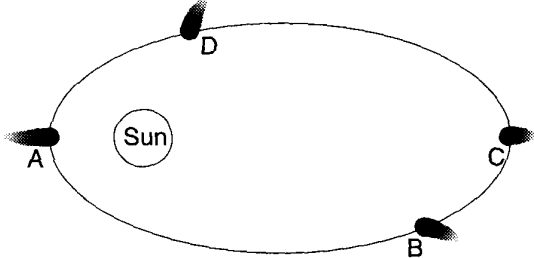1. A 0.50-kilogram object moves in a horizontal circular path with a radius of 0.25 meter at a constant speed of 4.0 meters per second. What is the magnitude of the object's acceleration?

   A) 8.0 m/s^2 B) 16 m/s^2

   C) 32 m/s^2 D) 64 m/s^2

2. The diagram below shows the elliptical orbit of a comet around the Sun
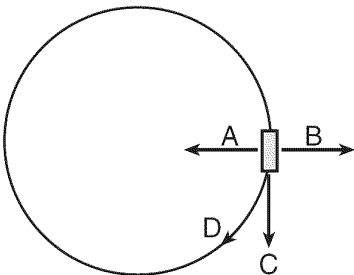

   (not drawn to scale)

   The magnitude of the centripetal acceleration of the comet is greatest at point

   A) *A*   B) *B*   C) *C*   D) *D*

3. An object travels in a circular orbit. If the speed of the object is doubled, its centripetal acceleration will be

   A) halved   B) doubled

   C) quartered   D) quadrupled

4. 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) *A*   B) *B*   C) *C*   D) *D*

5. Base your answer to the following question on the diagram below which 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*.
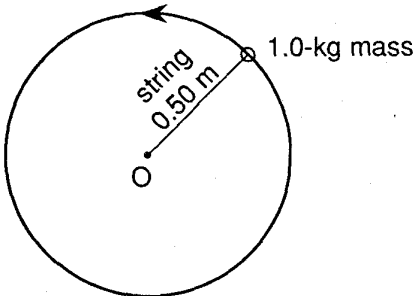
   While the object is undergoing uniform circular motion, its acceleration

   A) has a magnitude of zero

   B) increases in magnitude

   C) is directed toward the center of the circle

   D) is directed away from the center of the circle

6. An unbalanced force of 40. newtons keeps a 5.0-kilogram object traveling in a circle of radius 2.0 meters. What is the speed of the object?

   A) 8.0 m/s   B) 2.0 m/s

   C) 16 m/s   D) 4.0 m/s

7. The magnitude of the centripetal force acting on an object traveling in a horizontal, circular path will *decrease* if the

   A) radius of the path is increased

   B) mass of the object is increased

   C) direction of motion of the object is reversed

   D) speed of the object is increased

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

   A) F_c B) $2F_c$ C) $\dfrac{F_c}{2}$ D) $4F_c$

9. A ball of mass *M* at the end of a string is swinging 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?

   A) doubling *V* and doubling *R*

   B) doubling *V* and halving *R*

   C) halving *V* and doubling *R*

   D) halving *V* and halving *R*

10. Base your answer to the following question on the diagram below. 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 constant speed of 10. meters per second. [Neglect air resistance.]
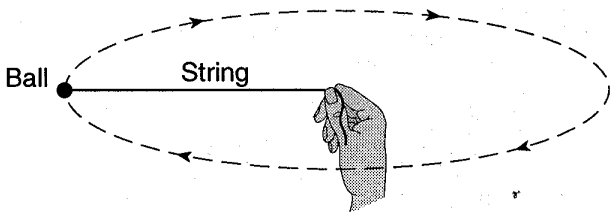
   The magnitude of the centripetal force required to keep the ball in this circular path is

   A) 5.0 N   B) 10. N   C) 20. N   D) 200 N

Base your answers to questions **11** and **12** on the information below.

A 2.0×10^3-kilogram car travels at a constant speed of 12 meters per second around a circular curve of radius 30. meters.

11. What is the magnitude of the centripetal acceleration of the car as it goes around the curve?

   A) 0.40 m/s^2 B) 4.8 m/s^2
   C) 800 m/s^2 D) 9,600 m/s^2

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

   A) toward the center of the circular curve
   B) away from the center of the circular curve
   C) tangent to the curve in the direction of motion
   D) tangent to the curve opposite the direction of motion

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13. Base your answer to the following question on the following information. 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.
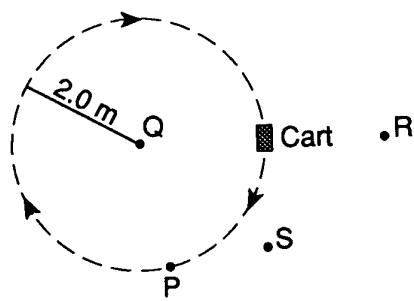
At the position shown, the velocity of the cart is directed toward point

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

14. The centers of two 15.0-kilogram spheres are separated by 3.00 meters. The magnitude of the gravitational force between the two spheres is approximately

   A) 1.11×10^{-10} N   B) 3.34×10^{-10} N
   C) 1.67×10^{-9} N   D) 5.00×10^{-9} N

15. The radius of Mars is approximately one-half the radius of Earth, and the mass of Mars is approximately one-tenth the mass of Earth. Compared to the acceleration due to gravity on the surface of Earth, the acceleration due to gravity on the surface of Mars is

   A) smaller   B) larger
   C) the same

16. What is the magnitude of the gravitational force between two 5.0-kilogram masses separated by a distance of 5.0 meters?

   A) 5.0×10^0 N   B) 3.3×10^{-10} N
   C) 6.7×10^{-11} N   D) 1.3×10^{-11} N

17. If the mass of one of two objects is increased, the force of attraction between them will

   A) decrease   B) increase
   C) remain the same

18. As a meteor moves from a distance of 16 Earth radii to a distance of 2 Earth radii from the center of Earth, the magnitude of the gravitational force between the meteor and Earth becomes

   A) $\frac{1}{8}$ as great   B) 8 times as great
   C) 64 times as great   D) 4 times as great

19. An object weighs 200. Newtons at a distance of 100. kilometers above the center of a small uniform planet. How much will the object weigh 200. kilometers above the planet's center?

   A) 400. N   B) 100. N
   C) 50.0 N   D) 25.0 N

20. If the mass of one of two particles is doubled and the distance between them is doubled, the force of attraction between the two particles will

   A) decrease   B) increase
   C) remain the same