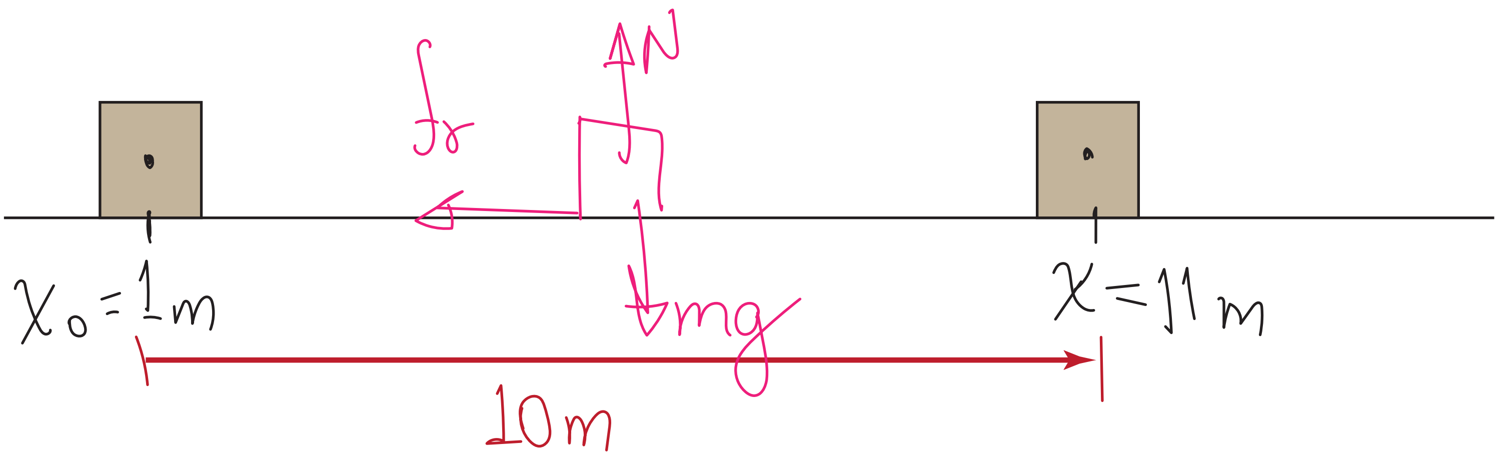
1.- A un bloque de 20 kg que se encuentra sobre un plano horizontal liso en el punto x_o =1 m y y_o = 0 se le aplica una fuerza que depende de la posición según la ecuación **P**= 10 (x^2) **i** N. Para un desplazamiento de 10 m calcule el trabajo realizado por: a) **P**. b) la fuerza de fricción, μ_C =0,3 c) el trabajo total realizado

R. a) 4433,3 J ; b)-588 J ; c) 3845,3 J



$$\Delta X = X - X_0 \Rightarrow \underline{X} = \Delta X + X_0 = 10 + 1 = 11\,m$$

$$\vec{P} = \underbrace{10X^2}_{P_x}\hat{\imath} \qquad P_x = 10X^2$$

$$W = \int F_x\,dx + \int \cancel{F_y\,dy}^{\,0} + \int \cancel{F_z\,dz}^{\,0}$$

$$W_P = \int P_x\,dx = \int (10X^2)\,dx = 10\int_1^{11} X^2 dx = 10\left.\frac{X^3}{3}\right|_1^{11}$$

$$W_P = \frac{10}{3}(11^3 - 1^3) \Rightarrow \boxed{W_P = 4433{,}33\ J}$$

$$W_P = 4{,}43\times10^3 = 4{,}43\,kJ$$

$$\sum F_y = 0$$
$$N - mg = 0$$
$$N = mg$$

b) $$W_{fr} = -\int fr\,dx = -\int \mu N\,dx$$

$$W_{fr} = -\int \mu mg\,dx = -\mu mg\int_1^{11} dx$$

$$W_{fr} = -\mu mg\,X\Big|_{X_0=1}^{X=11} = -\mu mg(X - X_0) = -\mu mg\,\Delta X$$

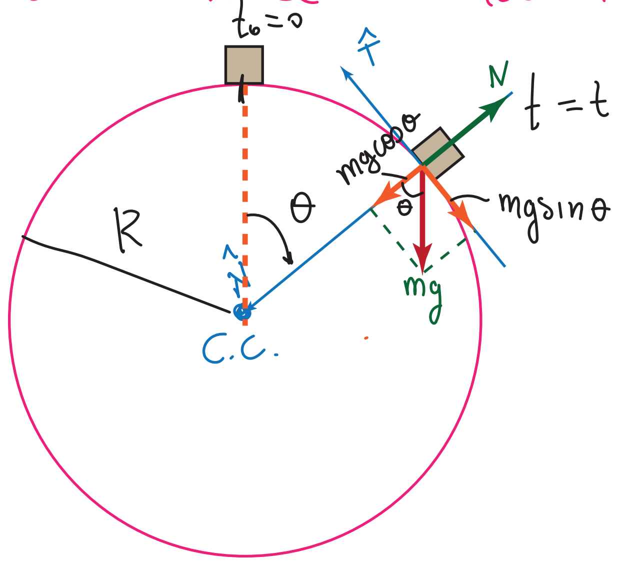
$$W_{fr} = -0{,}3(20)\,9{,}8\,(10) \Rightarrow \boxed{W_{fr} = -588\,J}$$

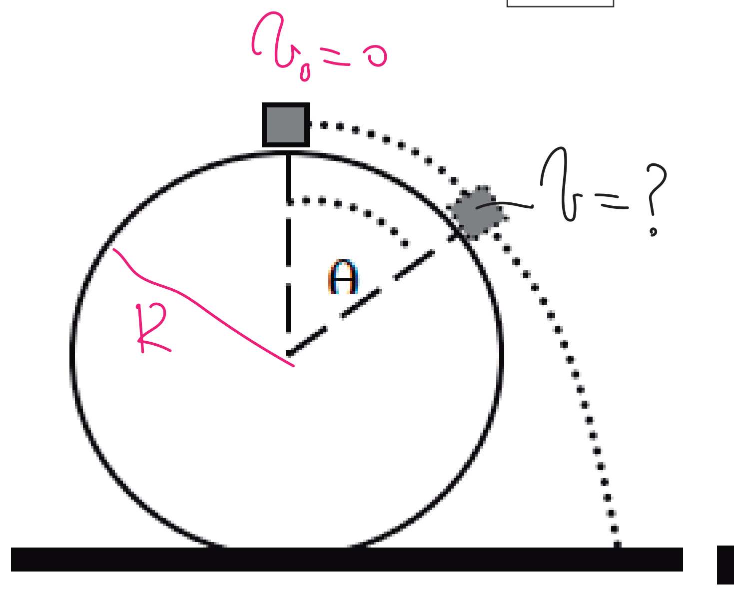
$$W_T = W_p + W_{fr} = 4433,33 + (-588)$$

$$\boxed{W_T = 3845,33\ J}$$

9.- Una partícula de masa m descansa en la parte superior de una esfera lisa de radio R. si se deja deslizar desde el reposo, para que valor del ángulo θ se desprende dela esfera. **R.48.18º**

Problema de Dinamica





$$\sum F_N = m\frac{v^2}{R}$$

$$\cancel{m}g\cos\theta - \cancel{N}^{\,0} = \cancel{m}\frac{v^2}{R}$$

$$Rg\cos\theta = v^2$$

$$\frac{v^2}{Rg} = \cos\theta \quad \ldots (1)$$

$$\sum F_T = m\,a_T \qquad a_T = \frac{dv}{dt}$$

$$\cancel{m}g\sin\theta = \cancel{m}\frac{dv}{dt}$$

$$dv = g\sin\theta\, dt\,\frac{d\theta}{d\theta}$$

$$dv = g\sin\theta\,\frac{d\theta}{d\theta/dt}$$

$$\frac{d\theta}{dt} = \omega = \dot{\theta}$$

$$v = R\omega$$

$$\omega = \frac{v}{R}$$

$$\frac{d\theta}{dt} = \frac{v}{R}$$

$$dv = g\sin\theta\,\frac{d\theta}{v/R}$$

$$\int_{v_0=0}^{v} v\,dv = Rg\int_{\theta_0=0}^{\theta}\sin\theta\,d\theta$$

$$\Rightarrow \left.\frac{v^2}{2}\right|_0^v = Rg\left(-\cos\theta\Big|_0^\theta\right) \Rightarrow \frac{1}{2}(v^2 - 0^2) = -Rg(\cos\theta - \cancel{\cos 0}^{\,1})$$

$$\frac{v^2}{2} = +Rg(1-\cos\theta) \Rightarrow \frac{v^2}{Rg} = 2 - 2\cos\theta \quad \ldots (2)$$

Ec. (1) = (2)

$$\cos\theta = 2 - 2\cos\theta$$

$$3\cos\theta = 2$$

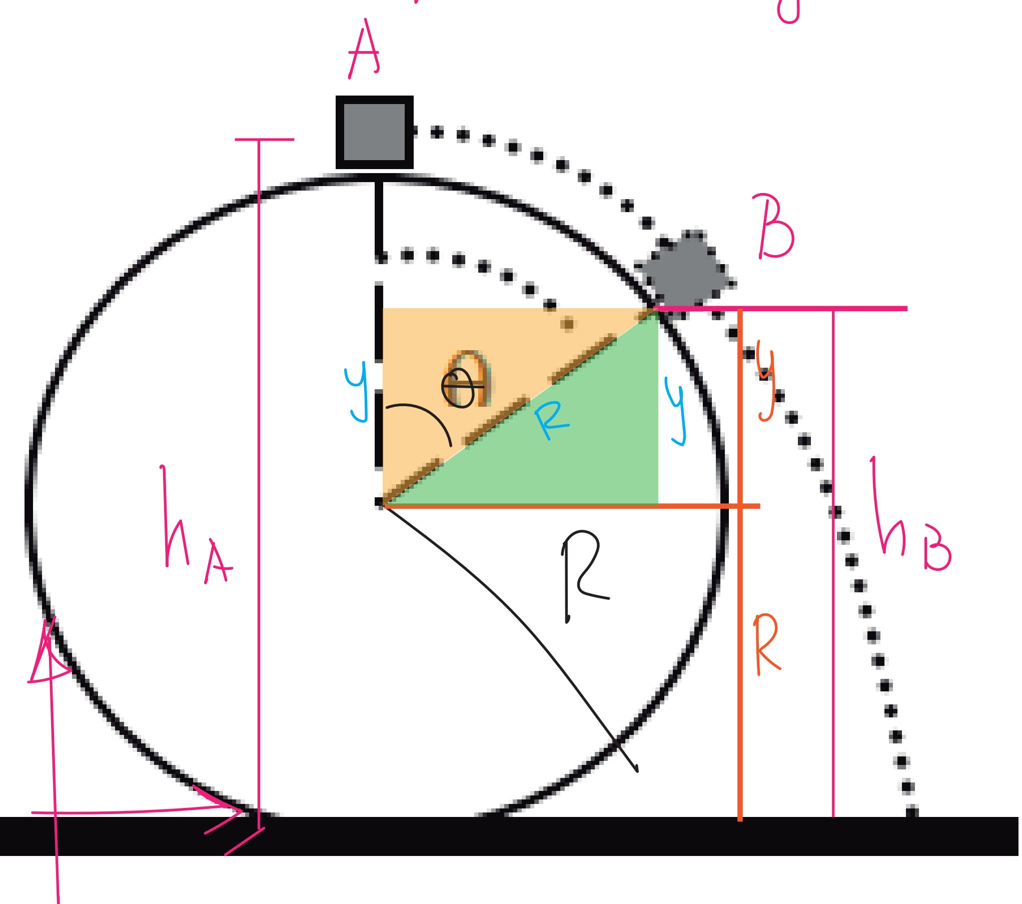
$$\cos\theta = \frac{2}{3}$$

$$\theta = \cos^{-1}\left(\frac{2}{3}\right) \Rightarrow \boxed{\theta = 48,19^\circ}$$

Metodo por Energias

$v = ?$

$v_B = v = ?$



$h_A = 2R$

$h_B = y + R$

$\cos\theta = \dfrac{y}{R}$

$y = R\cos\theta$

$h_B = R\cos\theta + R$

$$\sum E_A = \sum E_B + \cancel{W}^{0}$$

$$\cancel{E_C^A}^{0} + E_P^A + \cancel{E_E^A}^{0} = E_C^B + E_P^B + \cancel{E_E^B}^{0}$$

$$\cancel{m} g h_A = \frac{1}{2}\cancel{m} v_B^2 + \cancel{m} g h_B$$

$$\frac{1}{2}v^2 = g(h_A - h_B)$$

$$\frac{1}{2}v^2 = g\left(2R - (R\cos\theta + R)\right)$$

$$\frac{1}{2}v^2 = g\left(2R - R\cos\theta - R\right) \Rightarrow \frac{1}{2}v^2 = g\left(R - R\cos\theta\right)$$

$$\frac{1}{2}v^2 = Rg\left(1 - \cos\theta\right)$$

$$\frac{v^2}{Rg} = 2 - 2\cos\theta \quad \text{--- (3)}$$

$$\boxed{\theta = 48{,}19^{\circ}}$$

Sol.