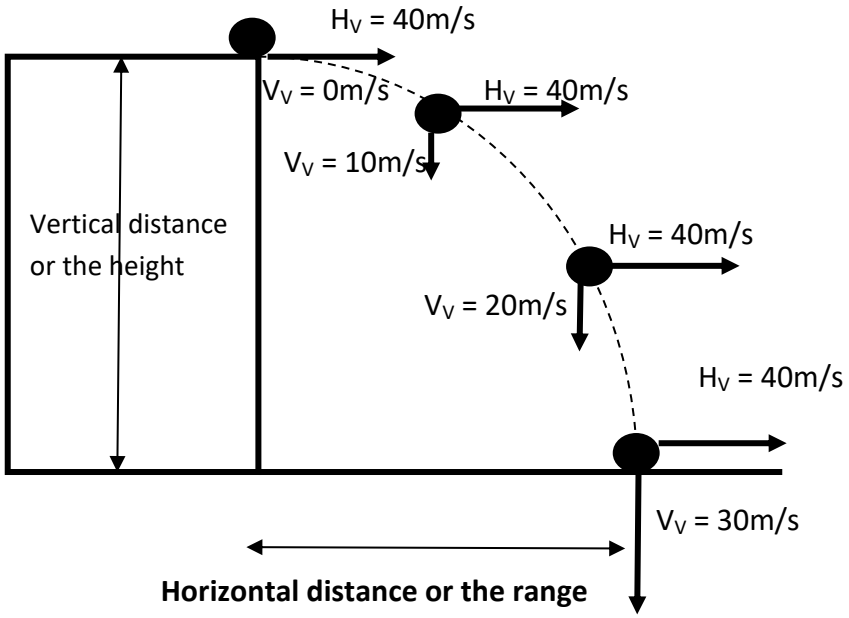
PENANG SANGAM HIGH SCHOOL
YEAR 12 PHYSICS
WEEK 14

Strand	MECHANICS
Sub Strand	Kinematics
Content Learning Outcome	At the end of the lesson students should be able to • Apply the 3 kinematic equations to solve projectile motion problems

Horizontally launched projectiles

Horizontally launched projectiles

here the object has an initial horizontal velocity. The vertical velocity at the start is 0m/s



a. Throughout the motion the horizontal velocity remains the same
b. The vertical velocity at the start is 0m/s and increases throughout the motion

c. To find the time of flight we will use

$$\mathbf{d = V_I\, t + \tfrac{1}{2}\, a\, t^2}$$

Where s is the vertical distance or the height and v_i must be the initial vertical velocity. (remember the velocity substituted in the formula must be in the same line as the distance)

d. To find the vertical velocity at any point use the formula

$V_F = V_I + at$

e. To find the range use the formula

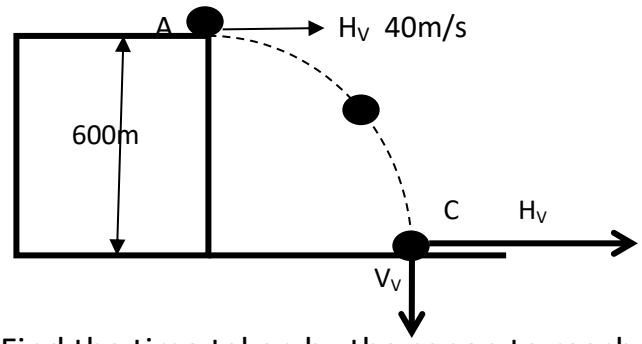
R = H_V x total time

f. At any point of the projectile there are two types of velocity ie vertical and horizontal. To find the velocity at any point use

Velocity = H_V + V_V both are vectors so put the direction and then use vector addition.

Eg. A canon is fired horizontally from a cliff at 40m/s.

V_V at start is 0m/s



a. Find the time taken by the canon to reach the bottom

$d = v_i t + \frac{1}{2} a t^2$ (d = 600m in the vertical direction, a = 10m/s^2 since object is moving down , v_i should be taken as zero since the distance put is the vertical distance therefore v_i should be the initial vertical velocity)

600 = 0(t) + ½ (10) t^2

600 = 5 t^2

600/5 = t^2

120 = t^2

t = 10.95s

b. Find the range

$$range = H_V \; x \; t.t$$

= 40 X 10.95

= 438m

c. Find the vertical velocity of the canon at the bottom

$$v_f = v_i + at$$

= 0 + 10 (10.95)

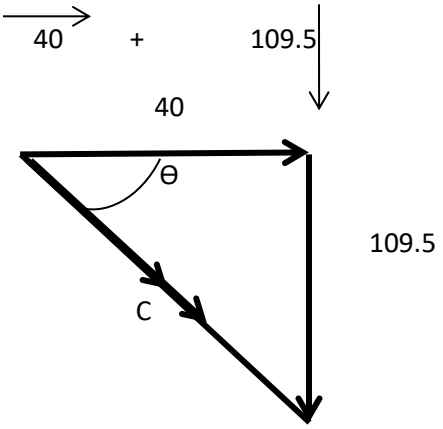
= 109.5 m/s ↓

d. What is the horizontal velocity at the bottom.
   The horizontal velocity remains same throughout the motion therefore is $\overrightarrow{40m/s}$

e. Find the velocity at the bottom
   Since there is both velocities at the bottom that is vertical and horizontal , add the two using vector addition. Remember velocity is a vector quantity.

Velocity at the bottom = H_V + V_V

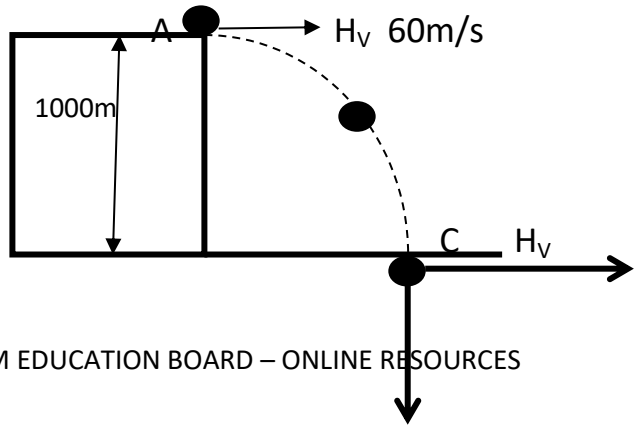
= $\overrightarrow{40}$ + 109.5 ↓



Find the size of C using Pythagoras theorem and find the angle

1. A canon is fired horizontally from a cliff at 60m/s.

V_V at start is 0m/s



V_V

a. Find the time taken by the canon to reach the bottom

$$d = v_i t + \frac{1}{2} a t^2$$

b. Find the range

$$range = H_V \; x \; t.t$$

c. Find the vertical velocity of the canon at the bottom

$$v_f = v_i + at$$

d. What is the horizontal velocity at the bottom.
The horizontal velocity remains same throughout the motion therefore is

e. Find the velocity at the bottom
Since there is both velocities at the bottom that is vertical and horizontal , add the two using vector addition. Remember velocity is a vector quantity.

Velocity at the bottom = H_V + V_V

= +

Find the size of C using Pythagoras theorem and find the angle