**Physics of Ice Skating**

**Grade 2**

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**Benchmarks**

* “I can observe the relationship between forces and motion.”
* “I can plan and conduct simple investigations.”
* “I can employ simple equipment and tools to gather data and extend the senses.”
* ‘I can communicate about observations, investigations, and explanations.”

**Materials:**

* A large sheet of sand paper
* A smooth surface (i.e. a table) – will have at elementary school
* A heavy book to slide in friction experiments
* Sitting spinner (from Harold Whitt of OSU physics dept)
* Weights for students to hold (it is good to have 2 waterbottles and 2 handheld weights – waterbottles for the students who have a hard time lifting the weights)
* Optional: “barf bucket” (only as a joke!)

**Procedure – If a large group (40-60 students), split in half. While half is doing friction, half can do the Spinning experiment, then they can switch.**

Friction

Start by asking the students if any of them have been ice skating before. What is different about walking on ice as compared to walking on concrete? If they describe it as being slippery, ask them what force it is that stops you from slipping. Hopefully they will eventually get to friction. If not, introduce it! Friction is a force that resists motion.

*Please note – there is a good chance these students have never seen this term before, so don’t be surprised if it’s all new to them! That’s okay! Just introducing it to them, even if they don’t fully understand, is enough. Don’t spend much time “lecturing” them.*

Give them a few examples. Come up with your own, or:

* When you are going down a slide, if there is a LOT of friction, then you don’t go very far! That is because **friction resists the motion of you sliding down the slide.** If there is very little friction, you will slide quickly down the slide.
* When the ground is really slippery, there is very little friction and you could fall. That is because there is no friction to oppose the motion of your foot. Normally, we can walk and run because friction stops our feet from sliding out from under us.

Ask the class:

* If you are out sledding in the wintertime do you want *a lot* of friction or *a little* friction? Why?
* If you are walking down the sidewalk in the wintertime, do you want *a lot* of friction or *a little* friction? Why?

Tell them we are going to do a small experiment to see how much friction there is on different surfaces. The three surfaces are ice, a table, and sandpaper. Have them predict which they think will have the **most** and **least** amount of friction. (If the term friction still confuses them, ask them which one it will slide the **most** on and which one it will slide the **least** on). Ask them how they can make an experiment to test this.

Have a student (or 3) come up to the front of the classroom to slide the book across both surfaces. Discuss their observations with them. Were their predictions correct? Which surface had the most friction? Which surface had the least friction? Can they relate this to their everyday life?

Ice Skating

Every day ice skaters are on a surface with *less* friction than, for example, a sidewalk or a floor. Discussion topic: Is there **any** friction on ice? Why or why not? (Yes, there is – otherwise the ice skaters wouldn’t be able to change directions, spin, or skate across the ice, just like how we need friction to walk forward).

Has anyone seen ice skaters spinning on ice? (Divers do this too). What do they do with their arms? Why do they do it?

Ask the students: What do they think determines how fast a skater spins? Write their guesses on the board. Now tell them we will test their hypotheses. (The list might have some silly answers but good guesses are weight/mass, size, how fast they start, etc).

Now show them the spinner and tell them that someone is going to sit on it and spin. How can they test their hypotheses on the board using the spinner?

Now try to run the experiments! –

Have one student sit with their legs crossed on the spinner. The best test will be with their arms open and closed with the weights. To do that, have them stretch their arms out with a weight in each hand. Start them at a slow spin. Then tell them to quickly pull their arms in and hug themselves. IF you do this in the middle with the other students watching, they should all visibly see the student speed up.

You can run other tests to test their hypotheses. All of these have to do with angular momentum! (The explanation with conservation of angular momentum is difficult to explain at that level, so it is probably better to just explain it as a science experiment to test hypotheses about what makes them go faster…)

**If you have extra time, try to let everyone who wants to have a chance to test the spinner!**