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.

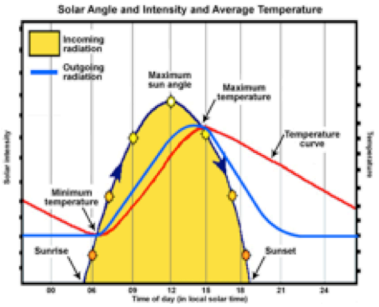
There is a 600-character limit for all questions

2) One of my most humbling experiences as a fledgling meteorologist (a.k.a. early learning experiences) occurred for Corvallis, Oregon during the winter 1980. 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. (Hint: use Figs. 2.12b and 2.18 of the text to infer the impact of clouds on surface temperature.)

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 did not mention in the narrative) where two of the curves are not consistent with the physics of radiative heat transfer. Which of two curves are inconsistent? Use the laws of radiation to explain what the inconsistency is between the two curves.

(Hint: compare the diagram with Figure 3.2 in the text.)



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

4) During a very cold, calm, winter night, why might you feel colder at low elevations (10 meters) than at a high elevation, ski resort (3000 meters) when the air temperatures are the same?