

PHET Projectile-Motion Lab

Name _____

Go to mrstomm.com → More → **Projectile Motion** to find the simulation.

Click INTRO to begin and follow your teacher's direction.

Test 1 - Cannon Height & Distance

1. Click and drag the left-side of the cannon to decrease the height to 3 m.
2. Make sure the cannon is at an angle of 0° with a speed of 15 m/s.
3. Click the fire button to launch your projectile and use the measurement tools to find the distance it traveled.
4. Based on your data, how does the height of the cannon affect the distance the projectile travels?

5. If you were able to change the height to 30 m, how far would the projectile travel? Explain.

Test 1: Height → Distance

Speed = 15 m/s Angle = 0°

| Height (m) | Distance (m) |
|------------|--------------|
| 3 | |
| 6 | |
| 9 | |
| 12 | |
| 15 | |

Test 2 - Cannon Angle & Distance - Click the yellow eraser tool to clear all your trajectories.

1. Set the cannon height at 5 meters, speed to 15 m/s, and start with an angle of 0° .
2. Click the fire button to launch your projectile and use the measurement tools to find the distance it traveled.
3. Click and drag the end of the cannon to set it to the angles shown in the chart. Record your data in the chart for each angle.
4. Based on your data, how does the angle of the cannon affect the distance the projectile travels?

5. At what point in the trajectory is the projectile the highest - start, middle, or end? Explain.

Test 2: Angle → Distance

Height = 5 m Speed = 15 m/s

| Angle | Distance (m) |
|-------|--------------|
| 0 | |
| 25 | |
| 45 | |
| 60 | |
| 75 | |

Test 3 - Projectile Speed & Distance - Click the yellow eraser tool to clear all your trajectories.

1. Set the cannon height at 5 meters and the angle to 0.
2. Click and drag the speed to match those shown in the chart and click the fire button to launch your projectile.
3. Record your data in the chart for each speed.
4. Based on your data, how does the speed of the projectile affect the distance the projectile travels?
5. If you were able to set the speed to 50 m/s, how far would the projectile travel? Explain.

Test 3: Speed → Distance

Height = 5 m Angle = 0°

| Speed | Distance (m) |
|-------|--------------|
| 5 | |
| 10 | |
| 15 | |
| 20 | |
| 25 | |

Test 4 - Projectile Mass & Distance - Click the **VECTOR** button and click the yellow eraser tool to clear all your trajectories.

1. Set the diameter to 0.5 m, mass to 2 kg, speed at 15 m/s, the angle to 45°, and check the box to turn on air resistance.
2. Click the fire button to launch your projectile. Record the data in the chart.
3. Use the slider to change the mass of the projectile and test each one. Record your distance in the chart for each one.
4. Based on your data, how does the mass of the projectile affect the distance the projectile travels?

Test 4: Mass → Distance

Height = 5 m Speed = 15 m/s

Angle = 45° Air Resistance = On

| Mass | Distance (m) |
|------|--------------|
| 2 | |
| 4 | |
| 6 | |
| 8 | |
| 10 | |

Final Challenge - Click the INTRO button and apply what you have learned to accomplish each task.

1. Click and drag the target to move it to a distance of 10 m from the cannon.
2. Select the pumpkin as your first projectile. Change the variables in the chart until you are able to hit the target. Record the cannon height, angle, and projectile speed in the chart.
3. Repeat the experiment with TWO other projectiles, but change the target distance to 20 m and 30 m.

| Target Distance | Projectile | Cannon Height | Cannon Angle | Projectile Speed |
|-----------------|------------|---------------|--------------|------------------|
| 10 m | Pumpkin | | | |
| 20 m | | | | |
| 30 m | | | | |