Ski Jump!

Using Spheros to Investigate Speed and Jump Length

Today, you will use Spheros to determine how far a Sphero can jump with varying speed and kinetic energy. After you learn the pattern, you will pick your own speed, make a prediction, and test it out!

Part 1: Collect Baseline Data

1. Wake up your Kindle Fire tablet by tapping the screen or quickly pushing the power button.
2. If Sphero Edu app is not already running, click on its icon to start it. When prompted, click as a Guest user.
3. Tap on the second icon along the bottom to open the programs. Find "Ski Jump" and tap on it.
4. You will see a very simple program – just one block. Make sure that it is set to "roll 0^o at 150 speed for 5 s". If any of the fields are incorrect, just tap on them and correct them.
5. Now you need to pair the tablet with your Sphero. Along the top, there are three icons on the right. Tap on the middle one (looks like a semicircle with speed lines extending to the left). Find your Sphero ID in the list and tap on it.
6. Bring your tablet and Sphero to your ski jump. Place Sphero on the starting line and line it up with your ramp. Next, you need to aim Sphero. Tap on the icon that says AIM on the top-right of your tablet screen. Drag the blue dot around until the blue tail-light of the Sphero is pointing at you (opposite the direction the Sphero will go). Then back out of that screen.
7. When you're ready, tap Start. Watch carefully to see where the Sphero lands!
8. Record the distance of your Sphero's jump in the data table below.
9. Repeat steps 6-8 for speeds 200 and 250.

Data & Analysis

Speed	Distance (m)	Kinetic Energy (J)
150 (1m/s)		
200 (1.35m/s)		
250 (1.7m/s)		

1. Calculate the kinetic energy the Sphero needed to make each jump. KE = ½ * mass * velocity. (You will need to measure the mass of your Sphero on a nearby scale or balance in kg).

2. What do you notice about the speed and kinetic energy needed to make shorter jumps versus farther jumps?

Adapted from SpheroEdu: Sphero Winter Olympics Ski Jumo (sic)

3. Is there a pattern to the speed and kinetic energy needed to make each jump? For example, does it take 2x more energy to go from a 4cm to an 8cm jump, or some other pattern?

Part 2: Make a Prediction

Using the pattern you discovered, make a prediction for another jump distance of your choice. Remember, the Sphero's speed is limited to 255.

In order for the Sphero to jump _____ cm it must be traveling at a speed of about

_____ and have a kinetic energy of about _____.

Now, test your prediction using the steps in Part 1.

1. What speed and kinetic energy were needed to make your jump? How close was your prediction to your actual results?

2. Kinetic energy depends on both speed (velocity) and mass. We tested what speed was needed to make different length jumps. What do you think would happen if we changed the mass and had a heavier Sphero? (ie, how does mass affect the distance a Sphero could jump?)