

## Chapter Title: Motion in Two and Three Dimensions

Sections: Projectile Motion, Uniform Circular Motion

## Chapter Title: Force and Motion-I

Sections: Newton's First Law, Force

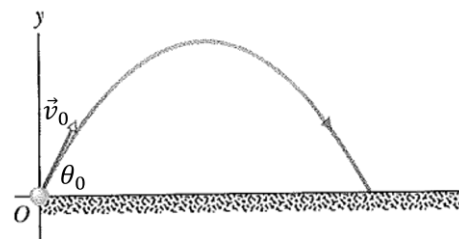
### Projectile Motion

It is an object propelled by applying an external force and then moves freely under the influence of gravity and air resistance. It is a two-dimensional motion.

$$\vec{v}_0 = \vec{v}_{0x} + \vec{v}_{0y}$$

$$\vec{v}_0 = v_{0x}\hat{i} + v_{0y}\hat{j}$$

$$v_{0x} = v_0 \cos \theta_0, v_{0y} = v_0 \sin \theta_0$$



### Horizontal Motion

Velocity = Displacement/ Time interval

$$v_{0x} = \frac{x - x_0}{\Delta t}$$

$$v_0 \cos \theta_0 = \frac{x - x_0}{t}$$

$$x - x_0 = (v_0 \cos \theta_0)t$$

Equation of motion

$$y - y_0 = v_{0y}t - \frac{1}{2}gt^2$$

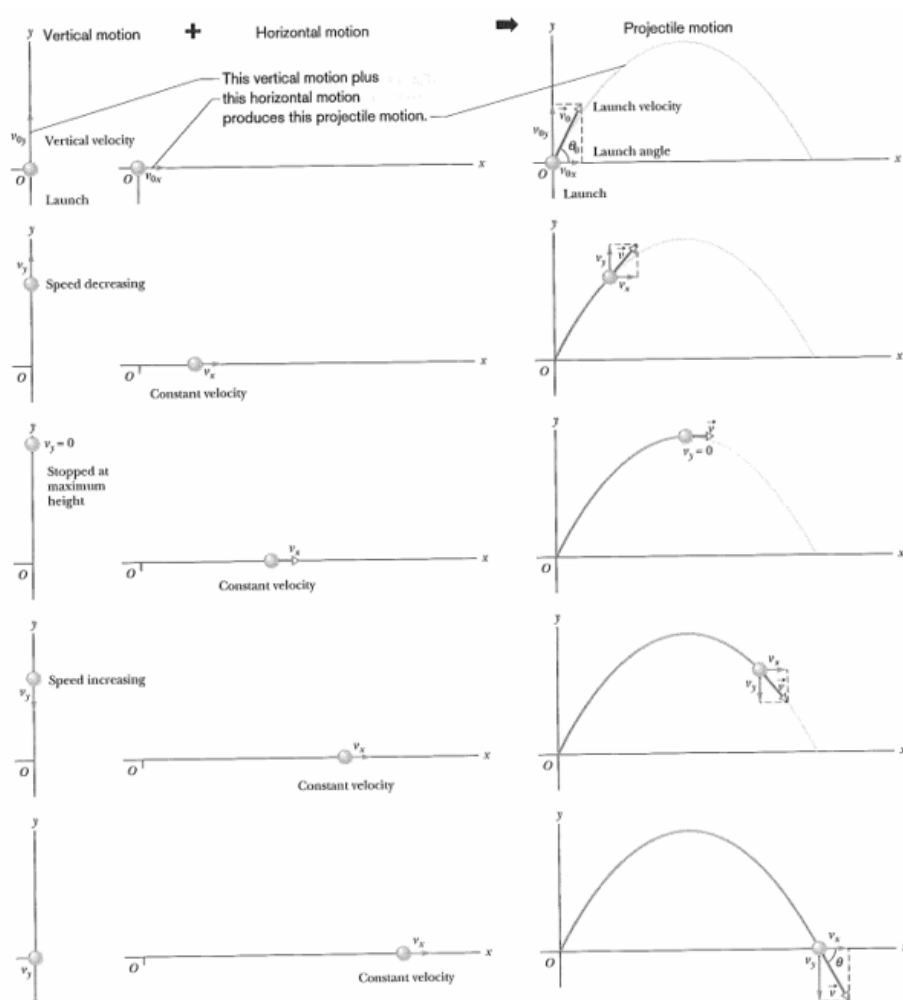
$$y - y_0 = (v_0 \sin \theta_0)t - \frac{1}{2}gt^2$$

$$v_y = v_0 \sin \theta_0 - gt$$

$$v_y^2 = (v_0 \sin \theta_0)^2 - 2g(y - y_0)$$

Equation of Path

$$y = (\tan \theta_0)x - \frac{gx^2}{2(v_0 \cos \theta_0)^2}$$



Horizontal Range:  $R = x - x_0$

$$0 = (v_0 \sin \theta_0)t - \frac{1}{2}gt^2$$

$$t = \frac{2v_0}{g} \sin \theta_0$$

$$R = (v_0 \cos \theta_0)t$$

$$R = \frac{v_0^2}{g} \sin 2\theta_0$$

Maximum value of R:  $\theta_0 = 45^\circ$

### Chapter: Force and Motion-I

Newtonian Mechanics: Fundamental laws are dealing with motion. It is also called Classical Mechanics.

#### Force

A force is a push or a pull. In other words, a force is an *interaction* between *two bodies* or between *a body and its environment*. That's why we always refer to the force that one body *exerts* on a second body.

#### Types

##### Contact Force:

When a force involves direct contact between two bodies, such as a push or pull that you exert on an object with your hand, it is called a contact force.

##### Normal Force:

Normal force is exerted on an object by any surface with which it is in contact. The adjective normal means that the force always acts perpendicular to the surface of contact, *no matter what the angle of that surface*.

##### Frictional Force:

The friction force exerted on an object by a surface act parallel to the surface, in the direction that opposes sliding.

##### Tension Force:

The pulling force exerted by a stretched rope or cord on an object to which it's attached is called a tension force.