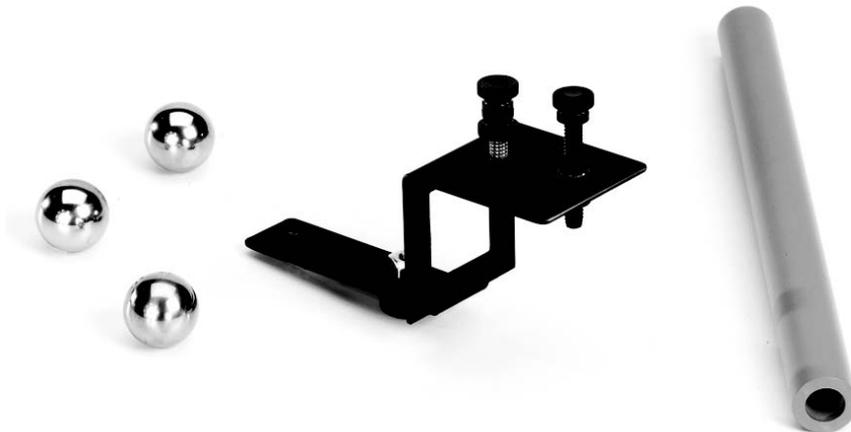




# Drop Shoot Accessory

Model No. ME-9859



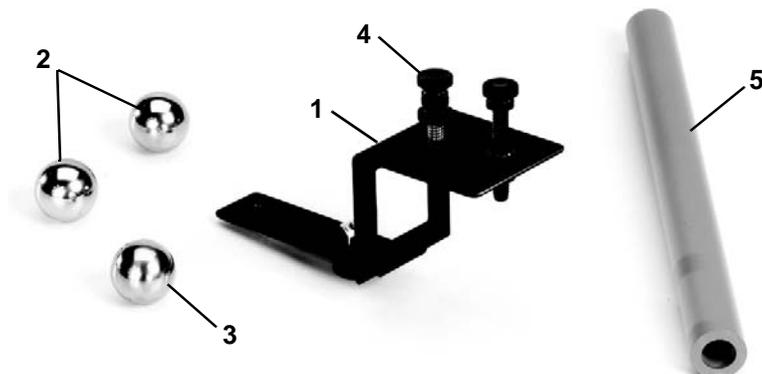
## Warranty

For a description of the product warranty, see the warranty description in the PASCO catalog.

# Drop Shoot Accessory

Model No. ME-9859

## Equipment List



Included Equipment	Replacement Part Number*
1. Drop Shoot Bracket	648-08601
2. 2.5 cm Steel Balls (2)	699-064
3. 2.5 cm Hollow Steel Ball	699-158
4. Mounting Hardware	
5. Loading Rod	648-08717

\*Use Replacement Model Numbers to expedite replacement orders.

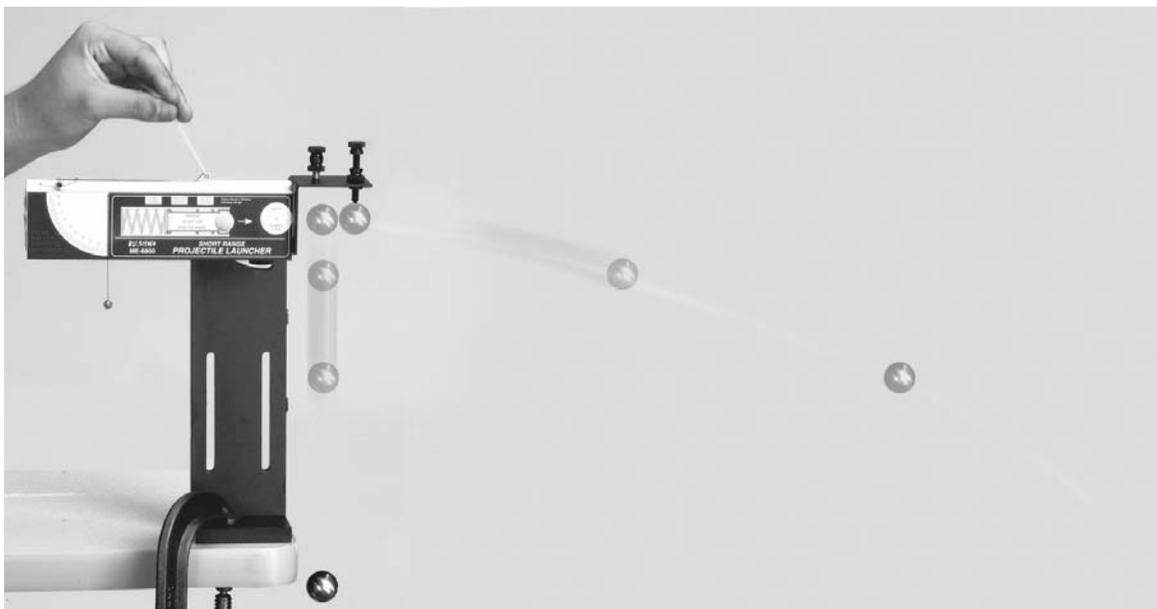
Additional Equipment Required	
Projectile Launcher	ME-6800 or ME-6801
C Clamp	SE-7285
Photogate Head	ME-9498A
Time of Flight Accessory	ME-6810
Smart Timer or Computer Interface	ME-9830

## Introduction

PASCO's Drop Shoot Accessory is designed to demonstrate the independence of motion in the x and y directions for a projectile. The included bracket can be used with either the Short Range Launcher (ME-6800) or Long Range Launcher (ME-6801). Mount a Photogate to the bracket to determine the muzzle velocity of the ball as it leaves the launcher. In addition, a Time of Flight Accessory can be used to compare the time of freefall for both balls.

## Independence of X and Y Motion

1. Mount the Projectile Launcher to a tabletop with a C clamp or other table clamp.
2. Using the attached plumb bob, set the launch angle to  $0^\circ$ .



3. Slide the Drop Shoot Bracket into the groove on the bottom of the Projectile Launcher.
4. Tighten the thumbscrew on the bottom to secure the bracket.



5. Connect a photogate as shown to measure the initial speed of the fired ball (optional). Since the photogate beam passes through the center of the ball's path, the velocity of the ball is calculated by the following equation:

$$velocity = \frac{\text{diameter of ball}}{\text{"blocked time"}}$$

6. Place the Time of Flight Accessory directly below the Drop Shoot Bracket.
7. Hang a solid steel ball from the magnetic screw.
8. Looking through the back of the launcher, adjust the magnetic screw until the "hanging ball" is centered on the sights.
9. Remove the "hanging ball."
10. Place a solid steel ball into the barrel and use the included loading rod to depress the plunger to the first click.
11. Replace the "hanging ball".
12. If velocity data is being collected with a photogate, click the Start button in DataStudio.
13. Pull the launch cord to release the balls.
14. Mark the position the "hanging ball" when it strikes the ground.
15. Click Stop in DataStudio to end data collection.
16. Position the Time of Flight Accessory such that the hanging ball will strike it and repeat the launch procedure.

17. Draw a force diagram for each ball as it flies through the air.
18. Based on these force diagrams, describe the motion of the balls in the x direction.
19. Based on these force diagrams, describe the motion of the balls in the y direction.
20. How does the time of free fall compare for the two balls? Explain.

## Changing Launch Velocity

1. Repeat the above experiment, depressing the plunger of the launcher to the "second click" instead of the "first click."
2. Draw a force diagram for each ball as it flies through the air.
3. Ask students to predict the horizontal range and time of free fall for this new launch setting.
4. How does the horizontal range compare to the "first click" setting? Explain.
5. How does the time of free fall compare to the "first click" setting? Explain.
6. What must be changed to affect the time of free fall?
7. If desired, repeat the experiment for the "third click."



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*Note: It is not recommended to use the most powerful launch setting on the Long Range Launcher (ME-6801) for this experiment.*

## Changing Mass

1. Repeat the above experiment, but hang the hollow steel ball instead of the solid steel ball. Use the solid steel ball in the launcher.
2. Draw a force diagram for each ball as it flies through the air.
3. Ask students to predict the horizontal range and time of free fall for this combination of balls.
4. How does the horizontal range for balls of unequal mass compare to using balls of equal mass? Explain.
5. How does the time of freefall for balls of unequal mass compare to using balls of equal mass? Explain.
6. What must be changed to affect the time of free fall?