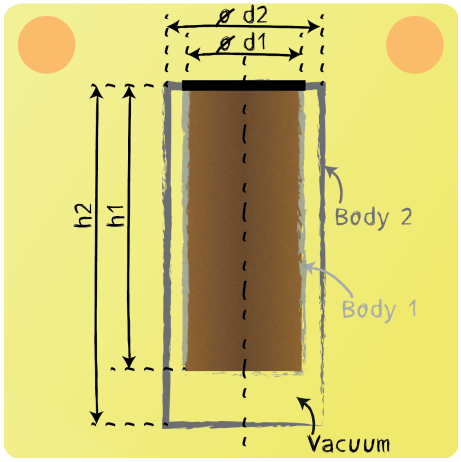
Exam Preparation Radiation 08

A thermos flask is used to keep drinks hot. The flask has two walls separated by a vacuum to minimize heat transfer. Determine the viewfactor Φ_{22}.



Outer surface body 1:

$$A_1 = \frac{1}{4}\pi d_1^2 + \pi d_1 h_1$$

Inner surface body 2:

$$A_2 = \frac{2}{4}\pi d_2^2 + \pi d_2 h_2 - \pi d_1 h_1$$

The outer surface of body 1 cannot emit on itsself, therefore:

$$\Phi_{11} = 0$$

Summation rule:

$$\Phi_{11} + \Phi_{12} = 1$$
$$\rightarrow \Phi_{12} = 1$$

Reciprocity rule:

$$\Phi_{21} \cdot A_2 = \Phi_{12} \cdot A_1$$
$$\rightarrow \Phi_{21} = \Phi_{12} \cdot \frac{A_1}{A_2}$$

Summation rule:

$$\Phi_{21} + \Phi_{22} = 1$$
$$\Phi_{22} = 1 - \Phi_{21} = 1 - \frac{\frac{1}{4}\pi d_1^2 + \pi d_1 h_1}{\frac{2}{4}\pi d_2^2 + \pi d_2 h_2 - \pi d_1 h_1}$$