



A ladder is leaning against a smooth wall. The coefficient of friction between the ladder and the floor is $\mu = 0.4$. It is at a critical orientation with height h and base line b . Jill is standing at a point where $L' = \beta L$, with $\beta < 0.5$.

What would happen to the ladder?

- A) It is stable.
- B) Critical condition remains.
- C) It will slip.

About O, the torque – equation is $h f' = \frac{bW}{2} + \beta b W_1$. (1)

For the ladder to be stable, it requires

$$F' = f' = \left(\frac{W}{2 + \beta W_1} \right) \frac{b}{h} \leq f_{max}^s = \mu (W + W_1). \quad (2)$$

From given, when $W_1 = 0$, (2) becomes an equality. So

$$\left(\frac{W}{2 + 0} \right) \frac{b}{h} = \mu (W + 0), \quad \text{or} \quad \mu = \frac{b}{2h}. \quad (3)$$

Substituting (3) into (2) gives

$$\left(\frac{W}{2 + \beta W_1} \right) \frac{b}{h} \leq \frac{b}{2h} (W + W_1), \quad \text{or} \quad \beta \leq \frac{1}{2}. \quad (4)$$

This implies that as long as Jill is below the midway point, the ladder is stable.

At $\beta = \frac{1}{2}$, it is at the critical situation.

Answer **A**.