1. A frozen lake has a surface area of 2.5 hectares. The ice at the surface has an average thickness of 45 cm.

   a. How many joules of energy does it take to melt all of the ice? Assume the ice is at 0 deg C and that the resulting melted liquid is also at 0 deg C. Do NOT assume ice has the same density as water; it's obviously somewhat less dense, so you need to find a value for the density.

   b. What is the energy for melting (found above) expressed per square meter? I.e., how many joules are needed to melt 1 m$^2$ of ice? Answer in units of J/m$^2$.

   c. If the sun can provide warming energy at a rate of 330 W/m$^2$, how many hours of sunlight are required to melt the ice? (Hint: Calculate the amount of time to melt 1 m$^2$ of ice. Since the sunlight hits all the “m2’s” with the same energy, that is also the length of time to melt all of the ice. And remember the definition of the Watt.)

2. The lower atmosphere over a large, sunny meadow has an observed temperature lapse rate that is linear at 10.8 deg C/1000 m. The air temperature at ground level is 28 deg C. The relative humidity at ground level is 65%.

   a. Is the air above the meadow stable, neutral, or unstable?

   b. If the moist air rises off the meadow, at what altitude, in meters, can a cloud start to form? (Hint: Use dew point and observed lapse rate)