**Newton’s Laws-Phet Simulation**

Following the instructions below and answer the questions as you complete each step.

1. Use the following link and click on the “Intro” option.

<https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html>

1. Use the dropdown in the brown box on the right side to change the item to “Car”.
2. Use your mouse to click and drag the cannon to a new angle. Then click the red cannon button at the bottom of the screen to fire the car out of the cannon.

* What angle degree do you need to set the cannon in order to make the car land on the red target? \_\_\_
* Make a prediction: How will the angle of projection need to change in order to hit the target, if you move the target farther from the cannon? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Click and drag the target to 20m.
2. Use your mouse to click and drag the cannon to a new angle. Then click the red cannon button at the bottom of the screen to fire the car out of the cannon.

* What angle degree do you need to set the cannon in order to make the car land on the red target? \_\_\_\_
* Why does the cannon angle need to change in order to hit the target?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Make a prediction: How will the landing position of the object change when you increase the initial speed of the object at launch, but keep the angle of launch the same? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Change the “Initial Speed” by sliding the blue marker and set the speed to 20 m/s. Then, launch the car.

* What is the distance between the object’s landing points when set to a higher initial speed? (Use the tape measure at the top of the screen) \_\_\_\_\_\_\_\_\_\_\_\_\_
* Why does an increase in speed cause the object to travel farther? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Test your claim**

1. Change the object being launched by using the drop down menu in the brown box on the right. Select any object.
2. Test and determine the angle needed to make your object hit the target at 15m.
3. Move the target to 20m. Test and determine the angle needed to make your object hit the target at 20m.

* Did the angle of the cannon need to be changed in the same way as it did when you tested the car? Why do you think that is so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Test and determine the difference in landing positions when the initial speed is increased.
2. Change the “Initial Speed” by sliding the blue marker and set the speed to 20 m/s. Then launch your object.

* Did the landing position of your object change in the same way as it did when you tested the car? Why do you think that is so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ANSWER KEY: COMPLETE THE ASSSIGNMENT ABOVE BEFORE USING THE ANSWER KEY.**

1. Use the following link and click on the “Intro” option.

<https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html>

2. Use the dropdown in the brown box on the right side to change the item to “Car”.

3. Use your mouse to click and drag the cannon to a new angle. Then click the red cannon button at the bottom of the screen to fire the car out of the cannon.

• What angle degree do you need to set the cannon in order to make the car land on the red target? -15,-20

• Make a prediction: How will the angle of projection need to change in order to hit the target, if you move the target farther from the cannon? The angle will increase.

4. Click and drag the target to 20m.

5. Use your mouse to click and drag the cannon to a new angle. Then click the red cannon button at the bottom of the screen to fire the car out of the cannon.

• What angle degree do you need to set the cannon in order to make the car land on the red target? 0,-5

• Why does the cannon angle need to change in order to hit the target?

The cannon must be positioned at a higher angle in order to shoot the object farther away.

• Make a prediction: How will the landing position of the object change when you increase the initial speed of the object at launch, but keep the angle of launch the same? The object will travel farther.

6. Change the “Initial Speed” by sliding the blue marker and set the speed to 20 m/s. Then, launch the car.

• What is the distance between the object’s landing points when set to a higher initial speed? (Use the tape measure at the top of the screen) 4.90 m

• Why does an increase in speed cause the object to travel farther? By increasing the acceleration of the object you are increasing the velocity. Acceleration and velocity are directly proportional.

Test your claim

7. Change the object being launched by using the drop down menu in the brown box on the right. Select any object.

8. Test and determine the angle needed to make your object hit the target at 15m.

9. Move the target to 20m. Test and determine the angle needed to make your object hit the target at 20m.

• Did the angle of the cannon need to be changed in the same way as it did when you tested the car? Why do you think that is so? Yes, because the cannon must have an increased angle in order to shoot the object farther, the type of object does not seem to matter.

10. Test and determine the difference in landing positions when the initial speed is increased.

11. Change the “Initial Speed” by sliding the blue marker and set the speed to 20 m/s. Then launch your object.

• Did the landing position of your object change in the same way as it did when you tested the car? Why do you think that is so? Yes, because you applied more force by increasing the initial speed. More force applied will increase the distance traveled.