



MINI ICE RINK



HAVE YOU EVER SLIPPED ON ICE? That unfortunate slip is the key to all winter sports. From snowboarding to hockey, the extra zip in these sports is due to the extra slip you get from ice. Now, to understand this slip you first have to understand the science of friction.

THE SCIENCE OF SLIP

Everything that moves experiences a force called friction. Friction slows down motion. It is caused by an object rubbing against the surface it is moving against. When a ball is rolled along the ground the energy of its motion is converted by friction into heat and sound, until it stops moving. The amount of friction is affected by two things: the texture of the surfaces, and the amount of force that is pushing them together. Friction exists because no matter how smooth a surface appears, microscopically it will be quite rough with tiny peaks and valleys. When two surfaces move against each other, the microscopic peaks and valleys catch on each other and slow the motion down. The rougher a surface is, the greater the amount of friction.

WINTER SPORT SCIENCE FUN

Ice has low friction and is slippery even though it can feel quite rough. Most things shrink when they freeze. However, the special way water molecules join together cause's water to expand when it freezes. This means if you then squeeze ice and force it to contract it will melt. Pressing on ice makes the surface melt, creating a layer of water then acts as lubricant filling in all the microscopic peaks and valleys and creating a smooth surface that reduces friction. Something you will have discovered yourself if you have had your feet skate out from under you. Winter sports equipment makes use of this science by using thin metal edges to concentrate the weight of the athlete and melt the ice. This creates a thin film of water under the athlete, reducing friction and maximizing their slip.



FORCE

A push or a pull.

FRICTION

A force that resists motion and occurs whenever there is contact between things moving at different speeds.



- 1 **If you roll something along the ground, does it roll forever?** *No, it eventually stops. This is because of friction.*
- 2 **Have you ever slipped on ice?** *Children's choice.*
- 3 **What are the names of some winter sports?** *Ice Skating, skiing, and sledding.*
- 4 **Is it easier to ride sled down a hill on a piece of rough carpet or a smooth hard plastic sled?** *It is easier on the sled because it is harder and smoother than the carpet and creates less friction.*



what YOU WILL NEED & before YOU BEGIN

- 1 **1 ¼ Sheet Aluminum Cake Sheet Pan** (12 x 8 x 1¼)
- 2 **2 Quarters** (Coins)
- 3 **1 Permanent Marker**
- 4 **1 cup**
- 5 **Access to a freezer**

- Take a pan and place it in a freezer so that it sits flat.
- Use a cup to fill the pan ¾ full with cold water.
- Mark a line on the side of the pan the level that the water reaches. Leave undisturbed for 24 hours.

EXPLORE & EXPERIMENT

- 1 **Ask the children to rub their hands together really fast.** What do they feel? Explain that the heat they feel is due to friction. Explain that friction is a force that slows things down.
- 2 **Place a quarter flat on table.** Have the children guess how far it will slide if pushed by one finger. Have a child try to slide it across a table. How far does it slide? The coin stops because friction steals away its motion.
- 3 **Try sliding the coin on a carpet or a piece of cloth.** Do the children think that the coin will slide more or less than the table? Have the children try as many different surfaces as they can find. Query the children to find out if rough or smooth surfaces generate more friction to stop the coin from sliding.

EXPLORE & EXPERIMENT (continued...)

- ④ **Take out the pan of water you placed in the fridge yesterday.** You may want to use gloves because it will be very cold.
- ⑤ **Place your quarters into the fridge to cool them down.** If the quarters are warm they will melt the ice too fast and sink in. Leave the pan out on a table for fifteen minutes.
- ⑥ **Have the children look at the line that you marked on the side of the pan.** Is the ice higher or lower than the mark? It should be higher. Explain that most things get smaller when they freeze solid, but because of the special way that water bonds together, it gets bigger and expands when it freezes.
- ⑦ **When the surface of your mini ice rink has gone from dull to shiny grab your quarters.** When the ice goes shiny it indicates the top has started to melt and a thin layer of water has formed on it. Have the children experiment with sliding coins across the surface. Ask the children if the coins slide easier on the ice or the table? The ice has really sped things up. 
- ⑧ **Have the children observe the ice. Is it rough or smooth?** The ice is quite rough, it may feel rougher than the table, but the coins still slide better. This is because the surface of the ice is turning into water, which acts as a lubricant. When winter athletes skate, snowboard, sled or ski they are getting extra zip as they slip along on a thin film of water.
- ⑨ **Remember that water expands when it freezes.** Well guess what? If you squeeze ice, it turns back to water. Have the children take a quarter and stand it up on the ice. What happens if they push down on it? The quarter sinks in. Can you see any water? Because the quarter has a thin edge when you pushed down all your force was applied to just the thin edge. This is a lot of force squeezing the ice. The ice under the coin melts allowing your coin to sink in. The water quickly freezes again and if you left your quarter in the ice you will see that it is now frozen in place. 

make THE CONNECTION

THINK ABOUT SKIS, SKATES AND SLEDS.

WHAT DO THEY ALL HAVE IN COMMON? They all run on thin edges. The thin edges on skates, sleds, skis and snowboards concentrate all the weight of into a small area. This extreme pressure squeezes the ice to create water for the athlete to slip on. Have the children share any experiences they have had doing winter sports. Ask the children explain how the equipment they used reduced friction. Show pictures of winter sports equipment and have the children find the edges that create the low friction slip. Have the children share any experiences they have had doing winter sports. Ask the children explain how the equipment they used reduced friction.

EXTEND & EVALUATE

Provide paper and pencils and have each child design sled or other piece of equipment to zip down a snowy hill. After the children have finished, encourage them to share their designs with the group.