Name

Date

Period

Projectile Motion Lab

*Special Notes: I have* ***bolded*** *the equipment you* ***need*** *for each station.*

*\*\*You MUST SHOW YOUR WORK for full credit\*\**

Here is the cm to m conversion. You will need it for problem #1, #3, and #4.

Convert from cm to m. There are 100 cm in 1 m.

\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_\_ =

Station 1

Measure the distance from your hand (where you *intend* to drop the **tennis ball** from) (\*measure in cm\*) straight down to the ground using a **tape measure**.

1a) Calculate how long it takes for the **tennis ball** to reach the ground?

\*Don’t forget to convert cm to m before you plug in your variables.\*

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | y-  vi-  t-  ag- | y= vi (t) + 0.5 (ag) (t)2 |

1b) Do the same experiment from 1a, but change what you drop. Use a **pen or pencil** instead of the ball.

\*Don’t forget to convert cm to m before you plug in your variables.\*

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | y-  vi-  t-  ag- | y= vi (t) + 0.5 (ag) (t)2 |

1c) How does mass effect the time it takes an object to drop?

1d) Calculate 1a using the moon’s gravity of 1.62 m/s2 instead of Earth’s gravitational pull. At what location (Earth or the Moon) will the tennis ball fall slower? What is the difference?

Station 2

You are using the **hot wheels track** to roll a **car** down a ramp, off of the ledge. (You will end up choosing two totally different angles for your track.) Measure the height for your track (the very end) straight down to the ground using a **tape measure**. You will be using the **photogate** to read the horizontal speed of the car. Make sure the photogate is *flashing* “km/hr”.

\*Don’t forget to convert cm to m before you plug in your variables AND convert photogate speed.

Convert photogate reading: \_\_\_\_\_\_\_km x 1000 m x 1 hr x 1 min = m/s

1 hr 1 km 60 min 60 s

2a) Determine the horizontal range of the car as it hits the ground?

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | x-  vx-  y-  viy-  t-  ag- | y= vi (t) + 0.5 (ag) (t)2 vx= x/t |

2b) Do the **same experiment from #3,** but now change the angle of the hot wheels track so that the speed changes. Complete the trial again.

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | x-  vx-  y-  viy-  t-  ag- | y= vi (t) + 0.5 (ag) (t)2 vx= x/t |

2c) Compare your data for 3a and 3b. Explain how the angle affects the speed of impact (aka- final speed).

2d) Does the speed of the object affect the horizontal distance at which the car landed? Compare 2a and 2b. Explain which one went further and why.

Station 3

Select a location above the ground. You will be dropping a **tennis ball** from this height. Use a **stopwatch** to measure the time it takes for the tennis ball to drop. Calculate the height of your launch.

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | y-  vi-  t-  ag- | y= vi (t) + 0.5 (ag) (t)2 |

Station 4

Find a safe location at any height above the ground. Measure this location from your “foot height” using the **measure tape** (straight up/down) and record. Now you will kick the **tennis ball** off of the selected location. Make sure to have someone “eye” where it lands. Once the ball has landed- mark the area and measure where the ball landed back to the launch area. The measuring tape should be on the ground the whole time. (DO NOT MEASURE TIME.)

\*Don’t forget to convert cm to m before you plug in your variables.

your measured vertical distance (y)-

your measured horizontal distance (x)-

|  |  |  |
| --- | --- | --- |
| Picture of activity | Variables | Equation |
|  | x-  vx-  y-  viy-  t-  ag- | y= viy (t) + 0.5 (ag) (t)2 and vx= x/t |

Extended questions:

5) If Earth’s gravitational pull is 9.8 m/s2, how fast would an object be travelling in 2 seconds? In 8 seconds?

\_\_\_\_\_\_\_\_\_x \_\_\_\_\_\_\_\_= \_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_ =

6) If mass doesn’t have an effect on gravitational pull, what could you do to alter an object’s horizontal range?

**Extra credit**- Double your height from 2a. Use the same horizontal speed. Recalculate. Does doubling your height double the horizontal range? Explain what is happening.