**Exploring Circular Motion**

**Part 1: Reflecting on Circular Motion Station Activities**

*Answer the following questions in your notebook. When asked to explain/justify, answer in COMPLETE sentences.*

1. Draw **Free Body Diagrams** showing the forces acting on each of the following objects:

1. Bowling ball tapped by golf club
2. Spinning bucket
3. “Passenger” of rolling chair

 b) . ***Find*** and ***describe*** a ***pattern*** for the direction of the forces acting on an object moving in a circle.

1. Based on your experience with the lab activities, what do **the forces** onall objects moving in circular motion have in common? ***Explain.***

Questions 3-7:  You swing a bucket in a vertical circle, in a counter-clockwise direction, as seen to the right.

3. The rope holding the bucket breaks when the bucket is at position A. Which vector arrow best represents the direction of the bucket’s velocity and motion directly after the rope breaks? **Justify your answer.**

4. If the rope instead breaks at position B, which vector arrow will represent the object’s velocity and motion just after the rope breaks? **Justify your answer.**



5. Sketch a diagram that shows where the bucket would have to be when the rope broke in order for the velocity vector arrow (direction of the bucket’s movement) to be: **Justify your answer.**

6. What keeps the bucket moving in a circular path? **Justify your answer.**

a. Centripetal force (force pulling toward the center of the circle)

b. Centrifugal force (force pulling toward the outside of the circle)

c. Inertia (object’s mass and ability to maintain its motion)

d. Friction from air resistance

7. When the rope breaks, what causes the bucket to move in a straight pathway? **Justify your answer.**

a. Centripetal force (force pulling toward the center of the circle)

b. Centrifugal force (force pulling toward the outside of the circle)

c. Inertia (object’s mass and ability to maintain its motion)

d. Friction from air resistance

8. Based on your experience with the lab activities, what do **the velocities** of all objects moving in circular motion have in common?

**Part 2: Research Centripetal Force**

Use chapter 9 of the Conceptual Physics textbook or the internet to answer the following questions (in full sentences).

1. What is meant by “linear speed/velocity” or “tangential speed/velocity”?
2. Define centripetal force.
3. Why is “centrifugal force” called a “fictitious force”?
4. Create a real world example of circular motion and describe how centripetal force is involved.

**Part 3: Identifying Centripetal Force**

For each of the situations listed below,

1. Sketch the situation
2. sketch a Free Body Diagram of the forces acting on the object
3. clearly identify which force(s) are providing the centripetal force.

\*\*Note: Although **Fc** is the symbol used for **Centripetal Force**, it is NEVER, EVER on a Free Body Diagram.

1. Earth orbiting the sun
2. Satellite orbiting the Earth
3. Car moving on a curved road
4. Ball on a string (horizontal circle)
5. Ball on a string (vertical circle)
6. Top of a loop on a rollercoaster ride

**Part 4:** **Design an Experiment that you could do to find out the equation for centripetal force.**

Hint: Think about ways that you could find the relationship between Centripetal Force, object velocity, object mass, and radius of the object path. (just explain your design/method – you do not have to perform the experiment)

**Part 5: Checking your understanding**

Two students, John and Emilia, were discussing their ideas about objects moving in a circle. ***Do you agree with John, Emilia or neither student? Explain your reasoning by providing evidence or experiences to support your answer.***

I disagree. Even if the object is going a constant speed, it is constantly changing direction, so it’s accelerating. In order to accelerate, it has to constantly have a net force acting on it…like with the rolling chair activity…there was constantly a force pulling the chair outward to make it move in a circle.

If an object is moving in a circle at a constant speed, then it is not accelerating. If it is not accelerating, that means there is no force acting on it—you could say it’s in equilibrium.

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