

566.

Problem 41.41 (RHK)

Radiation of intensity I is normally incident on an object that absorbs a fraction f of it and reflects the rest. We have to find the radiation pressure.

Solution:

Let us consider a unit area of the object on which radiation of intensity I is normally incident. It is given that the object absorbs a fraction f of it and reflects the rest. Pressure on the object due to the fraction of the radiation that is absorbed will be equal to the momentum transferred to the object.

$$P_{abs} = \frac{If}{c} .$$

The fraction of the radiation that is reflected will be $(1 - f)I$ and therefore the momentum transferred per unit time on a unit area of the object because of reflection of the radiation will be

$$\Delta P_{ref} = \frac{2I(1 - f)}{c} ,$$

which will be the additional pressure on the object.

Therefore, the total pressure on the object due to radiation will be

$$pressure = \frac{If}{c} + \frac{2I(1-f)}{c} = \frac{I(2-f)}{c}.$$

