Unity Student Worksheet

| Lesson 1: Force

Parameter check:

What parameters did you use in Lesson 1?: _____

The formula to calculate **force** is: _____

The formula that calculates **velocity** is: _____

The formula that calculates **acceleration** is: _____

There are a set of parameters that don't allow the ball to launch:

What are they? _____

Why don't they work? _____

Find the acceleration in the launch direction of your ball right after it was released, use the parameters you entered in the forces lesson. Write out the variables that you know first. then document your calculations.

Knowns:

F =

m =

a = ?

Calculate the average velocity of the ball in the horizontal axis using the distance and time displayed in the unity editor.

Knowns:

d =

t =

v_x = ?

Will the velocity profile in the x-axis change at different points along the trajectory of the projectile? Why or why not? _____

_____

Lesson 2: Energy

Parameter check:

What parameters did you use in Lesson 2? _____

What are the four kinematic equations?

_____ _____

_____ _____

Explain how the law of conservation of energy applies to the catapult and cannonball:

_____

_____

Use the kinematic equation to calculate the vertical velocity of the cannonball at the top of it's arc; use the parameters from lesson 2. The calculation for the initial vertical velocity components has already been started for you. Round the velocities to a whole number in your calculations.

Knowns:

V_i =

t =

a = 9.81 m/s^2

V_{fy} = ?

$$V_{iy} = V_i \sin(45)$$

$$V_{iy} = V_i \times 0.707$$

$$V_{iy} =$$

Use the same formula to find thevertical acceleration of your cannonball from the top of its arc to the bottom of the parabola. The final velocity you calculated above is now your initial velocity. Round your final answer to the nearest tenth.

Knowns:

V_{iy} =

V_{fy} =

t_i =

t_f =

a = ?

$$V_{fy} = V_f \sin(45)$$

$$V_{fy} = V_f \times 0.707$$

$$V_{fy} =$$

Was the vertical velocity at the midpoint you calculated close to zero m/s? What does your answer for the velocity reveal about the energy state of the ball? Will this always be the case?

_____

_____

_____

Is your answer for the vertical acceleration close to any significant value? What does your answer reveal about the movement of the ball in the vertical plane?

_____

_____

_____

What is the minimum mass of the ball needed to knock over all the blocks? _____

What is the minimum spring force value needed to knock over all the blocks? _____