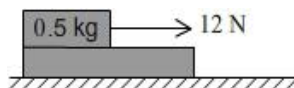


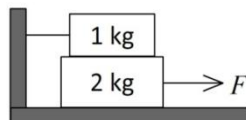
Laws of motion

Objective : Applying the concepts and relations in friction to some simple problems

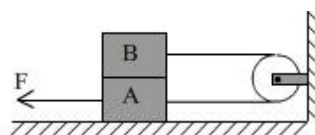
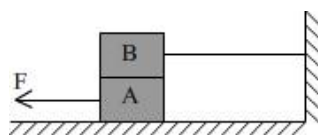
1. A body of mass 2 kg is placed on a horizontal surface having kinetic friction 0.4 and static friction 0.5. If force applied on the body is 2.5 N, the frictional force acting on it will be ($g = 10 \text{ ms}^{-2}$)
a) 8 N b) 5.8 N c) 2.5 N d) 1.2 N
2. A body moving with an initial velocity of 20 m s^{-1} is brought to rest within 100 m. Coefficient of kinetic friction between the surfaces in contact is ($g = 10 \text{ m s}^{-2}$)
a) 0.2 b) 0.8 c) 0.3 d) zero
3. A uniform iron chain of length 120 cm is placed on a rough horizontal table. If the coefficient of friction between the chain and the table is 0.5, the maximum length of chain that can hang from the edge of the table is
a) 20cm b) 40cm c) 60cm d) 80cm
4. A block of mass 0.5 kg is pulled by a force of 12 N as shown in the figure. Speed of the block is constant. Total force applied by the lower block on the upper block is



- a) 12 N b) 5 N c) 13 N d) 17 N
5. Two blocks of masses M and $2M$ are placed on a rough plank. The block of mass M just slides on the plank when acceleration of the plank is a . The minimum acceleration of plank to just slide the block of mass $2M$ is
a) $a/2$ b) a c) $2a$ d) $3a$
6. Coefficient of friction between the blocks is 0.1 and coefficient of friction between the lower block and the ground is 0.2. The minimum force required to pull the lower block is ($g = 10 \text{ ms}^{-2}$)

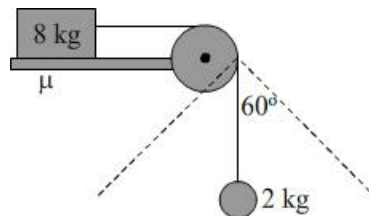


- a) 1 N b) 5 N c) 7 N d) 10 N
7. Consider two blocks A and B, each of mass m , connected as shown in the figure. Coefficient of friction for all the surfaces in contact is μ . A horizontal force F is applied to move the lower block A. The value of F such that the acceleration of lower block A is same in both the cases is

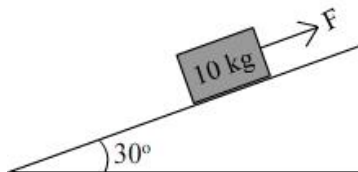


- a) $2\mu mg$ b) μmg c) $3\mu mg$ d) $(2/3)\mu mg$
8. In an arrangement given below, a body of mass 2 kg oscillates in a circular arc of amplitude 60° . The minimum value of coefficient of friction between the 8 kg mass and the surface of the table such that it does not slip is

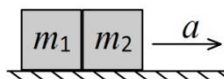
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- a) 0.25 b) 0.5 c) 0.4 d) 0.3
9. The smallest radius of a circle at which a bicyclist can travel if his speed 7ms^{-1} and the coefficient of static friction between the tyres and the road is 0.25 is
 a) 10 m b) 20 m c) 5 m d) 15 m
10. A block of mass 10 kg is placed on a rough inclined plane as shown in the figure. The coefficient of friction between the block and the inclined plane is $\frac{3}{4}$. The range of force to be applied such that the block remains at rest is



- a) $0 < F < 115$ b) $10 < F < 115$ c) $15 < F < 115$ d) $10 < F < 100$
11. A block, released from rest from the top of a smooth inclined plane of angle of inclination θ_1 , reaches the bottom in time t_1 . The same block, released from rest from the top of another smooth inclined plane of angle of inclination θ_2 , reaches the bottom in time t_2 . If the two inclined planes have the same height, then t_2/t_1 is
 a) $\sqrt{\frac{\sin(\theta_1)}{\sin(\theta_2)}}$ b) $\frac{\sin^2(\theta_1)}{\sin^2(\theta_2)}$ c) $\frac{\sin(\theta_1)}{\sin(\theta_2)}$ d) 1
12. A block takes twice as much time to slide down a rough 45° inclined plane as it takes to slide down an identical smooth 45° inclined plane. The coefficient of kinetic friction between the block and the rough inclined plane is
 a) 0.25 b) 0.50 c) 0.75 d) 1.0
13. The upper half of an inclined plane of inclination is perfectly smooth while the lower half rough. A block starting from rest at the top of the plane will again come to rest at the bottom if the coefficient of friction between the block and the lower half of the plane is given by
 a) $\mu = 2 \tan \theta$ b) $\mu = \tan \theta$ c) $\mu = 2/\tan \theta$ d) $\mu = 1/\tan \theta$
14. Two blocks m_1 and m_2 are placed in contact with each other on a horizontal surface. Coefficient of friction between both the blocks and the plane is same. The platform moves with an acceleration. Force of interaction between the blocks is



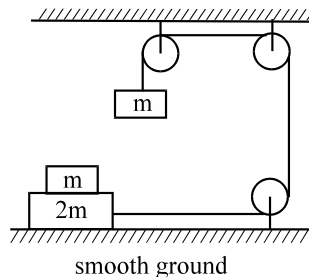
- a) zero in all cases b) zero only if $m_1 = m_2$

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c) non-zero only if $m_1 > m_2$

d) non-zero only if $m_1 < m_2$

15. In the arrangement shown in figure, there is friction between the blocks of masses m and $2m$ which are in contact. The ground is smooth. Mass of the suspended block is m . Block of mass m which is kept on mass $2m$, is stationary with respect to block of mass $2m$. Frictional force between m and $2m$ is (pulleys and strings are light and frictionless)



a) $\frac{3mg}{4}$

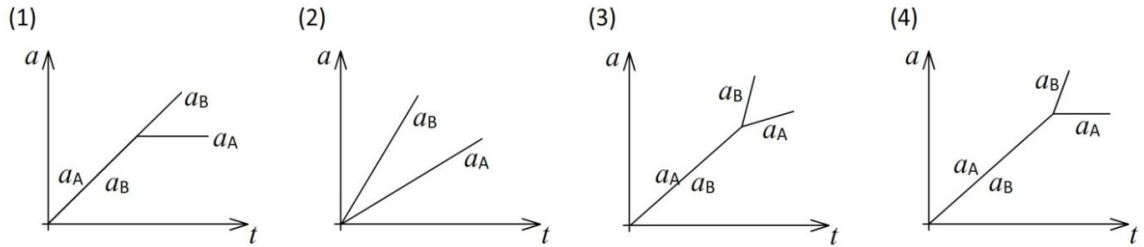
b) $\frac{mg}{4}$

c) $\frac{3mg}{2}$

d) $\frac{2mg}{3}$

16. Two blocks, A and B, of same masses, are resting in equilibrium on an inclined plane of inclination α with horizontal. The blocks are in contact each other, with block B higher than A. Coefficient of static friction of A with incline is 1.2 and that of B with the plane is 0.8. If the bodies are at rest then
- Frictional force on A is less than the frictional force on B
 - Frictional force on B is equal to frictional force on A
 - α is less than or equal to 45°
 - α is greater than or equal to 30°
17. A rope of length L and mass M is being pulled on a rough horizontal floor by a constant horizontal force $F = Mg$. The force is acting at one end of the rope in the same direction as the length of the rope. The coefficient of kinetic friction between rope and floor is $\frac{1}{2}$. Tension at the midpoint of the rope is
- $Mg/4$
 - $Mg/3$
 - $Mg/2$
 - Mg
18. A plank of mass 2kg and length 1 m is placed on a horizontal floor. A small block of mass 1 kg is placed on top of the plank, at its right extreme end. The coefficient of friction between plank and floor is 0.5 and that between plank and block is 0. b) If a horizontal force of 30 N starts acting on the plank to the right, the time after which the block will fall off the plank is ($g = 10 \text{ ms}^{-2}$)
- $2/3 \text{ s}$
 - $3/2 \text{ s}$
 - $1/3 \text{ s}$
 - $1/2 \text{ s}$
19. A block B is placed on block A. The mass of block B is less than the mass of block A. Friction exists between the blocks, whereas the ground on which the block A is placed is taken to be smooth. A horizontal force F increasing linearly with time begins to act on B. The acceleration a_A and a_B of blocks A and B respectively are plotted against t . The correctly plotted graph is

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20. A block of mass 10 kg is placed in a car going down an inclination of 60° . If the coefficient of friction between the floor of car and the block is $1/\sqrt{3}$, the acceleration a of the car such that the block does not slide on the car surface is

- a) $a \geq \frac{g}{\sqrt{3}}$ b) $a \geq \frac{2g}{\sqrt{3}}$ c) $a < \frac{g}{\sqrt{3}}$ or $a > \frac{2g}{\sqrt{3}}$ d) $\frac{g}{\sqrt{3}} \leq a \leq \frac{2g}{\sqrt{3}}$

Answers

1. c
2. a
3. b
4. c
5. b
6. c
7. a
8. b
9. b
10. a
11. c
12. b
13. a
14. a
15. b
16. c
17. c
18. a
19. d
20. d

For detailed solutions mail your request to sigmaaprc@gmail.com (mention the class / chapter / assignment number in the mail)