Unit 5 - Projectiles!

A **projectile** is anything that flies through the air, influenced only by:_____ _____ and _____ _____.

(we will ignore air resistance, which only affects objects that are extremely light or at very high velocities)

If the object is self-powered, it is **NOT** a projectile. If it flies like a rock, it is a projectile!

Which of these is a projectile?

___Cheerleader tossed ___football being passed
___Larry-boy ___Frisbee
___Paper airplane ___Water balloon
___Bottle rocket ___Curve ball

A curveball, frisbee and paper airplane, while not powered by something else like the bottle rocket is, clearly do NOT fly like a rock does. Something else is involved in their flights, so they are not true projectiles.

All projectiles travel the same way through the air!

The path a projectile takes through the air is called a _____.

Every projectile's trajectory takes the same shape: A _____! All projectiles travel in parabolic trajectories.

If it is not parabolic, it is not a true projectile.

Why a parabola?The parabola forms because the horizontal movement is controlled only by _____, while the vertical motion is affected by _____. Therefore, the horizontal motion is always _____ velocity, and the vertical motion is always _____. Since we can break vectors into independent components, we can consider and calculate vertical and horizontal motion separately. (that's good news! The math is much easier that way!)

Which formulas?

Our horizontal motion is constant, and we have only one constant velocity formula, so we use it!

$$d_h = v_h t$$

Since vertical motion is constantly accelerating, we can use any formula for acceleration from unit 2, with "g" as our "a". Most often used is:

$$d_v = gt^2/2 + v_{vi}t,$$

where v_{vi} is initial vertical velocity only!!! The only thing in common between the two formulas is the _____. Solve for time in one equation and then plug it into the other. It's easy!

Vivi throws a tennis ball sideways off a building with a 13.2 m/s velocity. If the building is 4.57 m tall, how far to the side does the ball hit?

Jessica is talking on her cell phone while driving 24.5 m/s and misses a turn, careening off a cliff and falling in a parabolic trajectory until her car explodes into a fireball 146 m from the base of the cliff. How tall was the cliff?