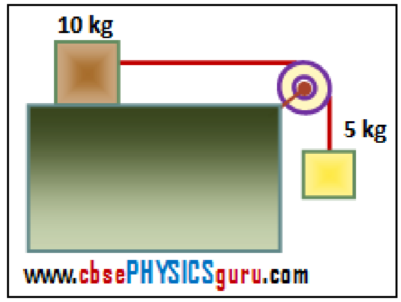
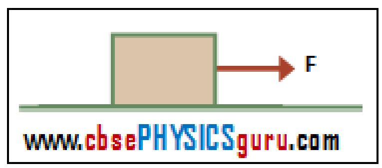
FRICTION



1. Identify the correct statement:
   (a) Static friction depends on the area of contact.
   (b) Kinetic friction depends on the area of contact.
   (c) Coefficient of static friction does not depend on the surfaces in contact.
   (d) Coefficient of kinetic friction is less than the coefficient of static friction.
2. A block of mass 5 kg lies on a horizontal surface in a truck, the coefficient of static friction between the block and the surface is 0.4. What is the force of friction on the block if the acceleration of the truck is 3 m/s^2? (Take g = 10 m/s^2):
   (a) 5 N (b) 10 N **(c)** 15 N (d) 20 N
3. A body of mass 40 kg resting on a rough horizontal surface is subjected to a force F which is just enough to start the motion of the body. If $\mu_s = 0.5$, $\mu_k = 0.4$ and the force F is continuously applied on the body, then the acceleration of the body is (Take g = 10 m/s^2):
   (a) zero **(b)** 1 m/s^2 (c) 2 m/s^2 (d) 4 m/s^2
4. A block of mass 5 kg is placed on the floor. The coefficient of static friction between the floor and the block is 0.4. A force F of 12 N is applied on the block as shown in figure. The force of friction between the block and the floor is (Take g = 10 m/s^2):
   (a) 4 N (b) 6 N (c) 12 N (d) 20 N
5. A homogeneous chain of length L lies on a table. The coefficient of friction between the chain and the table is μ. The maximum length which can hang over the table in equilibrium is:
   (a) $\left(\frac{\mu}{\mu-1}\right)L$ **(b)** $\left(\frac{\mu}{\mu+1}\right)L$ (c) $\left(\frac{\mu-1}{\mu+1}\right)L$ (d) $\left(\frac{\mu+1}{\mu}\right)L$



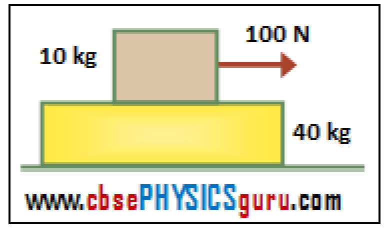
6. A horizontal force of 20 N is required to just hold a block of mass m stationary against a wall. The coefficient of friction between the block and the wall is 0.4. The mass of the block is (g = 10 ms^2):
   (a) 0.8 kg (b) 1.0 kg (c) 1.2 kg (d) 2 kg
7. An object is placed on the surface of a smooth inclined plane of inclination 45^0. It takes time t to reach the bottom. If the same object is allowed to slide down a rough inclined plane of same inclination, it takes time 2t to reach the bottom. The coefficient of friction is given by:
   (a) 0.25 (b) 0.40 (c) 0.55 **(d)** 0.75
8. The backside of a truck is open and a box of 40 kg is placed 5 m away from the rear end. The coefficient of friction of the box with the surface of the truck is 0.15. The truck starts from rest with 2 m/s^2 acceleration. The distance covered by the truck when the box falls off will be:
   (a) 20 m (b) 30 m (c) 40 m (d) 50 m
9. The coefficient of static friction between block of mass 10 kg and the surface as shown in figure is 0.2. What minimum mass should be placed over the 10 kg block so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless. (Take g = 10 m/s^2):
   (a) 5 kg (b) 10 kg **(c)** 15 kg (d) 20 kg

10. A 40 kg slab rests on a frictionless floor. A 10 kg block rests on top of the slab as shown in the figure. Coefficient of static friction between the block and the slab is 0.60 while the coefficient of kinetic friction between the block and slab is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. If g = 10 m/s^2, the resulting acceleration of the slab and the block will be, respectively:

(a) 0.5 m/s^2, 1.5 m/s^2 **(b)** 1.0 m/s^2, 6.0 m/s^2 (c) 2.5 m/s^2, 4.5 m/s^2 (d) 0.5 m/s^2, 4.5 m/s^2

11. In the figure shown, coefficient of friction between the two blocks is 2/5. If g = 10 m/s^2, the force of friction acting between the two blocks is:

(a) 8 N (b) 12 N (c) 16 N **(d)** 20 N

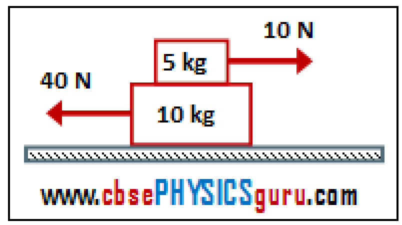


12. A wooden block of mass m resting on a rough horizontal surface is pulled by a force F as shown in figure. The coefficient of friction between block and surface μ. The minimum value of the force F to move the block will be:

(a) $\frac{\mu mg}{cos\theta + \mu\, sin\theta}$ (b) $\frac{\mu mg}{cos\theta - \mu\, sin\theta}$ (c) $\frac{\mu mg}{sin\theta + \mu\, cos\theta}$ (d) $\frac{\mu mg\, tan\theta}{cos\theta + \mu\, sin\theta}$

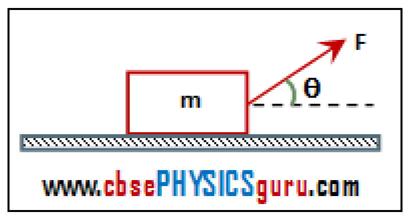
13. How large must F be in the figure shown to give the 4 kg block an acceleration of 1 m/s^2? The coefficient of friction between all surfaces is 0.1:

(a) 4 N (b) 5 N (c) 6 N **(d)** 11 N



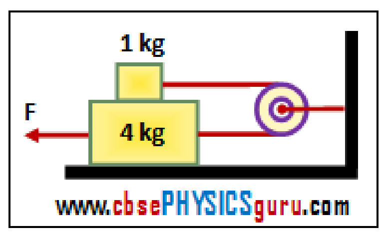
14. A force F pushes a block of weight W at an angle θ with the horizontal. The block is placed on a horizontal surface. If the angle of friction is ϕ, the magnitude of force F required to move the block is equal to:

(a) $\frac{Wcos\emptyset}{\sin(\theta+\emptyset)}$ **(b)** $\frac{Wsin\emptyset}{\cos(\theta+\emptyset)}$ (c) $\frac{Wcos\emptyset}{\sin(\theta-\emptyset)}$ (d) $\frac{Wsin\theta}{\cos(\theta+\emptyset)}$



15. A horizontal force, just sufficient to move a body of mass 2 kg lying on a rough horizontal surface, is applied on it. The coefficients of static and kinetic friction between the body and the surface are 0.6 and 0.4 respectively. If the force continues to act even after the block has started moving, the acceleration of the block in m/s^2 is (Take g = 10 m/s^2):

(a) 2 N (b) 3 N (c) 5 N (d) 0.5 N



16. A body takes time t to reach the bottom of an inclined plane of angle θ with the horizontal. If the plane is made rough, time taken now is 2t. The coefficient of friction of the rough surface is:

(a) $\frac{1}{4}\, tan\theta$ (b) $\frac{2}{4}\, tan\theta$ **(c)** $\frac{3}{4}\, tan\theta$ (d) $\frac{3}{5}\, tan\theta$

17. A block of mass m placed on a rough inclined plane of inclination θ = 60° can just be prevented from sliding down by applying a force F_1 up the plane and it can be just made to slide up the plane by applying a force F_2 up the plane. If the coefficient of friction between the block and plane is $\frac{1}{2\sqrt{3}}$, the relation between F_1 and F_2 inclined plane is:

(a) $5F_2 = 7F_1$ (b) $7F_2 = 5F_1$ (c) $5F_2 = 3F_1$ (d) $3F_2 = 4F_1$

18. A boy of mass 60 kg is climbing a vertical pole at a constant speed. If the coefficient of friction between his palms and the pole is 0.5 and $g = 10\ m/s^2$, the horizontal force that he is applying on the pole is:
(a) 300 N (b) 600 N (c) 900 N **(d)** 1200 N