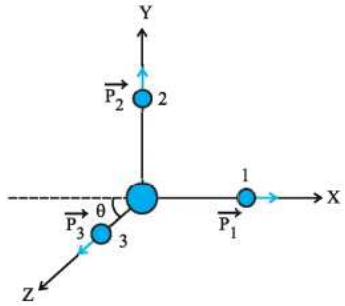
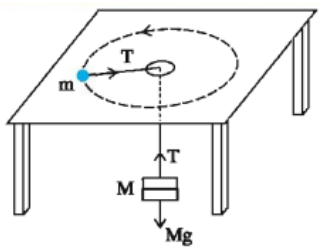
XI PHYSICS 05: LAWS OF MOTION 2018

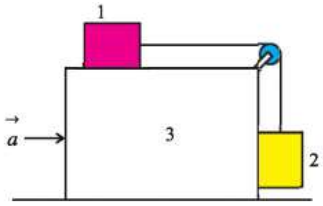
1. When 45 N force is applied on a body of mass m, acceleration of 4.5 m/s^2 is produced in it. The same force when applied on a body of mass m, acceleration off 9 m/s^2 is produced. Find the acceleration produced by the same force applied on these two bodies tied together. **(Ans: 3 m/s^2)**
2. A soldier ffires bullets, each of mass 50 g, from his automatic rifle wwith a velocity of 1000 m/s. If he can bear a maximum force of 200 N on his shoulder, find the maximum number of bullets which he can fire in a second. **(Ans: 4 bullets per second)**
3. A bomb in the steady state explodes into three fragments. Two fragments of equal masses move with velocity 30 m/s in mutually perpendicular directions. The mass of the third fragment is eual to three times the mass of each of these two fragments. Find the magnitude and direction of the velocity of this third fragment. **(Ans: 10√2 m/s, 45^o)**



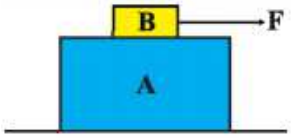
4. As shown in figure two strings AO and BO are tied with a rigid support and a body of 20 kg mass is suspended with a third string OC. In the equlibrium condition off this entire system, the strings AO and BO make angles 60^o and 30^o respectively with the horizontal. Assuming all these strings as massless, find the tensions produced in these strings. **(Ans: 100 N, 173 N and 200 N)**
5. A block of mass 15 kg is lying on an inclined plane of angle 30^o. In order to make it move upward along the slope with an acceleration of 25 cm/s^2, a horizontal force of 200 N is required to be applied on it. Calculate:
   a. Frictional force on the block
   b. Coefficient of kinetic friction
6. On a smooth horizontal surface of a table, a body of mass m is connected wwith the help of a light string passing through the hole on the surface, to a body of mass M suspended at the other end.
   a. In order that the body of mass M remains stationary obtain the condition fo the circular motion of the body of mass m in terms of v and r. **(Ans: $v^2/r = Mg/m$)**
   b. In the above case to maintain a uniform circular motion of a body of mass 110 kg, with a speed of 5 m/s, on the path of radius 2 m, what should be the mass suspended at the other end? **(Ans: 12.5 kg)**



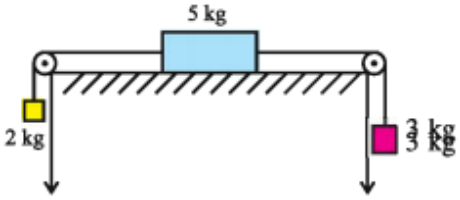
7. A disc is rotating around its centre in a horizontal plane at the rate of 100/3 rotations per minute. A coin is placed at a distance of 5 cm and another similar coin at 25 cm from its centre. The coefficient of static friction between the disc and the coins is 0.2. Which coin will be thrown away from the disc? Which coin will keep rotating with the disc?
8. A cyclist speeding at 18 km/h on a level road takes a sharp circular turn off radius 3 m without reducing the speed. The coefficient of static friction between the tyres and the road is 0.1. will the cyclist slip while taking the turn?
9. A circular racetrack of radius 300 m is banked at an angle of 30^o. if the coefficient of friction between the wheels of a race car and the road is 0.2, calculate:
   a. The optimum speed of the race car to avoid wear and tear on its tyres. **(Ans: 28.1 m/s)**
   b. The maximum permissible speed to avoid slipping. **(Ans: 38.1 m/s)**
10. As shown in figure, two blocks 1 and 2, of the same mass are in contact with block 3. The coefficient of friction between the surfaces of 3 and 11 and that between 3 and 2 is μ. The blocks 1 and 2 are tied by a light string and the string is passed over a frictionless pulley. With what minimum acceleration should the block 3 move, in horizontal direction, so that there is no motion of 1 and 2 with respect to 3?



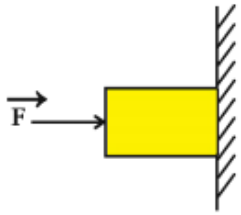
11. A block 'A' of 20 kg is put on a frictionless surface and another object 'B' of 2 kg is placed over it. The coefficient of friction between the surfaces of A and B is 0.25. a horizontal force of 2 N is applied on B. Calculate:
   a. The acceleration of block A and that of B **(Ans: 0.09 m/s^2)**
   b. Frictional force between A and B **(Ans: 1.82 N)**
   c. Calculate all these quantities again if the force on B is of 20 N. **(Ans: a_A = 0.25 m/s^2, a_B = 7.5 m/s^2)**



12. As shon in the figure blocks of masses 2 kg, 5kg and 3 kg are arranged wwith light strings and frictionless pulley fitted on frictionless horizontal surface. What is the acceleration of the system? **(Ans: 1 m/s^2)**



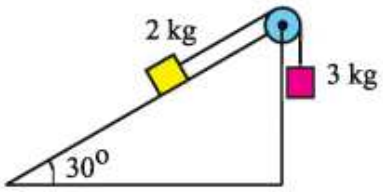
13. What is the value of the force F to be applied horizontally on a block of mass 5 kg which is in contact with a wall, as shown in figure, such that it does not fall down. The coefficient of friction between the block and the wall is 0.4. **(Ans: 125 N)**



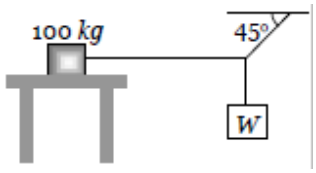
14. A stationary bomb explodes into three pieces. If the momenta of two pieces are 2i and 3j, then find the momenta of third piece. **(Ans: √13 units)**

15. As shown in figure, one block of 2 kg at one end and the other of 3 kg at the other end of a light string are connected. If this system remains stationary, find the magnitude and direction of the frictional force.

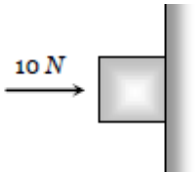
(Ans: 20 N)



16. The system shown in the figure is in equilibrium. The maximum value of *W*, so that the maximum value of static frictional force on 100 *kg*. body is 450 *N*, will be? **(Ans: 450 N)**



17. A horizontal force of 10 *N* is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is? **(Ans: 2 N)**



18. Two blocks are in contact on a frictionless table one has a mass *m* and the other 2 *m* as shown in figure. Force *F* is applied on mass 2*m* then system moves towards right. Now the same force *F* is applied on *m*. The ratio of force of contact between the two blocks will be in the two cases respectively. **(Ans: 1:2)**