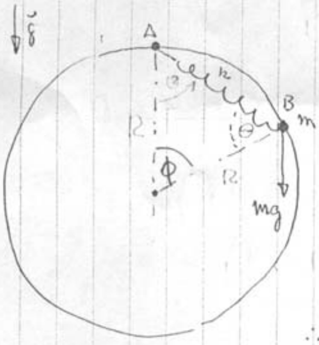

$$\boxed{k = \frac{3mg}{R}} \qquad \boxed{l_0 = \frac{R}{2}}$$

$$L = 2R\cos\theta$$

$$\Delta l = 2R\cos\theta - \frac{R}{2}$$

$$\therefore \boxed{\Delta l = \frac{R}{2}(4\cos\theta - 1)} \quad (1)$$

$\Delta l = 0$ para
$4\cos\theta - 1 = 0$
$\cos\theta = \frac{1}{4}$

$$\therefore V = \frac{1}{2}k(\Delta l)^2 - mg\,2R\cos\theta\cdot\cos\theta$$

$$\therefore \boxed{V = \frac{1}{2}k\frac{R^2}{4}(4\cos\theta - 1)^2 - 2mgR\cos^2\theta} \quad (2)$$

$$V' = \frac{kR^2}{\cancel{2}\cdot 4}\cdot\cancel{2}(4\cos\theta - 1)(-4\,\mathrm{sen}\,\theta) + 4mgR\,\mathrm{sen}\,\theta\cos\theta$$

$$\therefore V'_1 = \frac{kR^2}{4}\left[-16\,\mathrm{sen}\,\theta\cos\theta + 4\,\mathrm{sen}\,\theta\right] + 4mgR\,\mathrm{sen}\,\theta\cos\theta$$

$$= -4kR^2\,\mathrm{sen}\,\theta\cos\theta + kR^2\,\mathrm{sen}\,\theta + 4mgR\,\mathrm{sen}\,\theta\cos\theta$$

$$= -12mgR\,\mathrm{sen}\,\theta\cos\theta + 3mgR\,\mathrm{sen}\,\theta + 4mgR\,\mathrm{sen}\,\theta\cos\theta$$

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$$\therefore V' = -8mgR\,\mathrm{sen}\,\theta\cos\theta + 3mgR\,\mathrm{sen}\,\theta$$

$$\boxed{V' = -3mgR\,\mathrm{sen}\,\theta\left(\frac{8}{3}\cos\theta - 1\right)}$$

$$V' = 0 \Rightarrow \mathrm{sen}\,\theta_1 = 0 \Rightarrow \boxed{\theta_1 = 0}$$

$$\frac{8}{3}\cos\theta = 1 \rightarrow \boxed{\cos\theta_2 = \frac{3}{8}} \Rightarrow \theta_2 = \arccos\frac{3}{8} \approx 68^\circ$$

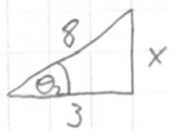
$$V'' = -3mgR\cos\theta\left(\frac{8}{3}\cos\theta - 1\right) - 3mgR\,\mathrm{sen}\,\theta\left(-\frac{8}{3}\,\mathrm{sen}\,\theta\right)$$

$$V'' = -3mgR\cos\theta\left(\frac{8}{3}\cos\theta - 1\right) + 8mgR\,\mathrm{sen}^2\theta$$

$$\theta_1 = 0 \implies V''(0) = -3mgR\left(\frac{8}{3} - 1\right) = -5mgR < 0$$

$\implies$ $\theta_1 = 0$ es inestable

$$\cos\theta_2 = \frac{3}{8} \implies$$



$$x = \sqrt{8^2 - 3^2} = \sqrt{55}$$

$$\implies \mathrm{sen}\,\theta_2 = \frac{\sqrt{55}}{8} \implies \mathrm{sen}^2\theta_2 = \frac{55}{64}$$

$$\cos\theta_2 = \frac{3}{8} \implies V''(\theta_2) = -3mgR\cdot\frac{3}{8}\cancel{\left(\frac{8}{3}\cdot\frac{3}{8} - 1\right)}^{\,0} + \cancel{8}mgR\cdot\frac{55}{\cancel{64}\,8}$$

$$\implies V''(\theta_2) = \frac{55}{8}mgR > 0 \implies \theta_2 \text{ es eq estable}$$

Para w^2 se necesita v^2:

en coord. polares (ρ, ϕ) $\implies v^2 = \dot{\rho}^2 + \rho^2\dot{\phi}^2$ / $\rho = R \implies \dot{\rho} = 0$

$$\implies v^2 = R^2\dot{\phi}^2$$

Pero $\phi = \pi - 2\theta \implies \dot{\phi} = -2\dot{\theta} \implies \dot{\phi}^2 = 4\dot{\theta}^2$

$$\implies K = \frac{1}{2}mv^2 = \frac{1}{2}mR^2\cdot 4\dot{\theta}^2 \implies \alpha = 4mR^2$$

$$\implies w^2 = \frac{V''(\theta_2)}{\alpha} = \frac{55g}{32R} \implies \boxed{T = \frac{2\pi}{w} = 2\pi\sqrt{\frac{32R}{55g}}}$$

2. a) $\vec{\omega} = \vec{\omega}_1 + \vec{\omega}_3$ ← Sistema móvil acompaña rotación de la barra DCA y a la rotación de la plataforma

$= -4\hat{\imath} + 3\hat{\jmath}$

$\therefore \boxed{\vec{\omega} = -4\hat{\imath} + 3\hat{\jmath}}$

b) $\vec{v}_A = \vec{\omega}_3 \times \vec{DA}$

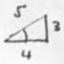
$= -4\hat{\imath} \times (0{,}9\hat{\imath} + 0{,}6\hat{\jmath})$

$\therefore \boxed{\vec{v}_A = -2{,}4\,\hat{k}}$

c) $\vec{v}_B = \vec{v}_A + \vec{v}_{rel} + \vec{\omega} \times \vec{AB}$

Pero, $\vec{v}_{rel} = \vec{\omega}_2 \times \vec{AB}$

$= 2\hat{k} \times (1{,}5\cos\theta\,\hat{\imath} + 1{,}5\,\text{sen}\,\theta\,\hat{\jmath})$



: $\text{sen}\,\theta = \frac{3}{5}$ y $\cos\theta = \frac{4}{5}$

$\therefore \vec{v}_{rel} = 2\hat{k} \times (1{,}2\hat{\imath} + 0{,}9\hat{\jmath})$

$\therefore \boxed{\vec{v}_{rel} = -1{,}8\hat{\imath} + 2{,}4\hat{\jmath}}$

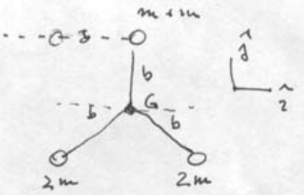
Además: $\vec{\omega} \times \vec{AB} = (-4\hat{\imath} + 3\hat{\jmath}) \times (1{,}2\hat{\imath} + 0{,}9\hat{\jmath})$

$= -3{,}6\hat{k} - 3{,}6\hat{k}$

$\therefore \boxed{\vec{\omega} \times \vec{AB} = -7{,}2\,\hat{k}}$

Finalmente, : $\vec{v}_A = -2{,}4\hat{k} - 1{,}8\hat{\imath} + 2{,}4\hat{\jmath} - 7{,}2\hat{k}$

$\therefore \boxed{\vec{v}_A = -1{,}8\hat{\imath} + 2{,}4\hat{\jmath} - 9{,}6\hat{k}}$



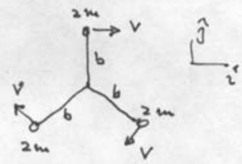
Velocidad del C. de M.

Antes del choque plástico: $6m \vec{V}_G = m v_0 \hat{i}$

$\therefore \boxed{\vec{V}_G = \frac{v_0}{6} \hat{i}}$ (1) 1.0

Las fuerzas que se desarrollan durante el impacto son fzas. interiores del sistema. No hay componentes de fzas exteriores en el plano del movimiento. Por lo tanto, $\vec{V}_G$ se mantiene inalterado y el C. de M. se mueve con movimiento rectilíneo uniforme.

Rotación del sistema: $\vec{\tau}_G = \vec{0} \Rightarrow \frac{d\vec{L}_G}{dt} = \vec{0} \Rightarrow \vec{L}_G = \text{cte}$. 1.0



$\therefore L_G(t=0^-) = L_G(t=0^+)$

$\therefore m v_0 \cdot b = 3 \cdot [(2m) V \cdot b]$ y como $V = b\omega$

$= 3 \cdot [(2m) b\omega \cdot b]$

2.0

$\cancel{m} v_0 \cdot \cancel{b} = 6 \cancel{m} b^{\cancel{2}} \omega \Rightarrow \boxed{\omega = \frac{v_0}{6b}}$ $\vec{\omega} = \frac{v_0}{6b}(-\hat{k})$

ω es cte.

Luego, de $\theta = \omega t \rightarrow \frac{2\pi}{3} = \frac{v_0}{6b} t^* \rightarrow t^* = \frac{4\pi b}{v_0}$ 1.0

Luego, la distancia d recorrida por G es

$d = V_G t^* \rightarrow \boxed{d = \frac{2}{3}\pi b}$ // 1.0