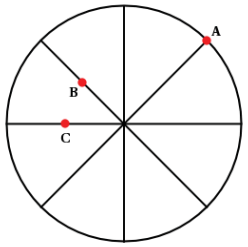
HW4 - due 6 pm Day 8 (Wed. Aug. 6)

1. Question Details OSColPhys1 6.P.020.WA. [2611845]

A rigid wheel of radius r rotates about an axis through the center and perpendicular to the plane of the wheel. Consider three points A, B, and C on the wheel, indicated by the small red circles. Location A is on the rim, locations B and C are on two different spokes of the wheel at a distance r/2 from the center. Consider the rotation of the wheel during a certain interval of time Δt.



(a) Which of the following is true regarding the angular velocity?

- All three points have the same angular velocity as all three points have the same angular displacement θ in the same time interval Δt.
- Points B and C will have half the angular velocity of point A as they are at half the distance from the center of the wheel compared to A.
- Points B and C will have twice the angular velocity of point A as they are at half the distance from the center of the wheel compared to A.

(b) Which of the following is true regarding the tangential speed?

- All three points have the same tangential speed as all three points have the same angular displacement θ in the same time interval Δt.
- Point A has a greater tangential speed as it is further away from the center of the wheel.
- Points B and C will have a greater tangential speed as they are closer to the center.

(c) Which of the following is true regarding centripetal acceleration? (Select all that apply.)

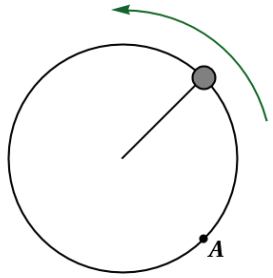
- All three points have the same centripetal acceleration as all three points have the same angular displacement θ in the same time interval Δt.
- Points B and C will have half the centripetal acceleration of point A as they are at half the distance from the center of the wheel compared to A.
- Points B and C will have twice the centripetal acceleration of point A as they are at half the distance from the center of the wheel compared to A.

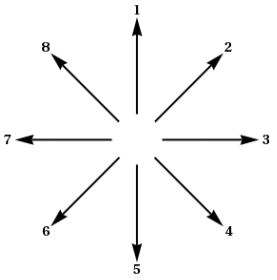
Supporting Materials

Physical Constants

2. Question Details OSColPhys1 6.P.026.WA. [2611743]

You whirl a ball tied to the end of the rope in a horizontal circle at constant speed, as shown in the diagram below. Use the direction rosette to answer the following questions.





9 magnitude zero

(a) What is the direction of the centripetal force acting on the ball when it is at location A?

(b) If the string breaks when the ball is at location A, in what direction will the ball move?

Supporting Materials

Physical Constants

3. Question Details OSColPhys1 6.P.004.WA. [2611605]

A truck with 0.360 m radius tires travels at 33.5 m/s. At how many radians per second are the tires rotating?

93.1 rad/s

What is this value in rpm?

889 rpm

Supporting Materials

Physical Constants

4. Question Details OSColPhys1 6.P.003.WA. [2611469]

In lacrosse, a ball is thrown from a net on the end of a stick by rotating the stick and forearm about the elbow. If the angular velocity of the ball about the elbow joint is 20.0 rad/s and the ball is 1.15 m from the elbow joint, what is the velocity of the ball?

23 m/s

Supporting Materials

Physical Constants

5. Question Details OSColPhys1 6.P.007.WA. [2611557]

Mary and her younger brother Alex decide to ride the 32-foot-diameter carousel at the State Fair. Mary sits on one of the horses in the outer section at a distance of 13 feet from the center. Alex decides to play it safe and chooses to sit in the inner section at a distance of 7 feet from the center.

(a) What is Mary's angular speed ω_M compared to that of Alex's angular speed ω_A? Give your answer as a multiple of ω_A.

$\omega_M =$ [ ] 1 ω_A

(b) What is Mary's tangential speed v_M compared to that of Alex's tangential speed v_A? Give your answer as a multiple of v_A.

$v_M =$ [ ] 1.86 v_A

Supporting Materials

Physical Constants

6. Question Details OSColPhys1 6.P.021.WA. [2611543]

Mary and her younger brother Alex decide to ride the 26-foot diameter carousel at the State Fair. Mary sits on one of the horses in the outer section at a distance of 11 feet from the center. Alex decides to play it safe and chooses to sit in the inner section at a distance of 6 feet from the center.

What is Mary's centripetal acceleration a_M compared to that of Alex's centripetal acceleration a_A? Give your answer as a multiple of a_A.

[ ] 1.83 a_A

Supporting Materials

Physical Constants

7. Question Details OSColPhys1 5.P.007.WA. [2613428]

A powerful motorcycle can produce an acceleration of 3.00 m/s^2 while traveling at 90.0 km/h. At that speed, the forces resisting motion, including friction and air resistance, total 425 N. What force does the motorcycle exert backward on the ground to produce its acceleration if its mass with rider is 250 kg?

[ ] 1180 N

Supporting Materials

Physical Constants

8. Question Details OSColPhys1 5.P.004.WA. [2613411]

Mary applies a force of 72 N to push a box with an acceleration of 0.44 m/s^2. When she increases the pushing force to 82 N, the box's acceleration changes to 0.61 m/s^2. There is a constant friction force present between the floor and the box.

(a) What is the mass of the box?

[ ] 58.8 kg

(b) What is the coefficient of kinetic friction between the floor and the box?

[ ] 0.08

Supporting Materials

Physical Constants

9. Question Details OSColPhys1 5.P.005.WA. [2613417]

In an exciting game, a baseball player manages to safely slide into second base. The mass of the baseball player is 83.3 kg and the coefficient of kinetic friction between the ground and the player is 0.53.

(a) Find the magnitude of the frictional force.

[ ] 433 N

(b) It takes the player 1.6 s to come to rest. What was his initial velocity?

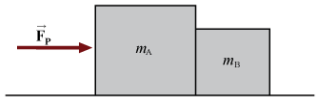
[ ] 8.31 m/s

Supporting Materials

Physical Constants

10. Question Details OSColPhys1 5.P.012.Tutorial.WA. [2668380]

Alex is asked to move two boxes of books in contact with each other and resting on a rough floor. He decides to move them at the same time by pushing on box A with a horizontal pushing force F_P = 8.9 N. Here A has a mass m_A = 10.2 kg and B has a mass m_B = 7.0 kg. The contact force between the two boxes is $\vec{F}_C$. The coefficient of kinetic friction between the boxes and the floor is 0.04. (Assume $\vec{F}_P$ acts in the +x direction.)



(a) What is the magnitude of the acceleration of the two boxes?

[ ] 0.125 m/s^2

(b) What is the force exerted on m_B by m_A? In other words what is the magnitude of the contact force $\vec{F}_C$?

[ ] 3.62 N

(c) If Alex were to push from the other side on the 7.0-kg box, what would the new magnitude of $\vec{F}_C$ be?

[ ] 5.28 N

Supporting Materials

Physical Constants

11. Question Details OSColPhys1 5.1.018. [2153374]

A contestant in a winter games event pushes a 56.0 kg block of ice across a frozen lake as shown in Figure 4.29(a). The coefficient of static friction is 0.1 and the coefficient of kinetic friction is 0.03.

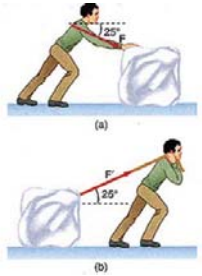


Figure 4.29

(a) Calculate the minimum force F he must exert to get the block moving.
63.5 N

(b) What is its acceleration once it starts to move, if that force is maintained?
0.72 m/s^2

12. Question Details OSColPhys1 5.1.019. [2153576]

A contestant in a winter games event pushes a 53.0 kg block of ice across a frozen lake with a rope over his shoulder as shown in Figure 4.29(b). The coefficient of static friction is 0.1 and the coefficient of kinetic friction is 0.03.

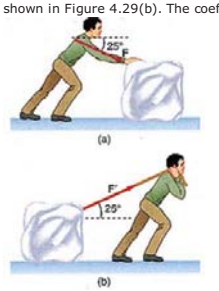


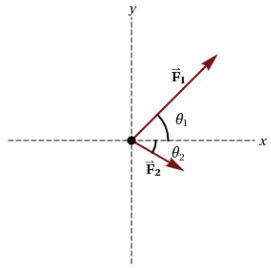
Figure 4.29

(a) Calculate the minimum force F he must exert to get the block moving.
54.8 N

(b) What is its acceleration once it starts to move, if that force is maintained?
0.655 m/s^2

13. Question Details OSColPhys1 5.P.006.WA. [2630311]

The diagram below is a top-down view of two children pulling a 11.4-kg sled along the snow. The first child exerts a force of F_1 = 16 N at an angle θ_1 = 45° counterclockwise from the positive x direction. The second child exerts a force of F_2 = 8 N at an angle θ_2 = 30° clockwise from the positive x direction.



(a) Find the magnitude and direction of the friction force acting on the sled if it moves with constant velocity.
magnitude 19.7 N
direction -158 ° counterclockwise from the +x-axis

(b) What is the coefficient of kinetic friction between the sled and the ground?
0.176

(c) What is the magnitude of the acceleration of the sled if F_1 is doubled and F_2 is halved in magnitude?
1.19 m/s^2

Supporting Materials

Physical Constants

14. Question Details OSColPhys1 5.P.020.Tutorial.WA. [2632682]

A book of mass 5 kg rests on a plank. You tilt one end of the plank and slowly increase the angle of the tilt. The coefficient of static friction between the book and the plank is 0.42. What is the maximum angle of tilt for which the book will remain stationary and not slide down the plank?
22.8 °

Supporting Materials

Physical Constants

15. Question Details OSColPhys1 5.P.024.WA. [2613427]

You are pushing a sled in which your little sister is seated up a 30° slope (one that makes an angle of 30° with the horizontal). If the mass of the sled and girl is 42 kg, and the coefficient of kinetic friction between the sled and the surface is 0.100, with what force do you need to push in order for the sled to move with constant velocity?

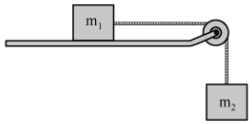
[ ] 241 N

Supporting Materials

Physical Constants

16. Question Details OSColPhys1 5.P.025.WA. [2613433]

A block of mass m_1 = 35 kg on a horizontal surface is connected to a mass m_2 = 18.9 kg that hangs vertically as shown in the figure below. The two blocks are connected by a string of negligible mass passing over a frictionless pulley. The coefficient of kinetic friction between m_1 and the horizontal surface is 0.32. (Assume gravity acts toward the $+y$ direction and the $+x$-axis is parallel to the surface and to the right.)



(a) What is the acceleration of the hanging mass? (Indicate the direction with the sign of your answer.)

[ ] 1.4 m/s^2

(b) Determine the tension in the cord. (Indicate the direction with the sign of your answer.)

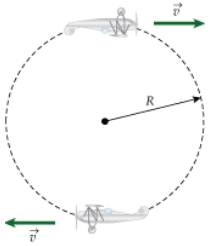
[ ] 159 N

Supporting Materials

Physical Constants

17. Question Details OSColPhys1 6.P.039.WA.mod [3102408]

A stunt pilot in an air show performs a loop-the-loop in a vertical circle of radius 3.53 × 10^3 m. During this performance the pilot whose weight is 688 N, maintains a constant speed of 2.20 × 10^2 m/s.



(a) Determine the normal force of the seat on the pilot when the pilot is at the highest point of the loop.

[ ] 275 N

(b) At what speed would the normal force of the seat on the pilot at the top of the loop equal zero? (At this speed, the pilot would feel "weightless" at the top of the loop!)

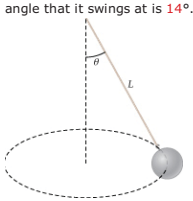
[ ] 186 m/s

(c) Determine the normal force of the seat on the pilot when the pilot is at the lowest point of the loop.

[ ] 1650 N

18. Question Details OSColPhys1 6.P.038.WA.mod [3102409]

A conical pendulum is a weight or bob fixed on the end of a string suspended from a pivot. It moves in a horizontal circular path, as shown in the diagram below. Suppose the bob has a mass of 0.37 kg, the length of the pendulum is 0.65 m and the angle that it swings at is 14°.



What is the speed of the mass?

[ ] 0.620 m/s

symbolic formatting help

Assignment Details

Name (AID): **HW4 - due 6 pm Day 8 (Wed. Aug. 6) (5979354)**
Submissions Allowed: **5**
Category: **Homework**
Code:
Locked: **No**
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