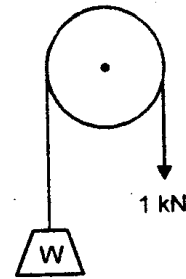**P1.** Find the range of the load W that can be kept in equilibrium with a force of 1 kN as shown. The rope makes one and half turns over the rough pulley. The angle of friction between the pulley and rope is 10°. State the direction of impending motion in each case. Prove the formula you use.
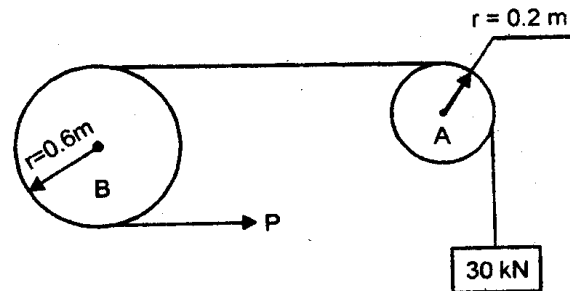
P2. A load of weight W is hanging from a rope wrapped 3 full rounds around the branch of a tree. If $\mu = 0.1$ and W = 2000 N, determine the force P to be applied at the other end of the rope to prevent the load from slipping down.
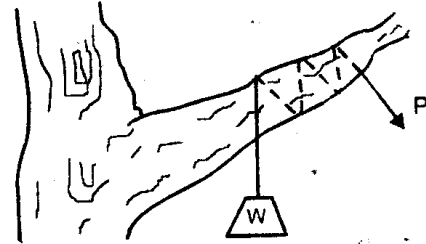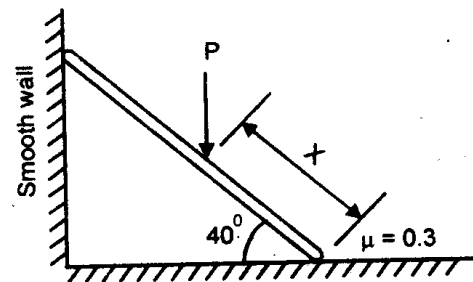
P3. Determine minimum force P required to just lift the 30 kN load.
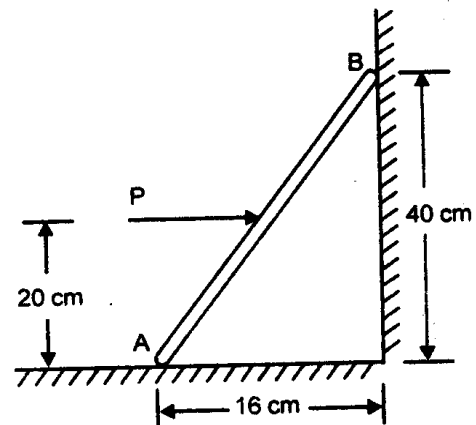a. $\mu = 0.3$ for both rough pulleys.
b. $\mu = 0.3$ for pulley A and $\mu = 0.5$ pulley B.

P4. A person of weight P ascends the 5 m ladder shown. How far up the ladder may the person climb before sliding motion of ladder takes place.

P5. A 100 N uniform rod AB is held in equilibrium as shown. If $\mu = 0.15$ at A and B, calculate the range of values of P for which equilibrium is maintained.

P6. The uniform bar has a mass of 35 kg. What rightward force P is needed to start the bar moving to the right. Take μ = 0.3 at all contact points.
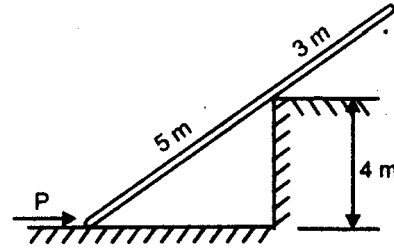
P7. A weightless ladder of length 8 m is resting against a wall and floor as shown. A man of weight 500 N wants to climb up the ladder.
a. Find how much distance 'x' along the ladder the man can climb without slipping.
b. A second person weighing 800 N wants to climb up the same ladder. Would he climb less than the earlier person? Find the distance covered.
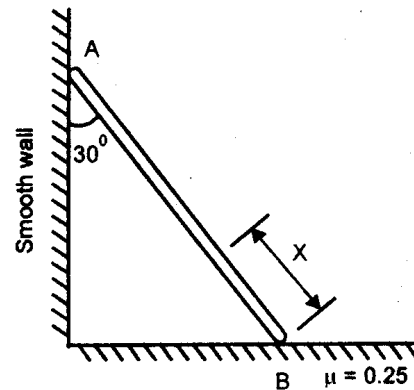
P8. A homogeneous block of weight W rests upon the inclined plane. If μ = 0.3, determine the greatest height h at which a force P parallel to the inclined plane may be applied so that the block will slide up the plane without tipping over.
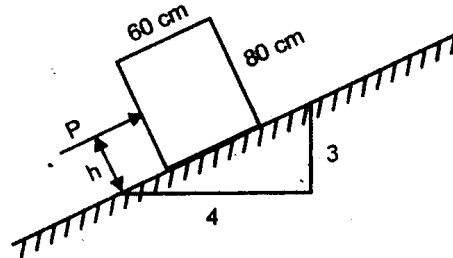
P9. A 1500 N cupboard is to be shifted to the right by a horizontal force P as shown. Find the force P required to just cause the motion and the maximum height upto which it can be applied.
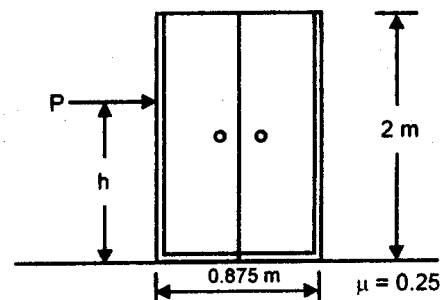
P10. Block A weighing 200 N is connected to another block of weight W by a cord passing over a rough fixed pulley. The weight W is slowly increased. Find its value for which motion just impends. Take μ for all contacting surfaces = 0.2
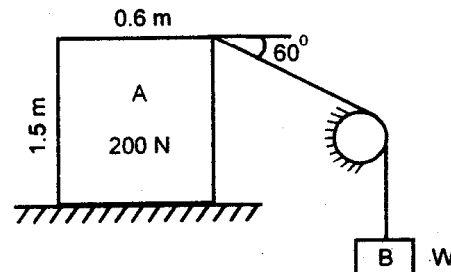
ANSWERS

P1. $190.37 \text{ N} \leq W \leq 5252.8 \text{ N}$.

P2. 303.6 N

P3. 123.3 kN, 231.19 kN

P4. x = 1.258 m

P5. $8.28 \text{ N} \leq P \leq 80.5 \text{ N}$

P6. 246.8 N

P7. 3.464 m, climbs same distance

P8. 57.14 cm

P9. 375 N, 1.75 m

P10. 88.83 N

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