MIND TREKKERS

Centripetal Force Mug Lesson Plan

Amount of time Demo takes: 1-2min

Materials:
1. A plastic cup.
2. Assortment of coffee/glass mugs
3. Paper towels
4. The SpillNot Cup Holder & Non-Slip Mat

Set up instructions: (if any)
1. Fill the cups/glasses/mugs about ½ - ⅔ full with water.
2. Make sure to practice this before the event starts.

SAFETY!
1. Be wary when letting children do this. They could let go of the apparatus at an inopportune moment in the swing and the cup, water, and holder could go flying. Use your judgement.

Lesson’s big idea
- The centripetal force in circular motion keeps things moving in the circle by always accelerating (changing the direction of motion of) the rotating object, forcing it to continue its circular path.
- When the water cup is spun around on the platform, the centripetal force acts toward the center of the circle, forcing the velocity to change in the path of the circle.

Instructional Procedure
1. Place water cup on apparatus.

Background information
Vocab -
centripetal force - the force that pushes objects “inward” as they experience circular motion.
acceleration - the rate of change of velocity of an object, either in direction or speed.

The main idea behind this motion is that the water in the cup is forced to move in a circle by a stronger force than gravity, which would normally pull the water out of the cup, getting the user wet. Instead, the cups forces the water to continue in the circular motion so long as the centripetal force continues to outmatch the gravitational force.
2. Two options:
   a. If the student appears brave enough (again: use your judgement), ask them to try to swing the water cup over their head. If they've never done this, they'll have to trust you and try to get a feel for it.
   b. If not, demonstrate it for the students first, and then ask them if they want to try. It doesn't take a great deal of force to make this demonstration work, so many age ranges should be able to do it.

3. If permissible, use the glass cup (more dramatic). Be extremely wary: this one is likely best done only by the Mind Trekker operating the demo since glass could potentially break if the students allow the cup to fall.

Assessment, Sample questions you can ask:

1. What other examples of centripetal acceleration can you think of? (Ans: swinging a ball on a rope around your head, a car turning around a corner, roller coasters in loop-de-loops are good starters here.)
2. Is there “too fast” of a speed at which you can spin the cup such that this doesn’t work? (Ans: no, unless the apparatus breaks.) Too slow? (Ans: Yes! If the centripetal force exerted on the cup by the holder drops to zero mid-swing, gravity will take over and the cup [with water] will fall!)

Clean Up

- If (and when) water gets spilled, be sure to clean it up and dry everything before storing it away in the kit again, lest mold should grow.

References


National K-12 Science Standards

- List by K-4, 5-8, 9-12 for each standard covered