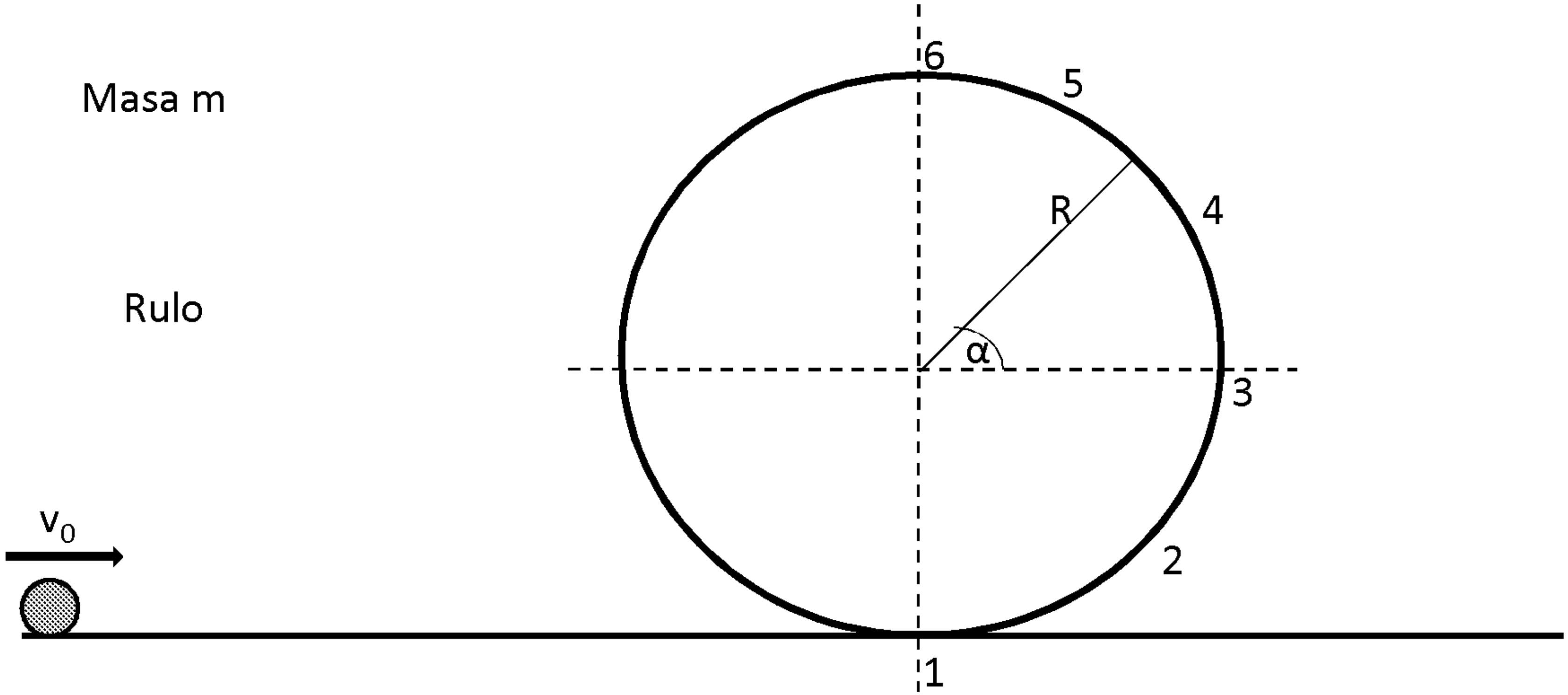
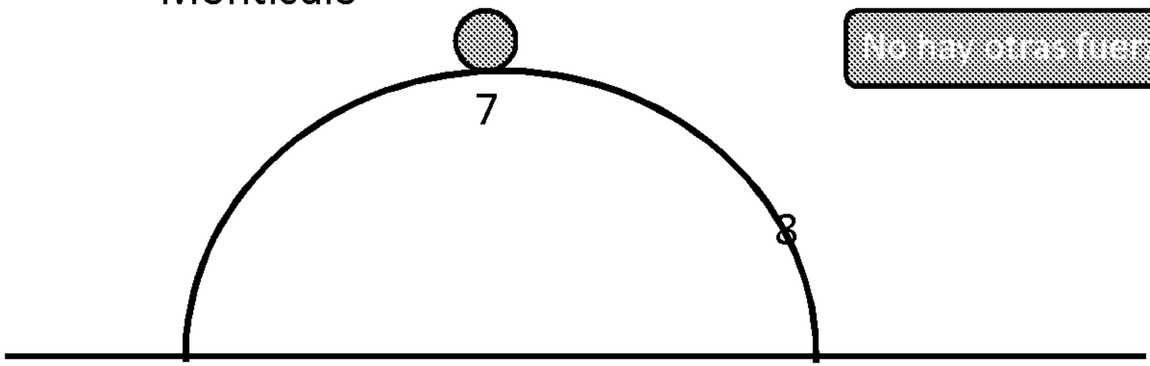
Masa m

Rulo



Montículo



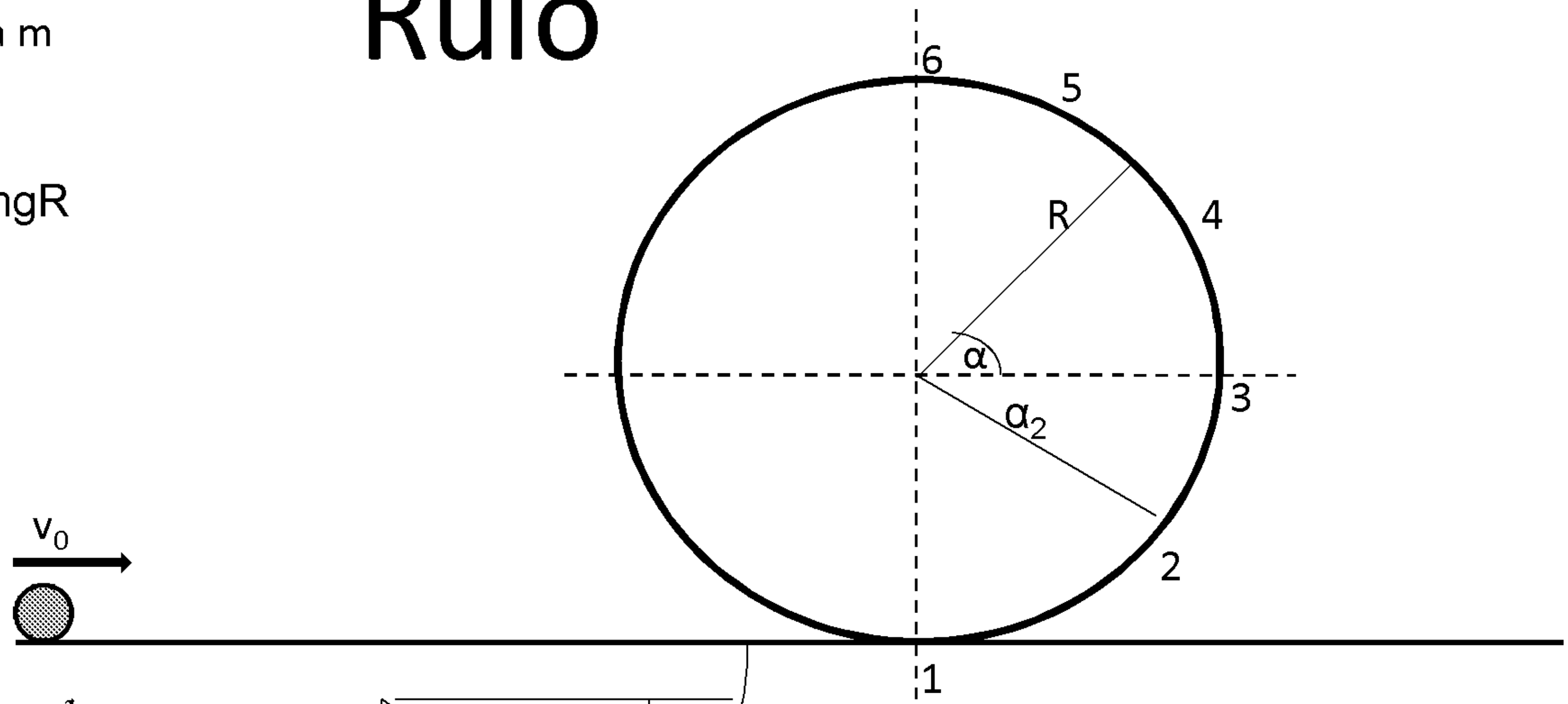
No hay pérdidas de energía por rozamiento

No hay otras fuerzas disipativas

Masa m

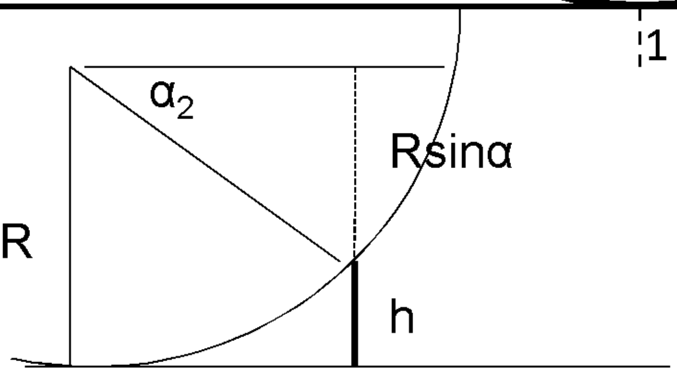
Rulo

$E<mgR$



$$E_0=\frac{1}{2}mv_0^2$$

$$E_2=mgh_2$$



$h_2 = R(1-\sin\alpha_2)$

α_2 en módulo

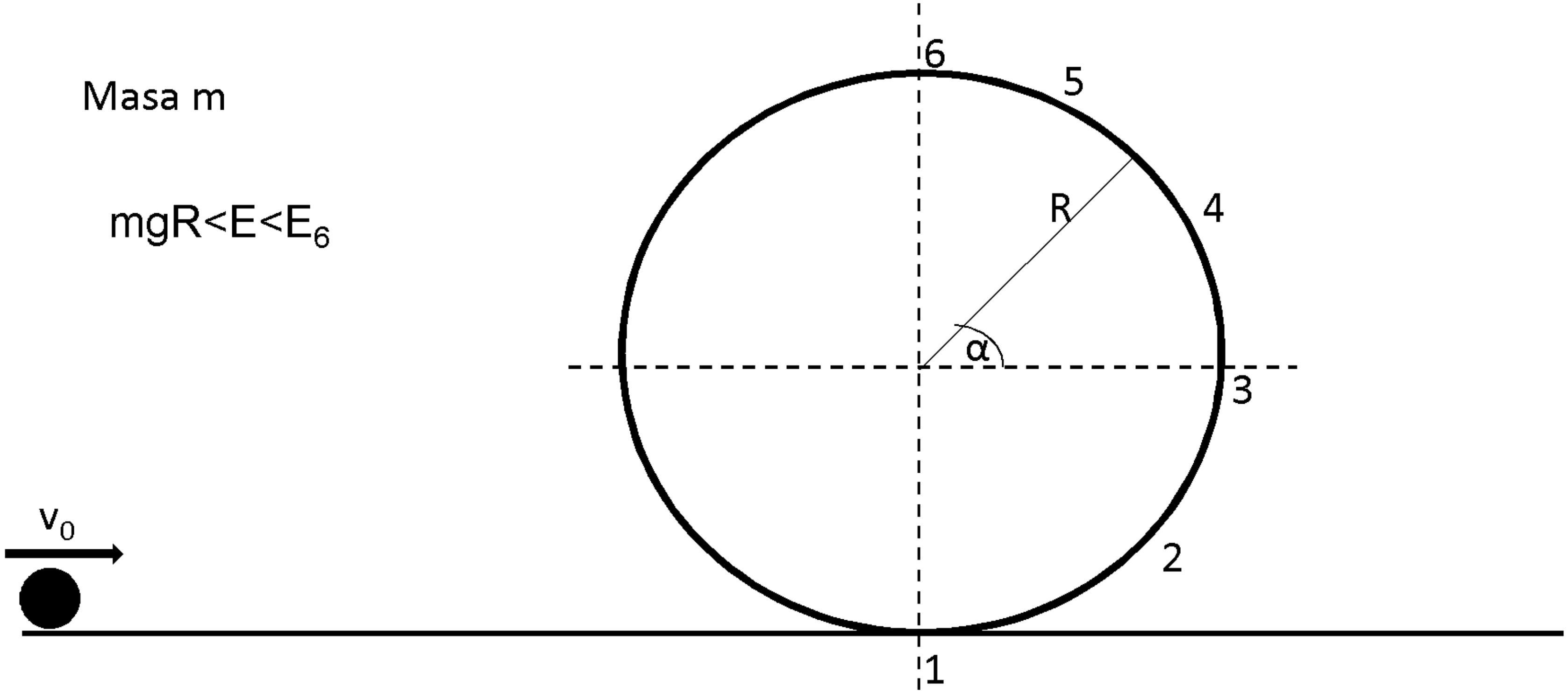
$$\frac{1}{2}mv_0^2=mgh_2$$

$$v_0=\sqrt{2gR(1-\sin\alpha)}$$

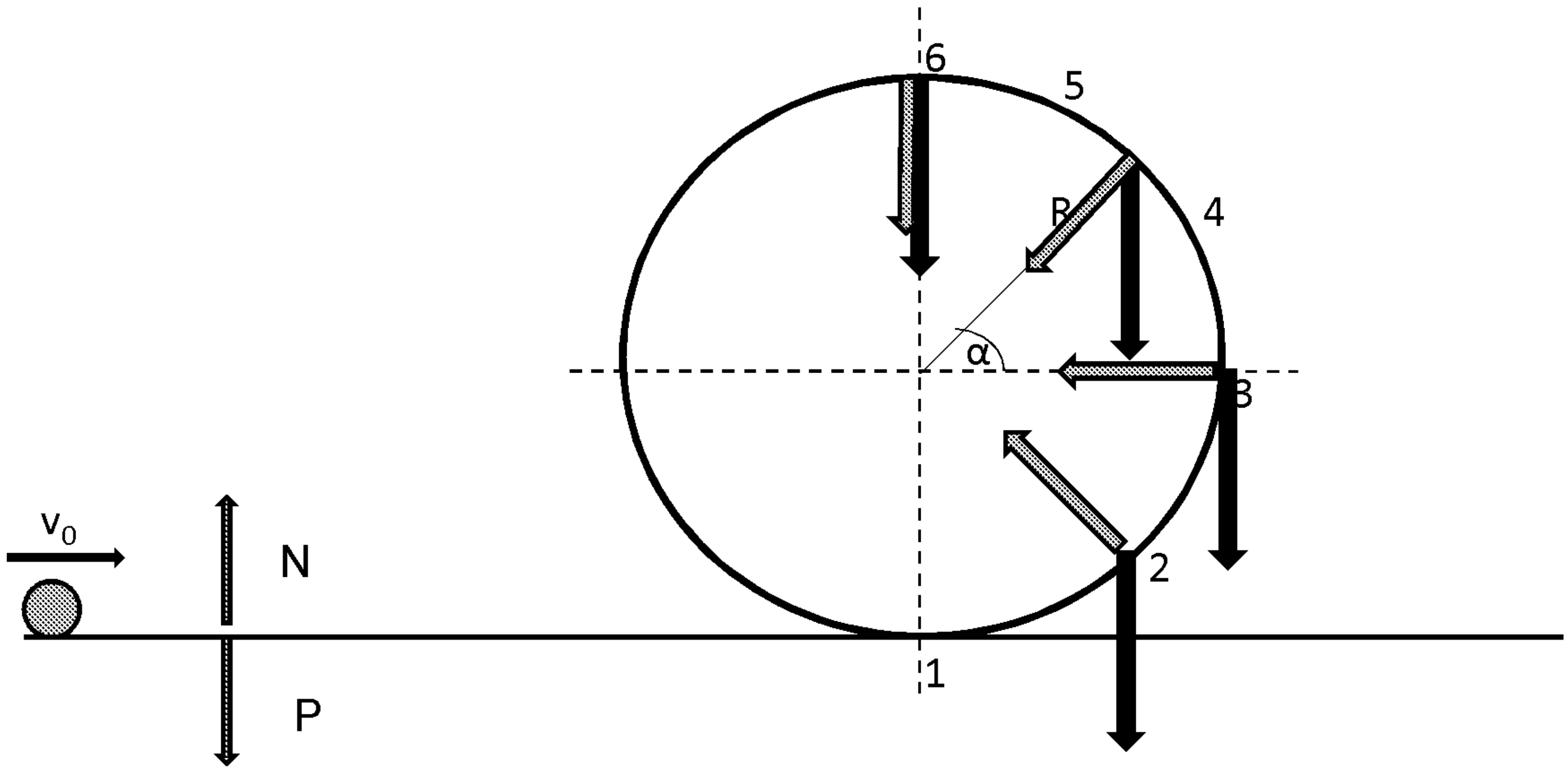
Rulo

Masa m

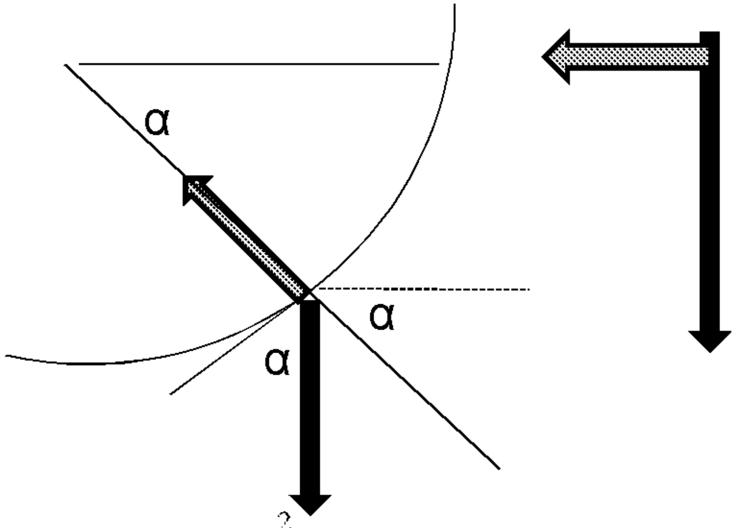
$mgR<E<E_6$



Fuerzas que actúan

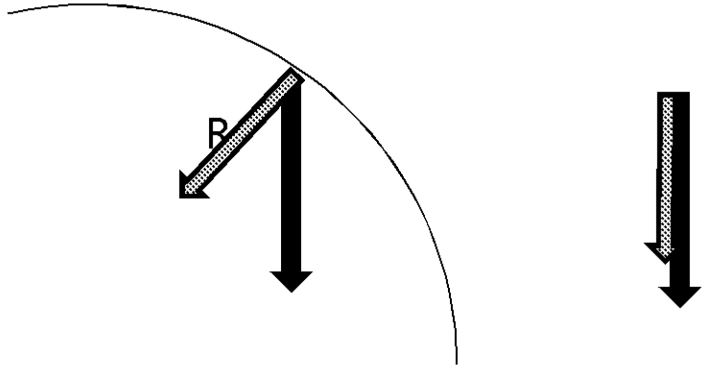


2do principio de Newton



$$N\text{-}P\sin(\alpha)=m\frac{v^2}{R}$$

$$P\cos(\alpha)=ma_t$$



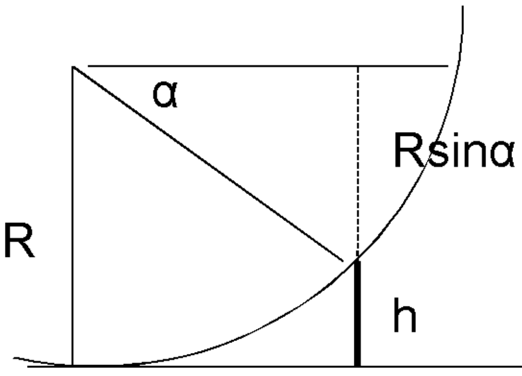
$$N+P\sin(\alpha)=m\frac{v^2}{R}$$

$$P\cos(\alpha)=ma_t$$

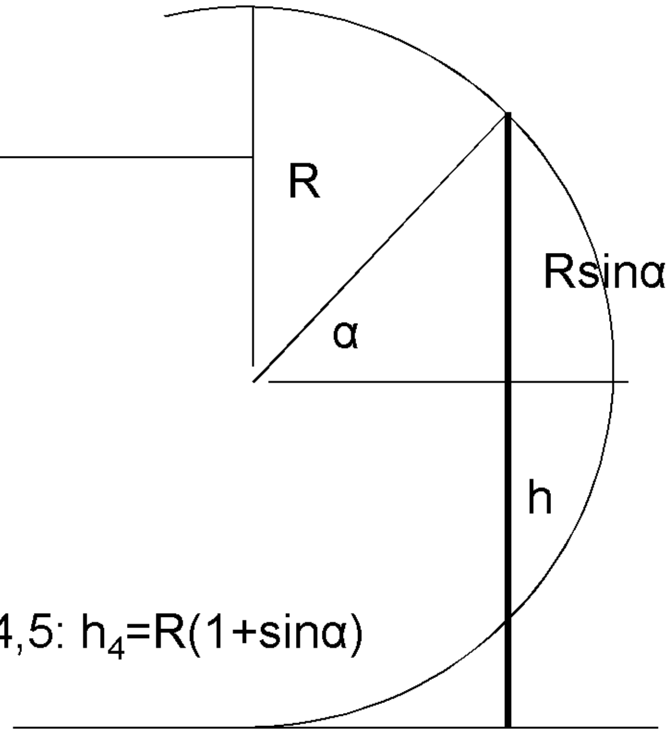
Altura en función del ángulo

0: $h_1=0$ v_1

1: idem 0



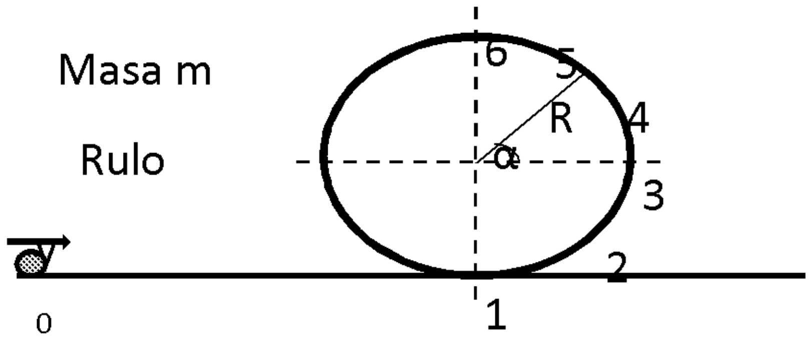
2: $h_2=R(1-\sin\alpha)$



4,5: $h_4=R(1+\sin\alpha)$

Masa m

Rulo



Energía

0: $E_0 = \frac{1}{2} m v_0^2$

En todos los demás sitios:

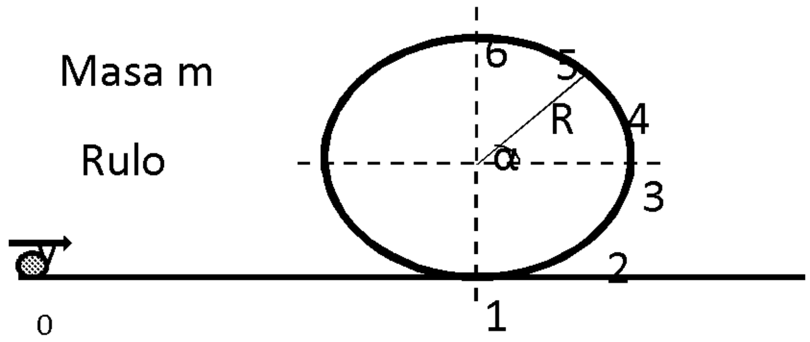
$$E = \frac{1}{2} m v^2 + mgh$$

h=R(1+sinα)

$$\frac{1}{2} m v_0^2 = \frac{1}{2} m v^2 + mgR(1+\sin\alpha)$$

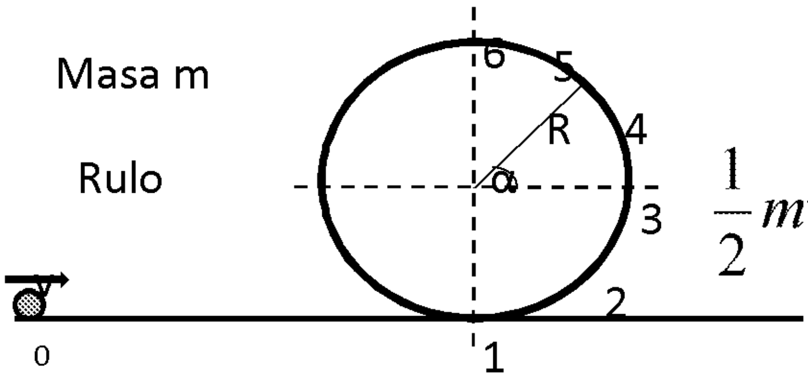
$$\mathrm{N+Psin(\alpha)=m}\frac{\mathrm{v}^2}{\mathrm{R}} \qquad \mathrm{mv}^2 = R[\mathrm{N+Psin(\alpha)}]$$

$$\frac{1}{2} m v_0^2 = \frac{1}{2} R[\mathrm{N+m\,g\,sin(\alpha)}] + m\,g\,R(1+\sin\alpha)$$



Masa m

Rulo



$$\frac{1}{2}mv_0^2=\frac{1}{2}R[\mathrm{N}+\mathrm{m\,g}\sin(\alpha)]+m\,g\,R(1+\sin\alpha)$$

Reordenando la ecuación:

$$\frac{1}{2}mv_0^2=\frac{1}{2}RN+mgR\left(1+\frac{3}{2}\sin\alpha\right)$$

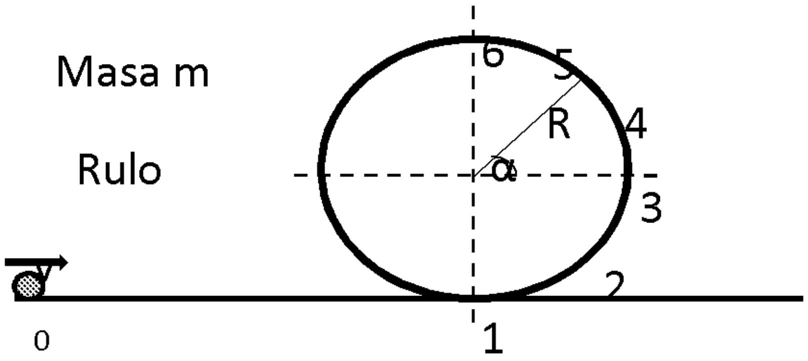
$$E_0=\frac{1}{2}RN+mgR\left(1+\frac{3}{2}\sin\alpha\right)$$

a) E_0:=2mgR

$$mgR=\frac{1}{2}RN+mgR\left(\frac{3}{2}\sin\alpha\right)$$

Se despega de la trayectoria si N=0:

$$\sin(\alpha)=\frac{2}{3}\rightarrow\alpha=41,81^\circ$$



¿Con qué energía llega a 6?

$$E_0 = \frac{1}{2} RN + mgR\left(1 + \frac{3}{2}\sin\alpha\right)$$

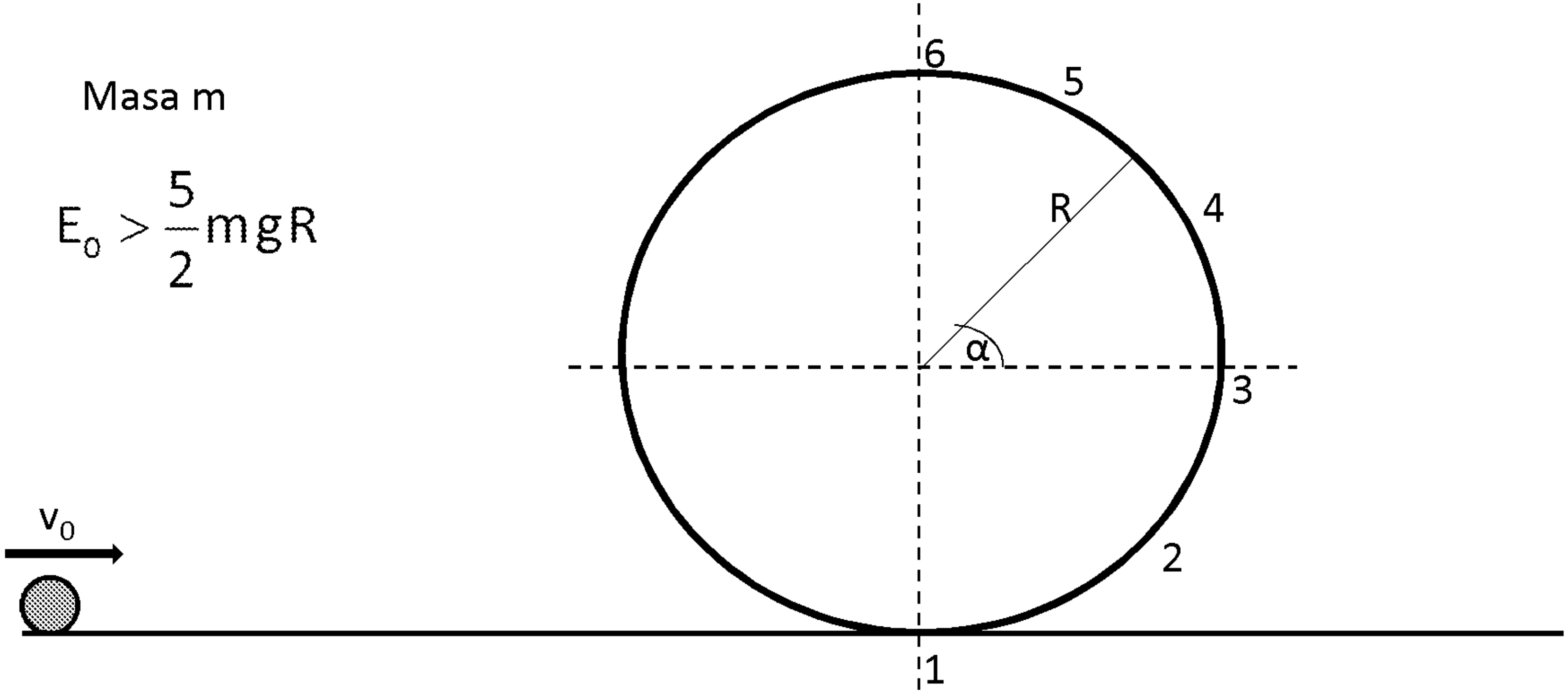
a) $\alpha = 90°$ $$E_0 = \frac{1}{2} RN + mgR\left(1 + \frac{3}{2}\right)$$

b) $N = 0$ $$E_0 = \frac{5}{2} mgR$$

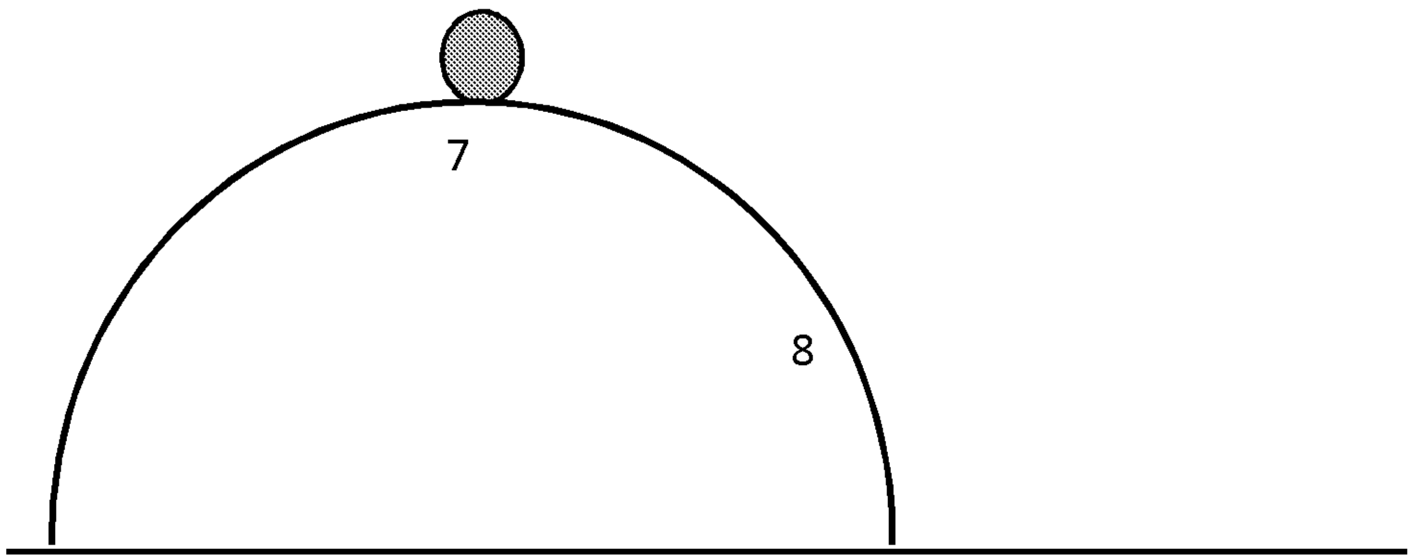
Rulo

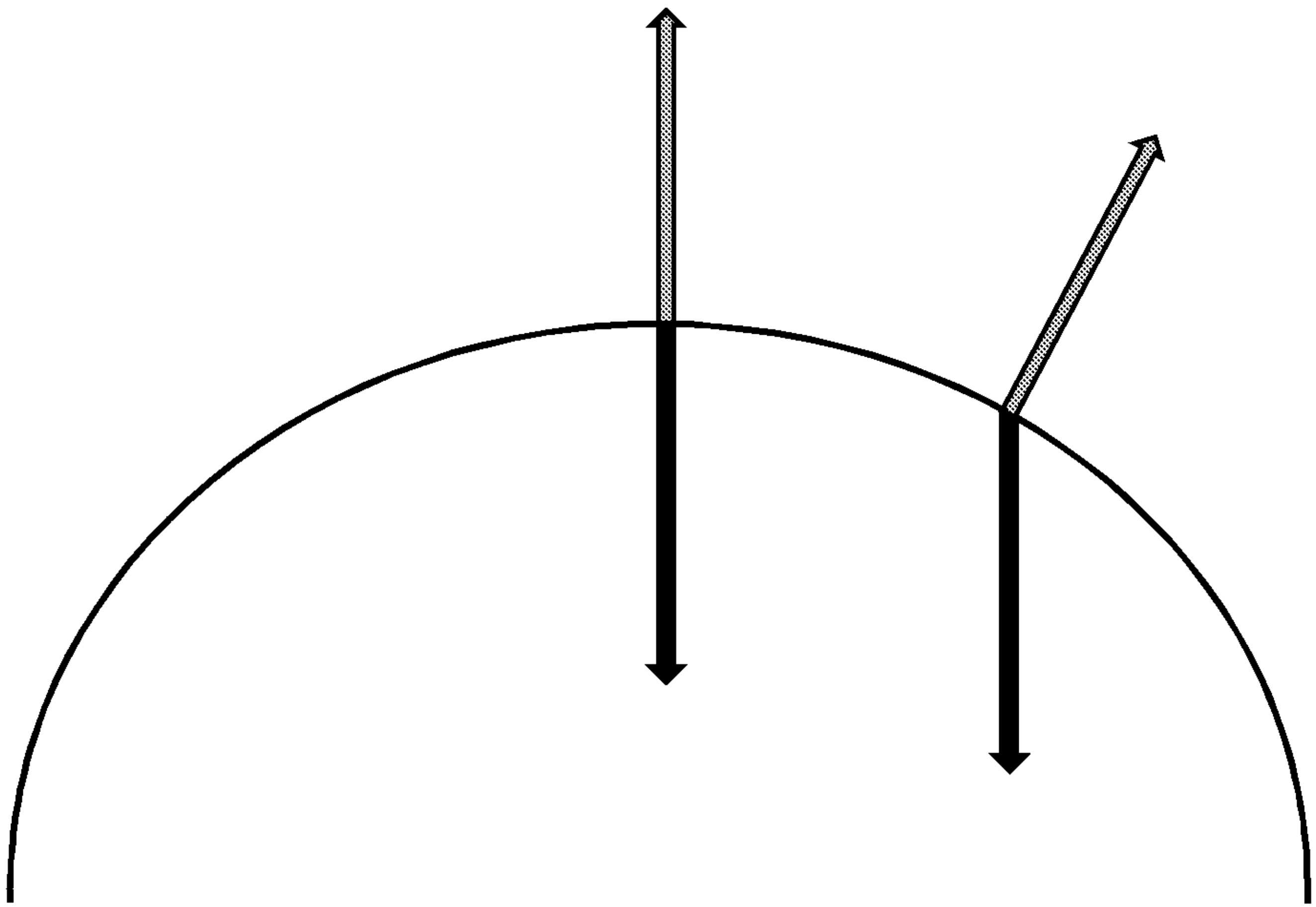
Masa m

$$E_0 > \frac{5}{2} mgR$$



Montículo





Energía

7: $E_0 = \frac{1}{2}mv_0^2 + mgR$

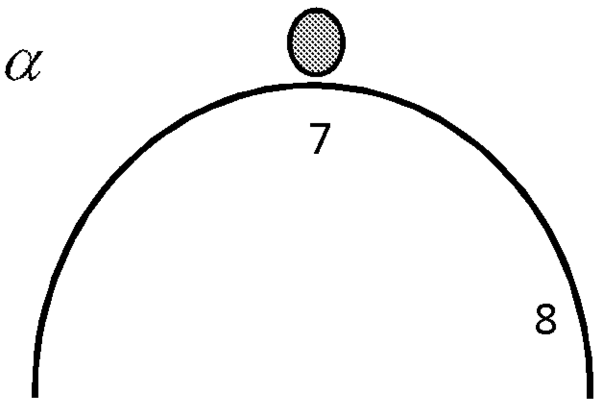
En todos los demás sitios: $E = \frac{1}{2}mv^2 + mgh$

h_8=R sin α

$$\frac{1}{2}mv_0^2 + mgR = \frac{1}{2}mv_8^2 + mgR\sin\alpha$$

$\mathrm{Psin}(\alpha)\text{-N=m}\frac{\mathrm{v}^2}{\mathrm{R}}$ $\mathrm{mv}^2 = R[\mathrm{N\text{-}Psin}(\alpha)]$

$$\frac{1}{2}mv_0^2 + mgR = \frac{1}{2}R[\mathrm{m\,g\,sin}(\alpha)\text{-N}] + m\,g\,R\sin\alpha$$



$$\frac{1}{2}mv_0^2 + mgR = \frac{1}{2}R[\mathrm{m\,g\,sin(\alpha)\text{-}N}] + m\,g\,R\sin\alpha$$

V_0 =0, se despega si N=0

$$\mathrm{mgR}=\frac{1}{2}\mathrm{R[m\,g\,sin(\alpha)]+m\,g\,Rsin\alpha}$$

$$\sin(\alpha)=\frac{2}{3} \to \alpha=41{,}81°$$