

## Put a Spin on It – Direct Instruction

### Nevada Academic Content Standards for Science

We realize that you will need to tailor the lesson and line of questioning to the grade level you teach, to best address the NSSCS that are covered. The following strands are applicable to this lesson:

#### Disciplinary Core Ideas

- PS2 Motion and Stability
  - PS2A Forces and Motion
  - PS2B Types of Interactions
  - PS2C Stability and Instability in Physical Systems
- PS3 Energy
  - PS3A Definitions of Energy
  - PS3B Conservation of Energy and Energy Transfer
  - PS3C Relationship Between Energy and Forces

#### Cross Cutting Concepts

- Cause and effect
- Scale, proportion and quantity
- Energy and matter
- Structure and function
- Interdependence of science, engineering, and technology

#### Science and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

### Introduction

A spinning top is a toy designed to spin rapidly on a flat surface, when torque (the rotational version of force) is applied. When kinetic energy is applied by torque, it sends the top into motion. The point where the top rotates is known as the axis of rotation, where the center of gravity lies. The movement of the top, or angular momentum, causes it to remain precisely balanced on its tip until friction pulls the top off center.

### Questions to Investigate

- What makes a toy top spin?
- What other materials or items could you use to design a top that spins?

### Questions to Investigate (continued)

- If you move the weight farther from the center of the top (axis of rotation), do you expect it to spin longer, shorter, or the same amount of time?
- If you add more weight to your top, how will this affect your spinning time?

### Materials

Recording Sheet  
Card Stock or Plastic 3-inch Circle  
Small Skewer or Golf Pencil  
2 Rubber Bands  
Tape  
Pennies  
Stop Watch

### Procedure

1. Cut a 3-inch circle from a piece of card stock or plastic.
2. Use a skewer or pencil to make a starter hole directly in the center of the circle.
3. Insert a small skewer or pencil through the center of the circle. The pointed end should extend through the circle  $\frac{3}{4}$  of an inch.
4. Stabilize the skewer or pencil by wrapping a rubber band around both ends of the pencil near the center of the circle.
5. Spin the top a few times (sharpened end down) to ensure that the skewer or pencil stays firmly attached and perpendicular to the circle.
6. Using tape, attach 4 evenly spaced pennies on the surface of the top, ensuring that all 4 pennies touch the rubber bands securing the pencil or skewer.
7. Take a few practice spins. Afterward, use a stopwatch to measure the amount of time your top spins before it stops moving. Record the time. Repeat until you have a record of three separate spins and recorded times.
8. Move the 4 pennies to the outer edge of the surface of the top, taking care to space them evenly.
9. Take a few practice spins. Afterward, use a stopwatch to measure the amount of time your top spins before it stops moving. Record the time below. Repeat until you have a record of three separate spins and recorded times.
10. Compare your times from both trials. Did the top spin longer with the pennies placed near the axis of rotation, or away from the axis of rotation?

### Record

#### PENNIES NEAR AXIS

SPIN 1

Spin Time:

SPIN 2

Spin Time:

SPIN 3

Spin Time:

#### PENNIES AWAY FROM AXIS

SPIN 1

Spin Time:

SPIN 2

Spin Time:

SPIN 3

Spin Time: