Assuming the Sun to be a spherical body of radius R at a temperature of TK, evaluate the total radiant powered incident of Earth at a distance r from the Sun

Where r_0 is the radius of the Earth and σ is Stefan's constant. (JEE MAIN 2006)

A $4\pi r_0^2 R^2 \sigma \frac{T^4}{r^2}$

B $\pi r_0^2 R^2 \sigma \frac{T^4}{r^2}$

C $r_0^2 R^2 \sigma \frac{T^4}{4\pi r^2}$

D $R^2 \sigma \frac{T^4}{r^2}$

Total power radiated by sun $= \sigma A T^4$

$= \sigma (4\pi R^2) T^4$

Power intensity at earth's surface $= \frac{\text{Total Power}}{\text{Total Area}}$

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

$\therefore$ Total power received by earth $=$ Power intensity $\times$ Area

$= \left(\frac{\sigma 4\pi R^2 T^4}{4\pi r^2}\right)(\pi r_0^2)$

$= \pi r_0^2 R^2 \sigma \frac{T^4}{r^2}$