HEAT & SPECIFIC + LATENT HEAT

Unit 20, Dr. John P. Cise, Professor of Physics, Austin Com. College, Austin Tx., jpcise@austincc.edu & New York Times, July 3, 2017 by C. Claiborne Ray

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The Science Behind 'Sticky' Ice

Q&A

INTRODUCTION: 10 gram finger tip initially at 98.6 ^{0} F touches 0^0 C frozen ice cube (see graphic at left). Heat leaves finger tip and melts some (M_{ICE} = ?) ice. Temperature of finger tip human tissue drops to 0^0 C as it gives up heat to the melting ice. Once warmth of finger tip dissipates, the water quickly refreezes, creating a icy link.

QUESTIONS: (a) Convert 98.6 ^{0} F to degrees C? , (b) Find mass of ice (M_{ICE} = ?, in gram units) which melted from the heat lost from the 10 gram finger tip?

HINTS: $Q = C\, m\, \Delta t$, $Q = m\, L_{FUSION}$, $C = (5/9)\,[F - 32]$
Latent heat of fusion of ice = 335 KJ/Kg.
Specific heat of human tissue = 3.558 KJ/Kg. ^{0}C
1000 g. = 1 kg.

ANSWERS: (a) 37^0 C , (b) M_{ICE} = ~ 3.95 grams

Q. Why is ice sticky?

A. Ice is sticky, but only to certain kinds of surfaces at certain temperatures. What really happens is **that conditions are just right for a shared ice layer to form between the two surfaces and link them. A warm, damp tongue or slightly sweaty finger may stick readily to an ice cube as the (((warmth temporarily melts ice at its surface;)))once the warmth has dissipated, the water quickly refreezes, creating an icy link.** If a cold, dry object touches the same ice cube, there is no melting and no adhesion. Most of the time, however, ice is slippery, as ice skaters and Antarctic penguins demonstrate. The slipperiness of ice has a more complex explanation or combination of explanations. It was long believed that pressure melting and frictional heating in some combination released liquid water at the surface of the ice, so that sharp or even smooth objects could glide across. More recent research has also focused on the idea that a permanent liquid-like layer lies atop the ice, even at temperatures far below the freezing point. And 2014 research published in the journal PCCP, Physical Chemistry Chemical Physics, suggests that a common supersolid skin, both elastic and temperature stable, covers both water and ice, and is responsible for its slipperiness. *question@nytimes.com*