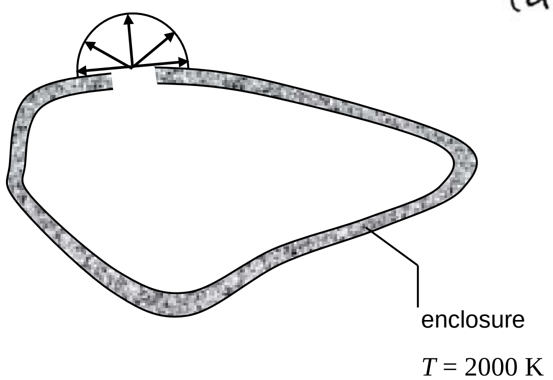
## Example

Consider a large, isothermal enclosure that is maintained at a uniform temperature of 2000 K.

(a) Calculate the emissive power of the radiation that emerges from a small aperture on the surface.
(b) What is the wavelength below which 10% of the emission is concentrated?
(c) What is the wavelength above which 10% of the radiation is concentrated?
(d) Determine the maximum spectral emissive power and the wavelength at which it occurs.




(a) $E_b = \sigma T^4$

$= 5.67 \times 10^{-8} \frac{W}{m^2 \cdot K^4} \cdot (2000)^4 K^4$

$= \boxed{9.07 \times 10^5 \ W/m^2}$

(b) $f_{0-\lambda_1} = 0.1$ From table $\lambda_1 T \approx 2200 \ \mu m \cdot K$

$\therefore \lambda_1 = \frac{2200 \ \mu m \cdot K}{2000 \ K} = \boxed{1.10 \ \mu m}$

(c) $f_{\lambda_2-\infty} = 0.1$, $f_{0-\infty} = 1$ $\Big\}$ $f_{0-\lambda_2} = 1 - f_{\lambda_2-\infty} = 1 - 0.1 = 0.9$

From table $\lambda_2 T = 9382 \ \mu m \cdot K$ $\lambda_2 = \frac{9382 \ \mu m \cdot K}{2000 \ K}$

$= \boxed{4.69 \ \mu m}$

(d) Wien's Displacement Law:

$\lambda_{max} T = 2897.8 \ \mu m \cdot K$

$\lambda_{max} = \frac{2897.8 \ \mu m \cdot K}{2000 \ K} = \boxed{1.45 \ \mu m}$

$$E_{b\lambda} = \frac{c_1}{\lambda^5 \exp(c_2/\lambda T - 1)} = \frac{3.742 \times 10^8 \ \frac{W \cdot \mu m^4}{m^2}}{(1.45)^5 \mu m^5 \exp\left(\frac{1.439 \times 10^4 \cdot \mu m \cdot K}{2897.8 \ \mu m \cdot K}\right) - 1} = \boxed{4.106 \times 10^5 \ \frac{W}{m^2 \cdot \mu m}}$$