Answer on Question #52055-Physics-Other

The Earth reflects approximately 38.0% of the incident sunlight from its clouds and surface. a. Given that the intensity of solar radiation at the top of the atmosphere is 1 370 W/m^2, find the radiation pressure on the Earth, in pascals, at the location where the Sun is straight overhead. b. State how this quantity compares with normal atmospheric pressure at the Earth;s surface, which is 101 kPa.

Solution

Of the intensity $S = 1370\frac{W}{m^2}$ the 38.0% that is reflected exerts a pressure

$$P_1 = \frac{2S_r}{c} = \frac{2(0.38)S}{c}.$$

The absorbed light exerts pressure

$$P_2 = \frac{S_a}{c} = \frac{0.62S}{c}.$$

Altogether the pressure at the subsolar point on Earth is

a.

$$P_{total} = P_1 + P_2 = \frac{1.38S}{c} = \frac{1.38\left(1370\frac{W}{m^2}\right)}{3.00 \cdot 10^8 \frac{m}{s}} = 6.16 \cdot 10^{-6} Pa.$$

b.

$$\frac{P_a}{P_{total}} = \frac{1.01 \cdot 10^5 Pa}{6.16 \cdot 10^{-6} Pa} = 1.64 \cdot 10^{10}\ times\ smaller\ than\ atmospheric\ pressure.$$