye on sandbags for leaks. With sand on the cafeteria floor, the wheels damage the floor surface.