THE SCIENCE OF SNOWMAN SURVIVAL

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Have you ever stopped to think about the wonder and mystery of snow? What is it exactly and what makes it so unique? According to Wikipedia, "Snow is precipitation in the form of flakes of crystalline water ice that fall from clouds." As a college physics professor I can appreciate such an accurate, concise definition. But we all know, especially down here in Texas, that the beauty and special characteristics of snow cannot be captured by such a dry, scientific description. Snow brings to mind quiet, soft mornings, pristine landscapes, sledding and, perhaps most importantly, snowmen! I would like to share with you an interesting and surprising journey my family has enjoyed over the last few winters that involves snow and our family snowman, Frosty.

It all started after an unusually heavy snowfall in February 2010. Families in our neighborhood immediately began building snowmen. My two young boys (ages 5 and 8 at the time) helped me. We decorated him and placed a string of flashing LEDs around his neck. To our dismay, however, local teenagers began destroying neighborhood snowmen and taking their decorations as trophies of their conquests. We quickly labeled these heartless vandals "snowman bandits." That's when the idea first popped into my mind — why not build a large snowman and use science to protect him and keep him from melting for as long as possible? And so our quest began, an ongoing project that has led to numerous adventures, a website with which to share them and the writing of a snowman survival book for children.

That same day I took the remains of our vandalized snowman, moved him to the center of our yard and rebuilt him. It was still very cold with plenty of snow on the ground. Our first job was to protect our new snowman from the snowman bandits. By this time, most of the other area snowmen had been torn down, so Frosty was a very tempting target. We kept watch from our front window and soon started seeing cars drive by and stop at our house; word was spreading that a large snowman with a tantalizing necklace was still standing. I walked out of our house regularly to discourage any attempts to harm the newest member of our family. However, it soon became obvious that more protection was needed. Teenagers were racing out of cars and across our yard to attack Frosty while attempting to steal the prize necklace.

The next day I began placing security devices around Frosty. It started innocently enough — a few trip wires here and there and a motion detector to warn us of approaching bandits. Next I purchased some electrical fence wire, poles and other equipment from the local hardware store to build a fake but very convincing electric fence around Frosty. After adding several more layers of trip wires and flood lights, Frosty's over-the-top fortification was complete. We were now ready for whatever the snowman bandits had planned!

With Frosty safely behind a security system, I turned my attention to the science of snowman survival. Snow is such an amazing substance, made possible by the polar nature of water molecules which gives them charged ends. Their unique V-shape structure forces them to form a six-sided crystal when freezing, and under the right conditions snowflakes form. When it comes to making a snowman last as long as possible, the key is minimizing heat transfer.

A motion detector and trip wires finished off Frosty's fortification.

Perhaps the most important secret is to use clean, white snow to make your snowman — no dirt, leaves or sticks! A snowman with a high albedo, or reflection coefficient, will absorb less of the sun's radiant energy. Dark materials such as dirt, leaves, or even dark clothing are snowman destroyers. A dark leaf embedded in a snowman will heat up and quickly form a cavity which promotes even more melting. As a snowman melts, any dirt in the snow will remain on the outer surface which, over time, builds up and forms a dark layer. Part of our daily snowman maintenance was to remove this thin, dirty outer layer of snow with a wire brush. After a week or so when all the other snow on the ground was long gone, we still had a large, clean white snowman that drew a lot of attention. I often had people drive by and stop to ask if Frosty was real and ask why he wasn't melting. Emails generated from Frosty's web page made for fun reading.

Other scientific aspects key to snowman survival include optimizing freeze/thaw weather cycles to strengthen the snow, using compacted snow, minimizing surface area to lower heating by convection, blocking rain and sun when possible and using an insulated base.

We made another snowman (Frosty 2.0) after a heavy snowfall in 2011. The snowman bandits returned, and frequently, but our defenses managed to hold. Our Frosty has survived group attacks with large sticks, blocks of concrete, paintball guns, even pumpkins! Most of the attacks came during weekend evenings, but the more determined bandits waited until 4 a.m. or for the coldest nights to launch their assaults. I would often sleep by our front window facing Frosty, dressed in winter clothing and running shoes to chase away the bandits. The police were called one night after a particularly daring attack! We've wondered what sorts of bounties have been placed on Frosty as the bandit's desperation grew. So far, Frosty's illuminated necklace, the ultimate trophy for the snowman bandits, has never been stolen. Perhaps the approaching winter will yield more snow and another snowman, Frosty 3.0, with more adventures. We hope so because we miss our Frosty, and I have a feeling that the snowman bandits do as well.

Visit Frosty's web page at 9LivesFrosty.com for more information and updates. You can also order our children's book titled "The Ultimate Snowman Survival Guide" online or read it for free on the website.