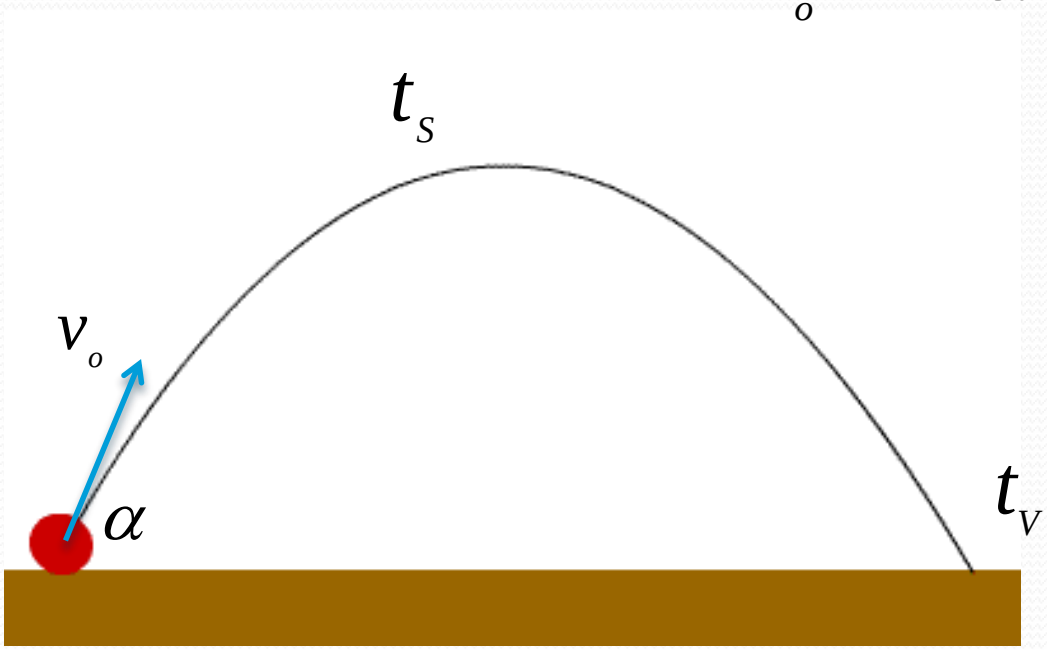
LANZAMIENTO INCLINADO

Tiempo de Vuelo

$$v_Y = v_{oY} - g\,t \qquad v_Y = v_o\,Sen\,\alpha - g\,t$$

$$v_{oY} = v_o\,Sen\,\alpha$$

$$0 = v_o\,Sen\,\alpha - g\,t_S \qquad t_S = \frac{v_o Sen\,\alpha}{g}$$



$$t_V = 2t_S$$

$$t_o = 0\,[s]$$

$$t_V = \frac{2\,v_o Sen\,\alpha}{g}$$

EJEMPLO

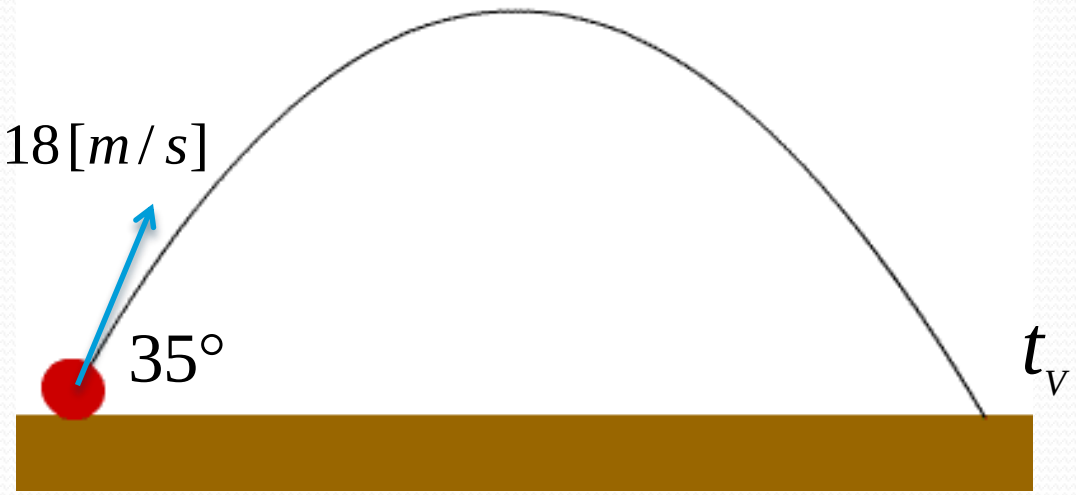
$sen\ 35° = 0{,}574$

2. Un bateador golpea la pelota con un ángulo de 35° y le proporciona una velocidad de 18 [m/s]. ¿ Cuánto tarda la pelota en llegar al suelo ?

2,1 [s] ;

$$t_V = \frac{2\, v_o Sen\, \alpha}{g}$$

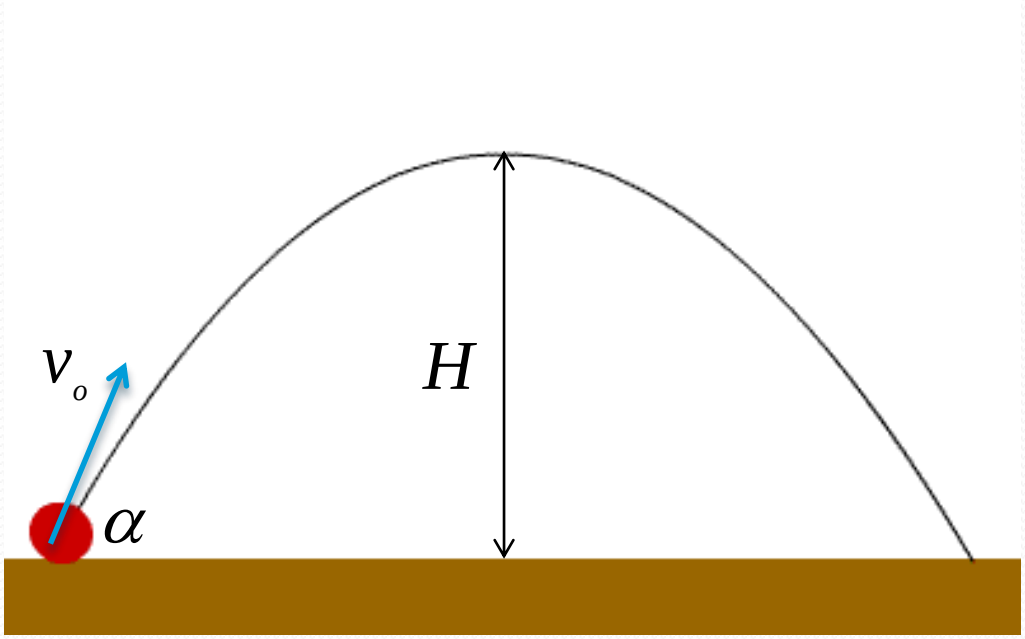
$$t_V = \frac{2.19.Sen\ 35°}{10}$$



$$t_V = \frac{2.19.0{,}574}{10}$$

$$t_V = 2{,}18\,[s]$$

Altura Máxima



$$v_Y^{\,2} = v_{oY}^{\,2} - 2\,g\,y$$

$$0 = v_{oY}^{\,2} - 2\,g\,H \quad 1$$

$$v_{oY} = v_o\,Sen\,\alpha \quad 2$$

2 en 1

$$0 = (v_o\,Sen\,\alpha)^2 - 2\,g\,H$$

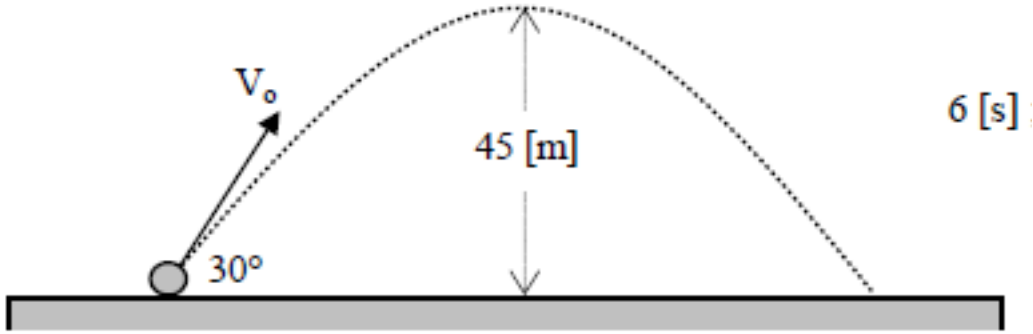
$$2\,g\,H = v_o^{\,2} Sen^2\alpha$$

$$H = \frac{v_o^{\,2} Sen^2\alpha}{2\,g}$$

EJEMPLO

$sen\,30° = 0{,}5$

16. Halla el tiempo de vuelo y la velocidad inicial "Vo".



$$t_V = \frac{2\,v_o Sen\,\alpha}{g}$$

$$H = \frac{v_o^{\,2} Sen^2 \alpha}{2\,g}$$

$$45 = \frac{v_o^{\,2}\,(0{,}5)^2}{20}$$

$$t_V = \frac{2\,.60.Sen\,30°}{10}$$

$$45 = \frac{v_o^{\,2} Sen^2 30°}{2\,.10}$$

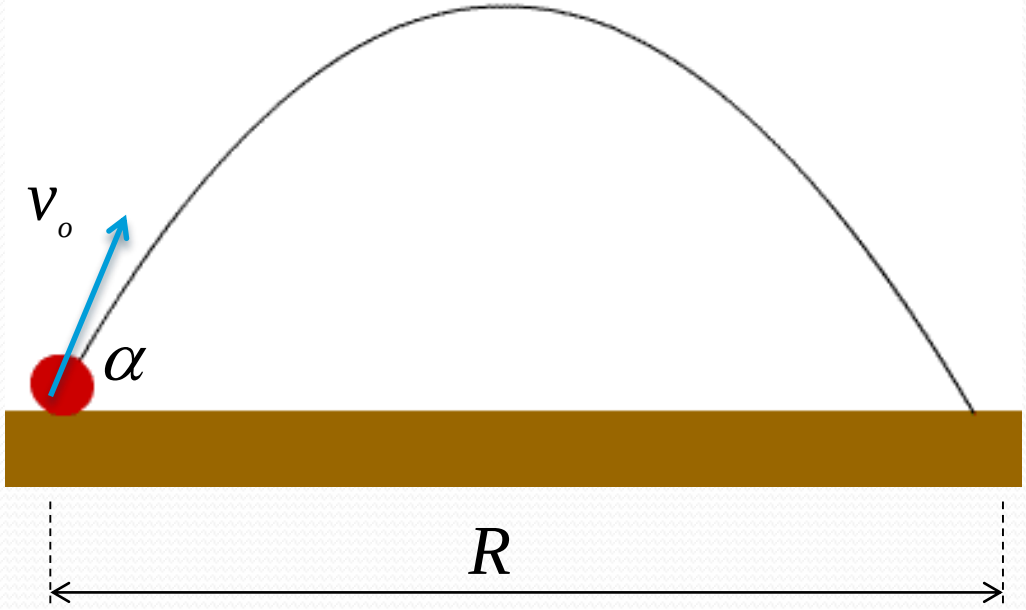
$$v_o = 60\,[m/s]$$

$$t_V = 6\,[s]$$

Alcance Máximo

$$x = v_X t \qquad R = v_X t_V \quad 1$$

$$Sen\ 2\alpha = 2 Sen\ \alpha\ Cos\ \alpha$$



$$v_X = v_o\ Cos\ \alpha \quad 2$$

$$t_V = \frac{2\, v_o Sen\ \alpha}{g} \quad 3$$

2 y 3 en 1

$$R = (v_o\ Cos\ \alpha)\ \frac{2\, v_o Sen\ \alpha}{g}$$

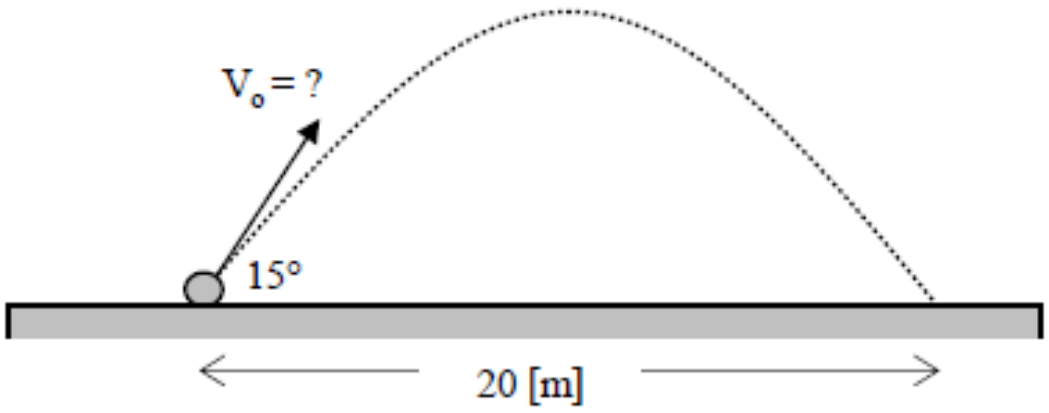
$$R = \frac{2\, v_o^{\,2}\ Sen\ \alpha\ Cos\ \alpha}{g}$$

$$R = \frac{v_o^{\,2}\ Sen\ 2\,\alpha}{g}$$

EJEMPLO

9. A partir del dibujo , calcular la velocidad inicial " Vo ".

$sen\ 30° = 0{,}5$



$$R = \frac{v_o^{\ 2}\ Sen\ 2\,\alpha}{g}$$

$$20 = \frac{v_o^{\ 2}\ Sen\ 2\,.15°}{10} \qquad 20 = \frac{v_o^{\ 2}\ Sen\ 30°}{10} \qquad 200 = v_o^{\ 2}.0{,}5$$

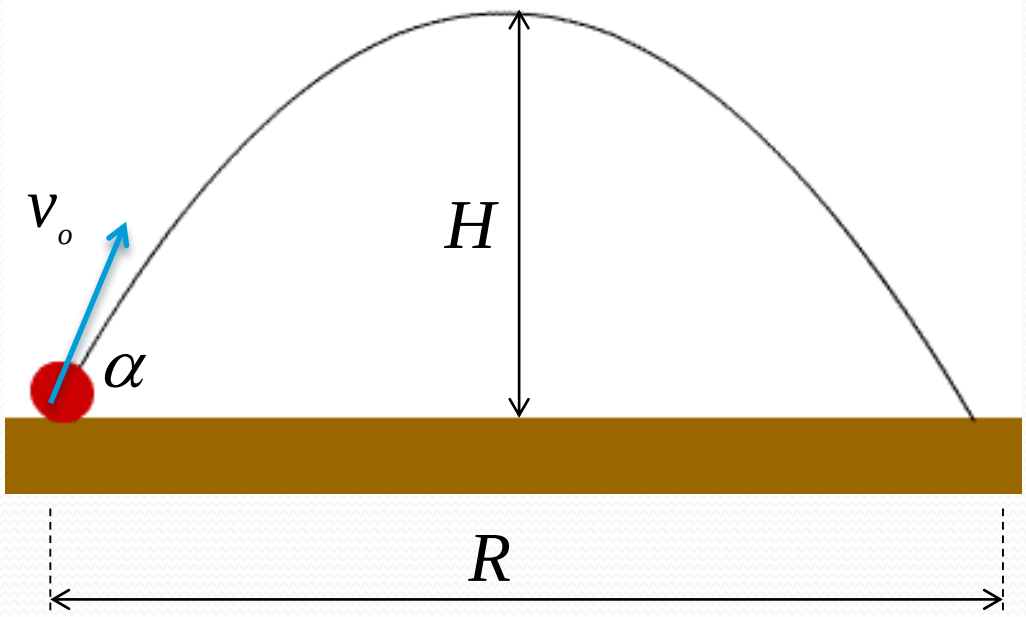
$$v_o = \sqrt{\frac{200}{0{,}5}} \qquad v_o = \sqrt{400}$$

$$v_o = 20\,[m/s]$$

Relación : H y R

$$R = \frac{2 v_o^2 \, Sen\,\alpha \, Cos\,\alpha}{g} \quad 1$$

$$Tg\,\alpha = \frac{sen\,\alpha}{\cos\alpha}$$



$$H = \frac{v_o^2 Sen^2\alpha}{2\,g} \quad 2$$

2 / 1

$$\frac{H}{R} = \frac{\dfrac{v_o^2 sen^2\alpha}{2\,g}}{\dfrac{2\,v_o^2 sen\,\alpha\,\cos\alpha}{g}}$$

$$\frac{H}{R} = \frac{sen\,\alpha}{4\cos\alpha}$$

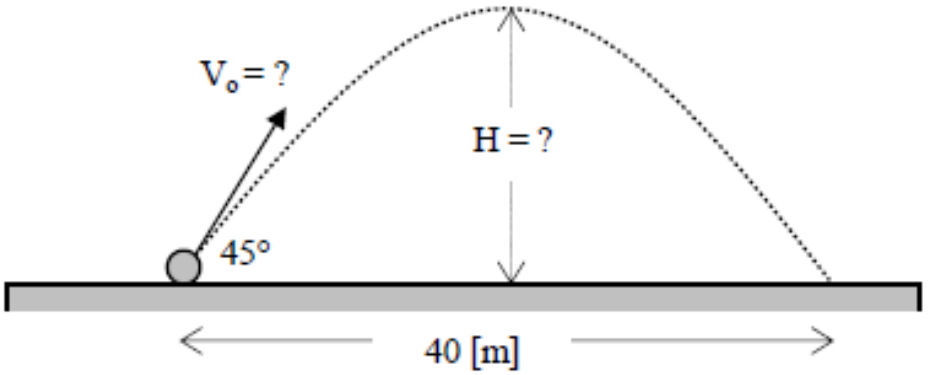
$$\frac{H}{R} = \frac{Tg\,\alpha}{4}$$

$$Tg\,\alpha = \frac{4\,H}{R}$$

EJEMPLO

$Tg\ 45° = 1$ $\quad sen\ 45° = \frac{\sqrt{2}}{2}$ $\quad sen\ 45° = 0{,}707$

10. Calcular la altura máxima " H " y la velocidad inicial " Vo ".



10 [m] ; 20 [m/s]

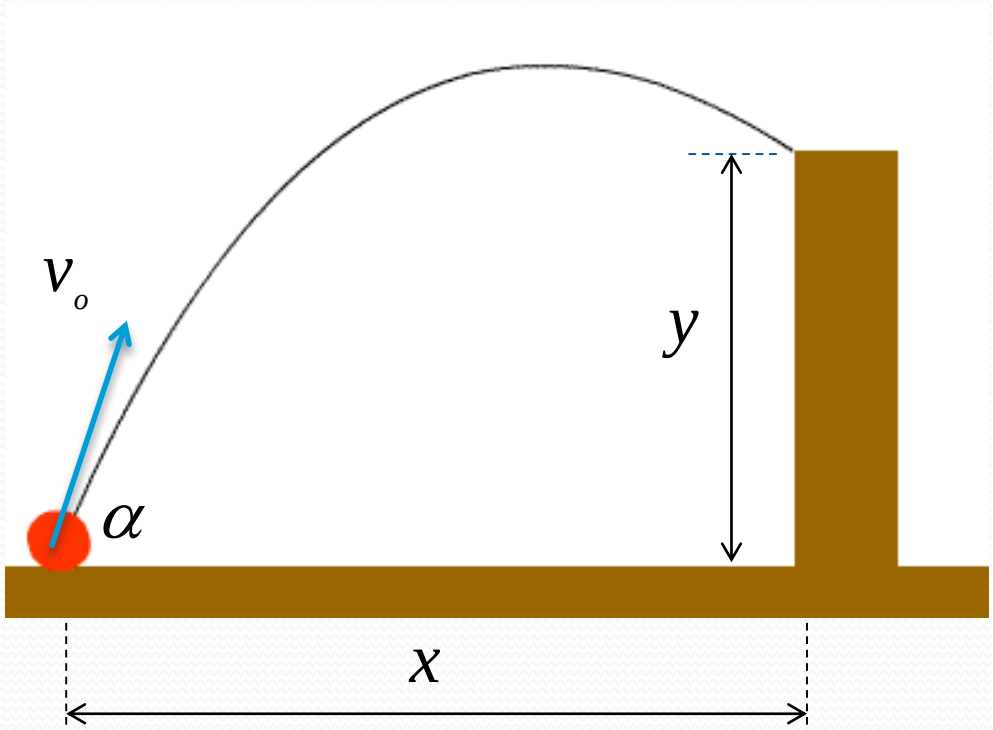
$$H = \frac{v_o^{\ 2} Sen^2 \alpha}{2\,g}$$

$$Tg\ \alpha = \frac{4\,H}{R} \qquad Tg\ 45° = \frac{4\,H}{40} \qquad 1 = \frac{4\,H}{40} \Rightarrow \boxed{H = 10\,[m]}$$

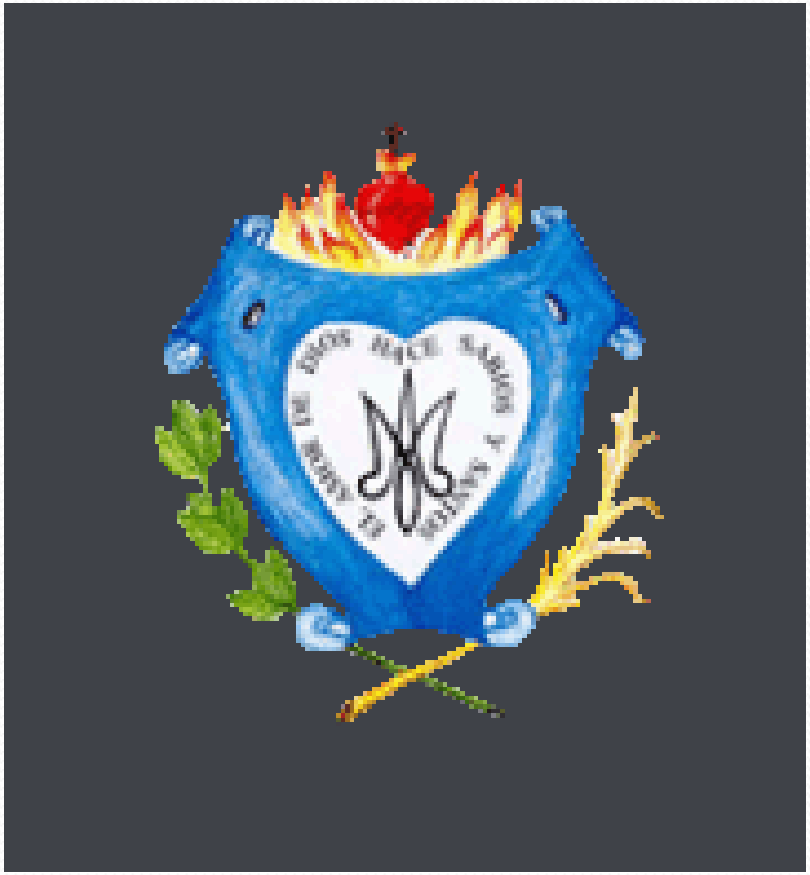
$$10 = \frac{v_o^{\ 2} Sen^2 45°}{2.10} \qquad 10 = \frac{v_o^{\ 2} \left(\frac{\sqrt{2}}{2}\right)^2}{20} \qquad v_o = \sqrt{400} \Rightarrow \boxed{v_o = 20\,[m/s]}$$

Ecuación de la Trayectoria

$$y = (tg\ \alpha)\ x - \frac{g}{2\,v_o^{\,2}\cos^2\alpha}\,x^2$$



EJEMPLO

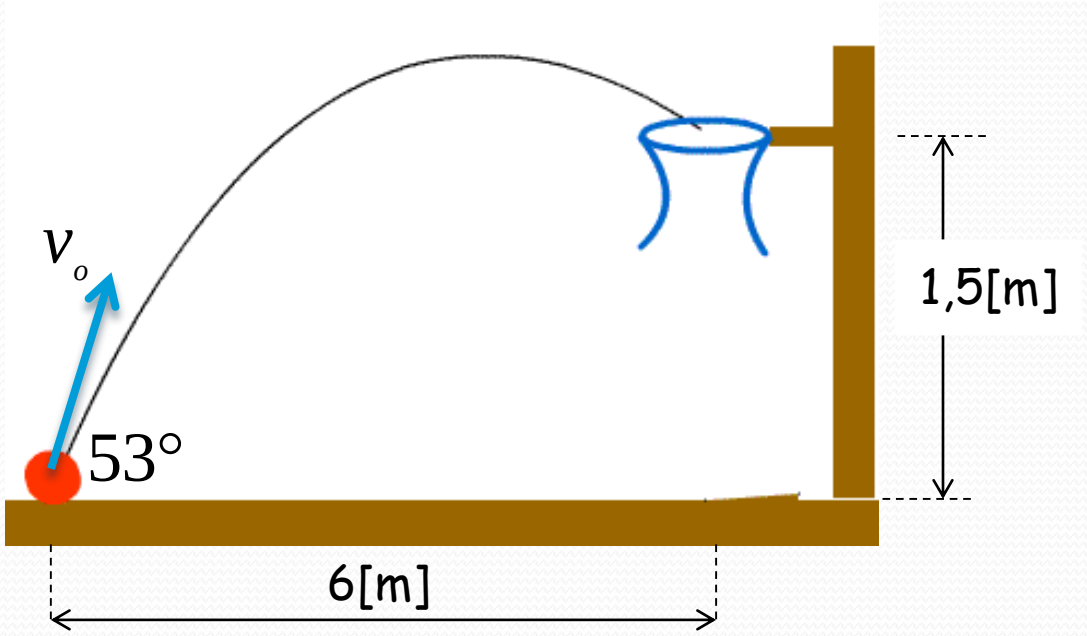


EJEMPLO

8,77 [m/s]

$tg\,53° = 4/3 \qquad \cos 53° = 3/5$

20. ¿ Con qué velocidad inicial se debe lanzar para que pase por el centro del aro ?



$$y = (tg\,\alpha)\,x - \frac{g}{2\,v_o^{\,2}\cos^2\alpha}\,x^2$$

$$1{,}5 = \frac{4}{3}\,6 - \frac{180}{v_o^{\,2}(3/5)^2}$$

$$1{,}5 = 8 - \frac{180}{v_o^{\,2}(9/25)}$$

$$1{,}5 = 8 - \frac{500}{v_o^{\,2}} \qquad \frac{500}{v_o^{\,2}} = 6{,}5$$

$$1{,}5 = (tg\,53°)\,6 - \frac{10}{2\,v_o^{\,2}\cos^2 53°}\,6^2$$

$$v_o = \sqrt{\frac{500}{6{,}5}}$$

$$v_o = 8{,}77\,[m/s]$$

Lanzamiento Inclinado

Jorge Cabrera