PHYSICS NAME _____
LAB: **PROJECTILE MOTION/** DATE _____ PERIOD __
MUZZLE VELOCITY AND RANGE OF A DART GUN

LAB PARTNERS: _____, _____, _____, _____,

MUZZLE VELOCITY

1. Place a lump of clay on a dart so that when the dart is fired straight up from the floor it will ALMOST reach the ceiling, but will NOT actually hit the ceiling. Measure the vertical distance it travels (to neares whole cm). (The measurement may be done with three meter sticks taped together. Be sure to account for overlap of the meter sticks where they are taped. Also, be sure to account for the tip of the dart being abo the floor when it is fired.) Repeat for a total of 5 trials and determine the average vertical distance.

TRIAL	1	2	3	4	5	AVERAGE
DISPLACEMENT (cm)						

IMPORTANT! BE SURE TO SAVE YOUR CLAY-LOADED DART IN THE ENVELOPE PROVIDED SO THAT YOU CAN USE IT AGAIN THE NEXT DAY IF NECESSARY! BE SURE TO RECORD YOUR NA AND THE DART GUN NUMBER ON THE ENVELOPE!

2. Use a kinematics equation to calculate the initial velocity of the dart. This will be the "muzzle velocity" the dart. In the space below, NEATLY and CLEARLY
a) LIST VARIABLES WITH VALUES AND UNITS
b) SHOW EQUATION USED
c) SHOW CALCULATION

v_f = EQUATION USED:

a = CALCULATION:

d =

v_i = ?

******* STOP! *******

DO NOT DO ANY FURTHER FIRING OF THE GUN UNTIL ALL MEMBERS OF THE LAB GROUP HA COMPLETELY FINISHED THE CALCULATIONS IN STEP 2 ABOVE AND STEP 3 BELOW, AND HA OBTAINED MY INITIALS AS DIRECTED FOLLOWING STEP 4. FURTHER FIRING OF THE GUN PRIOR TO DOING THIS MAY REDUCE YOUR CREDIT FOR THE LAB.

PREDICTED (EXPERIMENTAL) RANGE

3. Choose an angle between 30 and 60 degrees upward from horizontal at which you will LATER fire the d with the gun on the floor (DO NOT ACTUALLY FIRE THE GUN IN THIS STEP). Then use kinematics equation calculate the horizontal distance the dart should travel. This will be the predicted, or theoretical, range o the dart. Realize that the initial vertical and horizontal velocities will be the vertical and horizontal components of the "muzzle velocity" determined earlier, and that the sine and cosine of the angle chosen have to be used to obtain the values of the components. Ignore the small error introduced by the dart's in height off the floor when fired. In each of the spaces below NEATLY and CLEARLY
a) LIST VARIABLES WITH VALUES AND UNITS
b) SHOW EQUATIONS USED
c) SHOW CALCULATION

(OVER)

VERTICAL		HORIZONTAL	
$v_i = v \sin\theta =$		$v_i = v \cos\theta =$	
$v_f =$	EQUATION USED:	$v_f =$	EQUATION USED:
$a =$		$d =$	
$t =$	CALCULATION:	$a =$	CALCULATION:
		$t =$	

---

4. Record value obtained for predicted (theoretical) range in the space in the COMPARISON section (to nearest 0.01 m).

******* STOP! *******

WHEN EVERYTHING ABOVE HAS BEEN COMPLETED, OBTAIN MY INITIALS BEFORE PROCEEDING. FAILURE TO DO THIS MAY REDUCE CREDIT FOR THE LAB.

TEACHER INITIALS _____

ACTUAL (EXPERIMENTAL) RANGE

5. Hold the dart gun on the floor so that it is aimed at the angle used in the previous calculations. Use the large protractor provided. Be sure to use the same clay-loaded dart used in the muzzle velocity determination. Fire the dart and mark its landing place. Measure the distance from the firing point to the landing point. This is the actual, or experimental, range of the dart. (You may ignore the small error due the muzzle of the gun being slightly above the level of the floor when the dart is fired.) Record the value the space below (to nearest 0.01 m). Repeat twice more and find the average. Record the average value in space in the COMPARISON section (to nearest 0.01 m).

TRIAL	1	2	3	AVERAGE
RANGE (m)				

COMPARISON OF PREDICTED (THEORETICAL) RANGE WITH ACTUAL (EXPERIMENTAL) RAN

7. In the space below, show a calculation for the % Error between the predicted (theoretical) range and tl actual (experimental) range. Record the value in the table.

CALCULATION

PREDICTED (THEORETICAL) RANGE	m
ACTUAL (EXPERIMENTAL) RANGE	m
%ERROR	%

OBTAIN MY INITIALS ON THE LINE BELOW TO RECEIVE CREDIT FOR THE LAB.

TEACHER INITIALS _____