Kinematics
2 Dimensional Motion
Projectile Example Problem

Name _____

Date _____

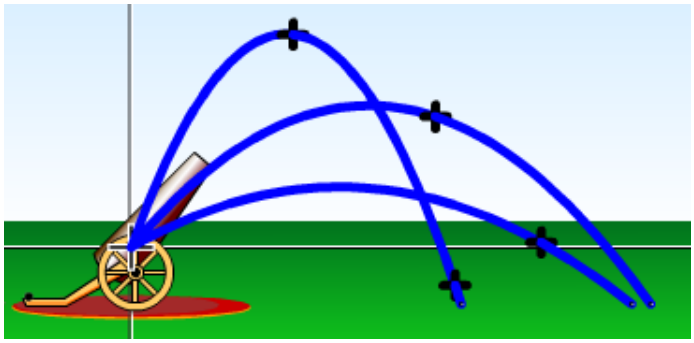
Period _____

Purpose – To investigate projectiles fired at angles. An object is fired at a speed of 14 m/s at three different angles.

Launch the Projectile Motion simulation. http://phet.colorado.edu/en/simulation/projectile-motion

Adjust the speed to 14 m/s then fire three projectiles at 30°, 50° and 70°. Keep all other initial conditions as given.

1. Identify the trajectories in the chart below on the diagram to the right as v_1, v_2 or v_3.
2. Resolve each of the velocity vectors into horizontal and vertical components.
3. Rank the time of flight for each velocity.



Velocity	Horizontal Component	Vertical Component	Time of Flight
v_1 = 14 m/s at 30°			
v_2 = 14 m/s at 50°			
v_3 = 14 m/s at 70°			

Below are freeze-framed pictures of the projectile at various times in its trajectory. Circle one of the three choices, ↑ (increasing), ↓ (decreasing), or zero that describes the projectile's **vertical (Y) motion**. Ignore air resistance.

v_1 while ascending

v: ↑ ↓ zero
a: ↑ ↓ zero

●

v_2 at the apex

v: ↑ ↓ zero
a: ↑ ↓ zero

●

v_3 while descending

v: ↑ ↓ zero
a: ↑ ↓ zero

●

Below are freeze-framed pictures of the projectile at various times in its trajectory. Circle one of the three choices, ↑ (increasing), ↓ (decreasing), zero, that describes the projectile's **horizontal (X) motion**. Ignore air resistance.

v_1 while ascending

v: ↑ ↓ zero
a: ↑ ↓ zero

●

v_2 at the apex

v: ↑ ↓ zero
a: ↑ ↓ zero

●

v_3 while descending

v: ↑ ↓ zero
a: ↑ ↓ zero

While the projectile is ascending its:

- horizontal velocity is constant/changing/zero and points _____ and the acceleration is _____
- vertical velocity is constant/changing/zero and points _____ and the acceleration is _____

When the projectile is at the apex its:

- horizontal velocity is constant/changing/zero and points _____ and the acceleration is _____
- vertical velocity is constant/changing/zero and points _____ and the acceleration is _____

While the projectile is descending its:

- horizontal velocity is constant/changing/zero and points _____ and the acceleration is _____
- vertical velocity is constant/changing/zero and points _____ and the acceleration is _____

What ties the horizontal and vertical equations of motion together? _____

Adjust the cannon's position until the crosshair on the cannon lies on the horizon (ground level). Fire a projectile at 14 m/s at 40° above the horizontal. Calculate the time of flight, the range and the maximum height of the projectile. Use the tape measure to check your answers. All measurements will be made with the tape measure in the horizontal or vertical position.

Time of Flight	Range	Height
time = 1.84 seconds		

Left click on the cannon and hold. Adjust the vertical elevation of the cannon. Fire another projectile at 14 m/s at 40° above the horizontal. How does the vertical elevation affect the time of flight, the range and height of the projectile?