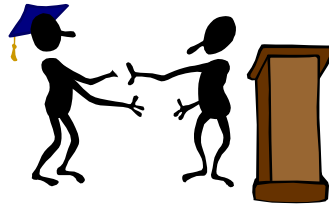


Key

DATA COLLECTION SHEETS 1, 2, 3, 4

There is a span of 29 units from the cannon wheel to the target.)

(Note: If setting is too high, cannon ball will shoot past the target and not register on the grid.)



Sheet #1

IV: Velocity

DV: Distance

6. Velocity

7. Angle, Gravity, Windage, Density

8. Control

Sheet #2

IV: Velocity

DV: Density

6. Gravity

7. Angle, Gravity, Windage, Density

8. Control

Sheet #3

7. Drag

8. Angle, Velocity, Gravity, Windage, Density

9. Control

Sheet #4

IV: Density

DV: Distance

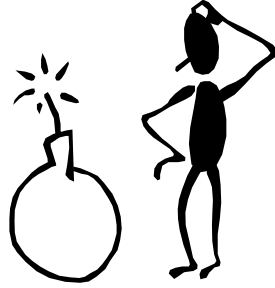
7. Density

8. Angle, Velocity, Gravity, Windage

9. Control

DATA COLLECTION SHEET #1

Try to hit the target in four tries starting with the default settings while only changing the velocity. All other variables will stay the same. {Note: Each box in the grid will be counted as a unit. Starting from the box that the cannon wheel is touching will be considered as one unit (or point A) and wherever the cannon ball lands will be considered the last unit (or point B). Count the units from point A to point B to get the distance your cannonball traveled.}



1. Trial 1: Do not change any settings for the first shot. Fire the cannon by clicking on the “shoot” button. Record the distance. Indicate a hit or miss by placing an “X” in the respective column.
2. Trial 2: Select a new velocity setting and record in “Velocity” column. Fire cannon ball. Record the distance in the “Distance” column. Record a hit or miss. Repeat step two two more times.
3. When you have completed your trials, label the velocity and distance columns as either the independent variable (IV) or the dependent variable (DV).
4. Signal the teacher when your group has finished the trials by having all four members raise their hands at the same time.
5. After you share your results with the teacher, you may proceed to *DATA COLLECTION SHEET #2*.

Trials	Angle	Velocity	Gravity	Windage	Density	Distance	Hit	Miss
1	60	50	-9.8	0	1.1			
2	60		-9.8	0	1.1			
3	60		-9.8	0	1.1			
4	60		-9.8	0	1.1			

6. Which variable in this experiment was manipulated? _____
7. Which variables stayed the same? _____
8. What are the variables called that did not change? _____

DATA COLLECTION SHEET #2

After you have successfully hit the target, double the gravity (i.e. raise it to -19.622). By what factor do you have to increase the velocity in order to now hit the target? Try to hit the target in four tries. (Note: Count the grids as in first worksheet.)



1. Trial 1: For first shot, leave velocity setting at 66. Double the gravity (-19.622). Select a velocity and write it down in the “Velocity” column. Fire the cannon by clicking on the “shoot” button. Record the distance. Indicate a hit or miss by placing an “X” in the respective column.
2. Trial 2: Select a new velocity setting and record in “Velocity” column. Fire cannon ball. Record the distance in the “Distance” column. Record a hit or miss. Repeat step two two more times.
3. When you have completed your trials, label the “Velocity” and “Distance” columns as either the independent variable (IV) or the dependent variable (DV).
4. Signal the teacher when your group has finished the trials by having all four members raise their hands at the same time.
5. After you share your results with the teacher, you may proceed to *DATA COLLECTION SHEET #3*.

Trials	Angle	Velocity	Gravity	Windage	Density	Distance	Hit	Miss
1	60	66	-19.622	0	1.1			
2	60		-19.622	0	1.1			
3	60		-19.622	0	1.1			
4	60		-19.622	0	1.1			

6. Which variable in this experiment was manipulated? _____
7. Which variables stayed the same? _____
8. What are these variables called? _____

DATA COLLECTION SHEET #3

Try to hit the target in two tries with the settings from DATA COLLECTION SHEET #2. Change the “Windage” to -14. (Note: Count the grids as in the first worksheet.) Before you fire the cannon, predict whether you will hit the target with the “Drag” button turned on or off.

PREDICTION: _____



1. Trial 1: Click on “Drag” button. Fire the cannon by clicking on the “shoot” button. Record the distance. Indicate a hit or miss by placing an “X” in the respective column.
2. Trial 2: Turn “Drag” off by clicking on the button again. Fire cannon ball. Record the distance in the “Distance” column. Record a hit or miss.
3. Was your prediction correct? _____
4. Signal the teacher when your group has finished the trials by having all four members raise their hands at the same time.
5. After you share your results with the teacher, you may proceed to *Data Collection Sheet #4*.

Trials	Angle	Velocity	Gravity	Windage	Density	Distance	Hit	Miss
1	60	93	-19.622	-14	1.1			
2	60	93	-19.622	-14	1.1			

6. Which variable did you manipulate? _____
7. Which variables stayed the same? _____
8. What are these variables called? _____

DATA COLLECTION SHEET #4

Try to hit the target in four tries with the settings from DATA COLLECTION SHEET #3. This time lower the density. (Note: Count the grids as in the first worksheet.) Before you fire the cannon, predict whether you will hit the target when you lower the density of the cannonball.

PREDICTION: _____



1. Trial 1: Click on “Drag” button. Fire the cannon with “Density” setting at 1.1 for first shot. Record the distance. Indicate a hit or miss by placing an “X” in the respective column.
2. Trial 2: Lower the density and fire second cannonball. Record the distance. Record a hit or miss by placing an “X” in the respective column. Repeat two more times.
3. Was your prediction correct? _____
4. When you have completed your trials, label the “Density” and “Distance” columns as either the independent variable (IV) or the dependent variable (DV).
5. Signal the teacher when your group has finished the trials by having all four members raise their hands at the same time.
6. Share your results with the teacher.

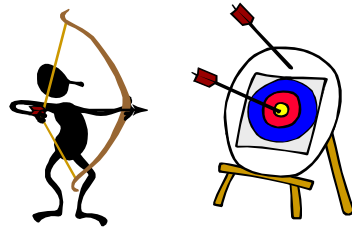
Trials	Angle	Velocity	Gravity	Windage	Density	Distance	Hit	Miss
1	60	93	-19.622	-14	1.1			
2	60	93	-19.622	-14				
3	60	93	-19.622	-14				
4	60	93	-19.622	-14				
5	60	93	-19.622	-14				

- _____
7. Which variable did you manipulate? _____

8. Which variables stayed the same? _____
9. What are these variables called? _____

VOCABULARY LIST

1. Independent variable: what changes in the experiment.
2. Dependent Variable: what changes as a result of the experiment.
3. Velocity: A rate of motion in a particular direction in relation to time.
4. Windage: The influence of the wind in deflecting a missile, such as a bullet, from its course.
5. Gravity: The gravitational force that the earth exerts on bodies at or near its surface.
6. Drag: A pull or draw heavily, slowly, or with great effort; haul. To cause to move with difficulty or as if by force.
7. Projectile: An object that is designed to be shot or otherwise projected, as a bullet.



8. Trajectory: Curved path described by a vehicle or projectile body, as a bullet, ballistic missile, or meteor, moving through space or the atmosphere.
9. Kinetic energy: Energy possessed by a body because of its motion.
10. Potential energy: Energy possessed by a body due to its position or form.

