

Ice Melting Blocks

Teacher Lesson Plan



Background Information

This set consists of two blocks of nearly the same appearance, but composed of different materials. One of these blocks seems cold to the touch while the other seems slightly warm. How much longer would it take an ice cube to melt on the cold block, as compared to the warm block?

The “cold” and “warm” blocks are both the same temperature (room temperature.) The ice cube on the “cold” block actually melts very quickly as compared to the ice cube on the “warm” block.

Two things are occurring here:

1. Things at the same temperature can feel as though they are at a different temperature.
2. The ice pieces on the two blocks melt at extremely different rates, in a way that is unexpected.

Both have the same explanation: The blocks are made of two different materials that have very different heat conductivities.

The “cold” block is aluminum, which has one of the highest heat conductivities of common materials. It feels cold because heat from your hand, which is warmer than room temperature, is rapidly conducted away from your hand into the aluminum. This cools your hand much more than you would expect and your brain tells you the object is colder than room temperature.

The “warm” block is made up of a rigid plastic foam. Plastic itself is a poor conductor of heat and the air or gas bubbles in this sample make this especially so. Heat is conducted more slowly from your hand and your brain tells you the object is warmer than room temperature.

An ice cube on the verge of melting is at 0°C. Transferring heat to the ice cube is necessary to melt it. Both of the blocks are at room temperature, much warmer than 0°C, and are able to conduct heat to the ice. However the high heat conductivity of the aluminum block allows it to conduct heat rapidly to the ice, resulting in rapid melting, whereas the low conductivity of the plastic causes very slow melting.

Student Procedure *(with answers)*:

1. Touch both blocks. How are the blocks alike? *(same size, same color)* How are they different? *(one is heavier)* Which feels warmer? *(The foam block will feel warmer.)*
2. Predict which block will cause ice to melt faster.
3. Place the O-rings on the blocks to prevent water from flowing off. Place an ice cube on each block.
4. Observe the rates at which the ice cubes melt. Which material is conducting heat into the ice faster? *(The aluminum block will melt ice much faster than the foam block.)*
5. After a few minutes, remove the ice and water, and touch the blocks again. Explain what you observe. *(The aluminum block feels even cooler now, and it is cooler. Energy stored as heat inside the block was transferred to the ice when it melted. Now the block has less thermal energy than before.)*
6. Explain why the aluminum block felt different at the beginning of the experiment. Was it a different temperature? *(The aluminum block felt cool at the beginning for the same reason that it melted the ice faster. It is better at conducting heat away from your hand, and makes your skin feel cool.)*

Adapted from: Arbor Scientific, www.arborsci.com