703.

Problem 49.5 (RHK)

A cavity whose walls are held at 1900 K *has a small hole*, 1.00 mm *in diameter, drilled in its wall. We have to find the rate at which energy is escaping through this hole from the interior of the cavity*.

Solution:

The total radiation power per unit area emitted from a cavity aperture is given by the Stefan-Boltzmann law, which states that

$I(T) = \sigma T^4$,

$\sigma = 5.670 \times 10^{-8}$ W m^{-2} K^{-4} .

Therefore, the rate at which energy will escape from a hole of diameter 1.0 mm from a cavity whose walls are held at 1900 K will be

$$\mathsf{E} = 5.670 \times 10^{-8} \times \pi \times \left(0.5 \times 10^{-3}\right)^2 \times (1900)^4 \text{ W}$$

$$= 0.58 \text{ W}.$$