Calculate the electric power which must be supplied to the filament of of a light bulb operating at 3000K. The total surface area of the filament is 810−6m2 and its emissivity is 0.92.

Solution

Use Stefan-Boltzmann law:

$$\frac{P}{A} = k\sigma T^4$$

P = power radiated, A = area of radiator, k= emissivity of radiator, $\sigma = 5.67x10^{-8} \frac{W}{m^2 K^4}$, and T = temperature in Kelvin.
Solve for P

$$P = A \bullet k\sigma T^4 = 8 \bullet 10^{-6} \bullet 0.92 \bullet 5.67 \bullet 10^{-8} \bullet 3000^4 = 33.8\ W$$

Answer: 33.8 W .