Chapter 3
Projectile Motion

Kittipong Siengsanoh, Ph.D.(Physics)

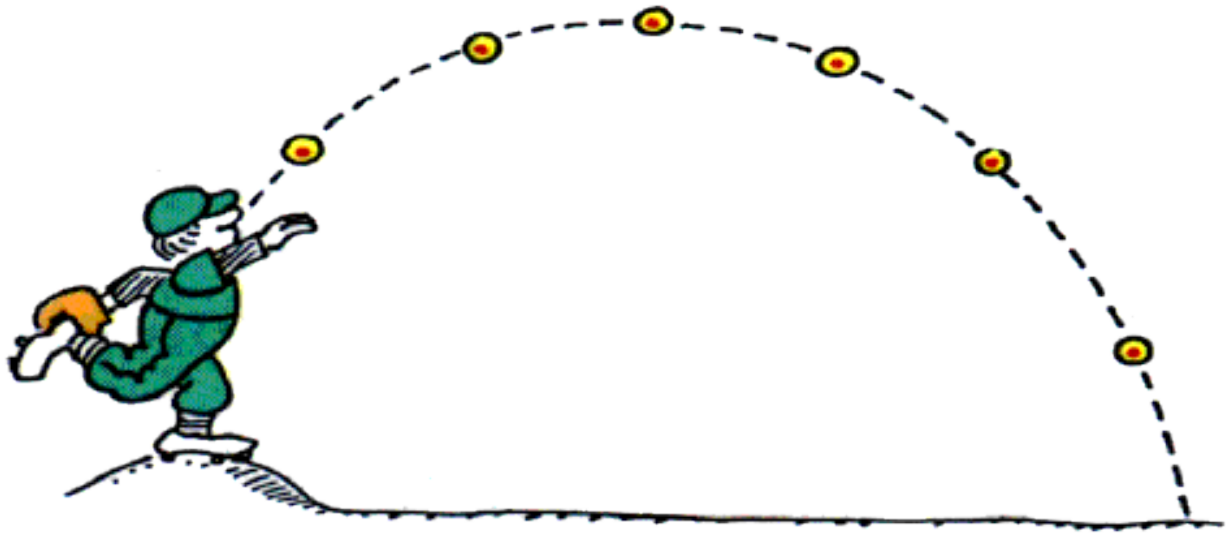
Physics, Science and Technology Department

Nakhon Pathom Rajabhat University

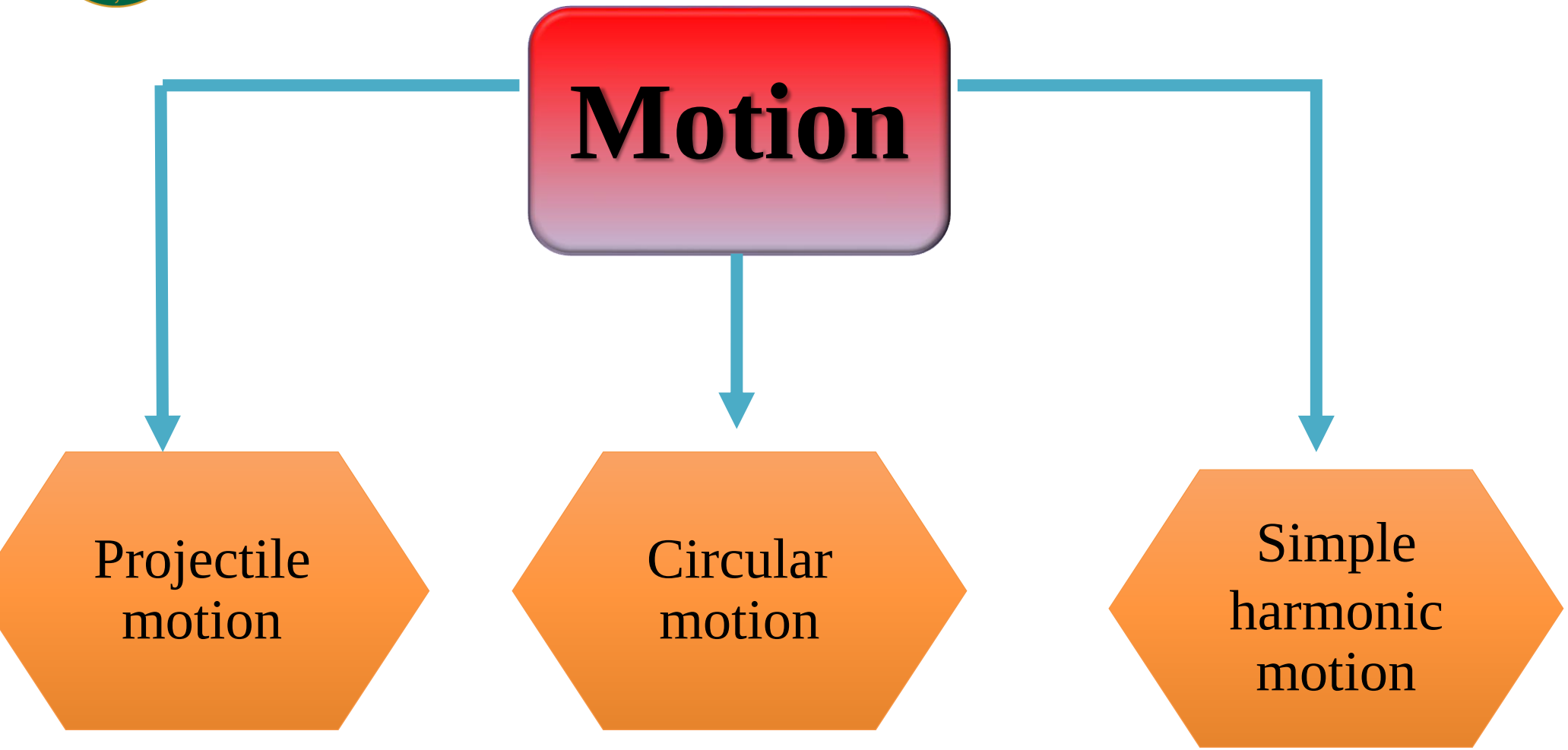
มหาวิทยาลัยราชภัฏนครปฐม
Nakhon Pathom Rajabhat University

Stand 4 : Force and Motion

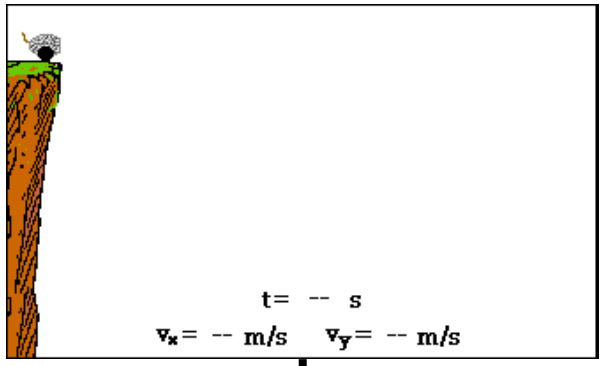
Standard Sc. 4.2 Understand the characteristics of motion of objects natural quest for knowledge and psychology, science communicating what is learn and put the knowledge to use.

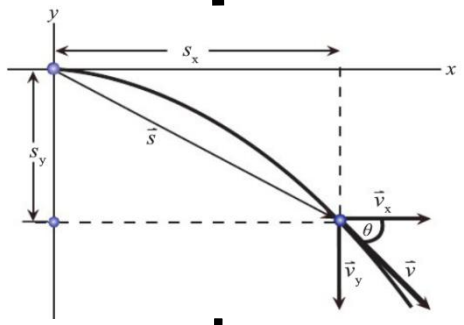


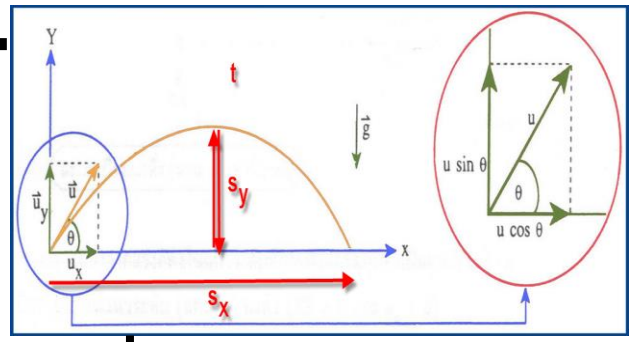
Class	Indicators	Learning core
M. 4-6	2. Observe and describe the Projectile motion, Circular and Simple Harmonic.	- Projectile motion as a movement trajectory curve with speed on the horizontal stabilizers and the acceleration in the vertical stabilizers. - Circular motion is moving with speed lines touch the circle and there is a force in the direction towards the center. - Simple Harmonic motion as moving go and back repeatedly Ex. The swing of the simple pendulum by the angle of maximum deviation from vertical has a constant throughout
	3. Discussion the results of the query and benefit about Projectile Motion, Circular and Simple Harmonic.	- The Projectile Motion can be utilized Ex. Playing tennis, Basketball. - The circular movement can be utilized Ex. The curved way of drive car to be safety. - The Simple Harmonic motion can be utilized for building a clock pendulum.


Motion
Projectile motion
Circular motion
Simple harmonic motion

Projectile Motion







Horizontal motion

$s_x = v_x t$

$s_y = \left(\frac{u_y+v_y}{2}\right)t$

Vertical motion

$s_y = u_y + gt$

$s_y = u_y t + \frac{1}{2}gt^2$

$v_y^2 = u_y^2 + 2gs_y$

Displacement

$s = \sqrt{s_x^2 + s_y^2}$

$\tan \propto = \frac{s_y}{s_x}$

Velocity

$v = \sqrt{v_x^2 + v_y^2}$

$\tan \theta = \frac{v_y}{v_x}$

Horizontal

$s_x = u_x t$

$s_x = (u \cos \theta)t$

Vertical

$s_y = u_y t + \frac{1}{2}a_y t^2$

$s_y = (u \sin \theta)t - \frac{1}{2}gt^2$

Initial velocity (*u*) → Speed at the beginning.

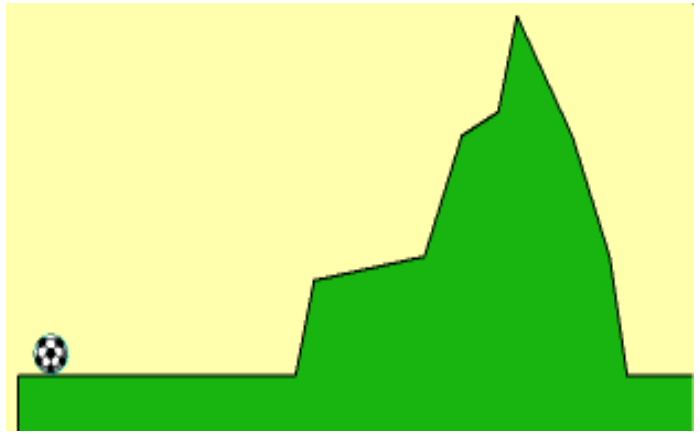
Final velocity (*v*) → Speed at the ending.

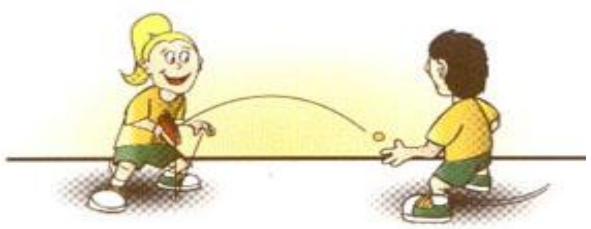
Distance (*S*) → Length along the path that all moving objects.

Displacement ($\vec{s}$) → The object moves from the starting position to the final position.

Gravitation force (g)

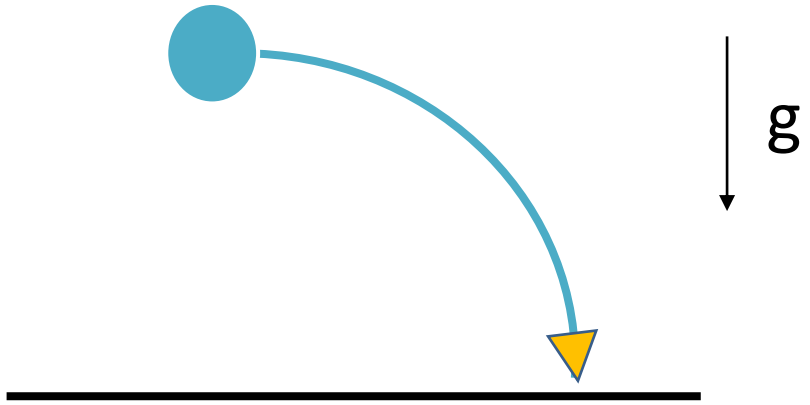
The acceleration to the gravity of the world and a direction perpendicular to the ground, the world.

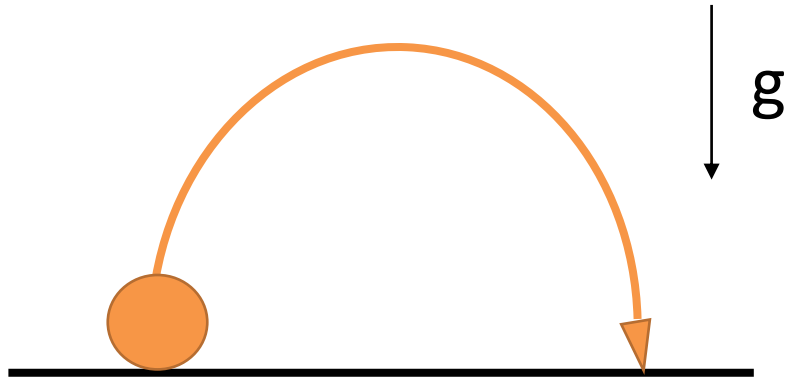




The Projectile motion

If consider the Projectile motion of the steel ball was throw by weight watchers or the movement of basketball was throw, will find that the movement is curved.



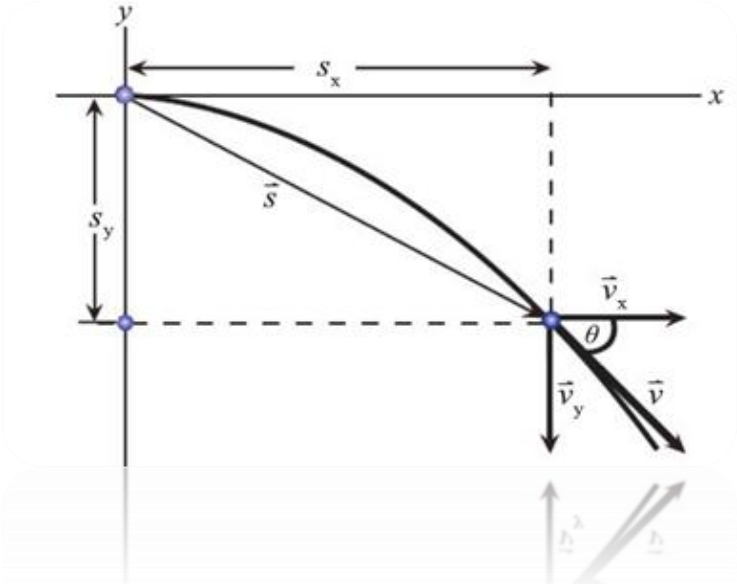


a=g

Horizontal motion and Vertical motion

Horizontal motion

Horizontal movement the object was hurl out on unchanged the horizontal movement because resultant force in the horizontal movement acts on the object is zero, by assume air resistance is worth very little until not be calculated.



Horizontal Direction Calculations

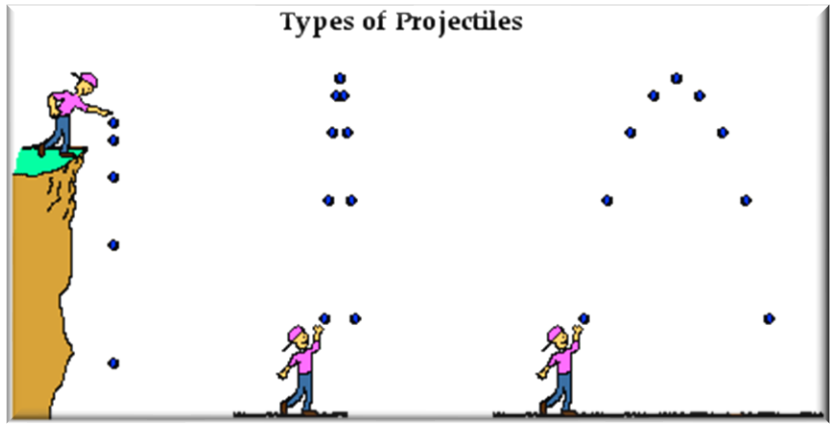
$$u_x = v_x = \frac{s_x}{t}$$

$$s_x = v_x t$$

s_x: Horizontal displacement.
u_x: Horizontal initial velocity.
v_x: Horizontal final velocity.
t : Time.

Vertical motion

Horizontal movement the object was hurl out on unchanged the horizontal movement because resultant force in the horizontal movement acts on the object is zero, by assume air resistance is worth very little until not be calculated.



Vertical Direction Calculations

$$s_y = u_y + gt$$

$$s_y = u_y t + \frac{1}{2} g t^2$$

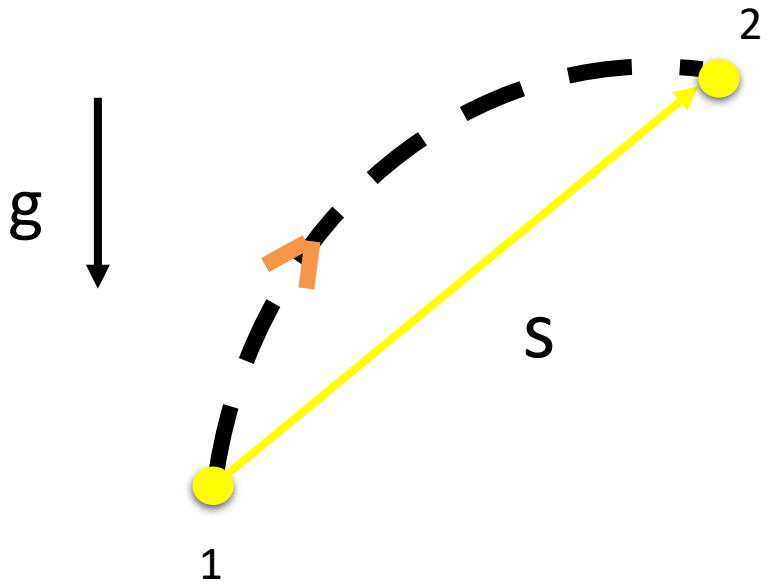
$$v_y^2 = u_y^2 + 2g s_y$$

$$s_y = \left(\frac{u_y + v_y}{2}\right) t$$

s_y: Vertical displacement.
u_y: Vertical initial velocity.
v_y: Vertical final velocity.
g : The value of acceleration where with gravity.
t : Time

Displacement and Velocity of The Object

Displacement and Acceleration of The Object



$\boldsymbol{s_x}$**:** Horizontal displacement of the object measured from the beginning.

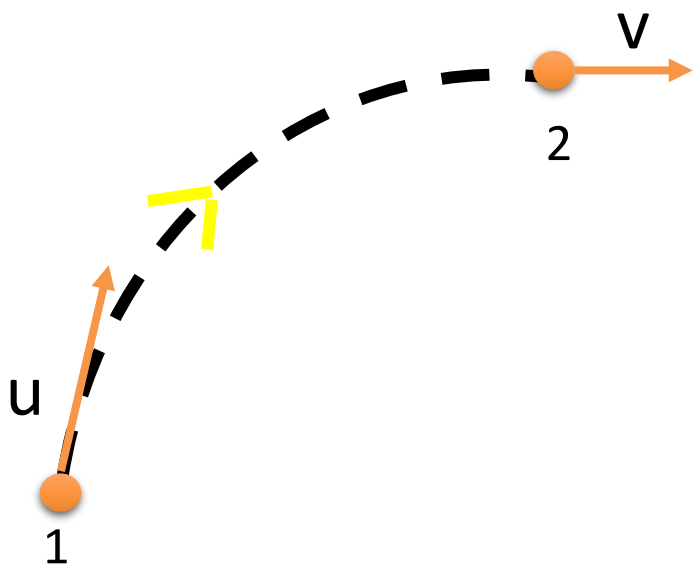
$\boldsymbol{s_y}$**:** Vertical displacement of the object measured from the beginning.

S: Displacement resultant force of the object measured from the beginning.

$$\mathbf{S} = \sqrt{{s_x}^2 + {s_y}^2}$$

$$\tan \propto = \frac{s_y}{s_x}$$

Velocity of the object



$$v = \sqrt{v_x^2 + v_y^2}$$

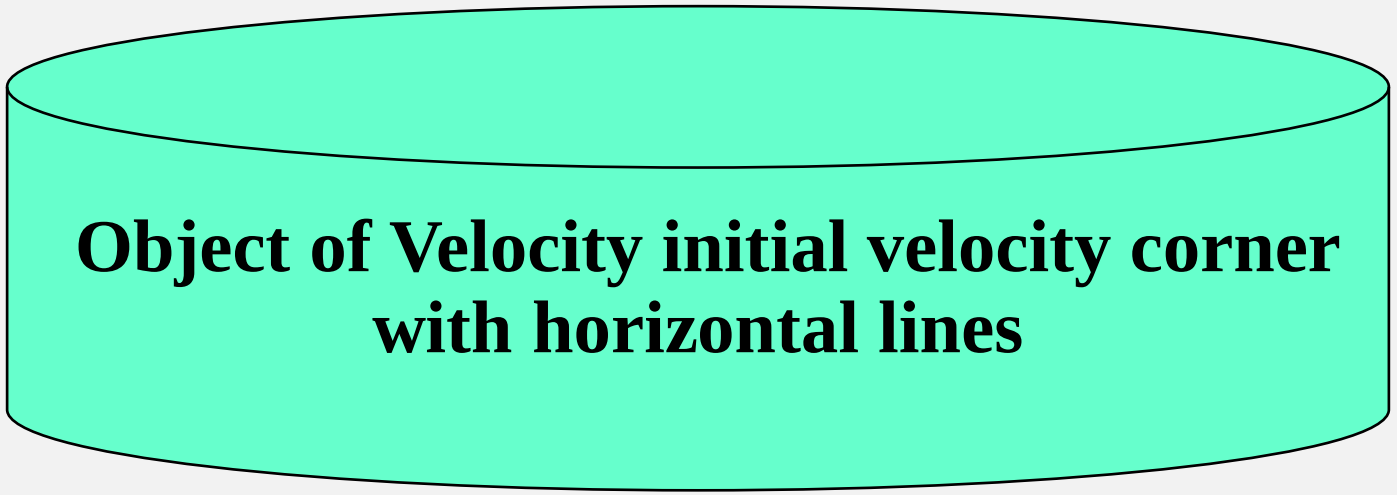
$$\tan\theta = \frac{v_y}{v_x}$$

v_x: Velocity of the object horizontal.

v_y: Velocity of the object vertical.

v: Velocity resultant force of the object in tangent.

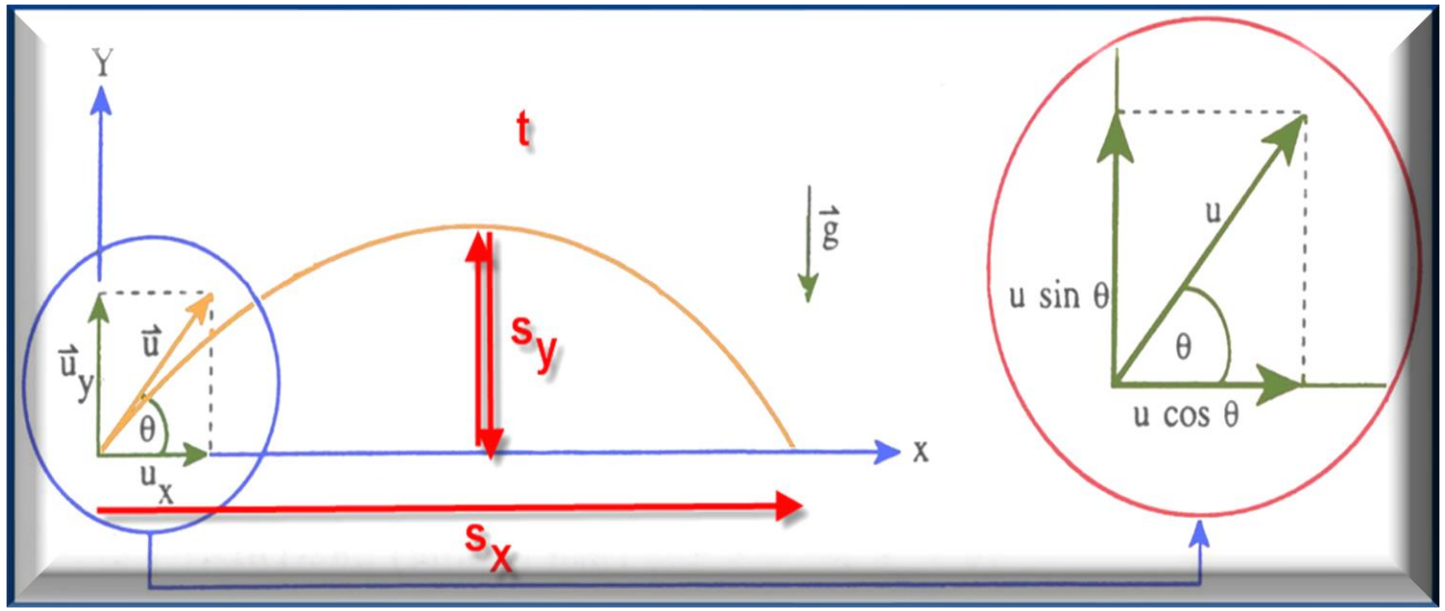
θ: Corner resultant force of the object in tangent do with horizontal.


Object of Velocity initial velocity corner
with horizontal lines

Horizontal

$$s_x = u_x t$$

$$s_x = (u \cos\theta) t$$

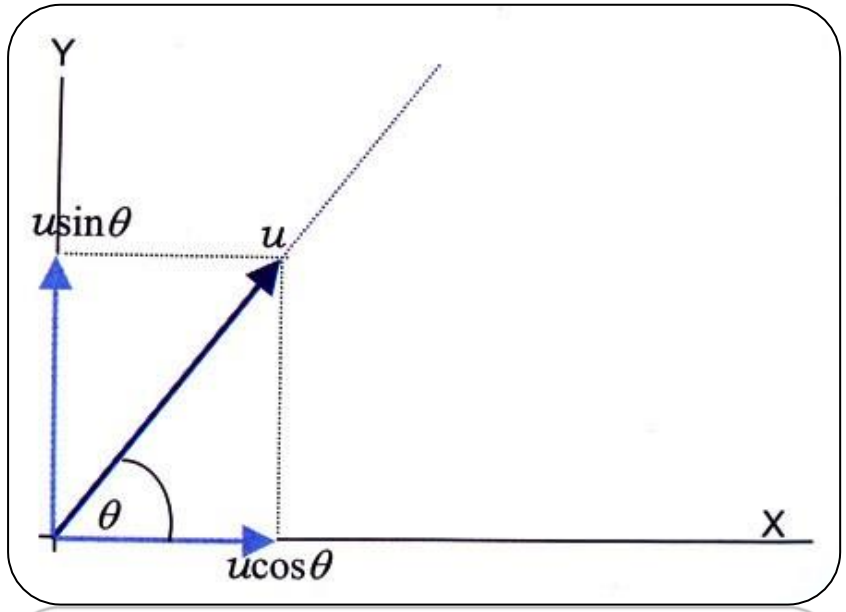


The Horizontal movement

- u_x: The speed in the horizontal streak.
- s_x : The displacement in the horizontal streak.
- t : Time of the movement.

Size displacement in a horizontal streak s_x or the distance an object moving in a horizontal streak from the start until the fall to the same ground level call it **Rang** of object.

Vertical



$$s_y = u_y t + \frac{1}{2} a_y t^2$$

$$s_y = (u \sin\theta)t - \frac{1}{2} g t^2$$

The vertical movement

u_y: The vertical $u_y = U\sin\theta$

a_y: The vertical acceleration equal to -g

s_y: The vertical displacement.

t : Time of the vertical movement equal to time of the horizontal movement.

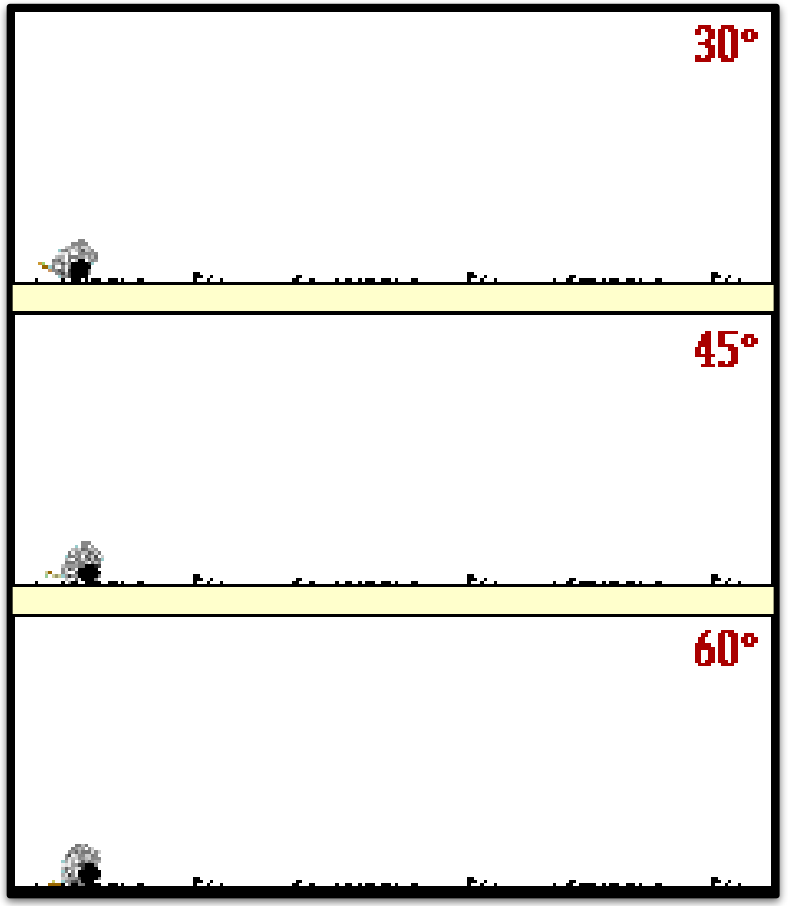
NOTE:

$S_y = 0$

$O = (u \sin\theta - \frac{1}{2} gt)t$

t = 0 :

$t = \frac{2u \sin\theta}{g}$



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