The distance between the earth and the sun is 1.5×10^8 km and the radius of the earth is 6400 km. What fraction of energy of the sun does reach the earth?

Solution:
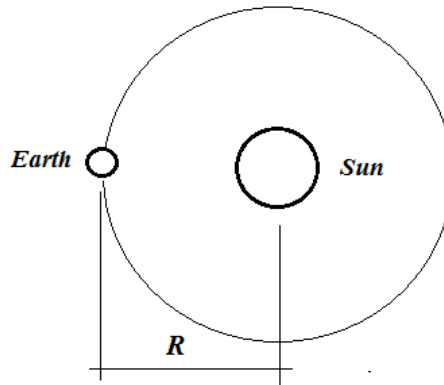
$$R = 1.5 \times 10^8 \; km$$

All the Sun's power P passes uniformly through a sphere with radius of R.

Calculate the total surface area of this sphere and call it S

$$S = 4\pi R^2$$

The Earth's disc also has a surface area that can be calculated from its radius. Call this surface

$$S_E = 4\pi R_E^2$$

The fraction of the Sun's power received by the Earth is thus:

$$f = \frac{P_E}{P} = \frac{S_E}{S} = \frac{R_E^2}{R^2} = \left(\frac{R_E}{R}\right)^2$$

Substituting

$$f = \left(\frac{6400}{1.5 \times 10^8}\right)^2 = 1.82 \times 10^{-9}$$

Answer: 1.82×10^{-9}.