Name: _____

Class: _____

Due Date: _____

Physics Topic 6 – Projectile Motion

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. E: A marble is rolling along a horizontal tabletop, which is 94.0 cm above the floor, when the marble reaches the edge of the table and then falls to the floor. How long will it take for the marble to strike the floor?

2. E: A rifle bullet, which has a mass of 57.0 g, is fired horizontally from a rifle which is held 94.0 cm above the floor, with a velocity of 385 m/s. How long will it take for the bullet to strike the floor?

3. E: A marble is fired horizontally from a launching device attached to the edge of a tabletop which is 94.0 cm above the floor. The marble then strikes the floor 2.35 m from the edge of the table.

   a. How long will it take for the marble to reach the floor?

b. What is the initial velocity of the marble as it leaves the launching device?

c. What will be the horizontal velocity of the marble as it reaches the floor?

d. What will be the vertical velocity of the marble as it reaches the floor?

e. What will be the direction and magnitude of the velocity of the marble as it reaches the floor?

4. E: Salah throws a ball with an initial speed of 47.0 m/s at an angle of 30.0° north of east 830. meters above the surface of the Earth.

   a. Complete the table:

$x_{\mathrm{i}} =$	$y_{\mathrm{i}} =$
$v_{\mathrm{i,x}} =$	$v_{\mathrm{i,y}} =$
$a_{\mathrm{x}} =$	$a_y =$

   b. What will be the horizontal velocity and horizontal acceleration of the ball (number and direction) when it reaches its maximum height?

   c. What will be the vertical velocity and vertical acceleration of the ball (number and direction) when it reaches its maximum height?

   d. How long will the ball be in the air for?

   e. What will be the range (horizontal distance) of the ball?

f. What will be the maximum height of the ball from the surface of the Earth after it is thrown?

g. How long will it take for the ball to reach its maximum height after it is thrown?

h. How long does it take for the ball to reach 400. m above the surface of the Earth after it is thrown?

i. How high above the surface of the Earth will the ball be 8.00 s after it is thrown?

j. How far horizontally does the ball travel during the first 8.00 s after it is thrown?

k. What will be the velocity of the ball (number and direction) 8.00 s after it is thrown?

l. What will be the displacement of the ball (number and direction) 8.00 s after it is thrown?

m. **Use a pencil and ruler!** Draw an *acceleration vs. time* graph, a *velocity vs. time* graph, a *speed vs. time* graph, a *displacement vs. time* graph, and a *distance vs. time* graph for the ball for both the horizontal direction and the vertical direction.

5. E: A projectile, which has a mass of 5.50 kg, is fired from the ground with an initial velocity of 169. m/s at an angle of 23.0° above the horizontal.

   a. Complete the following table:

$x_{\mathrm{i}} =$	$y_{\mathrm{i}} =$
$v_{\mathrm{i,x}} =$	$v_{\mathrm{i,y}} =$
$a_{\mathrm{x}} =$	$a_{\mathrm{y}} =$

   b. What will be the velocity of this projectile at the highest point of its projectile?

   c. What will be the total flight time of this projectile?

   d. What will be the height of this projectile at the highest point of its trajectory?

   e. What will be the range of this projectile?

f. What will be the vertical velocity of this projectile 3.50 s after it has been fired?

g. What will be the horizontal velocity of this projectile 3.50 s after it has been launched?

h. What will be the direction and magnitude of the projectiles velocity 3.50 s after it has been fired?

i. What will be the height of this projectile 3.50 s after it has been fired?

j. How far downrange will the projectile be 3.50 s after it has been fired?

k. What will be the final displacement of the projectile 3.50 s after the projectile has been fired?

6. E: A Spanish Galleon enters a harbor defended by cannon placed on top of a castle wall which is 135 m above the water level. The cannon have a known muzzle velocity of 323 m/s and are aimed 28.0° above the horizontal. How far from the base of the castle wall will the Galleon be within the range of the cannon?

7. E: A motorcycle is moving with a velocity of 36.0 m/s when it encounters a ramp which is 22.0 m long and meets the horizontal at an angle of 13.0°. The motorcycle goes up the incline without losing speed and flies off the end of the incline.

   a. Draw a figure.

   b. How long after the motorcycle leaves the end of the ramp will the motorcycle land on the ground?

   c. How far from the end of the ramp will the motorcycle land on the ground?

   d. How high above the ground will the motorcycle be at its highest point?

8. E: Abraham throws a ball horizontally eastward with an initial speed of 22.0 m/s from 830. m above the surface of the Earth.

   a. Complete the table:

$x_{\mathrm{i}} =$	$y_{\mathrm{i}} =$
$v_{\mathrm{i,x}} =$	$v_{\mathrm{i,y}} =$
$a_{\mathrm{x}} =$	$a_{\mathrm{y}} =$

   b. How long will the ball be in the air for after it is thrown?

   c. What will be the range of the ball?

   d. How long does it take for the ball to reach 400. m above the surface of the Earth after it is thrown?

   e. How high above the surface of the Earth will the ball be 8.00 s after it is thrown?

f. How far horizontally does the ball travel during the first 8.00 s after it is thrown?

g. What will be the velocity of the ball (number and direction) 8.00 s after it is thrown?

h. What will be the displacement of the ball (number and direction) 8.00 s after it is thrown?

9. E: Lot throws a ball at an initial speed of 12.0 m/s at an angle of 30.0° south of east from 830. m above the surface of the Earth.

   a. Complete the table:

$x_{\mathrm{i}} =$	$y_{\mathrm{i}} =$
$v_{\mathrm{i,x}} =$	$v_{\mathrm{i,y}} =$
$a_x =$	$a_{\mathrm{y}} =$

   b. How long will the ball be in the air for?

   c. What will be the range of the ball?

   d. How long after the ball is thrown does it take to reach 400. m above the surface of the Earth?

   e. How high above the surface of the Earth will the ball be 4.00 s after it is thrown?

   f. How far horizontally does the ball travel during the first 4.00 s after it is thrown?

g. What will be the velocity of the ball (number and direction) 4.00 s after it is thrown?

h. What will be the displacement of the ball (number and direction) 4.00 s after it is thrown?

10.E: A 25.0 kg ball is thrown from the edge of a very tall building with an initial speed of 20.0 m/s at an angle of 60.0° north of east. There is an infinitely tall vertical wall 120. m from the building.

a. Draw a figure.

b. Complete the table:

$x_{\mathrm{i}} =$	$y_{\mathrm{i}} =$
$v_{\mathrm{i,x}} =$	$v_{\mathrm{i,y}} =$
$a_{\mathrm{x}} =$	$a_{\mathrm{y}} =$

c. How much time does it take for the ball to hit the wall?

d. At which height above or below the original position where the ball is thrown will the ball hit the wall?

e. What will be the velocity of the ball (number and direction) when it hits the wall?

f. What will be the displacement of the ball (number and direction) when it hits the wall?

Take a break and play this video game:
https://universeandmore.com/motion-mapper/