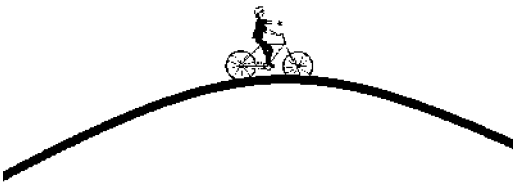
1. 

A bicycle moves at constant speed over a hill along a smoothly curved surface as shown above. Which of the following best describes the directions of the velocity and the acceleration at the instant it is at the highest position?

A) The velocity is towards the right of the page and the acceleration is towards the top of the page.

B) The velocity is towards the right of the page and the acceleration is towards the bottom of the page.

C) The velocity is towards the right of the page and the acceleration is towards the bottom right of the page.

D) The velocity is towards the right of the page and the acceleration is towards the top right of the page.

E) The velocity is towards the top right of the page and the acceleration is towards the bottom right of the page.

2. A racecar, starting at rest, travels 3 times around a closed track, and ends at rest. Which of the following are true concerning this motion?

I. The total displacement is zero
II. The average speed is zero
III. The average acceleration is zero

A) I, only

B) III, only

C) I and II, only

D) I and III, only

E) I, II, and III

3. A ball attached to a string is whirled around a horizontal circle of radius r with a tangential velocity v. If the radius is changed to $2r$ and the magnitude of the centripetal force is doubled the new speed is

A) $\frac{v}{2}$

B) $\frac{v}{\sqrt{2}}$

C) $\sqrt{2}v$

D) $2v$

E) $4v$

4. What is the centripetal acceleration of a ball swinging around a string when it passes one revolution in 5 seconds and the radius of its path is 1m?

A) $\frac{2\pi}{25}$

B) $\frac{\pi^2}{25}$

C) 2π

D) 4π

E) $\frac{4\pi^2}{25}$

5. An object is undergoing uniform circular motion. Which of the following statements is true?

A) The velocity is constant.

B) The acceleration is constant.

C) The acceleration is constant, but the velocity varies.

D) The velocity is constant, but the acceleration varies.

E) Both the acceleration and velocity vary.

6. An object is tied to a string and moves in a circular path at constant speed. Which of the following statements are accurate?

I. The net force on the object is zero.
II. The acceleration is zero.
III. The acceleration is constant.

A) II only

B) II and III only

C) I and III only

D) I, II, and III

E) None of the above are accurate

7. An object moves at constant speed in a circular path of radius r with a period of T. What is the object's acceleration?

A) 0

B) $\frac{2\pi}{Tr^2}$

C) $\frac{2\pi r}{T}$

D) $\frac{4\pi^2 r}{T^2}$

E) $\frac{4\pi^2}{Tr^2}$

Base your answers to questions **8** and **9** on the following situation.

An object weighing 10 N swings at the end of a rope that is 0.72 m long as a simple pendulum. At the bottom of the of the swing, the tension in the string is 12 N.

8. What is the magnitude of the centripetal acceleration at the bottom of the swing?

A) 2 m/s^2

B) 4 m/s^2

C) 10 m/s^2

D) 12 m/s^2

E) 22 m/s^2

9. What is the speed of the object at the bottom of the swing?

A) 0.6 m/s

B) 1.2 m/s

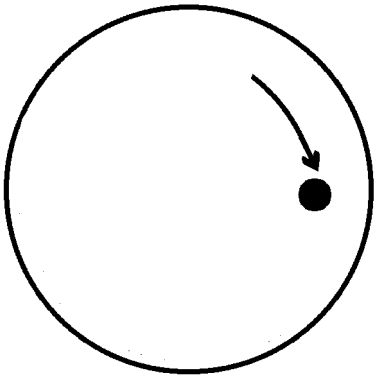
C) 2.0 m/s

D) 2.4 m/s

E) 7.2 m/s

Base your answers to questions **10** and **11** on the diagram below.

A horizontal turntable rotates with a constant rate. As viewed from above, an object on the turntable moves clockwise in a circle.



View from above

10. Which of the following best describes the direction of the frictional force on the object?

A) To the Left

B) To the right

C) Down

D) Up

E) Up and to the left

11. Which of the following best describes the direction of the velocity of the object when it is in the position shown?

    A) Down and to the left

    B) Down

    C) Down and to the right

    D) To the left

    E) To the right

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12. A ball of mass M is revolving on a string on a horizontal surface with a radius of R and a period of T. What is the tension in the string?

    A) $\frac{2m\pi^2 r}{T}$

    B) $\frac{4m\pi^2 r}{T^2}$

    C) $\frac{2m\pi^2 r}{T^2}$

    D) $\frac{4m\pi^2 r}{T}$

    E) $\frac{4m\pi r}{T^2}$

Base your answers to questions **13** and **14** on the following situation.

An object with a mass of 5 kg is attached to a 1 meter long rope and whirled in a vertical circle.

13. At the bottom of its path, the rope has a tension of 95 N. The object is moving most nearly

    A) 2 m/s

    B) 3 m/s

    C) 6 m/s

    D) 9 m/s

    E) 15 m/s

14. Of the following, which is the greatest speed of the object for which the rope would become slack at the top of its circular path?

    A) 1 m/s

    B) 2 m/s

    C) 4 m/s

    D) 5 m/s

    E) 10 m/s

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15. Base your answer to the following question on the following situation.

    An engineer wishes to design a roller coaster so that the cars will not fall when they are at the top of their circular path.

    Which of the following will have no effect on whether the cars remains on the track?

    A) The velocity of the cars as the pass the top of the circle.

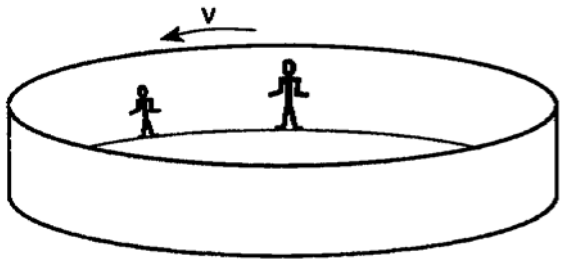
    B) The radius of the circular track.

    C) The mass of the cars.

    D) The distance from the top of the circle to the bottom.

    E) The acceleration due to gravity.

16. A 60 kg adult and a 30kg child are passengers on a rotor ride at an amusement park as shown in the diagram above. 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 below.



The magnitude of the frictional force between the adult and the wall of the spinning rotor is *F*. What is the magnitude of the frictional force between the child and the wall of the spinning rotor?

A) $\frac{1}{4}F$

B) $\frac{1}{2}F$

C) F

D) $2F$

E) $4F$

17. A vehicle of mass 3000 kg travels along an unbanked circular turn without leaving the road. If the turn has a radius of 10 m, and the coefficient of kinetic friction between the road and the tires is 0.25, what is the maximum speed the vehicle can travel without slipping?

A) 5 m/s

B) 7.5 m/s

C) 10 m/s

D) 25 m/s

E) 16 m/s

18. A car of mass *M* is traveling around an unbanked, rough, and circular road with a radius of *R* at a speed of 25 m/s. What is the minimum coefficient of kinetic friction required to allow the car to safely travel around the turn?

A) *RMg*

B) *Rg*

C) 625/Mg

D) 625/Rg

E) 625/RMg

19. The maximum speed a car can travel around an unbanked curve depends on all of the following **EXCEPT**

A) the diameter of the curve.

B) the acceleration due to gravity.

C) the mass of the car.

D) the coefficient of kinetic friction between the road and the tires.

E) the surface of the curve.

20. What is the maximum speed a vehicle can travel along a circular turn without leaving the road, if the turn has a radius of 50 m and the coefficient of kinetic friction between the road and the tires is 0.20?

A) 5 m/s

B) 10 m/s

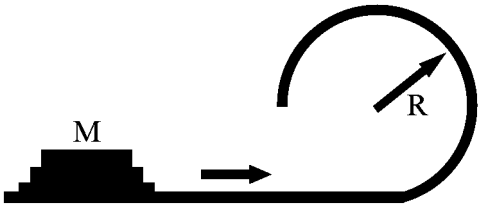
C) 15 m/s

D) 20 m/s

E) 25 m/s

21. Base your answer to the question below on the following information.

A small block of mass *M* is traveling on a track where a loop of radius *R* exists.



What minimum speed is needed to keep the block on the track?

A) $v = MgR$

B) $v = 2gR$

C) $v = gR$

D) $v = \sqrt{gR}$

E) $v = \sqrt{2gR}$

22. An 10 kg object moving in a horizontal circle of radius 5 m experiences a centripetal force of 50 N. What is the velocity of the object?

A) 0.5 m/s

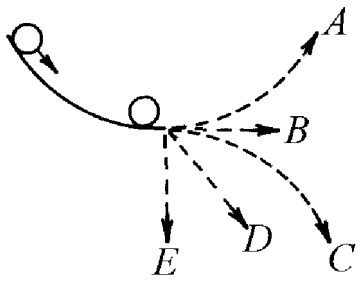
B) 1 m/s

C) 2.5 m/s

D) 5 m/s

E) 25 m/s

23. A ball rolls down a curved ramp as shown in the diagram below. Which dotted line best represents the path of the ball after leaving the ramp?



A) *A*

B) *B*

C) *C*

D) *D*

E) *E*

24. Base your answer to the following question on the picture below which shows the direction of motion of an object.

If the object moves with a constant speed *v* along the path shown, what is the direction of the net acceleration that acted on the object at the beginning of the path?

A) 

B) 

C)

D) 

E) 

25. Which of the following is true of the velocity and acceleration vectors of an object moving with a uniform speed in a circular path?

A) They are in opposite directions.

B) They are always equal in magnitude.

C) They are perpendicular in direction.

D) They are both tangent to the path of motion.

E) They are both directed toward the center of the circle.

Answer Key
Uniform Circular Motion MC Questions [Mar 28, 2011]

1. B
2. D
3. D
4. E
5. E
6. E
7. D
8. A
9. B
10. A
11. B
12. B
13. B
14. B
15. C
16. B
17. A
18. D
19. C
20. B
21. D
22. D
23. C
24. E
25. C

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