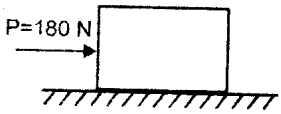
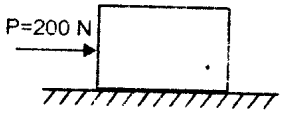
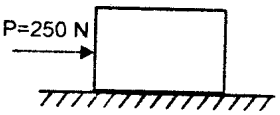
P1. For a 1000 N block kept on a rough surface, find the magnitude of the frictional force at the contact surface for the following cases. Take $\mu_s = 0.2$ and $\mu_k = 0.15$.



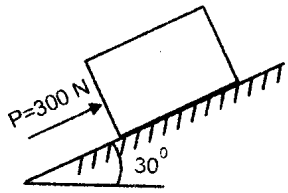
(a)



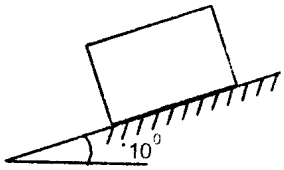
(b)



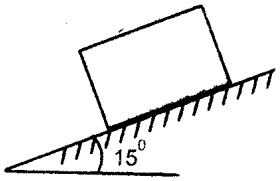
(c)



(d)

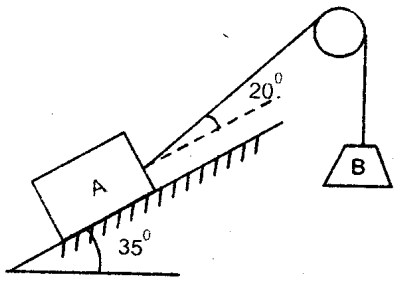


(e)

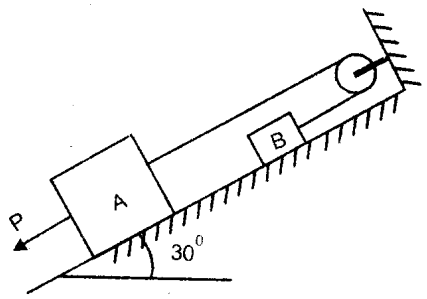


(f)

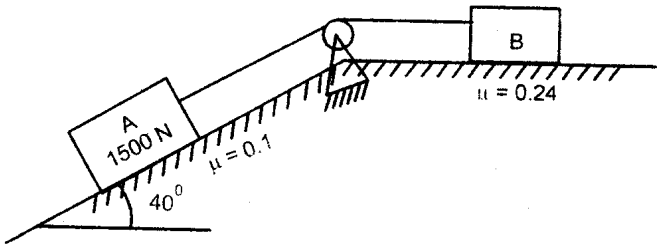
P2. Block A of weight 2000 N is kept on a plane inclined at 35°. It is connected to weight B by an in-extensible string passing over a smooth pulley. Determine weight of B so that B just moves down. Take $\mu = 0.2$



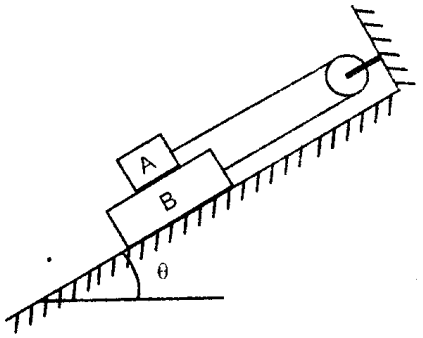
P3. Determine the force P to cause motion to impend. Take masses A and B as 9 kg and 4 kg respectively and coefficient of static friction as 0.25. The force P and rope are parallel to the inclined plane. Assume smooth pulley.



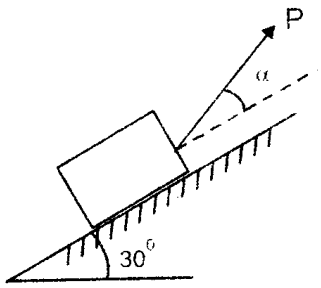
P4. What is the minimum value of mass of block B required to maintain the equilibrium? The rope connecting A and B passes over a frictionless pulley.



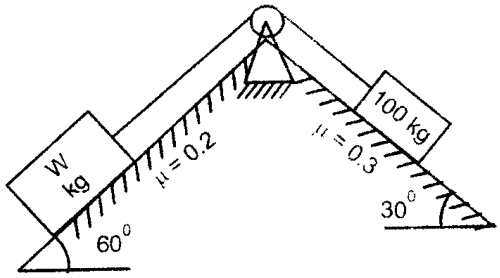
P5. Block A has a mass of 25 kg and block B has a mass of 15 kg. Knowing $\mu_s = 0.2$ for all surfaces, determine value of θ for which motion impends.
Assume frictionless pulley.



P6. Determine the minimum value and the direction of a force P required to cause motion of a 100 kg block to impend up a 30° plane. $\mu = 0.2$

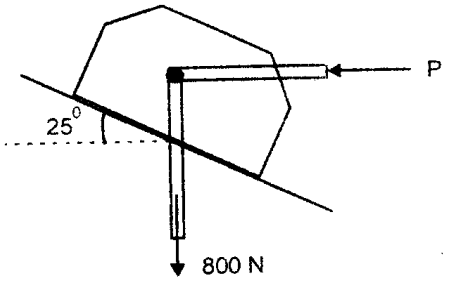


P7. Determine the least and greatest value of W for the equilibrium of the whole system.

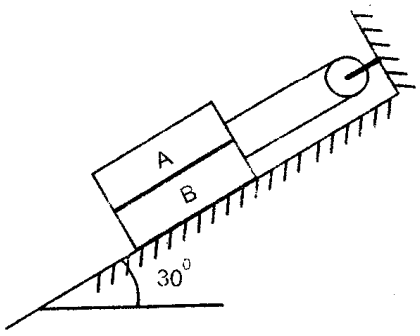


P8. A support block is acted upon by two forces as shown. Knowing $\mu_s = 0.35$ and $\mu_k = 0.25$, determine the force P required

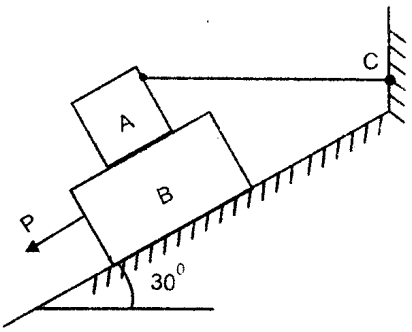
a. to start the block moving up the incline.
b. to keep it moving up.
c. to prevent it from sliding down.



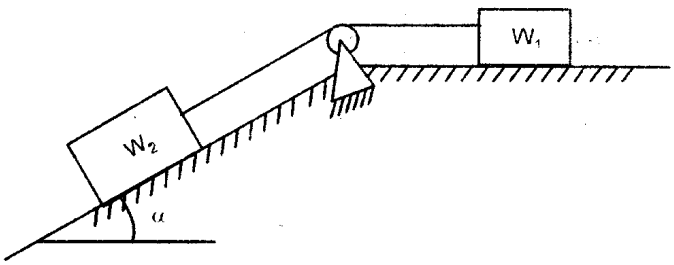
P9. Block A has a mass of 20 kg and block B has a mass of 10 kg. Knowing that the coefficient of static friction is 0.15 between the two blocks and zero between block B and the slope, find the magnitude of the frictional force between the two masses and tension in the string. Assume smooth pulley.



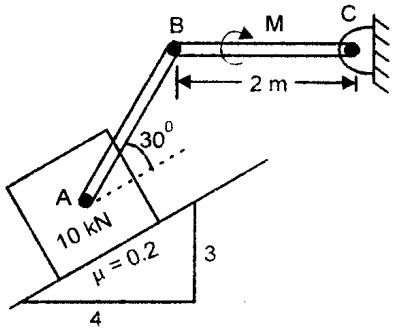
P10. Block A of mass 30 kg rests on block B of mass 40 kg. Block A is restrained from moving by a horizontal rope tied at point C. What minimum force P applied parallel to the plane is necessary to start block B down the plane. Take μ for all surfaces as 0.35.



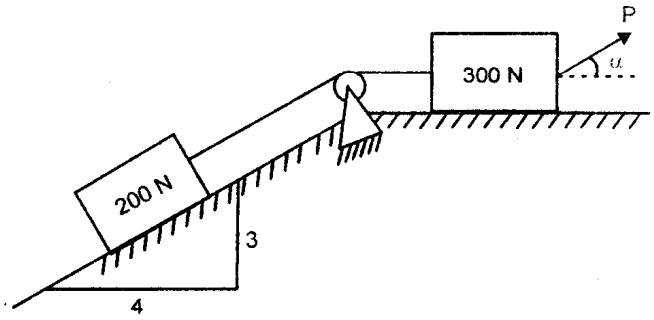
P11. Two blocks of weight W_1 and W_2 are connected by a flexible cord passing over a frictionless pulley and rest upon a horizontal and inclined plane respectively. Taking a particular case where $W_1 = W_2$ and μ is same for all surfaces, find the inclination α of the plane at which the motion will impend.



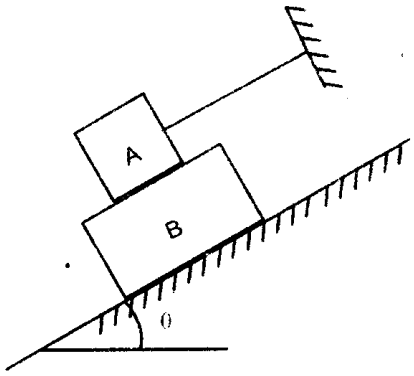
P12. The given figure shows a block A held in equilibrium on an inclined plane by a moment M applied to link BC. Link AB and link BC are hinged at B. The weight of the block is 10 kN. The rod BC is 2 m long. Assume the links to be weightless and hinges to be ideally smooth. Calculate moment M to just start motion of the block upwards. Take coefficient of friction between block and the plane to be 0.2.



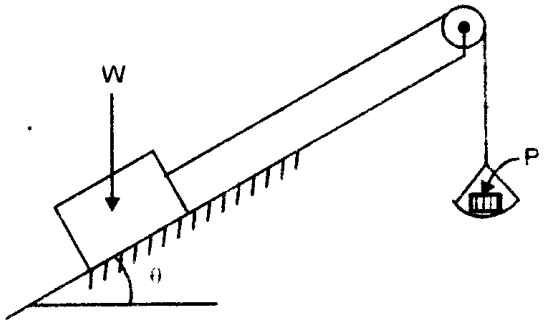
P13. Find the least value of P that will just start the system of blocks shown moving to the right. μ under each block is 0.3. Also find the corresponding value of α. Assume smooth pulley.



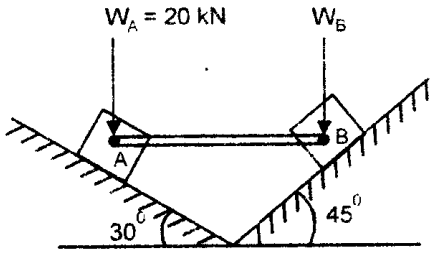
P14. What should be the value of angle θ for the motion of block B weighing 90 N to impend down the plane. The coefficient of friction for all surfaces of contact is 1/3. Block A weighs 30 N.



P15. Figure shows a weight W resting on a rough inclined plane having an angle of friction ϕ (θ > ϕ). It is connected to a pan of negligible weight by a string passing over a smooth pulley. Find the minimum value of weight P in the pan for equilibrium.



P16. Find the maximum value of W_B for the rod AB to remain horizontal. Also find the corresponding axial force in the rod.
Take μ = 0.2 for all contact surfaces.



ANSWERS

P1. (a) 180 N, (b) 200 N, (c) 150 N
(d) 129.9 N, (e) 173.65 N,
(f) 144.88 N

P2. 1463.1 N

P3. 3.09 N

P4. 360.7 kg

P5. 60.95°

P6. $\alpha = 11.3°$, P = 647.5 N

P7. 24.84 kg, 99.2 kg

P8. 780 N, 648.6 N, 80 N

P9. F = 24.5 N, T = 73.5 N

P10. 220.8 N

P11. $\alpha = 2 \tan^{-1} \mu$

P12. 14.45 kNm

P13. $\alpha = 16.7°$, P = 247 N

P14. 29.05°

P15. $P = W [\sin \theta - \cos \theta \tan \phi]$

P16. 26.35 kN, 17.57 kN