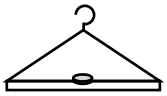
Round and Round We Go

Perform the following experiments in any order. Answer the questions in the spaces provided. Please leave equipment at each lab station for the next person.

1. Pennies in orbit
   Balance a penny on the end of the hanger hook as shown. With some practice, you can swing the hanger in circles while the penny remains in place. (For an easier 'orbit,' use the cardboard hanger as shown in the second figure).



   Q: Why doesn't the coin fall when it is at the top of its circular path?

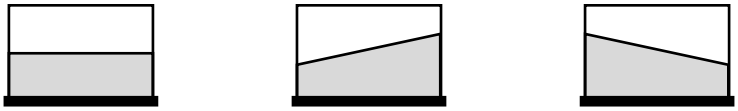
2. Cup in orbit
   Place some water in the paper cup and center the cup on the platform. Begin swinging the platform back and forth until you are able to swing the platform and cup in complete circles. (Be sure to wipe up any spills.)

   Q: Why doesn't the cup fall off the platform when it is at the top of its circular path?

3. There's a Hole in My Cup
   Using a bottomless cup, try to pick up a marble.

   Q: What technique did you use and why did it work?

4. Accelerometer
   The level of the water in the accelerometer shows you the direction of the acceleration. If it is not accelerating, the water level is flat, and if the water level is tilted, then it is accelerating, as shown below:



   Because it is so thin, it does a nice job of showing you only one component of the acceleration. Sit on the stool, hold the accelerometer out away from your body with one hand and give yourself a spin. While spinning, use the accelerometer to determine the direction of the acceleration.

   Q: In what direction is your hand accelerating?

5. Ball on a String
   Swing the ball on the string in circles above your head. BE CAREFUL NOT TO HIT ANYONE!

   Q: What would happen if you were to let go of the string? Try it! PLEASE BE CAREFUL NOT TO HIT ANYONE. Describe the motion of the ball after the string is released. Why does this occur? (HINT: Remember Newton's First Law of Motion?)

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6. Stairwell Demo
Obtain permission from your teacher to briefly leave the room. Carefully run up the stairs from the first to second floor in the stairwell by Mr. Bradford's room (262W). Note what you must do in order to turn the corner at the landing.

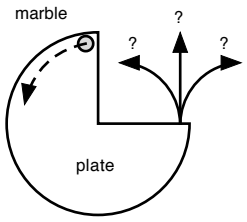
Q: Could you have made the turn without holding on to the railing? Describe the direction of the force your arm exerts on your body as you make the turn. In which direction would your body travel if you attempted to make the turn at high speed without the use of the railing?

7. Ye Olde Bucket of Water
Swing a bucket, about 1/3 full of water, over your head in a circle. (Be sure to wipe up any spills.)

Q: Why does the water remain in the bucket? What would happen if the bucket were to stop directly over your head?

Q: You know that gravity imparts a downward acceleration of 10 m/s^2 to the water when the bucket is at the top. If the water stays in the bucket at the top, what can be said about the acceleration of the bucket at the top?

8. Paper Plate Puzzle
If you roll a marble around the inside of the plate's rim, in which direction will the marble go when it gets to the cut edge? Will it continue to curve inward, go straight ahead, or curve outward? Try it!



Q: Explain your observations:

CONCLUSIONS:

1. When an object is moving in a circle with constant speed, is it accelerating? Explain your answer.

2. The direction of the acceleration of an object moving in a circle is _____.

3. To produce this acceleration, there must be a _____.

4. Therefore, whenever we see an object moving in a circle, we know there must be a _____ acting on the object. The direction of the net force is always _____ to the motion of the object and directed to the _____ of the circle.

5. If an object were traveling in a circle, and the force causing this motion were to somehow disappear, what would happen to the object?