Practice - Centripetal Motion

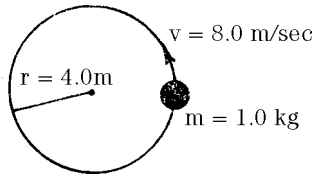
Name: _____ **Date:** _____

1. An object traveling with uniform circular motion has a centripetal acceleration due to the change in

   A. speed B. direction

   C. kinetic energy D. mass

2. The diagram here represents a mass of 1.0 kilogram traveling at 8.0 meters per second in a circular path of radius 4.0 meters.

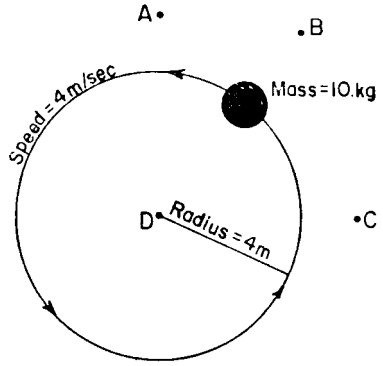


   What is the centripetal acceleration of the object?

   A. 10 m/sec^2 B. 2.0 m/sec^2

   C. 16 m/sec^2 D. 4.0 m/sec^2

3. The diagram shown represents a mass of 10.0 kilograms traveling at a constant speed of 4 meters per second in a horizontal circular path about point *D*.



   The centripetal acceleration of the satellite is directed toward point

   A. *A* B. *B* C. *C* D. *D*

4. What is the magnitude of the centripetal acceleration?

   A. 1 m/sec^2 B. 10 m/sec^2

   C. 40 m/sec^2 D. 4 m/sec^2

5. Which quantity would increase if the radius increased?

   A. period

   B. tangential velocity

   C. mass

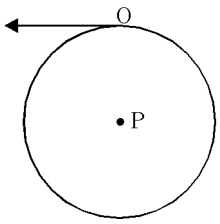
   D. centripetal acceleration

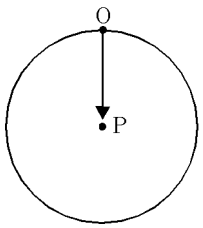
6. If the 10-kilogram mass is replaced with a greater mass, the centripetal acceleration will

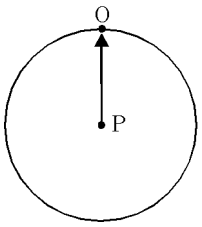
   A. decrease B. increase

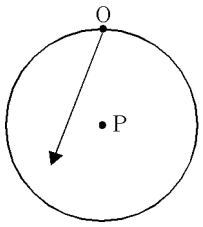
   C. remain the same

7. If object *O* is moving in a uniform circular motion around point *P* at constant speed, which vector shown represents a centripetal force?

A.


B.


C.


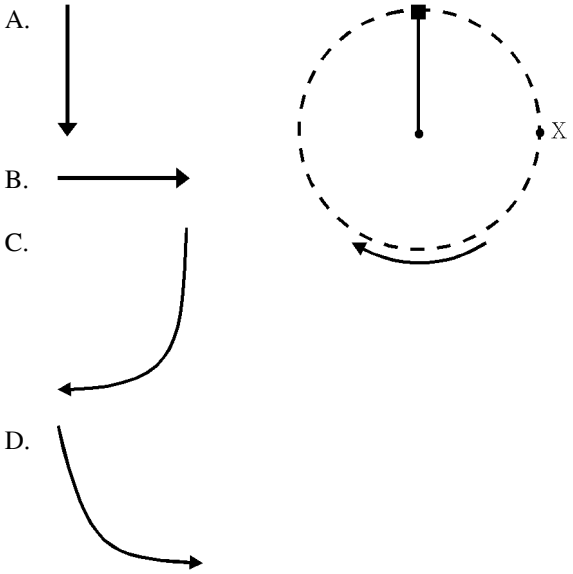
D.


8. If the velocity of a car traveling around a circular track doubles, its centripetal acceleration would be

A. $\frac{1}{2}$ as great B. 2 times greater

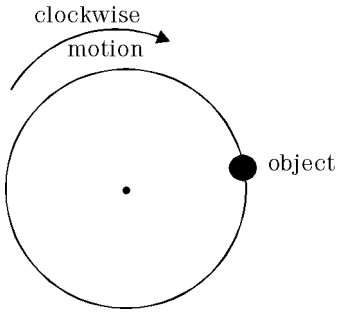
C. $\frac{1}{4}$ as great D. 4 times greater

9. An object on the end of a string rotates clockwise in a circle as shown in the diagram. If the string breaks when the object is at point *X*, which arrow below best represents the path of the object after the string has broken?

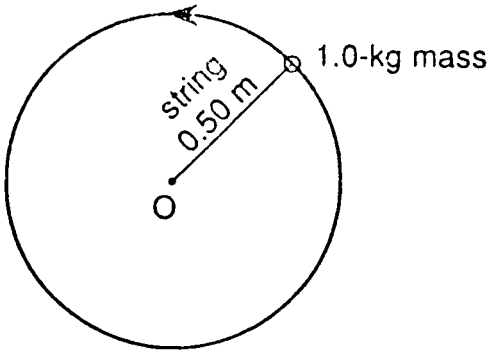


10. The diagram shows an object traveling clockwise in a horizontal, circular path at constant speed. Which arrow best shows the direction of the centripetal acceleration of the object at the instant shown?

A. ←
B. →
C. ↓
D. ↑



11. The diagram shows an object with a mass of 1.0 kilogram attached to a string 0.50 meter long. The object is moving at a constant speed of 5.0 meters per second in a horizontal circular path with center at point *O*.



What is the magnitude of the centripetal force acting on the object?

A. 2.5 N B. 10 N C. 25 N D. 50 N

12. While the object is undergoing uniform circular motion, its acceleration

A. has a magnitude of zero

B. increase in magnitude

C. is directed toward the center of the circle

D. is directed away from the center of the circle

13. If the string is cut when the object is at the position shown, the path the object will travel from this position will be

A. toward the center of the circle

B. a curve away from the circle

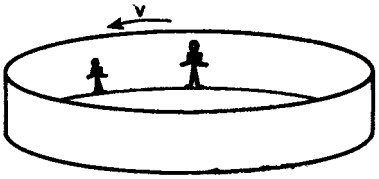
C. a straight line tangent to the circle

14. If the string is lengthened while the speed of the object remains constant, the centripetal acceleration of the object will

A. decrease B. increase

C. remain the same

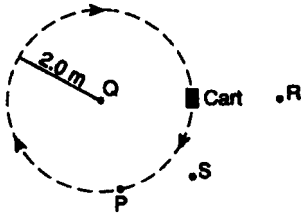
15. A 60-kilogram adult and a 30-kilogram child are passengers on a rotor ride at an amusement park. When the rotating hollow cylinder reaches a certain constant speed, v, the floor moves downward. Both passengers stay "pinned" against the wall of the rotor, as shown in the diagram.



Compared to the magnitude of the acceleration of the adult, the magnitude of the acceleration of the child is

A. less B. greater C. the same

16. The diagram shows a 5.0-kilogram cart traveling clockwise in a horizontal circle of radius 2.0 meters at a constant speed of 4.0 meters per second.



At the position shown, the velocity of the cart is directed toward point

A. *P* B. *Q* C. *R* D. *S*

17. At the position shown, the centripetal acceleration of the cart is directed toward point

A. *P* B. *Q* C. *R* D. *S*

18. If the mass of the cart was doubled, the magnitude of the centripetal acceleration of the cart would be

A. unchanged B. doubled

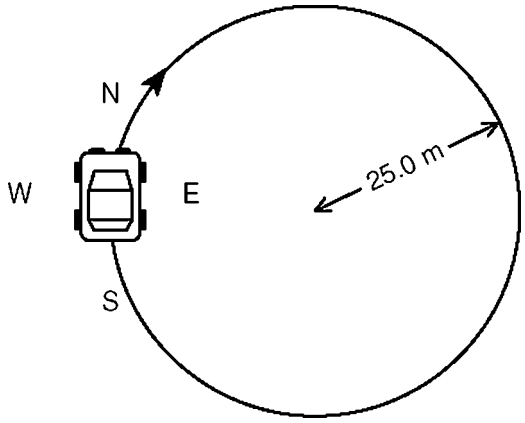
C. halved D. quadrupled

19. What is the magnitude of the centripetal force acting on the cart?

A. 8.0 N B. 20 N C. 40 N D. 50 N

20. Base your answer(s) to the following question(s) on the information and diagram below.

A 1.00×10^3-kilogram car is driven clockwise around a flat circular track of radius 25.0 meters. The speed of the car is a constant 5.00 meters per second.



What minimum friction force must exist between the tires and the road to prevent the car from skidding as it rounds the curve?

A. 1.25×10^5 N B. 9.80×10^4 N

C. 5.00×10^3 N D. 1.00×10^3 N

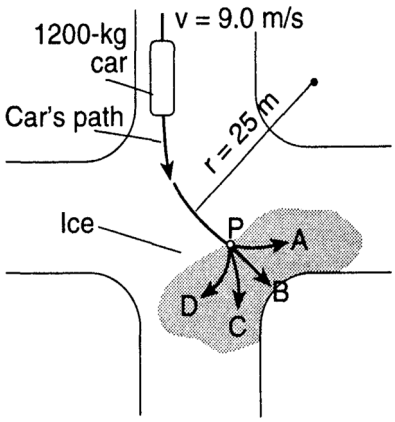
21. If the circular track were to suddenly become frictionless at the instant shown in the diagram, the car's direction of travel would be

A. toward E B. toward N

C. toward W D. a clockwise spiral

22. Base your answer(s) to the following question(s) on the information and diagram below.

A 1200-kilogram car traveling at a constant speed of 9.0 meters per second turns at an intersection. The car follows a horizontal circular path with a radius of 25 meters to point *P*.



At point *P*, the car hits an area of ice and loses all frictional force on its tires. Which path does the car follow on the ice?

A. *A* B. *B* C. *C* D. *D*

23. Calculate the magnitude of the centripetal force acting on Moon as it orbits the Earth, assuming a circular orbit and an orbital speed of 1.02×10^3 meters per second. [Show all work, including the equation and substitution with units.]

24. Base your answer(s) to the following question(s) on the information given below.

Friction provides the centripetal force that allows a car to round a circular curve.

Find the minimum coefficient of friction needed between the tires and the road to allow a 1600-kilogram car to round a curve of radius 80. meters at a speed of 20. meters per second. [Show all work, including formulas and substitutions with units.]

25. If the mass of the car were increased, how would that affect the maximum speed at which it could round the curve?

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1.
Answer: B
Points: 1

2.
Answer: C
Points: 1

3.
Answer: D
Points: 1

4.
Answer: D
Points: 1

5.
Answer: A
Points: 1

6.
Answer: C
Points: 1

7.
Answer: B
Points: 1

8.
Answer: D
Points: 1

9.
Answer: A
Points: 1

10.
Answer: A
Points: 1

11.
Answer: D
Points: 1

12.
Answer: C
Points: 1

13.
Answer: C
Points: 1

14.
Answer: A
Points: 1

15.
Answer: C
Points: 1

16.
Answer: D
Points: 1

17.
Answer: B
Points: 1

18.
Answer: A
Points: 1

19.
Answer: C
Points: 1

20.
Answer: D
Points: 1

21.
Answer: B
Points: 1

22.
Answer: B
Points: 1

23.
Answer: Example:

$F_c = ma_c$ and $a_c = \frac{v^2}{r}$

$F_c = \frac{mv^2}{r}$

$F_c = \frac{\left(5.98 \times 10^{24}\ \text{kg}\right)\left(3.00 \times 10^{4}\ \text{m/s}\right)^2}{1.5 \times 10^{11}\ \text{m}}$

$F_c = 3.59 \times 10^{22}\ \text{N}$

Points: 1

24.
Answer: 0.51
Points: 1

25.
Answer: It would have no effect on the maximum speed.
Points: 1