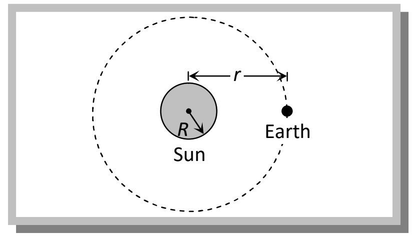
Temperature of the Sun and Solar Constant.

If R is the radius of the sun and T its temperature, then the energy emitted by the sun per sec through radiation in accordance with Stefan's law will be given by

$$P = eA\sigma T^4 = 4\pi R^2 \sigma T^4$$

In reaching earth this energy will spread over a sphere of radius r (= average distance between sun and earth); so the intensity of solar radiation at the surface of earth (called solar constant S) will be given by

$$S = \frac{P}{4\pi r^2} = \frac{4\pi R^2 \sigma T^4}{4\pi r^2}$$



i.e. $$T = \left[\left(\frac{r}{R}\right)^2 \frac{S}{\sigma}\right]^{1/4} = \left[\left(\frac{1.5\times10^8}{7\times10^5}\right)^2 \times \frac{1.4\times10^3}{5.67\times10^{-8}}\right]^{1/4} \simeq 5800\ K$$

As $r = 1.5\times10^8$ km, $R = 7\times10^5$ km, $S = 2\frac{cal}{cm^2 min} = 1.4\frac{kW}{m^2}$ and $\sigma = 5.67\times10^{-8}\frac{W}{m^2K^4}$

This result is in good agreement with the experimental value of temperature of sun, i.e., 6000 K.

The difference in the two values is attributed to the fact that sun is not a perfectly black body.