

LESSON 5: APPLYING NEWTON'S LAWS TO SKATING

Grade-Level Outcomes

Primary Outcomes

Safety: Uses physical activity and fitness equipment appropriately and safely, *with the teacher's guidance*. (S4.M7.6)

Movement concepts: Identifies and applies Newton's laws of motion to various dance or movement activities. (S2.M12.7)

Individual-performance activities: Demonstrates correct technique for basic skills in 1 self-selected individual-performance activity. (S1.M24.6)

Embedded Outcome

Social interaction: Demonstrates the importance of social interaction by helping and encouraging others, avoiding trash talk and providing support to classmates. (S5.M6.7)

Lesson Objectives

The learner will:

- demonstrate backward skating.
- demonstrate jumping over an obstacle.
- apply Newton's laws to in-line skating.

Equipment and Materials

Per student or every two students of similar size:

- Helmet (sanitized between interpersonal use)
- Pair of knee pads
- Pair of elbow pads
- Pair of wrist pads
- Pair of in-line skates
- 5 to 10 12- × 2- × 2-inch (30 × 5 × 5 cm) blocks, carpet squares, or similar pieces of equipment
- Paved and grassed area
- 4 to 20 cones (any size)
- 5 to 20 small blocks
- Low-level step or ramp with ample space for landings

Introduction

What are Newton's laws of motion? (law of inertia: tendency of objects to continue what they are doing; law of acceleration: the greater the mass, the greater the force needed to move that mass; law of action–reaction: for every action there is an equal and opposite reaction) How do they apply to in-line skating? If the wheels stop rolling fluidly, you will fall; the relationship among force, mass, and acceleration can make you fall if you skate too fast when your mass isn't distributed correctly by staying low; when you skate, the ground pushes back against you to propel you. We're going to apply these principles while learning to skate backward today.

Instructional Task:

Skate Backward by Shifting Body Weight Left and Right

■ PRACTICE TASK

Using Newton's laws, we are going to learn how to skate backward.

Instruct students using the following progressions:

- Step side to side: Students gain confidence stepping side to side and maintaining balance; as the heel drives outward, the wheels will begin to roll. Remind students to maintain the crouched position, with head up.
- Carve the letter C: Students begin to make the letter C as the outward leg steps; the hips begin to rotate to assist. Weight shifts from the back wheel to the front wheel as the C is formed.
- Students may opt to carve the letter C with each skate independently at first.
- Skate backward: Momentum created by carving the letter C will propel the skaters backward. Cue students to maintain the crouched position, with head up, glancing backward to ensure safety.

Split the group in two and have half the students practice skating backward at a comfortable speed, trying to maintain a straight line. When they reach their designated area, the other half will go.

Repeat until students are moving more fluidly.

Extensions

- Students may skate backward or forward around obstacles.
- Record students for video analysis.

Refinements

- Emphasize looking over the shoulder to make sure no one collides with another skater.
- Students watch video of themselves performing the skill and discuss body positioning during backward skating.

EMBEDDED OUTCOME: S5.M6.7. Discuss with students that backward skating is a difficult skill and they should encourage one another and be supportive while practicing. Provide feedback to students about how well they support classmates during the practice task.

Guiding questions for students:

- Is the law of inertia greater on surfaces that are paved or grass?
- How does the law of acceleration affect skating on grass?

Student Choices/Differentiation

- Students may practice side-to-side movements on grass or paved surfaces but will likely not feel the wheels begin to roll to encourage movement backward until on paved surfaces.
- Students may skate backward or forward along designated pathways using cones.

What to Look For

- Students begin with feet in the A position.
- Students press the heels outward in or out of sync for speed changes and then back inward like a C to propel.
- Making the C shape is heel driven initially, and then students' weight shifts to the toes for a flick motion to finish the C.
- Students look over the shoulder to navigate.

Instructional Task: Jump and Land

■ PRACTICE TASK

Using Newton's laws, review the previous jumping skills.

- Review jumping: Center weight over skates, set feet shoulder-width apart or slightly wider, bend knees, push upward with legs, keep head up, swing arms with elbows bent.
- Students practice jumping over a variety of obstacles.

Extensions

- Jump with a partner to explore height versus length of jumping.
- Students watch video of themselves performing the skill and discuss body positioning during backward skating.

Guiding questions for students:

- How did Newton's laws help with your jumping practice?
- How does the law of action–reaction explain jumping and landing successfully?
- How did bending the knees and pushing upward help you to jump vertically?
- How does your body absorb the force of landing? How does this action relate to Newton's laws?

Student Choices/Differentiation

- Students can jump up steps if they are spaced well apart to allow time for landing, and then down steps if students can maintain balance jumping upward.
- Students can jump over low-level ramps.
- Students can skate linearly, with small obstacles along the pathway to jump.

What to Look For

- Weight is over skates at all times.
- Arms are used for balance (generally in front or to the side, as needed).
- Knees are bent to begin jump and softened to land.

Formal and Informal Assessments

- Video analysis: backward skating, jumping, and landing
- Exit slip: In your own words, describe how Newton's laws apply to in-line skating.

Closure

Body positioning lends itself to success.

- What are key positioning points for backward skating? (Answer: knees bent, heels in a C)
- What are key positioning points for jumping? (Answer: knees bent, arms for balance, weight on skates)

Reflection

- Do I have enough practice opportunities for all levels of learners regardless of the skill they are mastering?
- Are most of the students getting the feel for skating backward?
- Could we partner students who struggle with balance when looking backward while skating with face-to-face partners who are skating forward to look out behind?

Homework

Think of other uses of Newton's laws of motion in other activities. Discuss your ideas with a friend or family member.

Resources

Miller, L. (2003). *Get rolling: The beginner's guide to in-line skating*. 3rd ed. Danforth, CA: Get Rolling Books.

Internet keyword search: "how to in-line skate backward," "how to in-line skate jump," "Newton's laws and in-line skating"