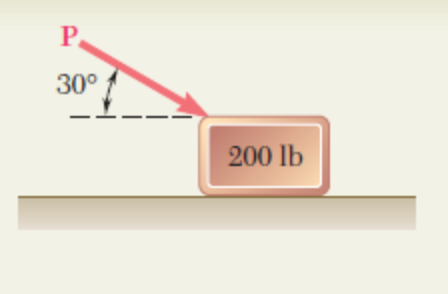
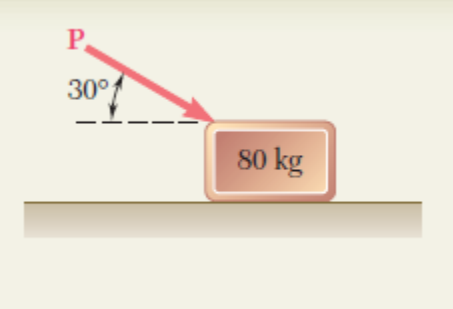
Tutorial sheet 6

1. A 200 lb block rests on a horizontal plane. Find the magnitude of the force **P** required to give the block an acceleration of 10 ft/s^2 to the right. The coefficient of kinetic friction between the block and the plane is $\mu_K = 0.25$. **[P = 151 lb]**



2. An 80 kg block rests on a horizontal plane. Find the magnitude of the force **P** required to give the block an acceleration of 2.5 m/s^2 to the right. The coefficient of kinetic friction between the block and the plane is $\mu_K = 0.25$.**[P = 535N]**



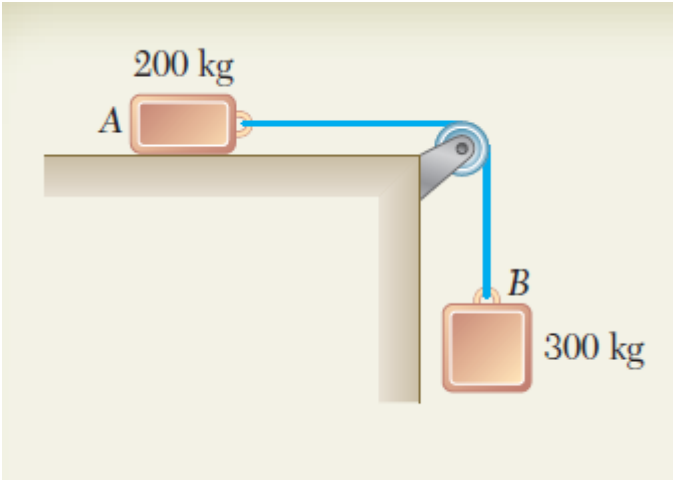
3. Two blocks of mass 60 kg and 15 kg are connected by the string and move along a rough horizontal surface when a force of 300 N is applied towards the right at the block of 60 kg mass. Apply D' Alembert principle to determine the acceleration of the blocks and tension the string. Assume that the coefficient of friction between the sliding surface of the blocks and the plane is 0.25. **[a= 1.547 m/s2, T= 60 N]**

4. A block of weight 2000 N rest on a rough horizontal surface ($\mu = 0.2$) and pulled by a force of 800 N at an angle of 300 to the horizontal. Determine the velocity attained by the block after it has moved 20 m starting from rest. Proceed to calculate the further distance moved by the body if the pull is removed. Use work-Energy relation. **[v= 8.55 m/s, s = 18.63 m]**

5. A body of 5 kg mass is initially at rest on a rough horizontal surface ($\mu = 0.2$) and is acted upon by a 20 N pull applied horizontally. Calculate: (a) the work done by the net force on the body in 5 seconds, (b) change in kinetic energy of the body in 5 seconds. **[work done= 259.59 Nm, Change in K.E.= 259.59]**

6. An automobile weighing 4000 N is driven down a 5° incline at a speed of 60 m/sec when the brakes are applied, causing a constant total braking force (applied by the road on the tires) of 1500 N. Determine the distance traveled by the automobile as it comes to a stop. **[x=637.4 m]**

7. Two blocks are joined by an inextensible cable as shown in figure. If the system is released from rest, determine the velocity of block A after it has moved 2 m. Assume that the coefficient of kinetic friction between block A and the plane is 0.25 and that the pulley is weightless and frictionless. **[v=4.43 m/sec]**



8. A 1300-kg small hybrid car is traveling at 108 km/h. Determine (a) the kinetic energy of the vehicle, (b) the speed required for a 9000-kg truck to have the same kinetic energy as the car.**[K.E.= 585 KJ and v=11.4 m/sec]**

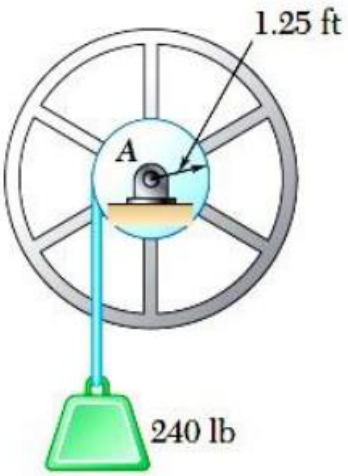
9. A 450 kg satellite is placed in a circular orbit 6400 km above the surface of the earth. At this elevation, the acceleration of gravity is 2.4 m/s^2. Determine the kinetic energy of the satellite, knowing that its orbital speed is 20,200 km/h. **[K.E= 7.08×10^9 J]**

10. A 4-kg stone is dropped from a height h and strikes the ground with a velocity of 25 m/s. (a) Find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped. (b) From what height h_1 must a 1 kg stone be dropped so it has the same kinetic energy? **[(a) K.E.=1250 J, h=31.9 m (b) h=127.4 m]**

11. A 1 kg stone is dropped from a height h and strikes the ground with a velocity of 25 m/s. (a) Find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped, (b) Solve Part a assuming that the same stone is dropped on the moon. (Acceleration of gravity on the moon = 1.62 m/s^2.) **[(a) K.E= 313 J, h=31.9 m, (b) K.E.= 313 J, h=192.9 m]**

12. Determine the maximum theoretical speed that may be achieved over a distance of 100 m by a car starting from rest, assuming there is no slipping. The coefficient of static friction between the tires and pavement is 0.75, and 60 percent of the weight of the car is distributed over its front wheels and 40 percent over its rear wheels. Assume (a) front-wheel drive, (b) rear-wheel drive.**[(a)v=29.714 m/sec, (b) v=24.261 m/sec]**

13. A 240-lb block is suspended from an inextensible cable which is wrapped around a drum of 1.25-ft radius rigidly attached to a flywheel in figure. The drum and flywheel have a combined centroidal moment of inertia is 10.5 $lb.ft.s^2$. At the instant shown, the velocity of the block is 6 ft/s directed downward. Knowing that the bearing at A is poorly lubricated and that the bearing friction is equivalent to a couple M of magnitude 60 lb.ft, determine the velocity of the block after it has moved 4 ft downward. **[V=12.01 ft/s]**



14. When the forward speed of the truck shown was 30 ft/s, the brakes were suddenly applied, causing all four wheels to stop rotating as shown in figure. It was observed that the truck skidded to rest in 20 ft. Determine the magnitude of the normal reaction and of the friction force at each wheel as the truck skidded to rest. **[N_A=0.175W, N_B= 0.325W, F_A= 0.122W, F_B=0.227W]**