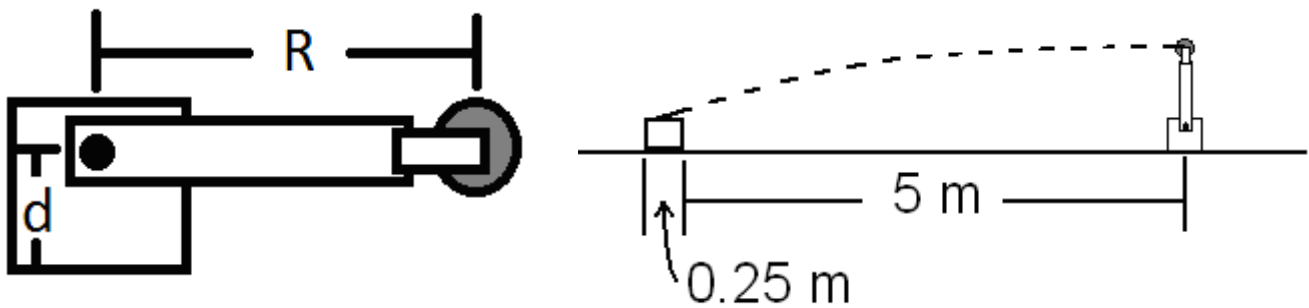


AP Physics 1 Unit #3 Pretest Problem

Name _____

Period _____

As part of an engineering competition a group of students are assigned the task of building a robotic arm that is capable of tossing a ball into a basket whose front edge is located a distance of 5.0 m away from the launch point of the ball as shown below. The ball has a diameter of 0.20 m and a mass of 0.50 kg. The basket has a rectangular shape that is 0.15 m tall, 0.25 m wide and 0.25 m long. When the ball is loaded into the robotic arm the center of the ball is located a distance of $R = 0.75$ m from the pivot point of the arm. The distance from the pivot to the ground is $d = 0.25$ m. Answer the following questions based on this information and the fact that you can ignore the effects of air resistance on the ball.



- 1) If the ball is to just clear the front edge of the basket how many seconds will it take the ball to travel from the release point to the front edge of the basket?

- 2) What is the minimum launch speed required for the ball to land in the basket?

- 3) What is the maximum launch speed the ball can have and still land in the basket?

4) The students wish to design the robotic arm so that the ball will pass through the center of the top opening of the basket. What is the necessary launch speed of the ball in this situation?

5) As a bonus challenge the team must attempt to have the robotic arm toss the ball into a moving basket. The basket is moving at a constant speed of 2.0 m/s in a straight line toward the arm and the ball will be launched at a horizontal speed of 12.0 m/s. At what distance x (measured along the floor starting at the point below the release point of the ball) should the basket be from the arm when the ball is thrown if the ball is to pass through the center of the top opening of the basket?