Homework–Module 1 Name:

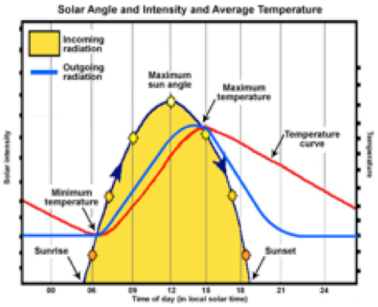
1) Warning signs such as the one to the right are common before bridges. And they are put there for good reason.

Why does the bridge get icy before the pavement on the ground when air temperatures drop below freezing? Use heat transfer concepts to explain your answer. Assume calm winds to simplify the discussion.

2) One of my most humbling experiences as a fledgling meteorologist (a.k.a. early learning experiences) occurred for Corvallis, Oregon during the winter of 1979-80. I forecast mostly clear, calm conditions overnight and a low near freezing (33˚F). It was indeed calm all night with cold air trapped in the Willamette Valley, and clear too…most of the night. Unfortunately for my forecast, low-clouds (stratocumulus) began to drift overhead after midnight, at which time the temperature warmed to 45˚F and stayed there through the rest of the night. My forecast low ended up 8˚F too cold, a major bust!

Use heat transfer concepts to explain why the surface temperature increased as the low clouds moved overhead.

3) The schematic to the right was shown in the overview slides to explain the diurnal cycle of temperature in terms of radiative balance. Unfortunately, the diagram has an error (that I intentionally omitted from the narrative) where two of the curves are not consistent with the physics of radative heat transfer. Which two curves are in error? Use the laws of radiation to explain what the inconsistency is between the two curves. (Hint: compare the schematic with Figure 3.02 in the Ahrens & Hanson.)



Black curve-incoming solar radiation
Blue curve-outgoing IR radiation
Red curve-temperature

4) Why would you feel warmer than what air temperature indicates on a very cold, calm, sunny day?

5) During a very cold, calm, winter night, why might you feel colder at low elevations (100 meters) than at a high elevation, ski resort (3000 meters) when the air temperatures are the same?