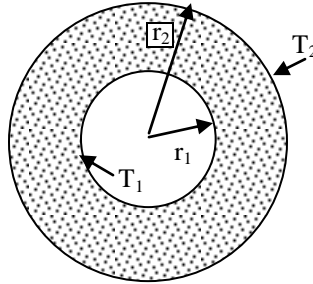


Heat Conduction in a Spherical Shell



Consider the above diagram to represent an orange, we are interested in determining the rate of heat transfer through the peel (the peel dimensions are a bit exaggerated!). Heat flow is along radial direction outwards.

Fourier's Law in radial coordinates

$$q_r = -kA \frac{dT}{dr}$$

Substituting the area of a sphere

Integrating, between $r = r_1$ and r_2 , and T_1 and T_2 ,

$$\frac{q_r}{4\pi} \left| -\frac{1}{r} \right|_{r_1}^{r_2} = -k \left| T \right|_{T_1}^{T_2}$$

$$\frac{q_r (r_2 - r_1)}{4\pi r_1 r_2} = -k (T_2 - T_1)$$

$$q_r = \frac{4\pi k r_1 r_2 (T_1 - T_2)}{(r_2 - r_1)}$$

The thermal resistance is expressed as