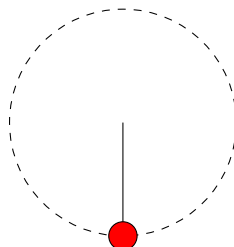


Student #: _____

Student Name: _____

Physics 12 Homework Class 3: Uniform Circular Motion

1. A ball is attached to a string and whirled clockwise in a vertical circle. **On the diagram itself**, label the direction of the



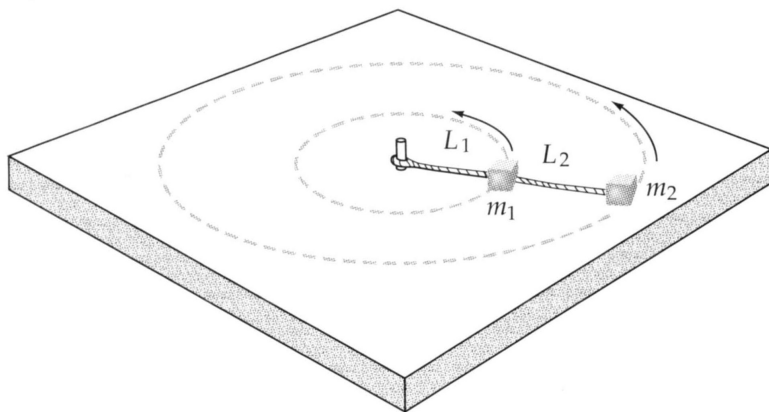
- (a) Centripetal acceleration (\mathbf{a}_c)
- (b) Instantaneous velocity (\mathbf{v})
- (c) Centripetal force (\mathbf{F}_c)

- _____ 2. In the previous question, the tension in the string will be the least
- (a) at the bottom of the circle
 - (b) at the top of the circle
 - (c) as the ball is moving towards the top of the circle
 - (d) as the ball is moving towards the bottom of the circle
 - (e) Trick question! Tension will be the same at all points in the circle.
- _____ 3. A girl stands on a rotating merry-go-round without holding on to a rail. The force that keeps her moving in a circle is the
- (a) frictional force on the girl directed away from the center of the merry-go-round
 - (b) frictional force on the girl directed towards the center of the merry-go-round
 - (c) normal force on the girl directed away from the center of the merry-go-round
 - (d) normal force on the girl directed towards the center of the merry-go-round
 - (e) weight of the girl
- _____ 4. A bicycle wheel has a radius of 0.5 m. When it spins, it completes one full turn in 1.6 s. A pebble wedged in the tread has a mass of 10 g. What is the centripetal force on the pebble?
- (a) 0.01 N
 - (b) 0.08 N
 - (c) 0.1 N
 - (d) 0.8 N
 - (e) 1 N
- _____ 5. A tetherball swings in a horizontal circle. If the radius of the swing is tripled but the tangential speed remains the same, by what factor does the centripetal force change?
- (a) Nine times greater
 - (b) Three times greater
 - (c) Remains the same
 - (d) One-third as much
 - (e) One-ninth as much

- _____ 6. A car of mass m drives on a flat circular track of radius R . To maintain a constant speed v on the track, the coefficient of friction μ between the tires and the road must be
- (a) mg
 - (b) $mg + \frac{mv^2}{R}$
 - (c) $mg - \frac{mv^2}{R}$
 - (d) $\frac{v^2}{gR}$
 - (e) $\sqrt{\frac{v^2}{gR}}$
7. When drawing free-body diagrams, does the label “centripetal force” get used? Why or why not?
8. A car exits a highway on a ramp that is banked at 15° with a radius of curvature of 65 m. If the ramp is extremely icy and the driver cannot depend on any friction to help make the turn, what is the safe speed that the driver can travel so that the car will not skid off the ramp?
9. A highway curve with a radius of curvature of 155 m must accommodate cars travelling at 50 km/h without friction. At what angle should the curve be banked?

10. A pilot of mass 65 kg in a jet aircraft makes a complete vertical circle in mid-air. The vertical circle has a radius of 1.70 km. The speed of the jet is 215 m/s. Determine the force of the seat on the pilot at
- (a) the bottom of the loop and
 - (b) the top of the loop
- (Note that at the top of the loop, the aircraft is upside down.)
11. A boy is twirling a 555 g ball on a 0.65 m string in a *horizontal* circle. The string will break if the tension reaches 15 N.
- (a) Draw a free-body diagram on the ball and indicate all forces acting on it.
 - (b) What is the centripetal force when tension is at maximum?
 - (c) What is the maximum speed at which the ball can move without breaking the string?

12. A block of mass m_1 is attached to a cord of length L_1 , which is fixed at one end. The mass moves in a horizontal circle supported by a frictionless table. A second block of mass m_2 is attached to the first by a cord of length L_2 and also moves in a circle, as shown in the diagram. If the period of the motion is T , find the tension in each cord.



13. Mass 1 (2.0 kg) sits on top of mass 2 (5.0 kg), which rests on a frictionless surface, as shown below. The coefficient of static friction between the two masses is $\mu_s = 0.30$. A string of length 5.0 m is tied to mass 2, and both masses are swung around in a horizontal circle. Calculate
- the maximum speed of the masses, and
 - the tension in the string.

