Vidyarohi Learning

Laws of Motion

Q.No.1: A block of mass '*m*' is placed on a surface with a vertical cross-section given by $y = \frac{x^3}{6}$. If the coefficient of friction is 0.5, the maximum height above the ground, at which the block can be placed without slipping is:

A. $\frac{1}{3}$ m

B. $\frac{1}{2}$ m

C. $\frac{1}{6}$ m

D. $\frac{2}{3}$ m

Q.No.2:
A hoop of radius r and mass m rotating with and angular velocity ω_0 is placed on a rough horizontal surface. The initial velocity of the centre of the hoop is zero. What will be the velocity of the centre of the hoop when it ceases to slip?

JEE 2013

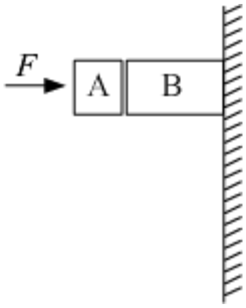
A. $\frac{r\omega_0}{4}$

B. $\frac{r\omega_0}{3}$

C. $\frac{r\omega_0}{2}$

D. $r\omega_0$

Q.No.3: Given in the figure are two blocks A and B of weight 20 N and 100 N, respectively. These are being pressed against a wall by a force *F* as shown. If the coefficient of friction between the blocks is 0.1 and between block B and the wall is 0.15, the frictional force applied by the wall on block B is:



JEE 2015

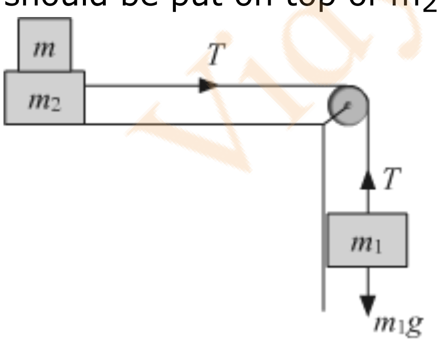
A. 100 N
B. 80 N
C. 120 N
D. 150 N

Q.No.4: The mass of a hydrogen molecule is 3.32×10^{-27} kg. If 10^{23} hydrogen molecules strike, per second, a fixed wall of area 2 cm^2 at an angle of 45° to the normal, and rebound elastically with a speed of 10^3 m/s, then the pressure on the wall is nearly : **JEE 2018**

A. 2.35×10^2 N/m^2
B. 4.70×10^2 N/m^2
C. 2.35×10^3 N/m^2
D. 4.70×10^3 N/m^2

Q.No.5: Two masses m_1 = 5 kg and m_2 = 10 kg, connected by an inextensible string over a frictionless pulley, are moving as shown in the figure. The coefficient of friction of horizontal surface is 0.15. The minimum weight m that should be put on top of m_2 to stop the motion is :

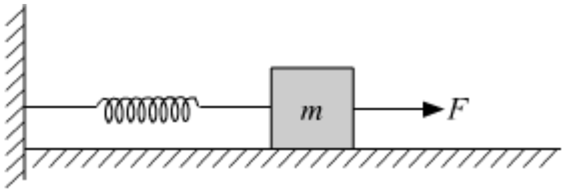
JEE 2018



A. 43.3 kg
B. 10.3 kg
C. 18.3 kg
D. 27.3 kg

Q.No.6: A block of mass, m lying on a smooth horizontal surface, is attached to a spring (of negligible mass) of spring constant k. The other end of the spring is fixed, as shown in the figure. The block is initially at rest in its equilibrium position. If now the block is pulled with a constant force F, the maximum speed of the block is:

JEE 2019



A. $\frac{2F}{\sqrt{mk}}$

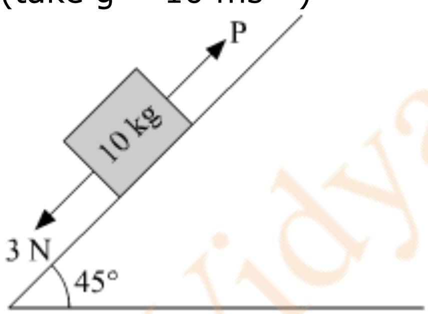
B. $\frac{F}{\pi\sqrt{mk}}$

C. $\frac{\pi F}{\sqrt{mk}}$

D. $\frac{F}{\sqrt{mk}}$

Q.No.7: A block of mass 10 kg is kept on a rough inclined plane as shown in the figure. A force of 3 N is applied on the block. The coefficient of static friction between the plane and the block is 0.6. What should be the minimum value of force P, such that the block does not move downward?
(take g = 10 ms^{-2})

JEE 2019



A. 32 N

B. 18 N

C. 23 N

D. 25 N

Q.No.8: A mass of 10 kg is suspended vertically by a rope from the roof. When a horizontal force is applied on the rope at some point, the rope deviated at an angle of 45° at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied is (g = 10 ms^{-2})

JEE 2019

A. 200 N

B. 140 N
C. 70 N
D. 100 N

Q.No.9: Two forces P and Q, of magnitude 2F and 3F, respectively, are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle θ is: **JEE 2019**

A. 120°
B. 60°
C. 90°
D. 30°

Q.No.10: A particle of mass *m* is moving in a straight line with momentum *p*. Starting at time $t = 0$, a force $F = kt$ acts in the same direction on the moving particle during time interval *T* so that its momentum changes from *p* to 3*p*. Here *k* is a constant. The value of *T* is : **JEE 2019**

A. $2\sqrt{\frac{k}{p}}$

B. $2\sqrt{\frac{p}{k}}$

C. $\sqrt{\frac{2k}{p}}$

D. $\sqrt{\frac{2p}{k}}$