Problem Solving Session 9

Problem 1:

The pressure of water vapor over ice is 3.88 mm Hg at -2°C and 4.58 mm Hg at 0°C. Estimate the heat of vaporization in this temperature interval (give your answer in J/mol).

Problem 2:

It has been suggested that pressure induced melting of ice is responsible for the ease at which a skater can slide. Carry out the following calculations to test this hypothesis. (Some useful information: the heat of melting is 6010 J/mol, the density of ice is 920 kg/m^3 and the density of liquid water is 997 kg/m^3).

(a) What increase in pressure beyond the regular pressure of 1 bar is required to lower the melting temperature by 5 degrees?

(b) Assume the skate is in contact with the ice over an area that has width of 5 mm and length of 15 cm and that the weight of the skater is 80 kg. What pressure is exerted on the ice by the skate?

(c) What is the melting temperature of ice at the pressure you estimated in part (b)?

(d) Given that people often go skating when the temperature is as low as -5 ° C, do you expect pressure induced melting explains how well skates slide on ice? Is there an alternative explanation?