10.302
Fall 2004
Discussion Problem for Recitation on
Tuesday, October 19, 2004

1. Consider a thin strip heater and its hemi spherical cylindrical reflector, as shown in the sketch. The diameter of the reflector is 15 cm and the height of the strip heater is 2 cm. Both may be treated as infinitely long. The temperature of the strip heater is 1100ºC and that of the environment is 20°C. All surfaces may be assumed to be black.

   (a) What is the view factor F_{22}? F_{24}? (where "4" denotes the general environment).
   (b) If the convective interactions may be ignored (i.e., h = 0), what is the steady-state temperature of the reflector?
   (c) If both sides of the reflector convectively interact with the environment, and if the heat transfer coefficient for each side is 15 W/m^2-K, what temperature will the reflector attain? Assume that the heater remains at 1100ºC. An answer to within ± 25 C will suffice.