Homework 2 – Due Friday, October 13th

Ice skates can move rapidly across ice because there is little friction between the skate blade and the ice. It has been suggested that the lack of friction under an ice skate is due to pressure-melting.

Useful Information:

Clausius-Clapeyron Relation: $\dfrac{dP}{dT} = \dfrac{L}{T\Delta v}$

[Watch your units]

P = Pressure (Pa)
T = Temperature (K)
L = Latent heat of fusion (J/kg)
v = change in specific volume at phase transition (m^3/kg)

Consider a 70-kg person skating on ice of temperature -5°C (23°F). The skate blade is 300 mm long and 1 mm wide.

(a) What is the contact area of the skate with the ice?

(b) What is the pressure exerted on the ice?

(c) By how many degrees is the melting temperature reduced?

(d) Argue for or against pressure-melting as the explanation for the low friction.