Solution

Physics 213 **Problem ?** **Week 7**

Freezing Supercooled Water

People often note that when they open a bottle of water that's been out on a cold night, it suddenly freezes. That's because it was previously supercooled, and the shaking, etc. triggers the formation of ice.

Say you have liquid water at -5°C. The true freezing point is 0°C. The specific heat of water is 4.2 J/g K. The latent heat of freezing is 333 J/g.

1. If there's not enough time for heat to flow in or out of the bottle as it freezes, what fraction of the water freezes?

As the water freezes, it releases heat, which raises the temperature. This process will continue until the temperature rises to 0° C. The water will absorb (4.2 J/g/K)×(5 K) = 21 J/g as the temperature rises. This amount of heat is generated by the freezing of this fraction, 21/333 = 0.063, of the water.