

## Example

A cryogenic fluid flows through a long tube of 20 mm diameter, the outer surface of which is diffuse and gray with  $\varepsilon_1 = 0.02$  and  $T_1 = 77$  K. (Ooh, that's cold!) The tube is concentric with a larger tube of 50 mm diameter, the inner surface of which is diffuse and gray with  $\varepsilon_2 = 0.05$  and  $T_2 = 300$  K. The space between the surfaces is evacuated. If the tube is 1 m long (into the paper)

- calculate the heat gain by the cryogenic fluid.
- If a thin radiation shield of 35 mm diameter and  $\varepsilon_3 = 0.02$  on both sides is inserted midway between the inner and outer surfaces, calculate the heat gain by the cryogenic fluid. What is the percentage change in heat gain?

