Ice Cube Melters

First Grade

Testable Question: 5 pts

How does the type and color of a surface, and the presence of salt affect how much ice melts with sunlight?

Prediction: 5 pts

I think that the black surfaces will melt more ice than the white surfaces, and that the salted surfaces will melt more ice than unsalted surfaces. I'm not sure if the type of surface (concrete/aluminum/wood) will make a difference. I think the black salted surfaces will melt the most ice, followed black unsalted, followed by white salted, and lastly white unsalted surfaces will melt the least amount of ice. I think the black unsalted and white salted surfaces will melt the same amount of ice.

Procedure: 5pts

1. Get the following materials of about the same size: two wooden blocks, two metal (aluminum) stands, and two concrete blocks.
2. Paint one set of the materials (1 of each: concrete, wood, aluminum) white, and the other set black. Let the paint dry.
3. On each surface, add 1 gram of salt on the left half of the surface, and NO salt to the right half of the surface.
4. Get 12 same-sized, same-shaped ice cubes made of tap water.
5. Take the first ice cube and put it on the digital scale to find its mass in grams (g). Record its mass on the data table, then set it on the black aluminum surface without salt. Work quickly so the ice doesn't have time to melt.
6. Repeat step 5 again for all the other cubes and surfaces, with and without salt. Work quickly.
7. Once each surface has one ice cube on it, set all the surfaces under direct sunlight together outside. Start the timer. Leave the ice cubes outside in the sunlight for 30 minutes.
8. After 30 minutes, dry each ice cube, and then use the digital scale to find its mass in grams again. Work quickly. Record the final mass on the data table.

Background: 5 pts

I chose this project because…
After a snow day, I noticed that the snow wasn't fully melted on the playground yet. After a few days, I noticed that there was still more snow on some parts of our playground than on other parts. I noticed that on the black top and the concrete there was no snow, but there was still snow on the wood chips. I know that black surfaces absorb sunlight. I also noticed there was salt on the sidewalk and the black top. I wondered if the different amounts of melted snow were because of the salt, or the color of the surface, or the type of surface the snow was on.

In my research I found out that…
Black and concrete surfaces melt the ice the most. Salt makes the ice melt more for all surfaces.

This project is important because…
Cars need to drive and people need to walk after it has snowed. Most sidewalks I see are made out of concrete and the roads are made out of black concrete. The sidewalks mostly are brown concrete. And on every snow day, the salt trucks salt the roads, and if the ice didn't fully melt, they add another layer of salt. And sometimes they salt the sidewalks if there is snow. It's important to use materials on the roads and sidewalks that will melt the ice and snow.

Constant Conditions: 10 pts

Independent Variable:

The type and treatment of each surface is the independent variable. There are three types of surfaces: wood, concrete, and aluminum. For each type of surface there will be one that is black and one that is white, and each black or white surface will be treated with salt or no salt.

Dependent Variable:

I will measure the change in mass of an ice cube on each type of surface before and after it spends 30 minutes in direct sunlight.

Constant Conditions:

- The same size and shape of each ice cube, made of tap water.
- The same amount of time (30 min.) each ice cube spends on each surface in direct sunlight.
- Use the same method of drying the ice cube with a towel and finding the mass of the ice cubes with the digital scale before and after exposure to sunlight. Wear cotton gloves when handling the ice.
- Same approximate size of each surface (wood, aluminum, concrete)
- Same type of salt (Kosher), and amount of salt (1 gram) for each salted surface.
- Same starting temperature of each surface (20 degrees Celsius)
- Same outdoor temperature for testing conditions (-2 degrees Celsius)

Data and Trials: 15 pts & 5 pts

Outside temperature at time of testing: -2℃

Type of Surface			Mass of ice cube in grams (g)		Calculations
			Before 30 minutes of sunlight	After 30 minutes of sunlight	Difference in mass of ice cube (g)
Wood	black	Salt	25.80	15.64	10.16
		No salt	24.92	20.04	4.88
	white	Salt	25.36	19.03	6.33
		No salt	24.89	23.40	1.49
Concrete	black	Salt	25.54	7.41	18.13
		No salt	26.83	9.04	17.79
	white	Salt	25.67	12.85	12.82
		No salt	24.70	12.22	12.48
Aluminum	black	Salt	25.93	10.60	15.33
		No salt	24.87	12.50	12.37
	white	Salt	27.58	18.17	9.41
		No salt	26.31	20.39	5.92

Data and Trials:

Ranking of each type of surface by amount of ice melted				
Rank order	metal/wood/concrete	black/white	salt/no salt	Mass of ice melted (g)
1	concrete	black	salt	18.13
2	concrete	black	no salt	17.79
3	metal	black	salt	15.33
4	concrete	white	salt	12.82
5	concrete	white	no salt	12.48
6	metal	black	no salt	12.37
7	wood	black	salt	10.16
8	metal	white	salt	9.41
9	wood	white	salt	6.33
10	metal	white	no salt	5.92
11	wood	black	no salt	4.88
12	wood	white	no salt	1.49

Data and Trials:

I noticed that…	
The surfaces of the top 6 *most melted* cubes…	The surfaces of the 6 *least melted* cubes…
- 4 of the 6 had a black surface - 4 surfaces were concrete, and 2 were metal. - All 4 of the 4 concrete surfaces were with the top 6 *most melted* cubes. - 4 of the 6 black surfaces were the top 6 *most melted* cubes. - 3 of the 6 salted surfaces were the top 6 *most melted* cubes.	- Only 2 of the six had a black surface. - 4 surfaces were wood, and 2 were metal. - All 4 of the 4 wooden surfaces were with the 6 *least melted* cubes. - 4 of the 6 white surfaces were with the 6 *least melted* cubes. - 3 of the 6 unsalted surfaces were with the 6 *least melted* cubes.

Data and Trials:

I noticed that for EVERY type and color of surface, the surface with salt melted MORE ice than the surface without salt!

The effect of salt added, versus no salt added for each surface	
Type of surface	**How much more ice was melted with salt added**
Black, wood	5.28 more grams of ice melted with salt added
White, wood	4.84 more grams of ice melted with salt added
Black, concrete	0.34 more grams of ice melted with salt added
White, concrete	0.34 more grams of ice melted with salt added
Black, aluminum	2.96 more grams of ice melted with salt added
White, aluminum	3.49 more grams of ice melted with salt added

Data and Trials:

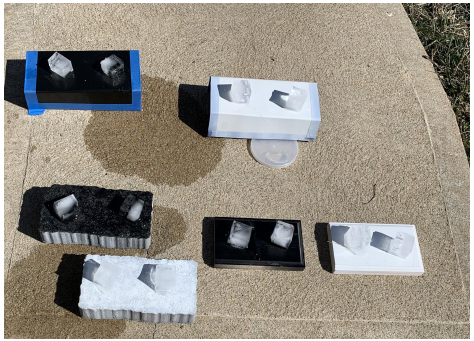
I think…

- That the type of surface matters. Concrete melted the ice the most.
- The color of the surface matters. Black surfaces melted the ice the most.
- Half the most-melted cubes had salt, and half didn’t. But adding salt always caused the ice to melt more. I need more testing to know about the effect of adding salt.

Data and Trials:

Before adding ice

10 min after adding ice



20 min after adding ice

30 min after adding ice

Data and Trials:

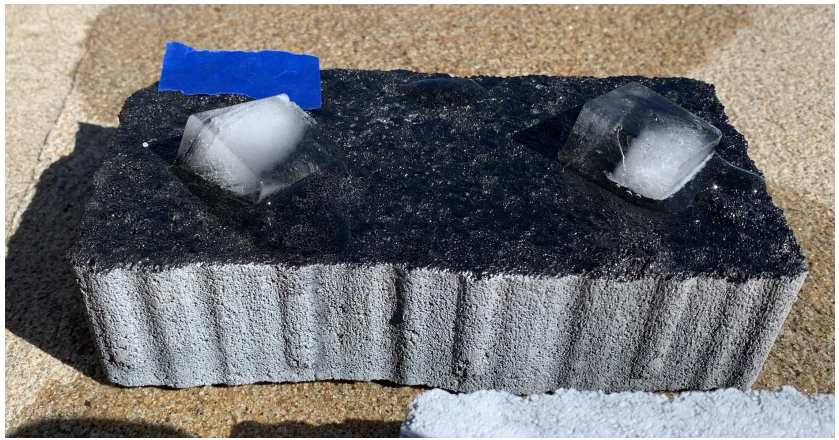
Black Concrete Surface Before and After

Black concrete surface after 0 minutes

Without salt

With salt

Black concrete surface after 30 minutes



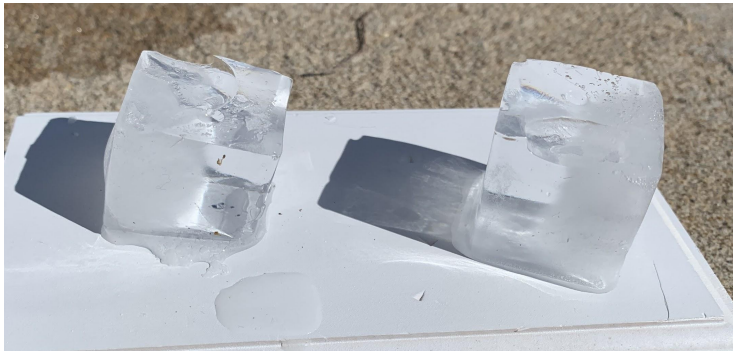
With salt

Without salt

Data and Trials:

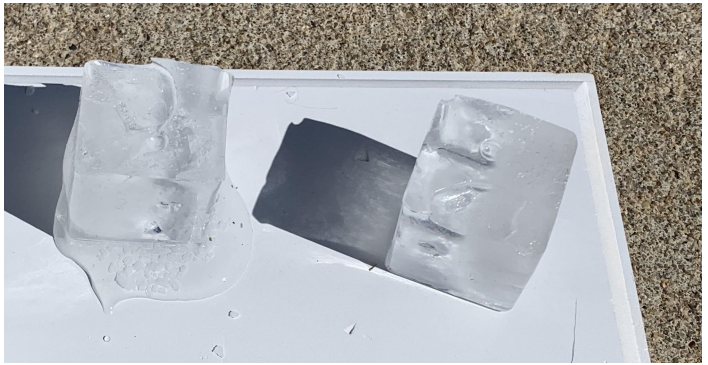
White Wooden Surface Before and After

White wooden surface after 0 minutes



With salt Without salt

White wooden surface after 30 minutes



With salt Without salt

Data and Trials:

We noticed that the wind outside seemed to affect the reading on the digital scale, so we made a shield out of boxes to protect our digital scale and get an accurate reading. It helped!

Conclusion and Reflection: 10 pts

I found out that…
Concrete and black surfaces melt ice the best. Adding salt to a surface always caused the ice to melt more.

I was surprised that…
Concrete surfaces were the best for melting ice. I expected none of the white surfaces to wind up in the most-melted category, but both white concrete surfaces did. I didn't know the type of surface mattered. Both the black and white concrete surfaces melted the same amount of ice when the salt was added. I wonder why both the white and black concrete melted 0.34 more grams of ice with salt - why were they the exact same amount? (Did we make a mistake?) I was surprised that adding salt had less effect on melting with the concrete surfaces compared to the other types of surfaces. Why did that happen? (Did we make a mistake?)

If I did this project again…
I would add more salt and test different amounts of salt on the same three surfaces. Maybe I would test different kinds of salt, including the kind of salt they put on sidewalks. I also want to know why concrete melted the ice better than the other surfaces.