Regents Physics- Circular Motion Problems- Uniform and otherwise

Name:_____ **Date:**_____

1.Rex and Doris are out on a date. Rex makes a rapid right-hand turn. Doris begins sliding across the vinyl seat and collides with Rex. To break the awkwardness, Rex and Doris begin discussing the physics of the motion which was just experienced. Rex suggests that objects which move in a circle experience an outward force. Thus, as the turn was made, Doris experienced an outward force which pushed her towards Rex.
Doris disagrees, arguing that objects which move in a circle experience an inward force. In this case, according to Doris, Rex traveled in a circle due to the force of his door pushing him inward. Doris did not travel in a circle since there was no force pushing her inward; she merely continued in a straight line until she collided with Rex.
Who is correct? Argue one of these two positions.

2. A 0.2 kg object is twirled in a horizontal plane on a 0.5 m rope at 1 revolution every 1.5 seconds. From this it can be found that the mass has a tangential speed of 2.09 m/s.

(a) What is the centripetal acceleration of the object?
(b) What is the centripetal force experienced by the object? Where is the force directed?
(c) Describe how the acceleration and velocity vectors are related in uniform circular motion.

3. A 945-kg car makes a 180-degree turn with a speed of 10.0 m/s. The radius of the circle through which the car is turning is 25.0 m. Determine the force of friction and the coefficient of friction acting upon the car.

4. An amusement park ride consists of a vertical cylinder that spins about a vertical axis. When the cylinder spins sufficiently fast, any person inside it is held up against the wall. Suppose that the coefficient of static friction between a typical person and the wall is 0.25 .

Let the mass of an typical person be 60 kg , and let 7m be the radius of the cylinder.
(a) Find the critical centripetal force its corresponding acceleration that needs to be generated so that a typical person will not slide down the wall.
(b) How fast must the cylinder turn to not let this person “down”?

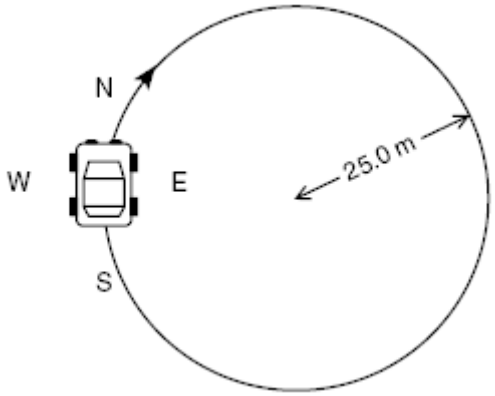
5. * Noah Formula is riding a roller coaster and encounters a loop. Noah is traveling 6 m/s at the top of the loop and 18.0 m/s at the bottom of the loop. The top of the loop has a radius of curvature of 3.2 m and the bottom of the loop has a radius of curvature of 16.0 m. (NOT UNIFORM CIRCULAR MOTION)

Use Newton's second law to determine the normal force acting upon Noah's 80-kg body at the top and at the bottom of the loop.

6*Anna Litical is riding on The Demon at Great America. Anna experiences a downwards acceleration of 15.6 m/s^2 at the top of the loop and an upwards acceleration of 26.3 m/s^2 at the bottom of the loop. (NOT UNIFORM CIRCULAR MOTION)

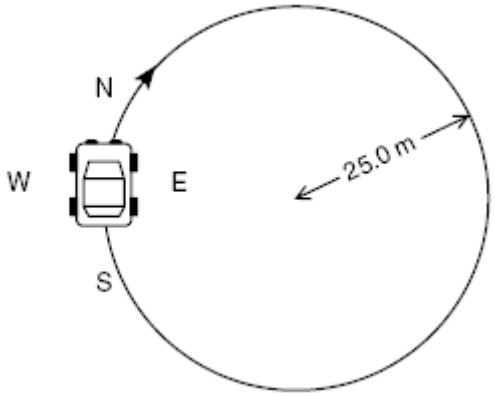
Use Newton's second law to determine the normal force acting upon Anna's 864 kg roller coaster car at the top and bottom of the loop.

7. A 1.00 x 10^3 kilogram car is driven clockwise around a flat circular track of radius 25.0 meters. If the circular track were to suddenly become frictionless at the instant shown in the diagram, the car's direction of travel would be



a) toward E **b)** a clockwise spiral **c)** toward W **d)** toward N

8. At the instant shown in the diagram, the car's centripetal acceleration is directed



a) clockwise **b)** toward E **c)** toward N **d)** toward W

9. As the car goes around the curve, the centripetal force is directed

a) tangent to the curve in the direction of motion

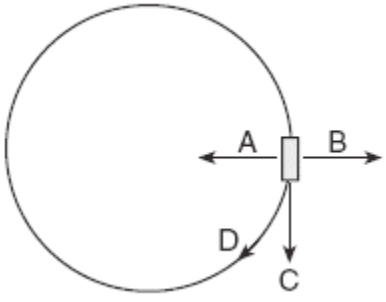
b) away from the center of the circular curve

c) tangent to the curve opposite the direction of motion

d) toward the center of the circular curve

10.

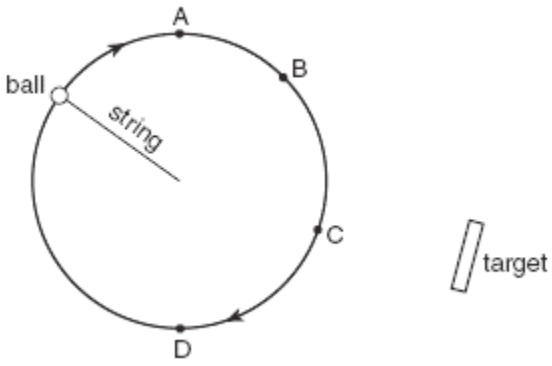
In the diagram below, a cart travels clockwise at constant speed in a horizontal circle. At the position shown in the diagram, which arrow indicates the direction of the centripetal acceleration of the cart?



a) B **b)** D **c)** A **d)** C

11.

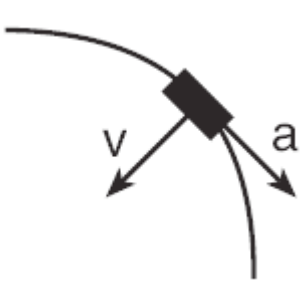
A ball attached to a string is moved at constant speed in a horizontal circular path. A target is located near the path of the ball as shown in the diagram. At which point along the ball's path should the string be released, if the ball is to hit the target?



a) D **b)** A **c)** B **d)** C

12.

car rounds a horizontal curve of constant radius at a constant speed. Which diagram best represents the directions of both the r's velocity, v, and acceleration, a?



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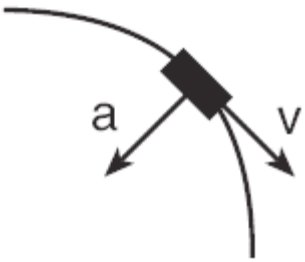

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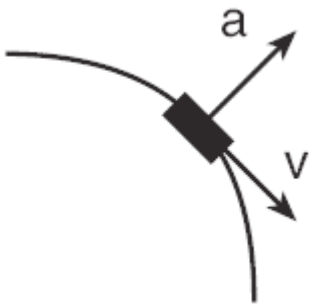
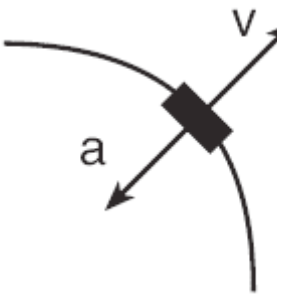


d)

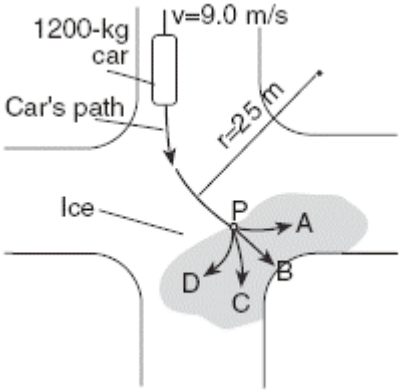


13. As a cart travels around a horizontal circular track, the cart must undergo a change in

speed **b)** inertia **c)** weight **d)** velocity

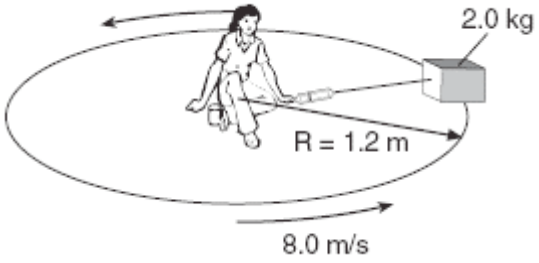
14.

ase your answer to this question on the information and diagram below. A 1200-kilogram car traveling at a onstant speed of 9.0 m/s turns at an intersection. The car follows a horizontal circular path with a radius of 25 neters to point P. At point P, the car hits an area of ice and loses all frictional force on its tires. Which path does ne car follow on the ice?



) A **b)** D **c)** B **d)** C

5. The diagram shows a student seated on a rotating circular platform, holding a 2.0-kilogram block with a spring scale. The lock is 1.2 meters from the center of the platform. The block has a constant speed of 8.0 meters per second. [Frictional forces n the block are negligible.] Which statement best describes the block's movement as the platform rotates?



) Its velocity is directed tangent to the circular path, with n inward acceleration.

c) Its velocity is directed perpendicular to the circular path, with an inward acceleration.

) Its velocity is directed perpendicular to the circular path, /ith an outward acceleration.

d) Its velocity is directed tangent to the circular path, with an outward acceleration.

6. A 1.0 x 10^3-kg car travels at a constant speed of 20. m/s around a horizontal circular track. Which diagram correctly epresents the direction of the car's velocity (v) and the direction of the centripetal force (Fc) acting on the car at one particular noment?

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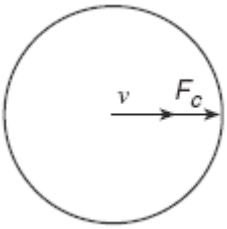

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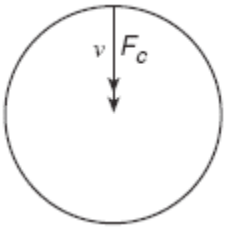

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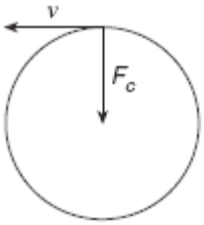

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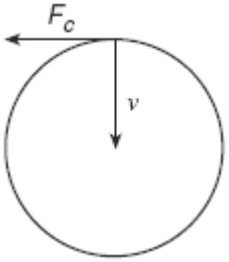
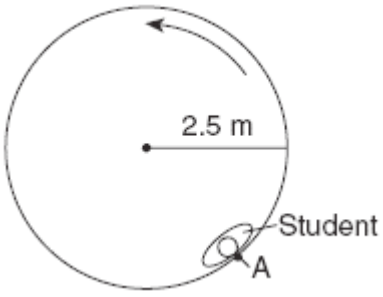


7. The diagram shows the top view of a 65-kg student at point A on an amusement park ride. The ride spins the student in a orizontal circle of radius 2.5 meters, at a constant speed of 8.6 m/s. The floor is lowered and the student remains against the /all without falling to the floor. Which vector best represents the direction of the centripetal acceleration of the student at point ?



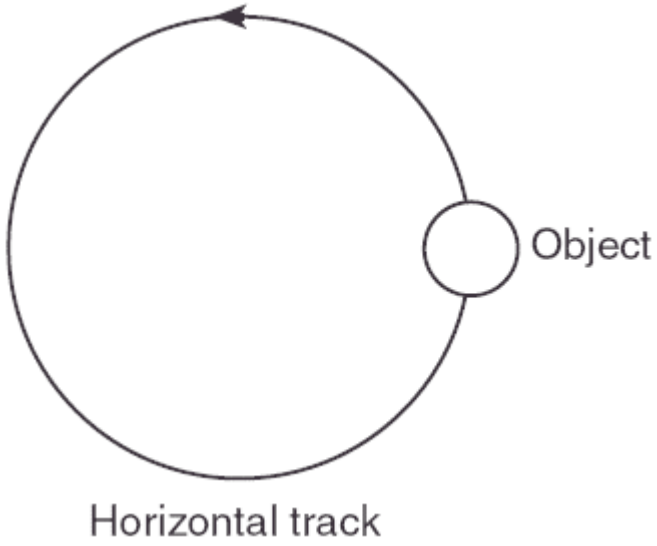
)

b)

c)

d)

8. The diagram below shows an object moving counterclockwise around a horizontal, circular track. Which diagram represents ıe direction of both the object's velocity and the centripetal force acting on the object when it is in the position shown?



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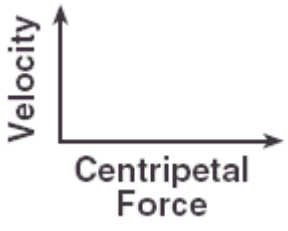

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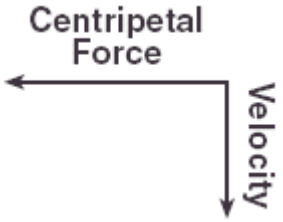

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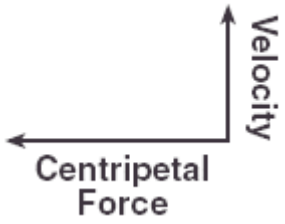

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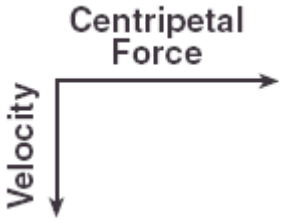
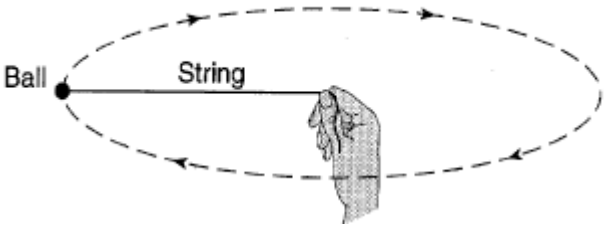


9. The diagram shows a student spinning a 0.10-kilogram ball at the end of a 0.50-meter string in a horizontal circle at a onstant speed of 10. m/s. [Neglect air resistance.] Which is the best description of the force keeping the ball in the circular ath?



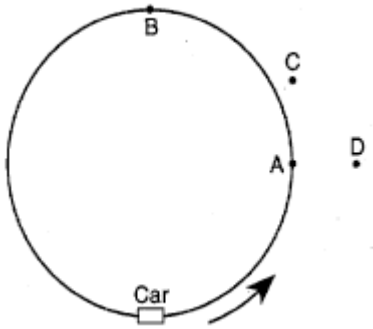
) perpendicular to the circle and directed away from the enter of the circle

) tangent to the circle and directed in the same direction ıat the ball is moving

c) perpendicular to the circle and directed toward the center of the circle

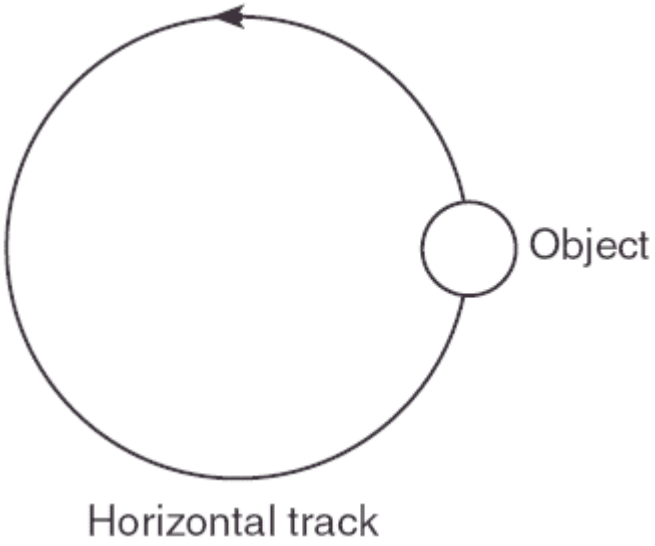
d) tangent to the circle and directed opposite to the direction that the ball is moving

0. A convertible car with its top down is traveling at constant speed around a circular track, as shown in the diagram below. When the car is at point A, if a passenger in the car throws a ball straight up, the ball could land at point



) D **b)** C **c)** B **d)** A

1. The diagram below shows an object moving counterclockwise around a horizontal, circular track. Which diagram represents the direction of both the object's velocity and the centripetal force acting on the object when it is in the position shown?



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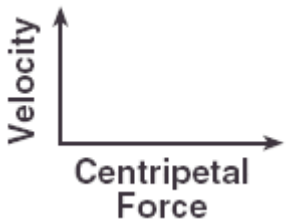

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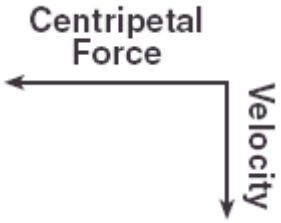

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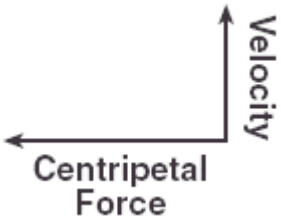

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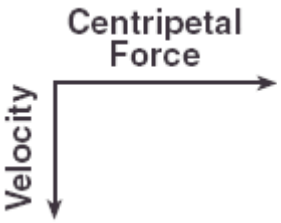
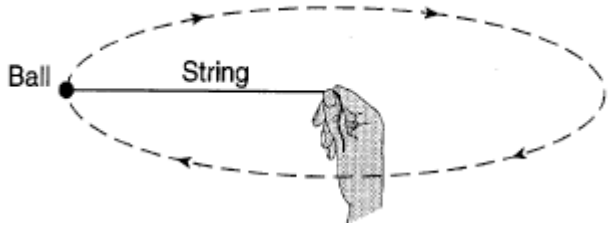


2. The diagram shows a student spinning a 0.10-kilogram ball at the end of a 0.50-meter string in a horizontal circle at a onstant speed of 10. m/s. [Neglect air resistance.] Which is the best description of the force keeping the ball in the circular ath?



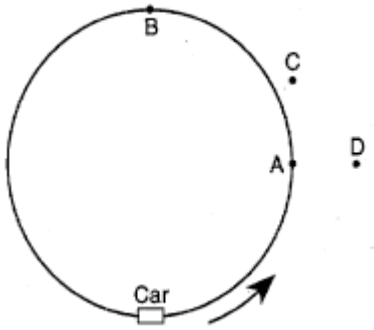
) perpendicular to the circle and directed away from the enter of the circle

c) perpendicular to the circle and directed toward the center of the circle

) tangent to the circle and directed in the same direction hat the ball is moving

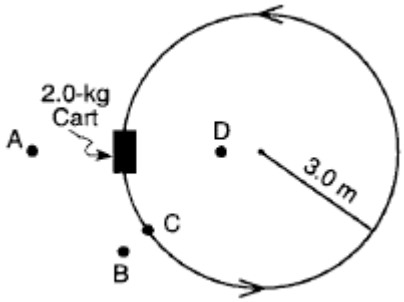
d) tangent to the circle and directed opposite to the direction that the ball is moving

3. A convertible car with its top down is traveling at constant speed around a circular track, as shown in the diagram below. When the car is at point A, if a passenger in the car throws a ball straight up, the ball could land at point



) D **b)** C **c)** B **d)** A

4. A 2.0-kg cart traveling at a constant speed in a horizontal circle of radius 3.0 meters. The magnitude of the centripetal force f the cart is 24 newtons. Which statement correctly describes the direction of the cart's velocity and centripetal force in the osition shown?



) Velocity is directed toward point C, and the centripetal orce is directed toward point A.

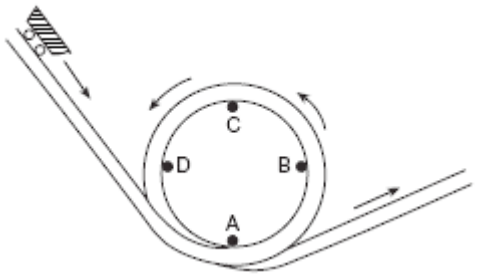
c) Velocity is directed toward point C, and the centripetal force is directed toward point D.

) Velocity is directed toward point B, and the centripetal

d) Velocity is directed toward point B, and the centripetal

orce is directed toward point A. force is directed toward point D.

5. Base your answers on the information and diagram below. A roller coaster cart starts from rest and accelerates, due to ravity, down a track. The cart starts at a height that enables it to complete a loop in the track. [Neglect friction.] The nagnitude of the centripetal force keeping the cart in circular motion would be greatest at point



) A **b)** C **c)** B **d)** D

6. Which factor, when doubled, would produce the greatest change in the centripetal force acting on the car?

) velocity of the car **b)** mass of the car **c)** radius of the track **d)** weight of the car

7. A ball of mass M at the end of a string is swung in a horizontal circular path of radius R at constant speed V. Which combination of changes would require the greatest increase in the centripetal force acting on the ball?

) halving V and halving R **c)** doubling V and doubling R

) halving V and doubling R **d)** doubling V and halving R

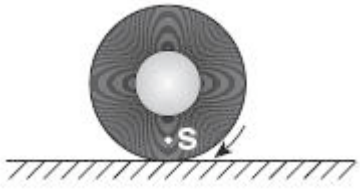
8. Centripetal force Fc acts on a car going around a curve. If the speed of the car were twice as great, the nagnitude of the centripetal force necessary to keep the car moving in the same path would be

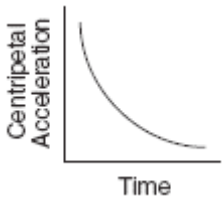
) Fc **b)** Fc/2 **c)** 2Fc **d)** 4Fc

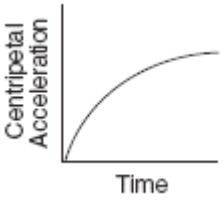
9. A child is riding on a merry-go-round. As the speed of the merry-go-round is doubled, the magnitude of the entripetal force acting on the child

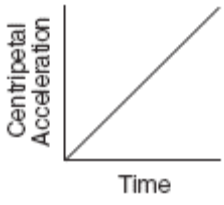
) is doubled **b)** remains the same **c)** is quadrupled **d)** is halved

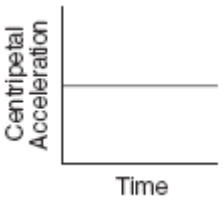
0. In the diagram below, S is a point on a car tire rotating at a constant rate. Which graph best represents the nagnitude of the centripetal acceleration of point S as a function of time?



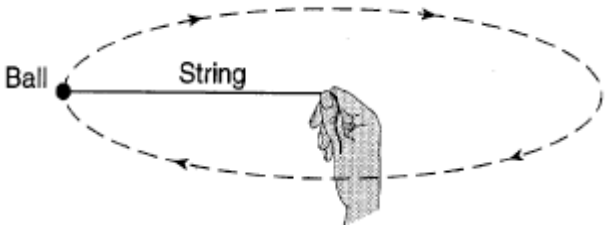
) 

b) 

c) 

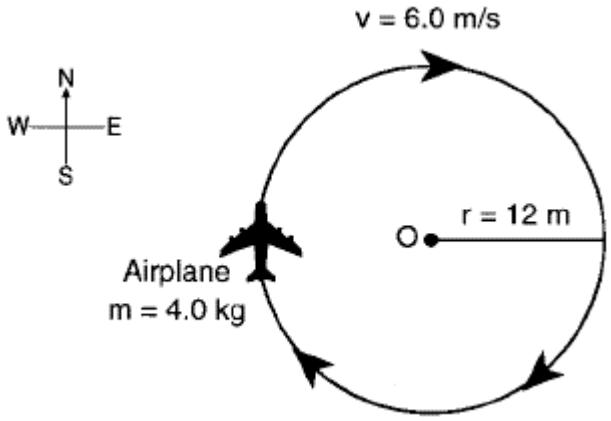
d) 

1. The diagram shows a student spinning a 0.10-kilogram ball at the end of a 0.50-meter string in a horizontal ircle at a constant speed of 10. m/s. [Neglect air resistance.] If the magnitude of the force applied to the string y the student's hand is increased, the magnitude of the acceleration of the ball in its circular path will



) decrease **b)** can't be determined **c)** increase **d)** remain the same

2. A 4.0-kg model airplane travels in a horizontal circular path of radius 12 meters at a constant speed of 6.0 ı/s. If the speed of the airplane is doubled and the radius of the path remains unchanged, the magnitude of the entripetal force acting on the airplane will be

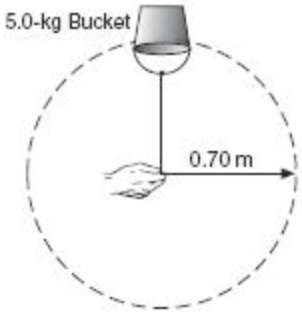


) twice as much **b)** one-fourth as much **c)** half as much **d)** four times as much

33. A 2.0 x 10^3 kilogram car travels at a constant speed of 12 m/s around a circular curve of radius 30. meters. What is the magnitude of the centripetal acceleration of the car as it goes around the curve?

a) 0.40 m/s^2 **b)** 800 m/s^2 **c)** 4.8 m/s^2 **d)** 9,600 m/s^2

34. The diagram below shows a 5.0-kg bucket of water being swung in a horizontal circle of 0.70-meter radius at a constant speed of 2.0 m/s. The magnitude of the centripetal force on the bucket of water is approximately

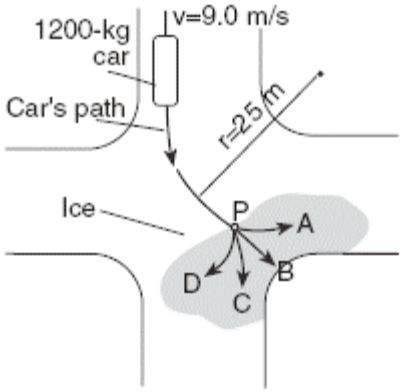


a) 200 N **b)** 29 N **c)** 5.7 N **d)** 14 N

35. A ball attached to a string is whirled at a constant speed of 2.0 m/s in a horizontal circle of radius 0.50 meter. What is the magnitude of the ball's centripetal acceleration?

a) 1.0 m/s^2 **b)** 2.0 m/s^2 **c)** 4.0 m/s^2 **d)** 8.0 m/s^2

36. Base your answer to this question on the information and diagram below. A 1200-kilogram car traveling at a constant speed of 9.0 m/s turns at an intersection. The car follows a horizontal circular path with a radius of 25 meters to point P. The magnitude of the centripetal force acting on the car as it travels around the circular path is approximately



a) 1.2×10^4 N **b)** 1.1×10^4 N **c)** 4.3×10^2 N **d)** 3.9×10^3 N

37. An amusement park ride moves a rider at a constant speed of 14 m/s in a horizontal circular path of radius 10. meters. What is the rider's centripetal acceleration in terms of g, the acceleration due to gravity?

a) 0g **b)** 3g **c)** 2g **d)** 1g