5.32) (a) The Clausius-Clapeyron equation says that the phase boundary obeys $\frac{dP}{dT} = \frac{L}{T\Delta V}$.
(on a P-T diagram)

This explains why the slope $\frac{dP}{dT}$ is negative: the change in volume when ice changes to water is negative, since the density of ice $= 917\ kg/m^3$ is lower than that of water, which is $\approx 1000\ kg/m^3$. [Of course, the latent heat L is a positive quantity due to the increase in entropy as ice → water.]

(b) $$\Delta P = \frac{L}{T} \cdot \frac{\Delta T}{\Delta V} = \frac{333\,kJ}{273\,K} \cdot \frac{(-1)\,K}{(1-(0.917)^{-1}) \times 10^{-3}\ m^3} \quad \text{(for 1 kg.)}$$

$$= \frac{333}{273} \times \frac{10^6}{0.09051} = 13.5 \times 10^6\ Pa \approx 135\ atm.$$

(c) $$P = \rho g h \Rightarrow h = \frac{P}{\rho g} = \frac{13.5 \times 10^6\ Pa}{(917\ kg/m^3)(9.81\ m/s^2)} = 1501\ m.$$

(d) Weight $\approx 80\ kg \times g \approx 800\ N$.
Skate area $\approx 25\ cm \times 0.2\ cm \approx 5 \times 10^{-4}\ m^2$.
$$P \approx \frac{800}{5 \times 10^{-4}} = 160 \times 10^4 \cong 16\ atm.$$

Thus, P is not enough to depress the melting point.