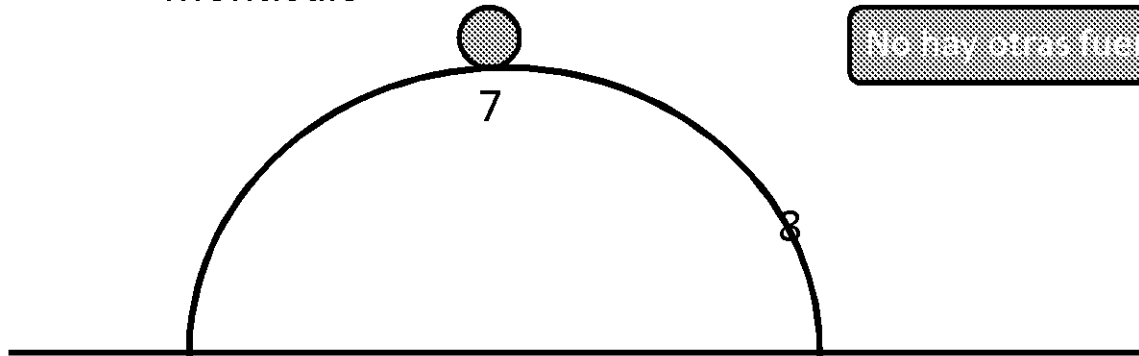


Montículo



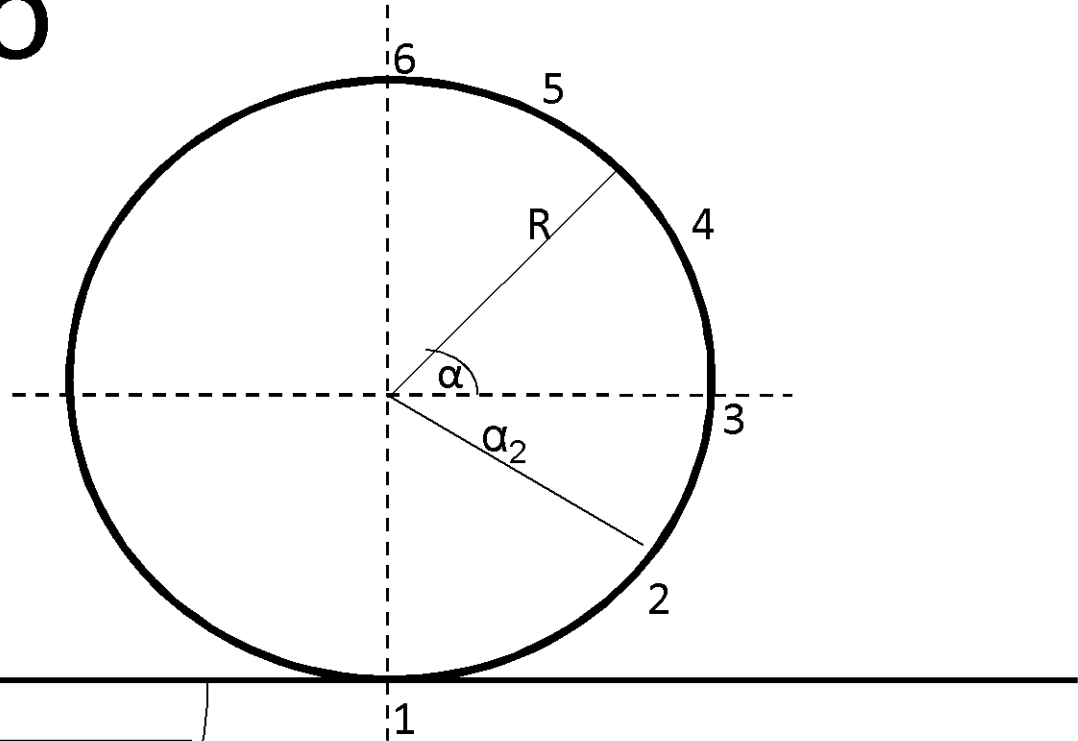
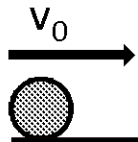
No hay pérdidas de energía por rozamiento

No hay otras fuerzas disipativas

Rulo

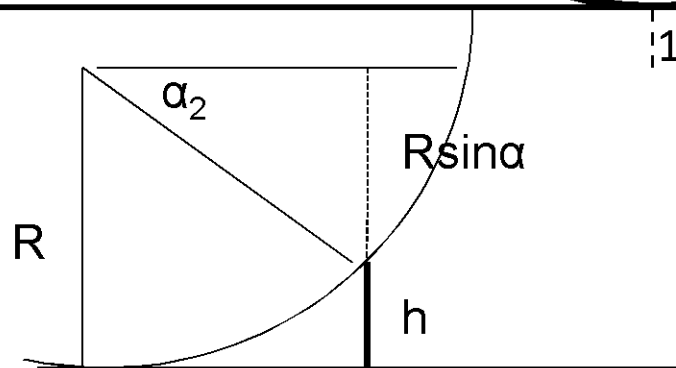
Masa m

$E < mgR$



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

$$E_2 = mgh_2$$



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

α_2 en módulo

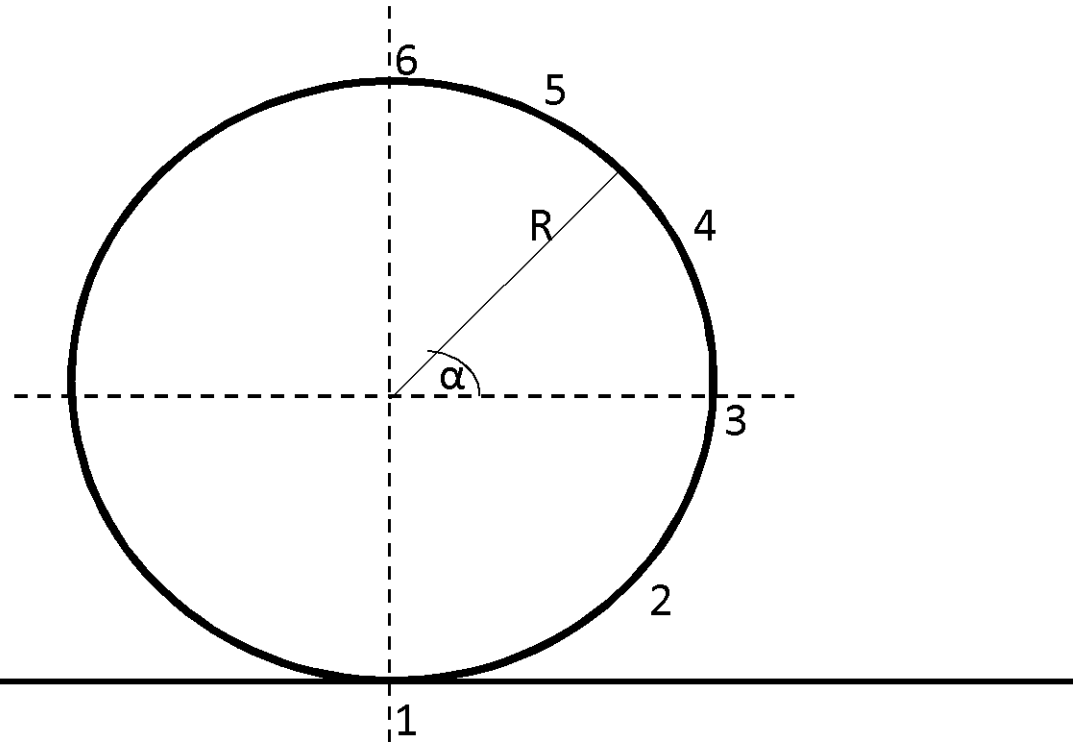
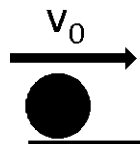
$$\frac{1}{2}mv_0^2 = mgh_2$$

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

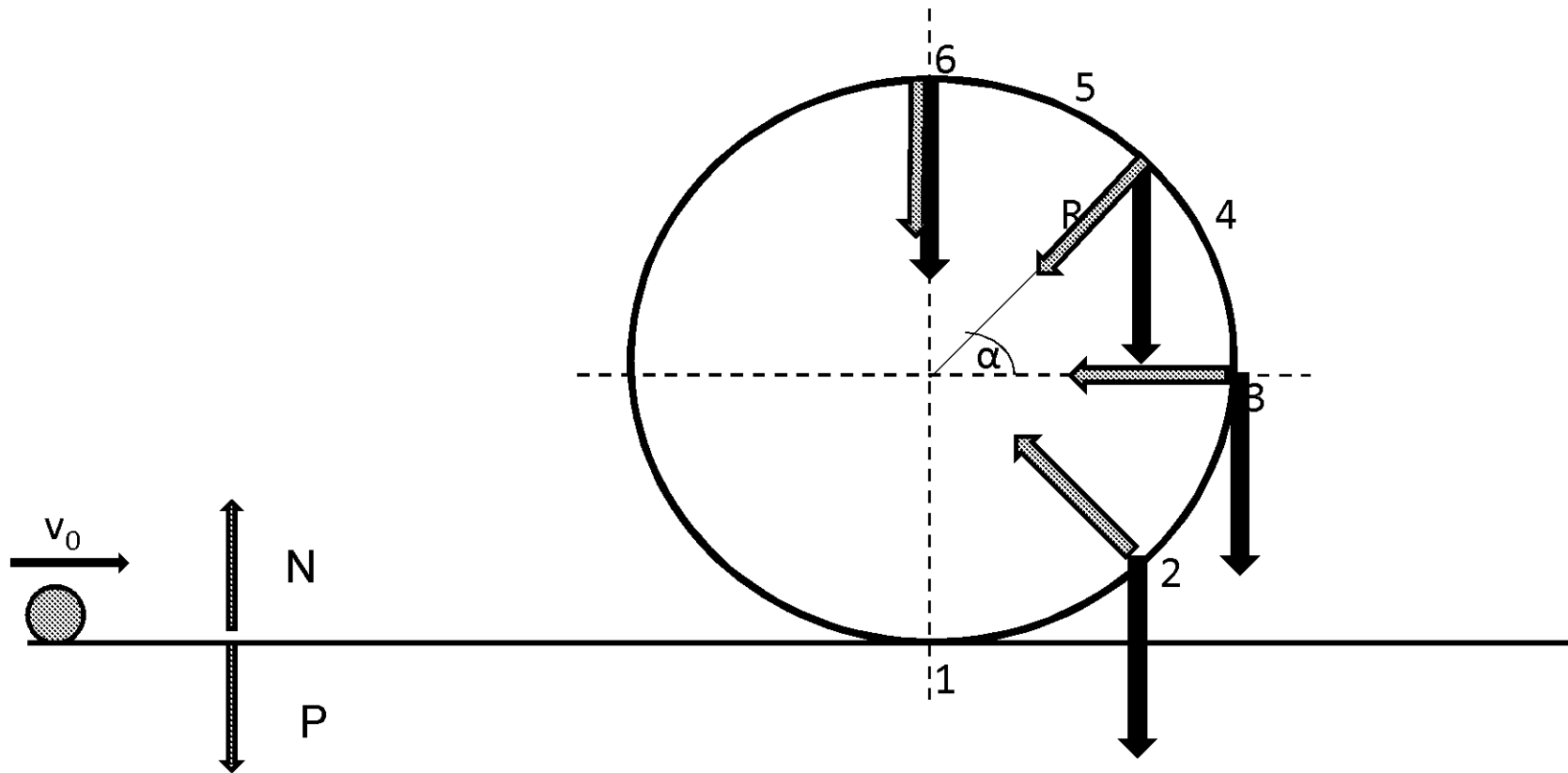
Rulo

Masa m

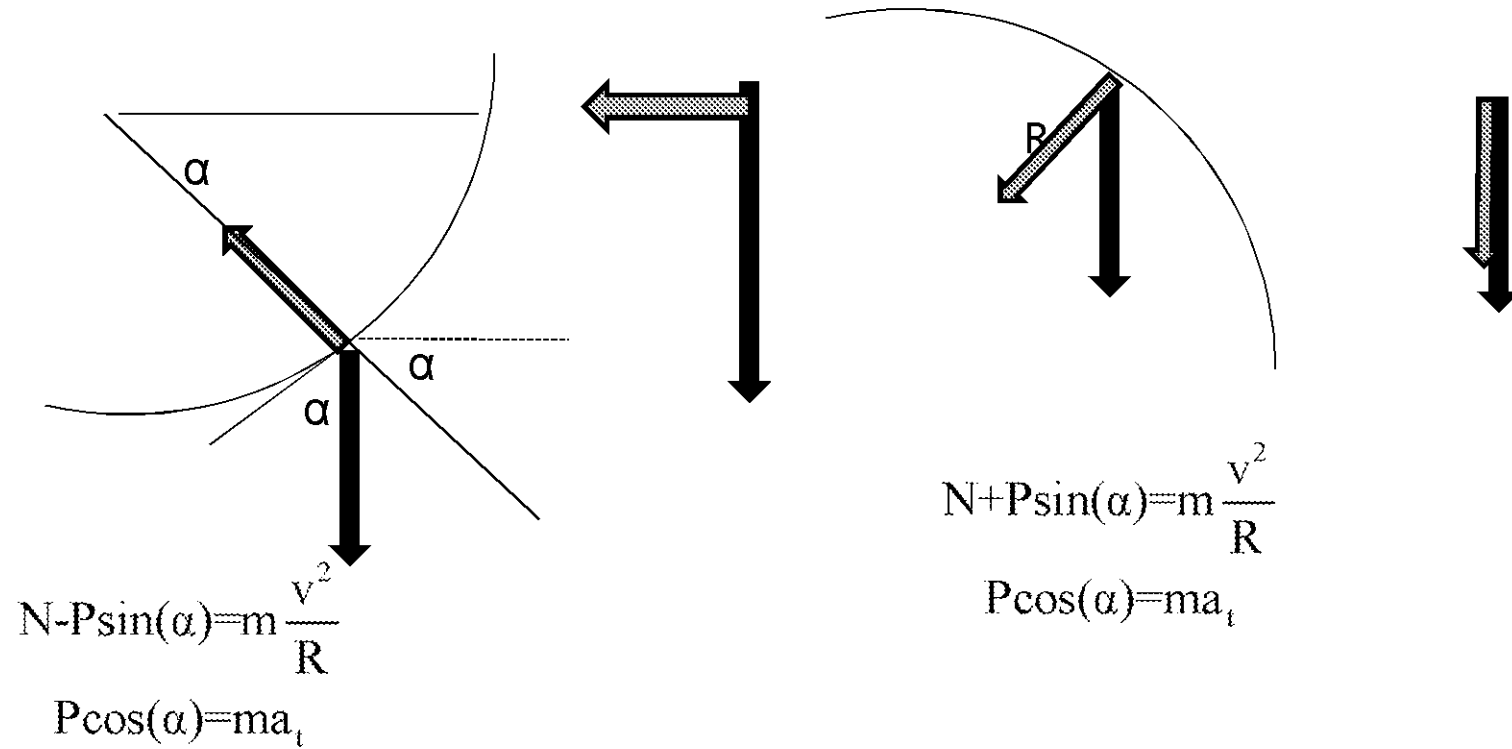
$$mgR < E < E_6$$



Fuerzas que actúan



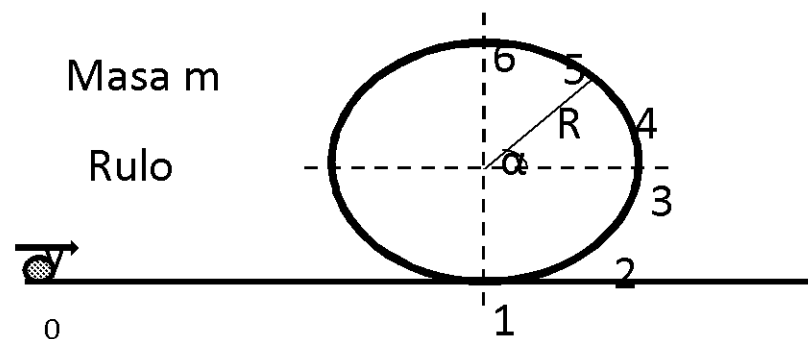
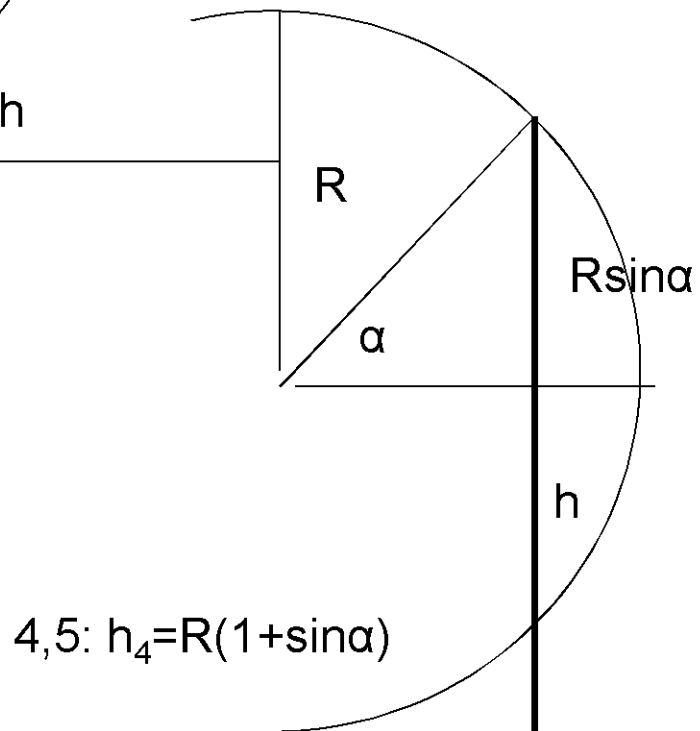
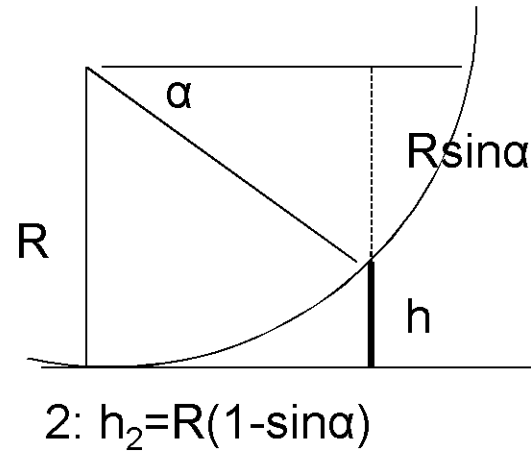
2do principio de Newton



Altura en función del ángulo

0: $h_1=0$ v_1

1: idem 0



Energía

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

En todos los demás sitios:

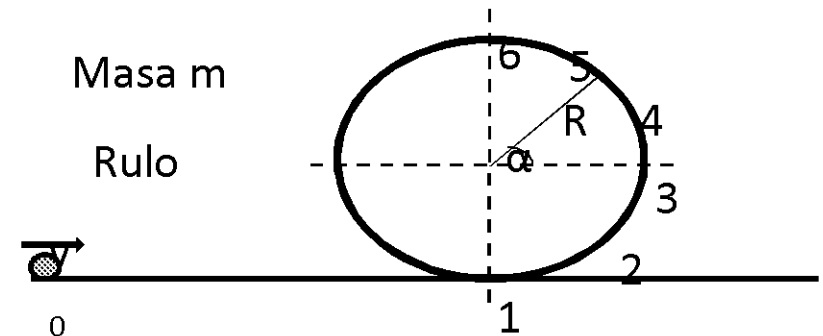
$$E = \frac{1}{2} m v^2 + m g h$$

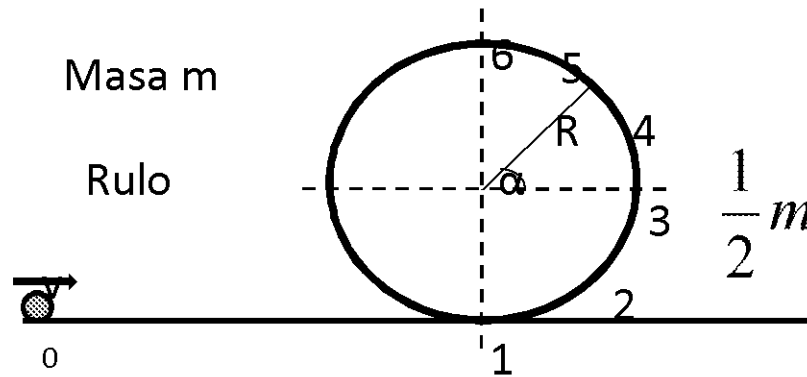
$$h = R(1 + \sin \alpha)$$

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

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

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





$$\frac{1}{2}mv_0^2 = \frac{1}{2}R[N + mg \sin(\alpha)] + mgR(1 + \sin \alpha)$$

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 $N=0$:

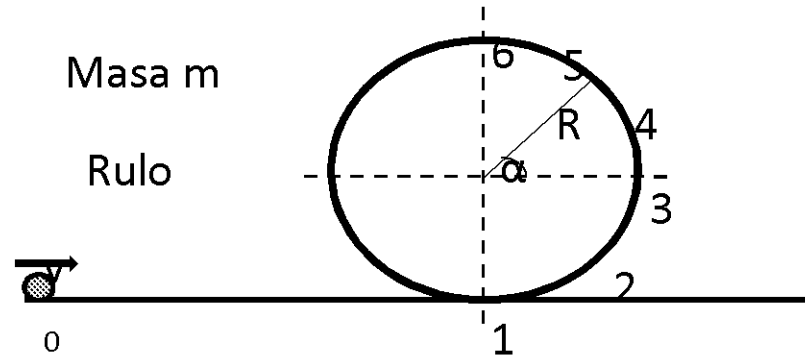
$$\sin(\alpha) = \frac{2}{3} \rightarrow \alpha = 41,81^\circ$$

¿Con qué energía llega a 6?

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

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

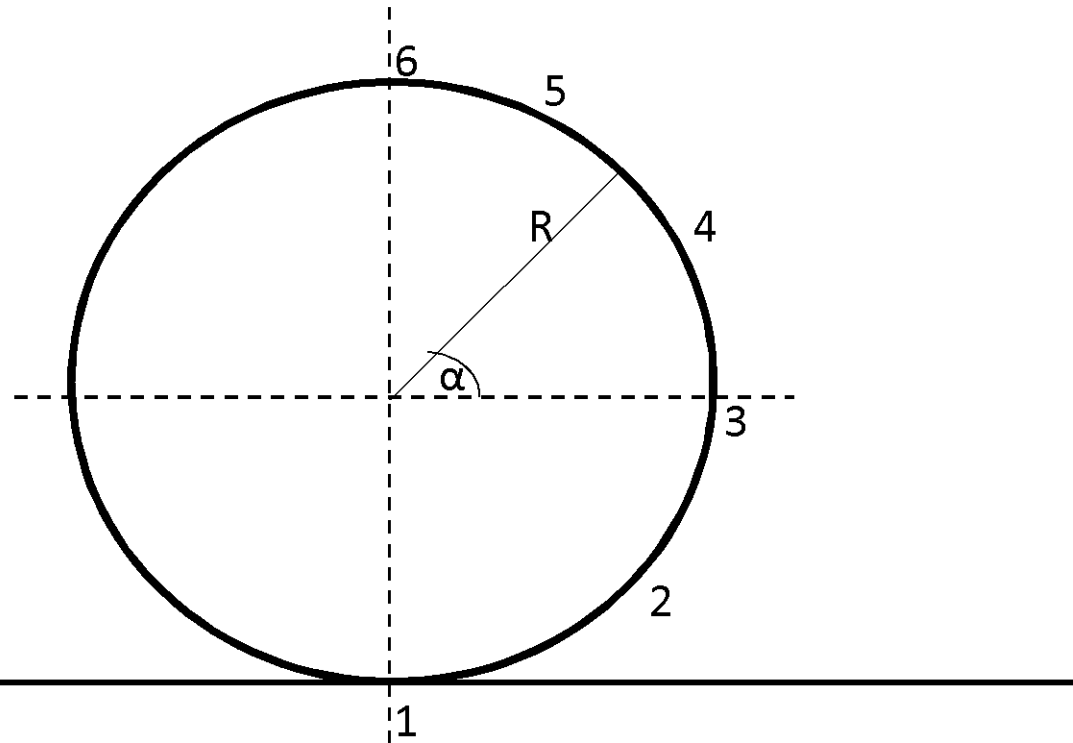
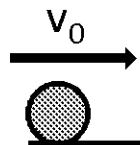
b) $N = 0$ $E_0 = \frac{5}{2}mgR$



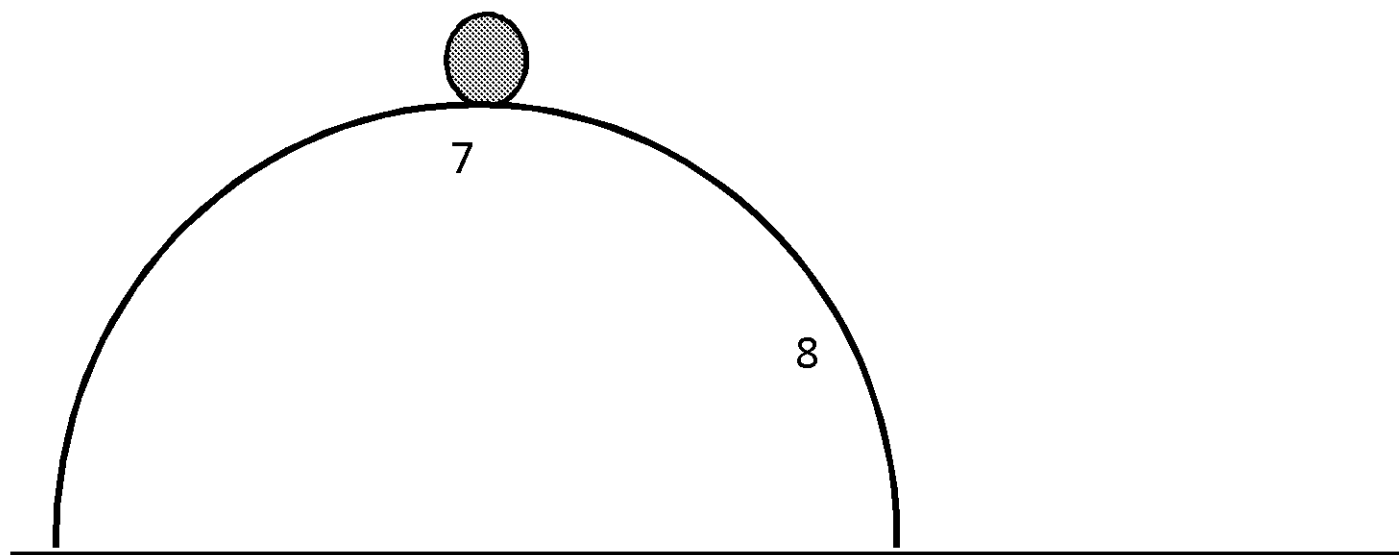
Rulo

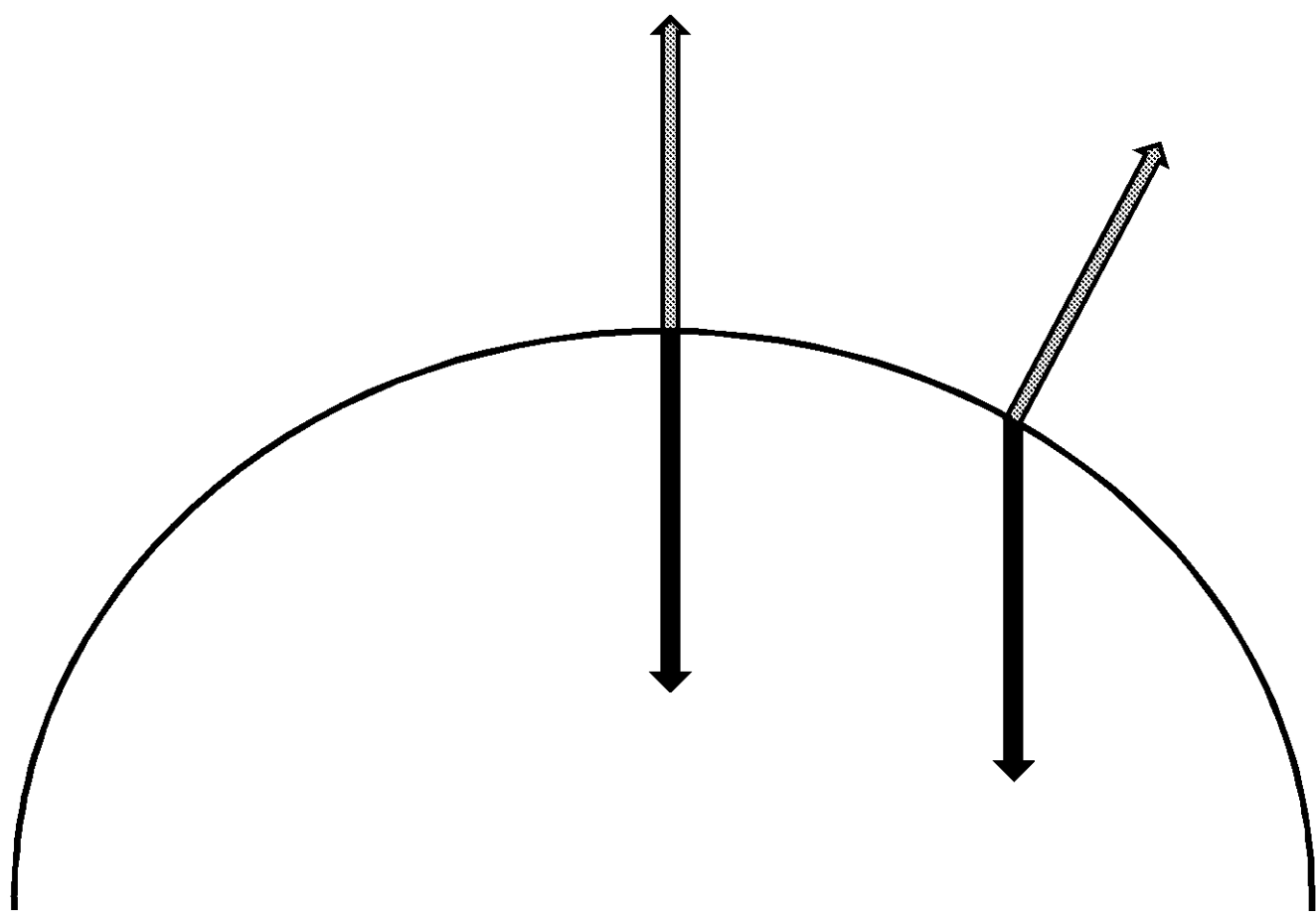
Masa m

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



Montículo





Energía

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

En todos los demás sitios:

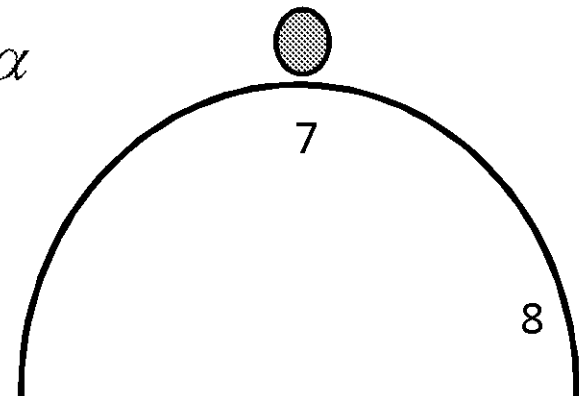
$$E = \frac{1}{2}mv^2 + mgh$$

$$h_8 = R \sin \alpha$$

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

$$P \sin(\alpha) - N = m \frac{v^2}{R} \quad mv^2 = R[N - P \sin(\alpha)]$$

$$\frac{1}{2}mv_0^2 + mgR = \frac{1}{2}R[mg \sin(\alpha) - N] + mgR \sin \alpha$$



$$\frac{1}{2}mv_0^2 + mgR = \frac{1}{2}R[mg \sin(\alpha) - N] + mgR \sin \alpha$$

$V_0 = 0$, se despega si $N=0$

$$mgR = \frac{1}{2}R[mg \sin(\alpha)] + mgR \sin \alpha$$

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

