Experiment 3 (M5)

The Horizontal Projectile Motion

1- Purpose

To examine the horizontal projectile motion in the inclined plane

2- Apparatus

Air table set, launcher, wooden block, ruler.

3- Theory

An object, launched horizontally with an initial velocity υ_{ox}, moves under the influence of gravitation. This motion, called as horizontal projectile motion(Fig. 3.1), has two components: one is horizontal component and the other one is vertical component. Horizontal component obeys Newton's 1st Law of Equilibrium and vertical component obeys Newton's 2nd Law of Motion; 1st and 2nd experiments, respectively.

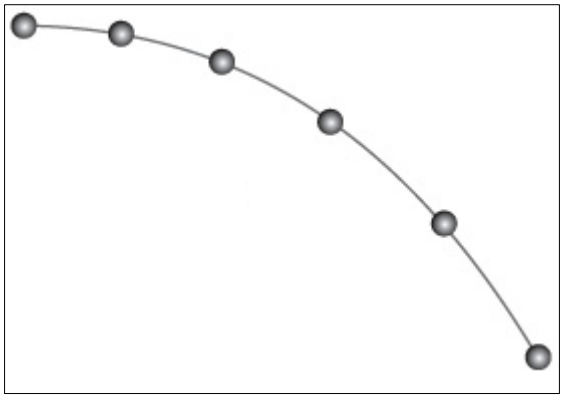

Fig 3.1 path of a horizontal projectile motion

The motion in the horizontal component (say x - axis) has an equation of motion as:

$$x(t) = \vartheta_{ox} \cdot t = \vartheta_{ox} \cdot t$$

$$\text{at } t = 0, \qquad \vartheta_{ox} = \vartheta_o$$

Additionally, the motion in the vertical component (say y - axis) has an equation of motion as:

$$y(t) = \vartheta_{oy} \cdot t + \frac{1}{2} a \cdot t^2 = \frac{1}{2} a \cdot t^2$$

$$\text{at } t = 0, \qquad \vartheta_{oy} = 0$$

If we insert *t* (from Eq. 3.1) into Eq. 3.2, finally we get the equation of motion in vertical component (y - axis) in terms of *x* (displacement in horizontal component):

$$y(x) = \frac{a}{2\vartheta_o^2} x^2$$

4- Procedure

- *Operate air compressor and balance the air table.*
- *Locate the wooden block to the back leg of the air table and find the slope of the air table.*
- *Keep one of the discs (pucks) unmoved at the left (or right) lower side of the air table.*
- *Locate the launcher, whose angle is adjusted to zero, at the right (or left) upper side of the air table.*
- *Put the other disc (puck) to the launcher and practise launching. When you are ready, follow 6th step.*
- *Adjust spark timer (generator) to a proper frequency or period.*
- *Operate again air compressor and launch the disc (puck). Be careful while gethering data (path A): As soon as you launch the disc (puck) push the spark timer (generator) pedal.*
- *Just after you gether horizontal projectile motion data, locate the disc (puck) to the top of the air table and gether the free fall data (path B).*
- *Check out your data if it is proper.*
- *Give numbers to your data points 0,1,…,5 starting from first data point.*
- *Find out x- and y- axes on your data sheet (apply parallel fitting).*
- *Find flight time t_f, range (travelled distance on x - axis) R. Using these two data, calculate the initial velocity of the disc (puck) υ_{ox}.*

- *Starting from zero point show the displacements on y – axis (use dimensioning rules). Record them into table 3.1.*

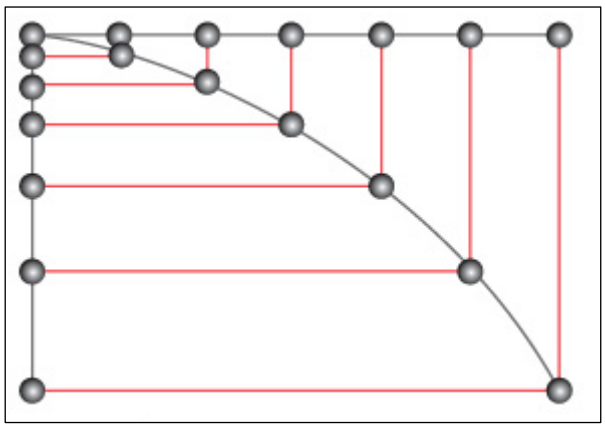

Fig. 3.2 Data dimensioning

- *Determine the accelerations of path A and path B plotting y – t^2 graph, seperately.*
- *Compare these result with teoretical one, 980 cm/s^2.*

5- Data

	B path		A path		
#	x±Δx	y±Δy	y±Δy	t±Δt	t^2 ±Δt^2
0					
1					
2					
3					
4					
5					

Table 3.1 Horizontal projectile motion data

6. Questions

1. *Analyse the motion in x- and y- axes. Which type of motion does the disc follow?*