Example *Two identical blocks of weight W are supported by a rod inclined at 45° with the horizontal as shown in Fig. 9.7.*

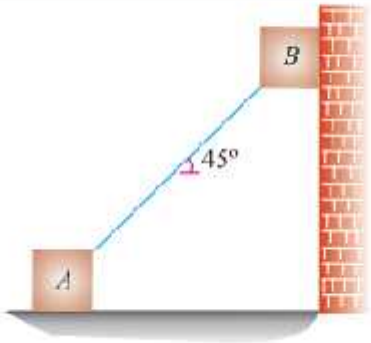


Fig.

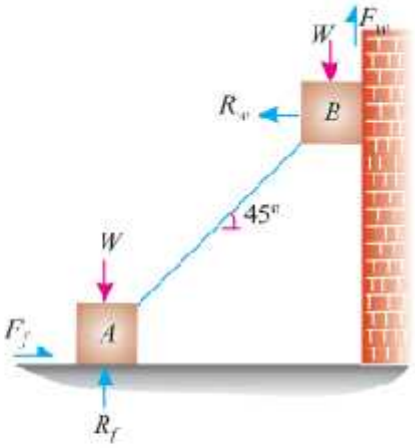
If both the blocks are in limiting equilibrium, find the coefficient of friction (μ), assuming it to be the same at floor as well as at wall.

Solution. Given: Weight of blocks A and $B = W$ and inclination of rod with the horizontal $(\alpha) = 45°$.

Let μ = Coefficient of friction, and

l = Length of the rod.

The forces acting on both the blocks are shown in Fig.



Resolving the forces vertically.

$$F_w + R_f = 2W$$

or $$\mu R_w + R_f = 2W \quad ...(\because F_w = \mu R_w) ...(i)$$

and now resolving the forces horizontally.

$$R_w = F_f = \mu R_f \quad ...(ii)$$

Now substituting this value of R_w in equation (i).

$$\mu (\mu R_f) + R_f = 2W$$

$$\mu^2 R_f + R_f = 2W$$

$$R_f (\mu^2 + 1) = 2W$$

$$\therefore \quad R_f = \frac{2W}{\mu^2 + 1} \quad ...(iii)$$

and now substituting this value of R_f in equation (ii),

$$R_w = \mu \times \frac{2W}{\mu^2 + 1} \quad ...(iv)$$

Taking moments of the forces about the block A and equating the same,

$$R_w \times l \cos 45° + F_w \times l \cos 45° = W \times l \cos 45°$$

$$R_w + F_w = W$$

or $$R_w + \mu R_w = W$$

$$R_w (1 + \mu) = W$$

Substituting the value of R_w from equation (*iv*),

$$\frac{\mu \times 2W}{\mu^2 + 1}(1 + \mu) = W$$

or $$2\mu\,(1 + \mu) = \mu^2 + 1$$

$\therefore$ $$2\mu + 2\mu^2 = \mu^2 + 1$$

$$\mu^2 + 2\mu - 1 = 0$$

Solving it as quadratic equation for μ.

$$\mu = \frac{-2 \pm \sqrt{(2)^2 + 4}}{2} = 0.414 \qquad \textbf{Ans.}$$