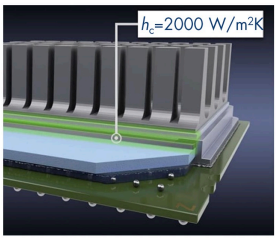
Example

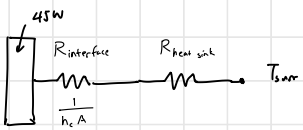
A thin electronic component with a surface area of 950 cm^2 is cooled by having a heat sink on its top surface with thermal Resistance, $R_{heat\ sink}$. The electronic component dissipates 45 W of heat through an interface with conductivity, h_c, to surroundings at 30°C.

What is the temperature of the electronic component
Does the heat sink play a significant role in heat dissipation?



T_{surr} = 30°C
$R_{heat\ sink}$ = 0.3 K/W

- All heat leaves through heat sink



$$\dot{Q} = \frac{T_s - T_{surr}}{R_{total}}$$

$$R_{total} = R_{interface} + R_{heat\ sink}$$

$$= \frac{1}{2000\ [W/m^2K]\ (950\ cm^2)\ \left(\frac{1m}{100cm}\right)^2} + 0.3\ [K/W]$$

$$= 0.3053\ [K/W]$$

$$T_s = T_{surr} + \dot{Q} R_{total}$$

$$= 30^\circ C + 45[W] \times 0.3053\ [K/W]$$

$$= 43.7^\circ C$$

$$\frac{R_{interface}}{R_{total}} = \frac{0.0053}{0.3053} = 1.74\ \%$$