

## Hands-On Science Activity

Dear Parent,

Your student has been taking the Future Goals - Hockey Scholar™ online course, in partnership with the National Hockey League (NHL®) and the National Hockey League Players' Association (NHLPA).

This course uses the game of hockey to teach students about important science concepts. From calculating kinetic and potential energy to understanding phases of matter, students apply their scientific understanding to real-world scenarios. These six lessons use the Scientific Method to guide students through the process of making predictions, collecting data, and conducting analysis.

This packet contains additional hands-on activities to help students apply what they learned outside of the classroom. Students will build, play, and prepare a miniature ice rink as they explore science concepts. These hands-on science activities provide an additional opportunity for students to complete extension activities at home while having fun with the material.

Enjoy!

## MAKE A RINK

How do arenas get the temperature of ice just right before a hockey game? If it's too cold, the ice can be harder than it should be and break apart. If it's too warm, the ice can be soft and get slushy when players skate across it. Ice should be smooth as glass but soft so that players' skates can dig in as they change directions.

Build your own ice rink to find out the best temperature.

**Level:** Easy

**Time:** 30 minute prep time the night before + 15 minutes

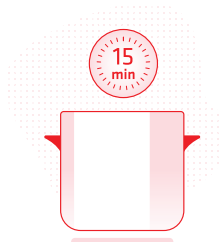
### MATERIALS

- |                   |                |              |
|-------------------|----------------|--------------|
| ■ 6 Cups of Water | ■ Butter Knife | ■ Pencil/Pen |
| ■ 9x13 Cake Pan   | ■ Small Pot    | ■ Timer      |

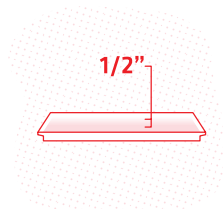
### PREP (To be done the night before)



- 1 In a small pot, boil 6 cups of water. This will remove trapped air molecules from the water.



- 2 Allow the water to cool off for 15 minutes.



- 3 Pour the water into the cake pan until there is about 1/2 inch of water.



- 4 Place the pan of water into the freezer to freeze overnight.

## DIRECTIONS

- 1 Take the pan of ice out of the freezer and place it on a table.
- 2 Take a butter knife and “skate” over the ice. Skate both up and down and in a figure 8 with your knife. Use enough force to scratch the ice.
- 3 Observe the scratches from both motions. How deep are the scratches? How hard is the ice? Imagine playing hockey on this ice. Would you be able to move and change directions easily as you follow the puck?
- 4 Write down your observations in the chart below.
- 5 Place the pan in the refrigerator. Wait 15 minutes and take the ice pan out again. Repeat Step 2 and write down your observations.
- 6 Leave the ice on the table for 15 more minutes. Repeat Step 2 and write down your observations.
- 7 When you are finished testing your rink, put the pan of ice back in the freezer so it doesn't melt!

### Observations

Type of Ice	Condition of Ice	Is the Ice Easy to Skate On?
From the freezer		
From the refrigerator		
Left on table for 15 minutes		

Which version of the ice pan do you think would make the best ice hockey rink?

Once you have decided on which version of the ice you would like to use, record your observations again.

## DID YOU KNOW?

Kinetic energy is the energy an object has because of its motion. The coldest solid water molecules (or ice) have the lowest kinetic energy because the molecules are moving the slowest. When heat is transferred to the ice, the kinetic energy increases, the molecules move faster, and the temperature goes up. When the molecules start moving fast enough, the solid ice turns into liquid water, and the kinetic energy increases.

Based on the three types of ice you tested, what level of kinetic energy makes for the best hockey ice?

- (A) Low kinetic energy
- (B) Medium kinetic energy
- (C) High kinetic energy

**Now that you know the best ice for hockey, you are ready to play!**

# PLAY ON YOUR RINK

Level: Easy

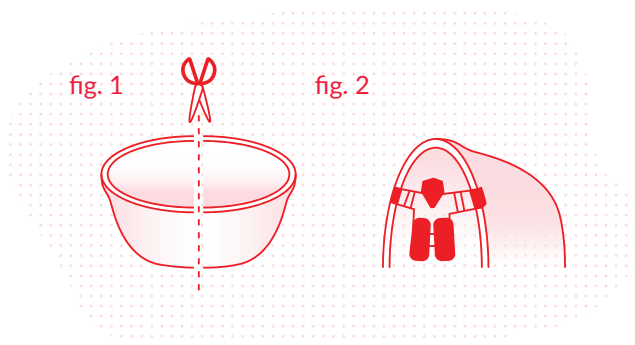
Time: Approximately 30 minutes

## MATERIALS

- 9x13 "Ice Rink"
- Scissors
- Timer
- Butter Knife
- Pen/Pencil
- Paper Goalie
- Nickel
- Yogurt Cup

## DIRECTIONS

- Place your rink in the freezer while you collect your other materials.
- While the rink is still in the freezer, make a goal by cutting the yogurt container in half (fig. 1). Place the halved container upside down at the end of the pan. This will be your goal. For an added challenge, cut out the figure of a hockey goalie on page 4 and attach it to the container so it covers up some of the opening like a goalie defending the goal (fig. 2).



- Take a nickel and a butter knife. The butter knife will be your hockey stick and the nickel will be the puck. Shoot the nickel with the knife. Set a timer or stopwatch and play for 2 minutes. How many shots did you make? How did the ice hold up? Put your rink back in the freezer while you record your data in the table below.
- Now, try this again for another 2 minutes. Observe the condition of the ice and record your data below.

- Finally, try this again for another 2 minutes as the third period of game play. Record your data below.
- When you are done, put the pan of ice back in the freezer so it doesn't melt!

## Observations

Periods	Number of Goals In 2 Minutes	Condition of Ice
Period 1 (2 minutes)		
Period 2 (2 minutes)		
Period 3 (2 minutes)		

How did the condition of the ice affect the way the nickel slid on the rink?

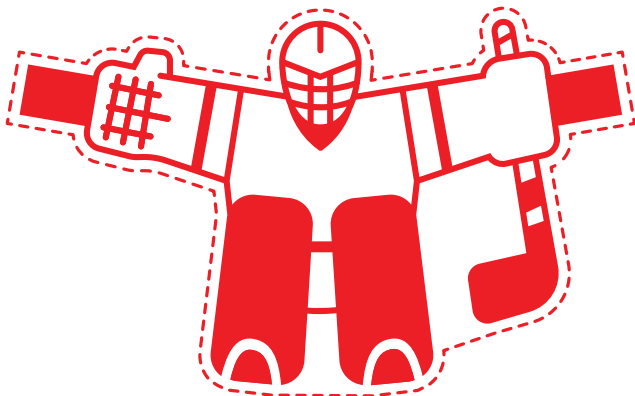
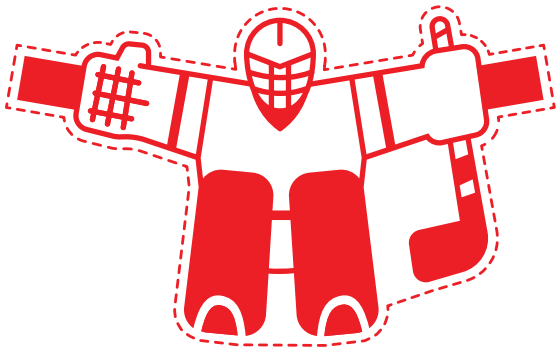
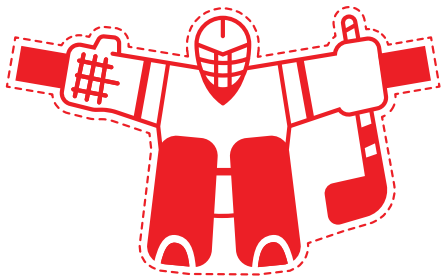
## DID YOU KNOW?

The kinetic energy of the ice increases the more you play on your ice rink! Two things make the kinetic energy of the ice increase: heat from the surrounding air and the kinetic energy that transfers from the hockey players. When the kinetic energy of the ice goes up, the molecules move faster, and the temperature goes up. In a real hockey rink, kinetic energy from the ice transfers to coils that are located under the ice. This keeps the ice cold enough so that the ice doesn't melt.

What kind of energy is affecting the ice?

- (A) Heat Energy
- (B) Kinetic Energy
- (C) Potential Energy

GOALIE CUT OUT

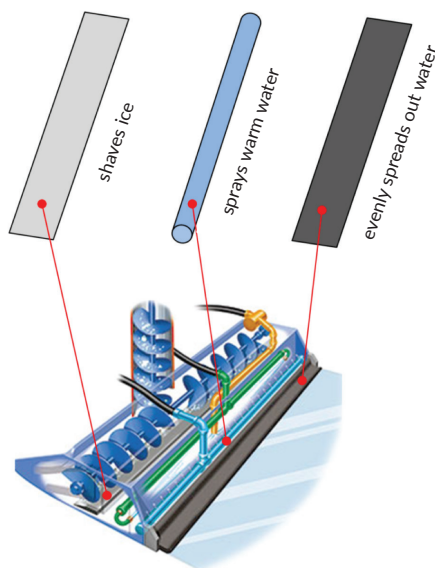


## INTERMISSION

Now you've played on your ice, your ice is scratched up. Did you know kinetic energy is the reason that hockey games have three 20 minute periods? The kinetic energy of the players damages the condition of the ice as the game goes on. Playing for long periods scratches up the ice, making it hard to play on. Hockey arenas solved this problem by using an ice resurfacing machine called a Zamboni<sup>®</sup> machine to resurface the ice between periods.



A Zamboni<sup>®</sup> machine uses the kinetic energy of motion to shave ice off of the rink surface. It also uses heat energy by laying down a layer of warm water which freezes clearer and faster and helps the water to bond better by melting the top layer of ice. After the Zamboni machine passes by, kinetic energy from the liquid water transfers through the ice to the coils below the ice rink. When the kinetic energy of the thin layer of liquid water is low enough, it turns into ice. This makes the surface ready for game play. Here is a picture that shows the inside of a Zamboni machine.



Now you can prepare your hockey rink like a Zamboni machine does!

**Level:** Easy

**Time:** Approximately 30 minutes

### MATERIALS

- 9x13 "Ice Rink"
- Rag or Sponge
- Timer
- Warm Water
- A Library/Credit Card or Spatula

- 1 Place your scratched-up rink in the freezer while you collect your other materials.
- 2 Take your rink out of the freezer.
- 3 Scrape small chips of ice off the top of your rink using a spatula, a library or credit card, or any other household item with a straight edge that can fit in your pan.
- 4 Place wash rag/sponge in warm water, and then squeeze most of the water back out of the washrag.
- 5 Use the warm, wet wash rag or sponge to wipe the top of the rink, leaving a small amount of water on the surface of the rink.
- 6 Put your rink back in the freezer for 15 minutes to refreeze.
- 7 Take your rink out of the freezer. Now you can challenge your friends to play again!

### DID YOU KNOW?

A Zamboni machine uses warm water to prepare the surface of the ice instead of cold water. Since warm water has faster moving molecules, it has a higher kinetic energy than the ice. This causes the top layer of the ice to melt and fill in all the scratch marks. When the water refreezes, the ice will be smooth again and ready for the game.

## FUN FACTS ABOUT THE ZAMBONI® MACHINE

### HOW MUCH SNOW DOES A ZAMBONI MACHINE COLLECT FROM RESURFACING AN ICE RINK?

The kinetic energy of the hockey players chips off lots of “snow,” or little pieces of ice. A Zamboni machine picks up about 60 cubic feet of snow each time it cleans the ice. That’s enough to fill the back of a pickup truck!

### HOW MUCH WATER DOES A ZAMBONI® MACHINE LEAVE BEHIND ON THE ICE?

A Zamboni machine leaves behind warm water. The water fills in some of the scratches and the kinetic energy makes some of the ridges melt. A Zamboni machine leaves behind about 180 gallons of water each time it repairs the ice. That’s more than two bathtubs full of water!

### HOW DOES A ZAMBONI® MACHINE KEEP MOVING ON THE SLIPPERY ICE?

Traction is important to maximize the efficiency and performance of the ice resurfacer. The Zamboni machine has tires that have small metal studs that “grab” onto the ice. This way it doesn’t slip and slide. The little holes that the tires make get fixed at the same time as the scratches in the ice. The warm water from the Zamboni machine fills them in!

### HOW FAR DOES A ZAMBONI® MACHINE TRAVEL EVERY YEAR?

A Zamboni machine only travels  $\frac{3}{4}$  of a mile each time it cleans the ice, but it cleans the ice many, many times. Most Zamboni machine machines travel 2,000 miles each year! That’s almost all the way from the Atlantic Ocean to the Pacific Ocean.

### HOW LONG WOULD IT TAKE A ZAMBONI® MACHINE TO TRAVEL FROM THE ATLANTIC TO THE PACIFIC OCEAN?

A Zamboni machine travels pretty slow, about 9 miles per hour. Resurfacers can operate using batteries and electric power or they may also run on a variety of fuel types including LPG, CNG, gasoline or diesel fuel. At 9 miles per hour, it only takes 7 minutes to clean a hockey rink. To travel from the Atlantic to the Pacific would take a lot longer. It would take a Zamboni machine 10 days, 22 hours, 26 minutes, and 40 seconds to travel the 2,362 miles from Jacksonville Beach, FL, to San Diego, CA. Or 14 days, 13 hours, 33 minutes, and 20 seconds to travel the 3146 miles from St. Johns, Newfoundland to Victoria, B.C.

### HOW THICK DOES ICE NEED TO BE TO HOLD A ZAMBONI® MACHINE?

A Zamboni machine weighs over 10,000 pounds. This means gravity is pulling down with 10,000 pounds of force, and the surface needs to push up with as much force or the surface will break. Ice on a lake would need to be more than 15 inches thick to hold all that weight without cracking. Ice in a hockey rink is on top of a solid floor so it only needs to be about 1 inch thick.

### WHAT ELSE DID FRANK INVENT?

Frank Zamboni also invented the Astro Zamboni machine, which removes rain water from AstroTurf and prevents unnecessary rain delays in outdoor sporting games. Mr. Zamboni developed two more machines for use on AstroTurf, one to help roll and unroll the surface and another that removes paint lines.

Source: <https://zamboni.com/about/fun-facts/>

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#### Multiple Choice Answers:

Based on the three types of ice you tested, what level of kinetic energy makes for the best hockey ice? **ANSWER: B**

What kind of energy is affecting the ice? **ANSWER: A & B**