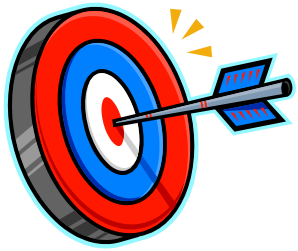
BULL'S EYE PERFORMANCE LAB!

***Purpose**: To demonstrate the independent nature of horizontal and vertical components of velocity for a projectile.*



Our Variables for This Lab:

t = time through the photogate at the base of the track
d = diameter of the steel marble
d_v = vertical height or the marble at launch
d_h = horizontal range of the marble
v_h = horizontal velocity of the marble

Materials:

- Straight track
- Physics stand
- CPO photogate and timer
- 1 steel marble
- Vernier Caliper
- 1 meter stick

Procedure:

1. Set up the Straight Track apparatus so that it is at the 11th hole from the bottom of the Physics Stand and tighten the attachment knob so it is stable.
    a. Make sure that the edge of the track is flat against the lab station and at the edge of the station so that the marble will launch horizontally.
2. Set up the photogate timer in the following way:
    a. Clamp one photogate directly onto the straight track at the very end of the track. It should be placed underneath of the track itself so that when the marble passes through it blacks the sensor. (See the sample setup or ask for help if you're confused).
    b. Attach the gate to the timer box using the phone cables. The gate should be "Gate A."
    c. Set the timer to "Interval" mode. Make sure that the light under "A" is lit.
3. **Complete #1 on the lab handout:** With your group, determine how you will calculate d_h.
4. Discuss how you will be consistent with units of measurement throughout your calculations.
5. MAKE SURE THAT THE GATE AT THE END OF THE RAMP IS UP SO THE MARBLE DOESN'T LEAVE THE TRACK. If a marble hits the ground, your team will be disqualified! Be careful!
6. **Complete #2 on the lab handout:** You are able to measure the diameter of the marble (d), the time it takes the marble to pass through the photogate (t), and the vertical height at launch (d_v). Organize your trials and write your final measurements on the lab handout.
7. **Complete #3 on the lab handout:** Next, show your calculation of the initial velocity of the marble (v_h).
8. **Complete #4 on the lab handout:** Once you have completed collecting data, show your calculation of the range of the marble (d_h).
9. **Complete #5 on the lab handout:** Affix your bull's eye to the floor according to your calculated prediction of d_h. Call your teacher over to witness your actual trial!
10. *If you miss, try again, dropping the ball from a different height on the track. Attach a separate piece of paper with new calculations written out, and a new predicted value for d_h.*

***Instructions**: Please show all of your work on this handout!*

\+ /15

Name: _____ **Period:** _____

BULL'S EYE LAB HANDOUT

This will be taken into account as your lab is scored.

1. You are able to measure d, d_v, and t. Show, step-by-step below, what calculations you will make to ultimately determine d_h.

2. Make all necessary measurements and organize your data below. INCLUDE UNITS!

d = _____

t = _____

d_v = _____

3. Clearly write out your calculations of the initial horizontal velocity, v_h. Make sure that you show your equations in variable form before substituting in your values. DON'T LET THE BALL DROP YET!

v_h = _____

4. Clearly write out your calculations of the horizontal range, d_h. Make sure that you show your equations in variable form before substituting in your values. AGAIN, DON'T LET THE BALL DROP!

d_h = _____

5. Affix your bull's eye to the floor according to your calculated prediction of d_h. Call your teacher over to witness your actual trial! Record your final score for the bull's eye below:

\+ /**5**

***If you miss, try again, dropping the ball from a different height on the track. Attach a separate piece of paper with new calculations written out, and a new predicted value for d_h.*