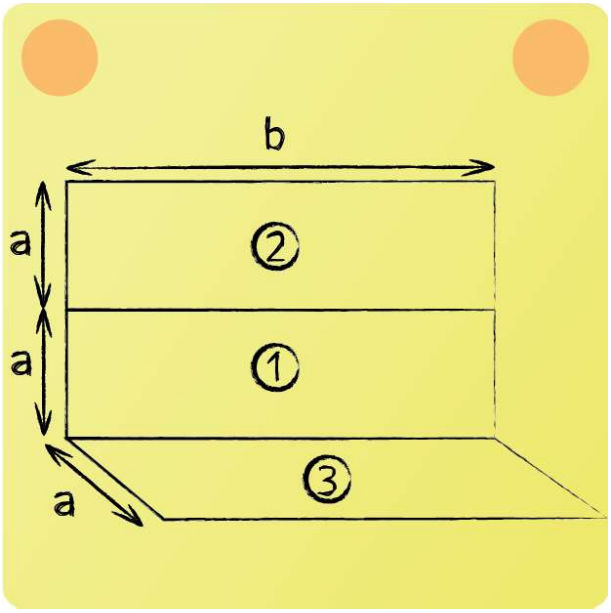
Exam Preparation - Radiation 3



Determine the net rate of heat transfer from surface 2 to 3. Assume the surfaces to be blackbody surfaces.

For $\Phi_{3\to1}$:

$$\frac{Z}{X} = \frac{Y}{X} = 0.3 \Rightarrow \Phi_{3\to1} = 0.26$$

For $\Phi_{3\to(1+2)}$:

$$\frac{Z}{X} = 0.6 \ \wedge \frac{Y}{X} = 0.3 \Rightarrow \Phi_{3\to(1+2)} = 0.32$$

Summation rule results in:

$$\Phi_{3\to2} = \Phi_{3\to(1+2)} - \Phi_{3\to1} = 0.06$$

Reciprocity rule results in:

$$\Phi_{2\to3} = \Phi_{3\to2}$$

And thus:

$$\dot{Q}_{\text{net } 2\to3} = A \cdot \sigma \left(\phi_{2\to3} T_2^4 - \phi_{3\to2} T_3^4\right) = 14.2 \text{ kW}$$