

Practice problems, Physics 102 Common Exam 2, Fall 2024

Chapters 4, 5 (sec. 1, 2, 4), 6 (sec. 1, 3)

1. A particularly scary roller coaster contains a loop-the-loop in which the car and rider are completely upside down at the top. If the radius of the loop is 13 m, what is the minimum speed the car must have at the top so that the rider does not fall out while upside down? Assume the rider is not strapped to the car.

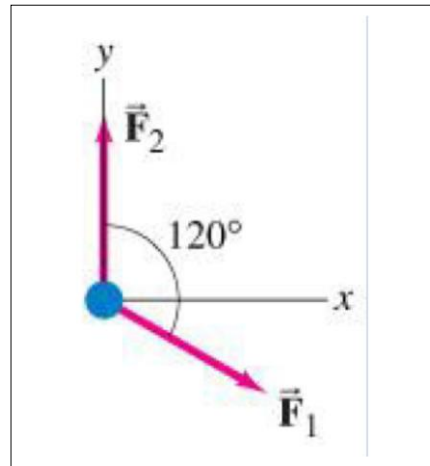
2. A 10.0 kg block rests on a frictionless surface and is attached to a vertical peg by a rope. What is the tension in the rope at the bottom of the swing if the block is whirling in a vertical circle of radius 2.00 m with a linear speed of 20 m/s?

3. Two masses, 6 kg and 4 kg, are connected by a massless cord that is slung over a pulley. The masses are released from rest and begin to move. What is the acceleration of the masses?

4. An 80 kg woman stands on a scale in an elevator. When the elevator starts to move, the scale reads 700N. Is the elevator moving upward or downward?

5. A 10,000 kg truck collides with a 1,000 kg car. During the collision, the magnitude of the force on the car from the truck is 10,000 N. What would be the magnitude of the force on the truck from the car?

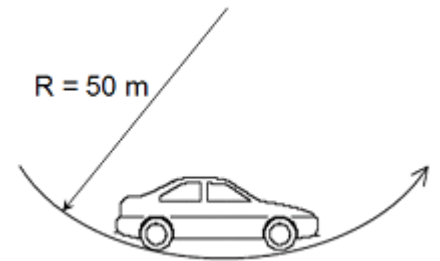
6. Two forces F_1 and F_2 are applied on a 22.0 kg object on a frictionless horizontal tabletop, as shown in the following figure. Suppose $|F_1| = 8.6$ N and $|F_2| = 13.2$ N. Determine the magnitude of the acceleration of the object.



7. A 10-kg object is hanging by a very light wire in an elevator that is traveling upward. The tension in the rope is measured to be 75 N. What are the magnitude and direction of the acceleration of the elevator?

8. A box weighing 88.0 N rests on a horizontal surface. The coefficient of static friction between the box and the surface is 0.50 and the coefficient of kinetic friction is 0.30.
- A) What is the magnitude of the friction force if a worker applies a horizontal force of 36.0 N to the box and the box is initially at rest?
 - B) What minimum horizontal force must be applied to move the box?

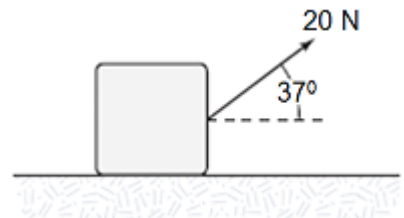
9. A car moving at 10.0 m/s encounters a depression in the road that has a circular cross-section with a radius of 50 m. What is the normal force exerted by the seat of the car on a 80.0-kg passenger when the car is at the bottom of the depression?



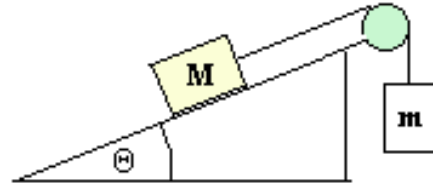
10. A block of mass 4 kg, which has an initial speed of 6 m/s at time $t = 0$, slides on a horizontal surface. Calculate the work W that must be done on the block to bring it to rest.

11. A force of 80 N is applied to a 50 kg mass in the direction of motion for a distance of 6 m and then the force acts in the direction opposite to the motion for the next 4 m. For the 10 m travel, how much total work is done by the varying force?

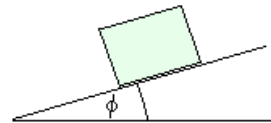
12. A 5.0-kg block is dragged over a rough horizontal surface by a constant force of 20 N acting at an angle of 37° above the horizontal as shown. If the 5 N friction force opposes its motion, what is the block's change of kinetic energy after traveling distance of 5 m?



13. The system shown is on verge of starting moving up the incline. Each block weighs 20 N and an incline angle is 28° . The coefficient of static friction between the block M and the incline is closest to:

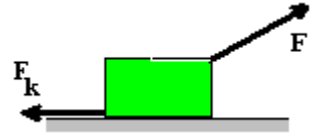


14. A 5-kg block slides down an inclined plane with acceleration of 1.2 m/s^2 . If the incline angle is $\phi = 25^\circ$ what is the magnitude of friction force that plane exerts on the block?



A 5-kg block is pulled across a horizontal plane. A pulling force F has a magnitude of 24 N and makes an angle of 28° with a horizontal. A 8 N friction force opposes its motion.

15. For the above situation, find the block's acceleration.
16. What is the coefficient of kinetic friction between the block and the plane?



17. An 85-g arrow is fired from a bow whose string exerts an average force of 105 N on the arrow over a distance of 75 cm. What is the speed of the arrow as it leaves the bow?

1. 11 m/s
2. 2098 N
3. 2 m/s²
4. Downward
5. 10,000
6. 0.54 m/s²
7. -2.3 m/s² downward
8. A) 36N B) 44N
9. 944 N
10. -72 J
11. 160 J
12. 54.9 J
13. 0.6
14. 15 N
15. 2.6 m/s²
16. 0.21
17. 43 m/s

