Eye Wonder

S.C. Standards & Classroom Activities for Eye Wonder Zamboni

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Eye Wonder

Standards need to be updated.

Grade 5

Standard: IV.B.2.a.

Distinguish among gravity, friction, magnetism, drag, lift, and thrust.

Type of Activities: Lab

Introduction- After watching the video, students will perform this lab to see how friction or lack of friction on different surfaces can affect movement, such as the need for the spikes on the wheels of the Zamboni.

Background: Friction is defined as surface resistance to motion. This means that friction is what keeps something from sliding across something else. In order for something to overcome friction, necessary force must be exerted to compensate. When you rub your hands together and feel the heat and resistance, this is friction. When you apply the brakes of a bicycle and the wheels stop rolling, what is actually causing you to slow down is the friction between the wheels and the ground. Different surfaces have different degrees of friction. A rock, uneven road with have more resistance to movement (friction) than a smooth, ice-covered road. In your school, it is safer to walk across a carpeted room with wet feet after it has been raining than down the linoleum floors of the hallway. In the room, you probably won't slide because the friction between your wet feet and the uneven threads of the carpet is greater than the friction between your

feet and the slick linoleum of the hall. When it is necessary to move across slick surfaces where friction is reduced, therefore, you will need to use something to keep you from sliding

Activity: Sliding on ice.

This is a lab that illustrates how different materials have greater or lesser amounts of friction.

Materials: A pan with frozen water lining the bottom, a long board (at least 2 feet long), a large piece of fabric that you can use to cover the board, a small wooden block or brick, protractor

Procedure:

1. Using textbooks, stack one under one end of the pan with the ice. Measure the angle of the incline using the protractor.
2. Place the block/brick on the top end and see if it slides. If it does not, add another textbook, measure the angle of the incline, and see if the brick will slide. Repeat until it slides.
3. Repeat the above steps using the long wooden board.
4. Wrap the board in the fabric and repeat the above steps.
5. Record all data on a chart.

Follow-up: Have students make recommendations on what could be done to increase the friction between the brick and the ice. Have them also suggest ways to reduce the friction between the brick and the wood.

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Zamboni

Grade 5, 6, 7, 8

Standard: I.C.1.a&b. (5th/8th) I.B.1.a&b. (6th/7th)

Identify a specific need for a product (a).

Determine whether the product will meet the needs and be used (b).

Type of Activities: Pre-activity Brain storm and Follow-up Evaluation

Introduction- Before watching the video, the students will work in small groups to come up with a plan for cleaning and resurfacing the ice of a skating rink. Then, after watching the segment, they will evaluate their own design by comparing it with the description of the Zamboni in the video.

Background: What makes ice slippery when you skate on it is that the ice begins to melt and the water creates a slick surface on top of the ice that slides. What makes ice skates work is the pressure of your weight being focused on such a small point (the narrow blade of ice) causes the ice to melt beneath your skates. This makes the surface slick and allows you to slide on the skates. In order to stop, you need to drag your skate against the ice, which causes **friction** between you and the ice that slows you down. This, however, causes damage to the ice by making the surface uneven and also causes it to melt. As more people continue to skate, the

more this builds up until there is more slush and water on the surface than clean ice. This can make things dangerous by making it too slippery for skaters.

Activity: What to do with all that ice?

This is a group brainstorm activity that will test the student's ability to design a method for cleaning and resurfacing the ice of a skating rink without prior information from the video.

Materials: none

Procedure:

6. Students will work in small groups to come up with a way to clean and resurface the ice of a skating rink in a fast, efficient way. They can create their own Zamboni designs, but if they do, they must explain how it works. Make sure students address all of the issues, such as evening out the surface, removing excess melt water, resurfacing so that you don't completely shave away your ice, and evening out the new surface.

7. Have one student in the group draw the design.

8. Following the video, the students will compare their designs with the description of the method actually used. They will report on how different or similar their design was to the one from the video, as well as recommendations for modifications to their own designs

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Modifications: You may want to freeze ice into the bottom of a small pan or baking sheet at home (if your freezer has room or see if the school cafeteria can) and use this as a model in the classroom to demonstrate with.

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Grade 6

Standard: IV.A.1.f. & IV.C.3.c.

Classify substances based on melting points, boiling points, and solubility data (f).

Design an experiment that reduces the rate at which a substance melts (c).

Type of Activities: Lab

Introduction- After watching the video, students will conduct an experiment that demonstrates the principle that water can freeze at different rates depending upon certain situations, such as the use of hot water for the Zamboni.

Background: Heat is generated in matter by the movement of molecules. The higher the temperature, the faster the molecules move. Except at absolute zero degrees Kelvin (the lowest possible temperature in the universe) the molecules of most matter are constantly in motion. The speed of that motion dictates what phase of matter it exists as. Moving very slowly results in something being a solid. This happens either as a result of low temperature or extremely high pressure (the inner core of the Earth is hot enough to melt iron and nickel, but the extreme pressure keeps

the molecules from moving faster than a solid). If the molecules move faster, the matter becomes a liquid (melts) and if they move very fast, matter becomes a gas (vaporizes). The molecules in of hot water are moving faster than the molecules of cold water. Because they are moving so fast, they lose their energy (cool off) quicker than water that is already cold. They also can arrange themselves in crystal patterns quicker than the slower moving molecules of cold water. For this reason, hot water is used by the Zamboni to refreeze the surface after it is cleaned and scraped.

Activity: Freezing hot water.

This activity is a post-video lab that illustrates how water freezes at different rates under different circumstances, therefore, it can only be done if you have access to a freezer you can monitor regularly during the lab (this will take a while, so you should have other things for them to do while the water is freezing).

Materials: three thermometers, four beakers filled with water (hot water, cold water, and room temperature fresh water, hot plate, freezer, timer

Procedure:

9. One beaker of water is heated to near boiling (just below 100° C). Another is cooled to 25° C in a refrigerator or freezer. All three should have 25 ml of water in them.

10. The initial temperatures are taken and recorded as time zero.

11. All three are placed in a freezer with their thermometers.

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12. Temperature is measured every five minutes without taking them out of the freezer.

13. Results should be displayed in a chart and graph.

Modifications: Because it may be difficult to have a class where you will have access to a freezer, you may have students perform this at home and only time when they actually freeze instead of the rate of temperature decrease which would require thermometers.

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Grade 6-8

Standard: I.C.3.a. (6th & 7th), I.D.3.a. (8th)

Explain how science and technology are essential to each other.

Type of Activities: Evaluation/Research

Introduction- After watching the video, students will come up with how many different aspects of science are involved in both the maintenance of the skating rink and the Zamboni.

Background: Science is an integral part of many parts of life, including ice-skating. Chief among the sciences are chemistry (the study of the different chemical properties of different things), physics (the study of motion, energy, and light), and thermodynamics (the study of how different things react to changes in temperature). Chemistry is important to coolant used to keep the ice cold: **polyglycote**. This also deals with thermodynamics. The chemical is obviously very cold because it removes the heat from ice, keeping its temperature down in much the same way that coolant that flows through the coils behind your refrigerator keeps it cold. Physics is also important for many reasons. The coloring of the ice is a function of the light reflected off the paint and to your eyes. The use of warm water instead of cold to resurface the ice is also a function of physics and thermodynamics. The molecules in hot water are moving faster and therefore lose energy (heat) quicker than cold water. They also arrange

themselves in a crystal pattern faster. Ice skates work because of the physics and chemistry of water. The pressure of your weight concentrated on the narrow blade causes the ice to melt even though the surface of the ice is below freezing. The spikes on the wheels of the Zamboni are used to increase the friction between the wheels and the slick ice, which is also a function of physics.

Activity: The science of ice-skating.

This activity is a post-evaluation/research project that can either be done as a post-video class discussion or write up or can be used as an independent, out of class research project.

Materials: none

Procedure:

14. Students will either participate in a class-wide discussion or work individually on figuring out how many different ways science is used in video (or this can be used as a research project). Be sure to tell student that they must explain each example and what about it relates to one of the sciences.

15. The instructor should provide simple definitions of chemistry, physics, and thermodynamics to give the students an idea of what sorts of things to be thinking of.

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Follow-up: Have students make recommendations on what could be done to increase the friction between the brick and the ice. Have them also suggest ways to reduce the friction between the brick and the wood.

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Credits

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