Projectiles

Vertical Motion

SUVAT formula

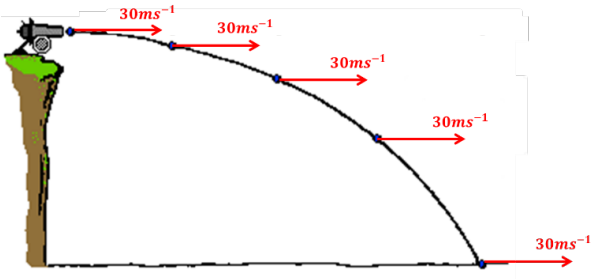
S = vertical displacement
U_v = vertical component of U
V_v = vertical component of V
A = -9.8
T = **time**

Horizontal Motion

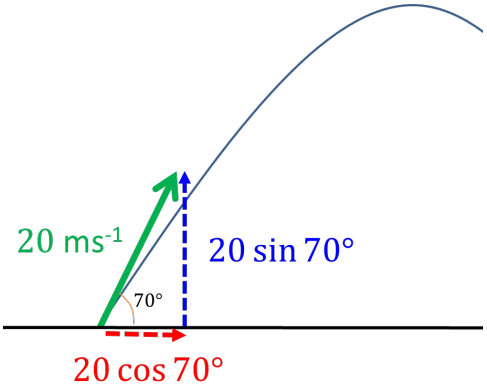
$$Speed = \frac{Distance}{Time}$$

Distance = horizontal displacement
Speed = horizontal component
Time = **time**

Horizontal speed will remain constant.

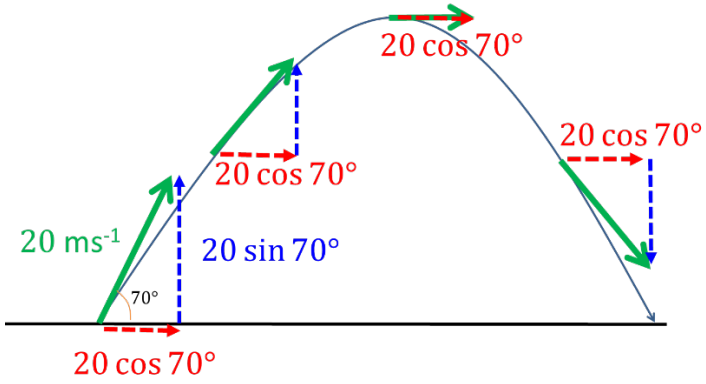


Breakdown speeds at given points into vertical and horizontal components



Maximum Height

The vertical speed will be zero.



Solving

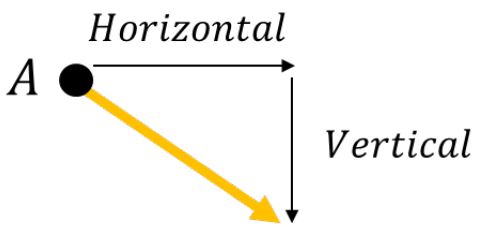
Resolve Vertically
and
Resolve Horizontally

Velocity at a Point

Find the horizontal velocity at point A

Find the vertical velocity at point A

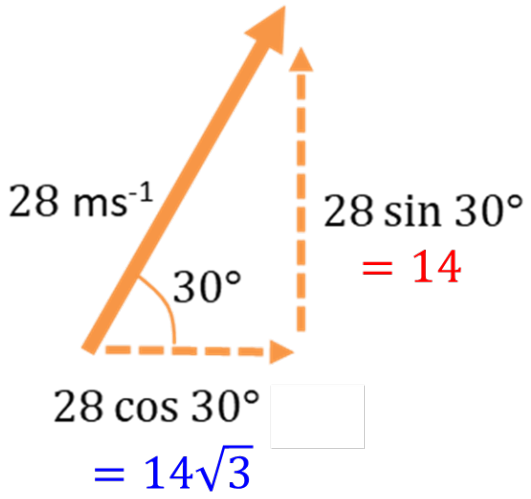
Then find the resultant velocity at point A using Pythagoras.



$$\sqrt{(Horizontal)^2 + (Vertical)^2}$$

Example:

A particle P is projected from a point O on a horizontal plane with speed 28 ms^{-1} and with angle of elevation $30°$. After projection, the particle moves freely under gravity until it strikes the plane at a point A.
Find:
a) the greatest height above the plane reached by P
b) the time of flight of P
c) the distance OA



Vertical

S =

U = 14

V = 0

A = −9.8

T =

Horizontal

Distance =

Speed = $14\sqrt{3}$

Time =

a) *Resolve Vertial*

$v^2 = u^2 + 2as$

$0 = 14^2 + 2 \times (-9.8) \times s$

$s = 10$

b) *Resolve Vertical*

S = 0

U = 14

V = 0

A = −9.8

T =

$s = ut + \frac{1}{2}at^2$

$0 = 14t - 4.9t^2$

$t = 2.857$

c) *Resolve Horizontial*

Distance =

Speed = $14\sqrt{3}$

Time = 2.857

Distance = Speed x Time

$= 28 \cos 30° \times 2.857$

$= 69.28$