Circular Motion and Inertia

Read from **Lesson 1** of the **Circular and Satellite Motion** chapter at **The Physics Classroom**:

http://www.physicsclassroom.com/Class/circles/u6l1c.html
http://www.physicsclassroom.com/Class/circles/u6l1d.html

MOP Connection: Circular Motion and Gravitation: sublevels 3 and 4

Review Questions:

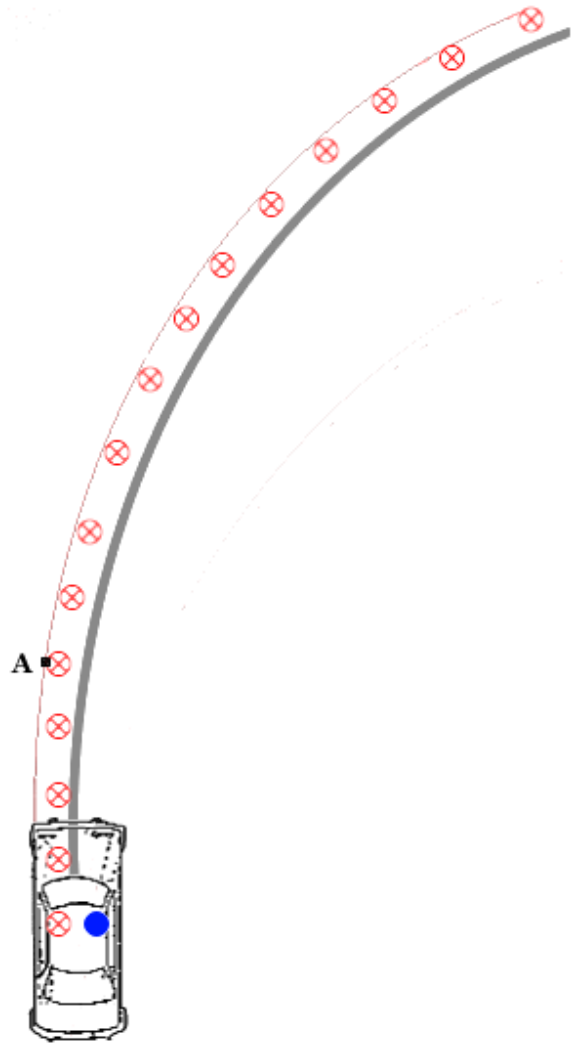
1. Newton's first law states: An object at rest will _____.

   An object in motion will _____

   unless acted upon by _____.

2. Inertia is ...

Applications of Newton's First Law to Motion in Circles:
The diagram below depicts a car making a right-hand turn. The driver of the car is represented by the *circled X*. The passenger is represented by the solid circle. The seats of the car are vinyl seats and have been greased down so as to be *smooth as silk*. As would be expected from Newton's law of inertia, the driver continues in a straight line from the start of the turn until point A. The path of the driver is shown.



Once at point A, the door pushes the driver inward towards the center of the circle. With an inward force, the driver can make the circular turn.

3. On the same diagram, show the path of the passenger from the start of the turn until the passenger strikes the driver. Mark the passenger's position with a solid circle. Put a dot at the point where the driver and passenger *make contact*; label this as point B.

4. Describe the motion of the passenger from the start of the turn until point B.

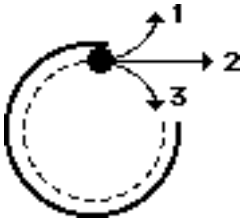
   Describe the motion of the passenger from point B for the rest of the turn.

5. From point B for the remainder of the turn, place arrows on the diagram to indicate the direction of the force of the driver pushing on the passenger. Label these arrows with an **F**.

6. In this example, the collision between the passenger and the driver can be explained by exerting that _____ .
   a. an outward force pushed the passenger towards the driver.
   b. an outward force pulled the passenger towards the driver.
   c. the passenger traveled straight-ahead and an inward force pushed the driver into the passenger.

7. Rex Things and Doris Locked are out on a date. Rex makes a rapid right-hand turn. Doris begins sliding across the vinyl seat (which Rex had waxed and polished beforehand) and collides with Rex. To break the awkwardness of the situation, Rex and Doris begin discussing the physics of the motion that was just experienced. Rex suggests that objects that move in a circle experience an outward force. Thus, as the turn was made, Doris experienced an outward force that pushed her towards Rex. Doris disagrees, arguing that objects that 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.

8. Noah Formula guides a golf ball around the outside rim of the green at the *Hole-In-One Putt-Putt Golf Course*. When the ball leaves the rim, which path (1, 2, or 3) will the golf ball follow? _____ (Note that this diagram depicts the *God's eye* view.) Explain why.



9. Suppose that you are a driver or passenger in a car and you travel over the top of a small hill in the road at a high speed. As you reach the crest of the hill, you feel your body still moving upward; your *gluts* might even be *pulled* off the car seat. It might even feel like there is an upward push on your body. This upward sensation is best explained by the _____.
   a. tendency of your body to follow its original upward path
   b. presence of an upward force on your body
   c. presence of a centripetal force on your body
   d. presence of a centrifugal force on your body

10. Darron Moore is on a *barrel ride* at an amusement park. He enters the barrel and stands on a platform next to the wall. The ride operator flips a switch and the barrel begins spinning at a high rate. Then the operator flips another switch and the platform drops out from under the feet of the riders. Darron is *plastered* to the wall of the barrel. This sticking to the wall phenomenon is explained by the fact that _____.
    a. the ride exerts an outward force on Darron which pushes him outward against the wall
    b. Darron has a natural tendency to move tangent to the circle but the wall pushes him inward
    c. air pressure is reduced by the barrel's motion that causes a suction action toward the wall
    d. the ride operator coats the wall with cotton candy that causes riders to stick to it

Learning to Learn Strategy

Always take time to reflect upon your own belief system that governs how you interpret the physical world. Be aware of your personal "mental model" which you use to explain why things happen. The idea of this physics course is **not** to acquire information through memorization but rather to analyze your own preconceived notions about the world and to dispel them for more intelligible beliefs. In this unit, you will be investigating a commonly held misconception about the world - that motion in a circle is caused by an outward (centrifugal) force. This misconception or wrong belief is not likely to be dispelled unless you devote some time to reflect on whether you believe it and whether it is intelligible. After considering more reasonable beliefs, you will be more likely to dispel the belief in a centrifugal force in favor of a belief in an inward or centripetal force.