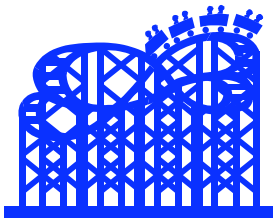
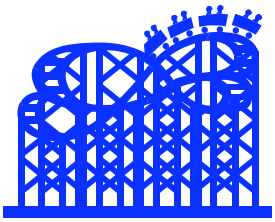


LOOP THE LOOP



OBJECTIVES: To determine the minimum height from which a marble can be released and clear a circular loop.

EQUIPMENT: marble, large roller coaster loop, small roller coaster loop, meter stick

PART I: Big Guy

1. Sketch the experimental set up below. Label the following in your diagram:
   - Height of loop = 25 cm (above table top)
   - Radius of loop = 10.5 cm
   - Point A (the release point)
   - Point B (top of the loop)
   - Unknown height h (height of point A)

2. Determine the velocity of the marble at B if it just clears the loop. Think about what provides the centripetal force at the top if the marble just makes it around.

3. While the marble travels from its release point to the top of the loop, it encounters an average frictional force equal to twenty percent of its weight. If the path length is 90 cm, how much energy does the marble lose traveling from point A to point B? Express your answer in terms of m.

4. Determine the height of A if the marble is released there from rest.

5. Test it out in my presence.

PART II: Little Guy

6. Repeat step 1 with the new dimensions:
   - Height of loop = 17 cm
   - Radius of loop = 7.5 cm
   - A, B, and h

7. Determine the height of A (minimum height required for marble to clear loop) if the marble experiences the same frictional force on this roller coaster over a path length of 52 cm.

8. Test it out in my presence.

9. A marble made of a different material encounters an average frictional force equal to thirty percent of its weight. What would happen to this marble if it was released from point A? Why?

10. Let's say the original marble is released from rest at a height of twice that found in #7. The new path length to the top of the loop is 97 cm.
    a) What is the speed of the marble at the top of the loop?

    b) What is the normal force acting on the marble at the top of the loop? (Express your answer in terms of m.)