

PHET Projectile-Motion Lab

ANSWER KEY

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?

As the height of the launch increases, the distance the projectile travels also increases.

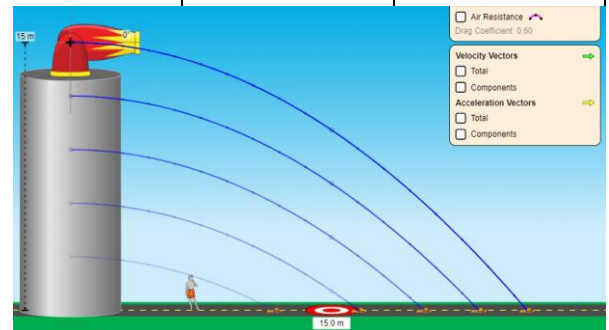
5. If you were able to change the height to 30 m, how far would the projectile travel? Explain.

Answers will vary - include an explanation that tells how you calculated your answer.

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?

As the angle of the launch increases ($0 \rightarrow 75$), the height of the trajectory also increases, but the projectile does not travel as far.

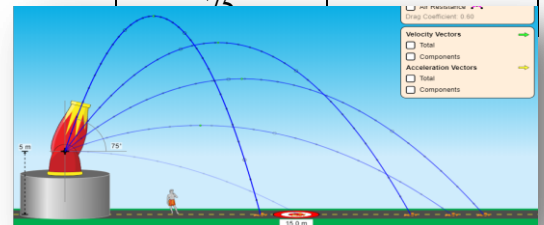
5. At what point in the trajectory is the projectile the highest - start, middle, or end? Explain.

The highest point in the trajectory is near the middle if you are using an angle greater than 0 .

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?

As the speed of the launch increases, the distance the projectile travels also increases.

5. If you were able to set the speed to 50 m/s, how far would the projectile travel? Explain.

Answers will vary - include an explanation that tells how you calculated your answer.

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?

As the mass of the projectile increases, the distance the projectile travels increases a small amount.

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.

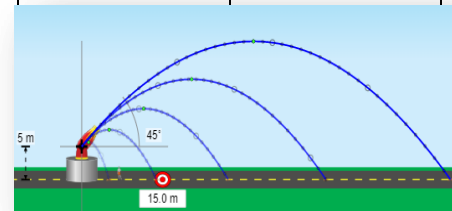
Target Distance	Projectile	Cannon Height	Cannon Angle	Projectile Speed
10 m	Pumpkin			
20 m				
30 m				

Answers will vary - include an explanation that tells how you calculated your answer.

Test 3: Speed → Distance

Height = 5 m Angle = 0°

Speed	Distance (m)
5	
10	
15	
20	
25	



Test 4: Mass → Distance

Height = 5 m Speed = 15 m/s
Angle = 45° Air Resistance = On

Mass	Distance (m)
2	
4	
6	

