

575.

Problem 41.33 (RHK)

A person lies in the Sun for 2.5 h, exposing an area of 1.3 m^2 at 90° to the Sun's rays of intensity 1.1 kW m^{-2} . Assuming complete absorption of the rays, we have to find the momentum delivered to that person.

Solution:

If the incident radiation is completely absorbed, the rate of transfer of momentum to an area A placed normal to the radiation of intensity I is

$$\frac{\Delta p}{\Delta t} = \frac{I}{c} A.$$

Therefore, the total amount of momentum that will be transferred to the person of area

$$A = 1.3 \text{ m}^2$$

when exposed to the Sun's rays of intensity 1.1 kW m^{-2} for 2.5 h will be

$$p = \frac{1.1 \times 10^3 \times 1.3 \times 2.5 \times 3600}{3 \times 10^8} = 42.9 \times 10^{-3} \text{ kg m s}^{-1}.$$