Projectile Motion

Section 3.3

Objectives

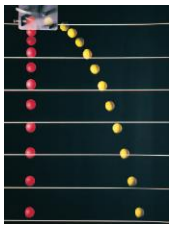
- **Recognize** examples of projectile motion.
- **Describe** the path of a projectile as a parabola.
- **Resolve** vectors into their components and **apply** the kinematic equations to **solve** problems involving projectile motion.

Projectiles

- Objects that are thrown or launched into the air and are subject to gravity are called **projectiles.**
- **Projectile motion** is the curved path that an object follows when thrown, launched, or otherwise projected near the surface of Earth.
- If air resistance is disregarded, projectiles follow **parabolic trajectories.**
  - What would happen to the motion if air resistance is NOT ignored?

Projectiles

- The vertical and horizontal motion of a projectile are independent of each other
  - The horizontal motion is constant



Pushed off a cliff…

Vertical Motion that Falls From Rest

$$v_{f,y} = a_y \Delta t$$
$$v_{f,y}{}^2 = 2a_y \Delta y$$
$$\Delta y = \frac{1}{2} a_y (\Delta t)^2$$

Horizontal Motion of a Projectile

$$v_x = v_i = constant$$
$$\Delta x = v_x \Delta t$$

Draw Example

Shot in the air…

$$v_x = v_{x,i} = v_i \cos\theta = constant$$
$$\Delta x = (v_i \cos\theta)\Delta t$$
$$v_{y,f} = v_i \sin\theta + a_y \Delta t$$
$$v_{y,f}{}^2 = v_i{}^2 (\sin\theta)^2 + 2a_y \Delta y$$
$$\Delta y = (v_i \sin\theta)\Delta t + \frac{1}{2} a_y (\Delta t)^2$$

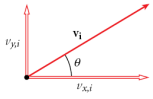
Draw Example

Solving Projectile Motion Problems

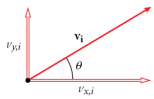
- Resolve the vector into "X" and "Y"
- In the vertical direction, the acceleration a_y will equal, g (–9.81 m/s^2) because the only vertical component of acceleration is free-fall acceleration.
- In the horizontal direction, the acceleration is zero, so the velocity is constant.

Solving Projectile Motion Problems

- **Projectiles Launched Horizontally**
  - The initial vertical velocity is 0.
  - The initial horizontal velocity is the initial velocity.
- **Projectiles Launched At An Angle**
  - Resolve the initial velocity into *x* and *y* components.
  - The initial vertical velocity is the *y* component.
  - The initial horizontal velocity is the *x* component.



Solving Projectile Motion Problems



Other Videos

- Remember to look at the math