Skating 1

# Skating

Skating 2

## Introductory Question

- A rotary lawn mower spins its sharp blade rapidly over the lawn and cuts the tops off the grasses. Would the blade still cut the grasses if they weren't attached to the ground?

A. Yes
B. No

Skating 3

## Observations about Skating

- When you're at rest on a level surface,
  - without a push, you remain stationary
  - with a push, you start moving that direction
- When you're moving on a level surface,
  - without a push, you coast steady & straight
  - with a push, you change direction or speed

Skating 4

## 4 Questions about Skating

- Why does a stationary skater remain stationary?
- Why does a moving skater continue moving?
- Why does a skater need ice or wheels to skate?
- How does a skater start or stop moving?

Skating 5

## Question 1

- Why does a stationary skater remain stationary?
  - What keeps the dishes in place on a table?
  - If I pull the tablecloth, what will happen?
  - Does the speed at which I pull matter?

Skating 6

## Physics Concept

- Inertia (just the first part)
  - A body at rest tends to remain at rest

Skating 7

## Question 2

- Why does a moving skater continue moving?
  - What keeps a moving banana moving?
  - Can I slice a moving banana in midair?

Skating 8

## Physics Concept

- Inertia (the whole thing)
  - A body at rest tends to remain at rest
  - A body in motion tends to remain in motion

Skating 9

## Newton's First Law (Version 1)

- An object that is free of external influences moves in a straight line and covers equal distances in equal times.

Skating 10

## Question 3

- Why does a skater need ice or wheels to skate?
  - Why does a hovercraft need an air cushion?

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## Keeping It Simple

- Real-world complications mask simple physics
- Solution: minimize or overwhelm complications
- To demonstrate inertia:
  - work on level ground (goodbye gravity)
  - use wheels, ice, or air support (goodbye friction)
  - work fast (overwhelm friction and air resistance)

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## Physical Quantities

- Position – an object's location
- Velocity – its change in position with time

Skating 13

## Newton's First Law (Version 2)

- An object that is free of external influences moves at a constant velocity.

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## Physical Quantities

- Position – an object's location
- Velocity – its change in position with time
- Force – a push or a pull

Skating 15

## Newton's First Law

- An object that is not subject to any outside forces moves at a constant velocity.

Skating 16

## Introductory Question (revisited)

- A rotary lawn mower spins its sharp blade rapidly over the lawn and cuts the tops off the grasses. Would the blade still cut the grasses if they weren't attached to the ground?

A. Yes
B. No

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## Question 4

- How does a skater start or stop moving?
  - What does a push do?
  - What does a skater respond to a push?
  - Do all skaters respond equally to equal pushes?

Skating 18

## Physical Quantities

- Position – an object's location
- Velocity – change in position with time
- Force – a push or a pull
- Acceleration – change in velocity with time
- Mass – measure of object's inertia

Skating 19

## Newton's Second Law

- An object's acceleration is equal to the net force exert on it divided by its mass. That acceleration is in the same direction as the net force.

acceleration = net force/mass

net force = mass · acceleration

Skating 20

## Clicker Question

- To find the full bottle of water, without lifting anything, you should

A. compare the velocities of the two bottles.
B. compare the positions of the two bottles.
C. push each bottle and observe its acceleration.
D. consult a Ouija board.

Skating 21

## Summary about Skating

- Skates can free you from external forces
- When you experience no external forces,
  - You coast – you move at constant velocity
  - If you're at rest, you remain at rest
  - If you're moving, you move steadily and straight
- When you experience external forces
  - You accelerate – you move at a changing velocity
  - Acceleration depends on force and mass