uestion 3

Question 1

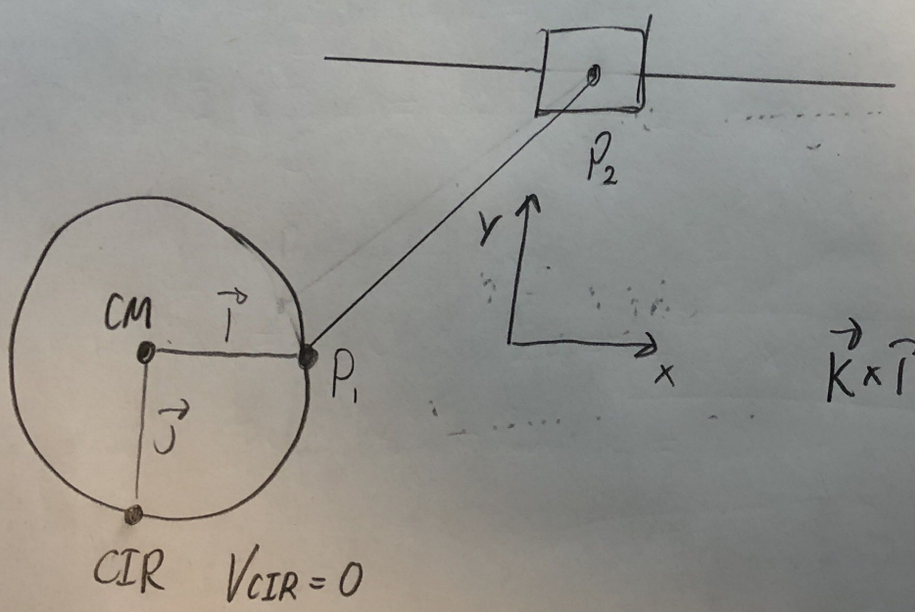
A. i) $\vec{H} = I_h \vec{w}_h + \vec{R} \times m\vec{v} + I_r \vec{w}_r$

$\vec{H} = I_h \vec{w}_h + \vec{R} \times m(\vec{R}\vec{w}_h) + I_r \vec{w}_r$

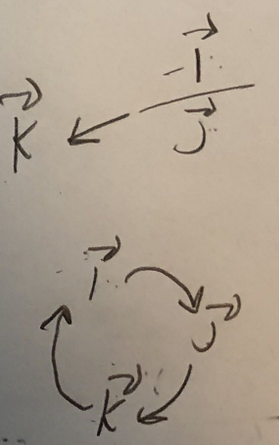
$\vec{H} = I_h \vec{w}_h + \vec{R}\, m(\vec{R}\vec{w}_h) + I_r \vec{w}_r$

ii) $\vec{H}$ constant, quand $\vec{R} \uparrow$, $\vec{w}_R \downarrow$ $\vec{w}_h \downarrow$ pour que H reste constant

B.



$\vec{K} \times \vec{i} = \vec{j}$



i) $V_{CM} = \cancel{V_{CIR}}^{0} + W R_{CM/CIR}$

$W = \dfrac{V_{CM}}{R_{CM/CIR}}$

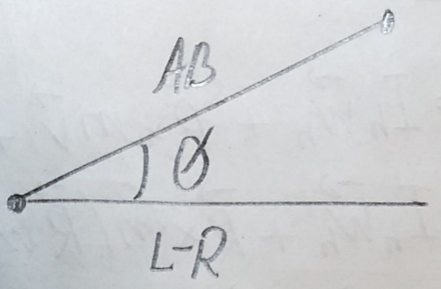
$V_P = V_{CM} + W R_{P/CM}$

$= V_{CM} + \dfrac{V_{CM}}{R_{CM/CIR}} R_{P/CM}$ même norme

$= -V_{CM}\vec{i} + V_{CM}\vec{j}$

Question 3

ii) $$V_{p_1} = \frac{W_o}{R} = \frac{W_{AB}\cos\theta}{(L-R)}$$



$$AB\cos\theta = L-R$$

$$AB = \frac{L-R}{\cos\theta}$$

Question 3

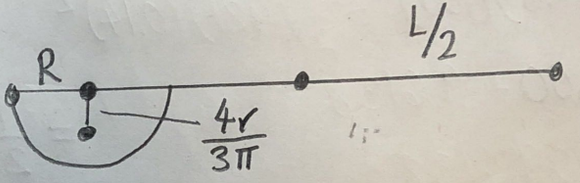
A.

Question 2

$m_t = 6\,kg$ $L = 2m$ $m_D = 10\,kg$ $R = 30\,cm = 0.3$

pivot B $K = 981\ N/m$

initialement immobile $\theta = 0$



A. $I_{tige} = I_{cm} + md^2$

$= \frac{1}{12}ml^2 + md^2$

$= \frac{1}{12}(6)(2)^2 + (6)(0.7)^2$

$= 4.94$

$I_{disque} = \left(\frac{1}{2} - \frac{16}{9\pi^2}\right)mr^2 + md^2$

$= \left(\frac{1}{2} - \frac{16}{9\pi^2}\right)(10)(0.3)^2 + (10)\left(\frac{4(0.3)}{3\pi}\right)^2$

$= 0.288 + 0.162$

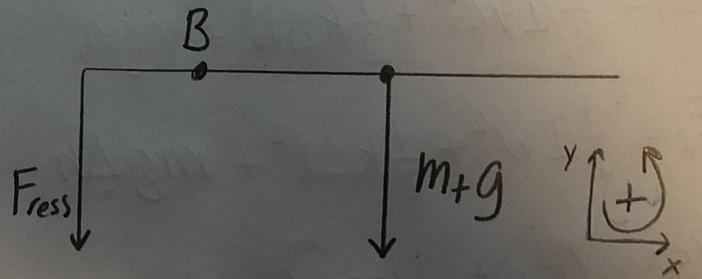
$= 0.45$

$I_{tot} = I_{tige} + I_{disque}$

$= 4.94 + 0.45$

$= \boxed{5.39\ kg\,m^2}$

B. $\sum M_B = 0$



$0 = +R F_{res} - \left(\frac{L}{2} - R\right)m_t g$

$0 = 0.3 \cdot 981\,\Delta l_0 - 0.7 \cdot 6 \cdot 9.81$

$\Delta l_0 = 0.140m$

C. $\Delta E = E_2 - E_1 = 0$ conservation énergie mécanique

pas de frottement et de force qui font un travail

$E_1 = \frac{1}{2} m_p v_0^2$

$= \frac{1}{2}(0.5)(100)^2$

$= 2500$

$E_2 = \frac{1}{2} m_p (v_0 \cos\alpha)^2 + \frac{1}{2} I w^2$

$= \frac{1}{2}(0.5)(100\cos(30°))^2 + \frac{1}{2}(5.39) w^2$

$2500 = 1875 + 2.695 w^2$

$w = 15.2$ rad/s

$\frac{1}{2}(981)\Delta l_0^2$ et $mg\Delta h$

↑ la longueur n'a pas changer après l'impact ni la hauteur

$E_2 = 1875 + 2.695 w^2$

D. $\Delta E = E_2 - E_1 = 0$ conservation énergie mécanique

$E_1 = \frac{1}{2} I w_0^2 + \frac{1}{2} k \Delta l_0^2$

$E_2 = \frac{1}{2} I w^2 + \frac{1}{2} k \Delta l^2 + mg\Delta h$

CM de objet

$\bar{x}_1 = \frac{4(0.3)}{3\pi}$

$\bar{x}_2 = \frac{l}{2} = 1$

$\frac{1}{2}(5.39)(15.2)^2 + \frac{1}{2}(981)(0.14)^2$

$= \frac{1}{2}(5.39) w^2 + \frac{1}{2}(9.81)(0.471)^2 + (16 \cdot 9.81 - 0.455)$

$632.2666 = -70.33 + 2.695 w^2$

$\Delta l = 2\pi(0.3)\left(\frac{90}{360}\right)$

$= 0.471$m

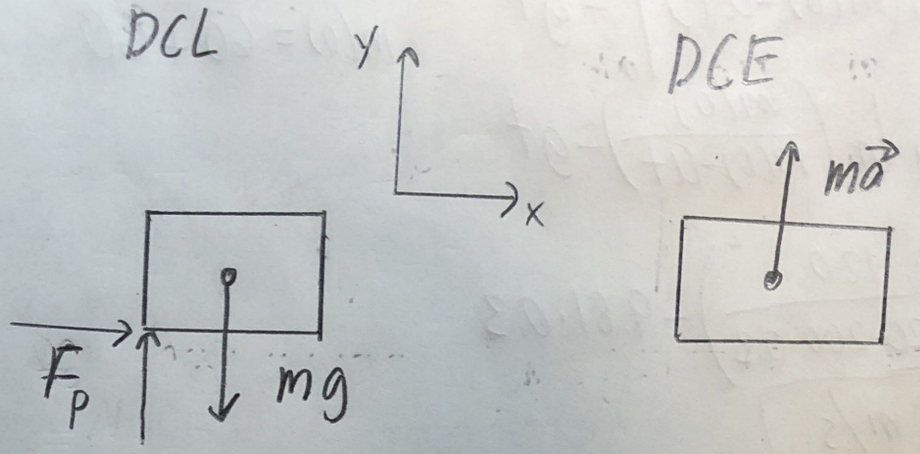
$w = 16.1$ rad/s

$\bar{x} = \frac{4 \cdot 0.3}{3\pi} \cdot 10 + 1 \cdot 6$

$\bar{x} = 0.455$ m

Question 3

A.



B.

$$U_{eau} = \frac{\left|\frac{dV}{dt}\right|}{S} = \frac{0.2}{100\times10^{-4}} = 20\,m/s$$

donc $F_p = \left|\frac{dm}{dt}\right| V_{eau} = \rho\left(\frac{dV}{dt}\right) V_{eau}$

$= 1000 \cdot 0.2 \cdot 20 = \boxed{4.00\times10^{3}\,N}$

C. $U = \frac{F_p}{V} = \frac{4000}{20} = 200\,kg/s$

$\sum F_y = ma$

$F_p - m(t)g = ma(t)$

$a(t) = \frac{U V_{eau}}{m(0) - Ut} - g$

$v(t) = v(0) + \int_0^t a(t)\,dt$

$= 0 + \int_0^t \left(\frac{U V_{eau}}{m(0) - Ut} - g\right) dt$

$$v(t) = \frac{-u\,V_{eau}}{u} \ln(m(0)-ut)\Big|_0^t - gt \qquad m(0) = 60+60$$

$$v(t) = V_{eau} \ln\left(\frac{m(0)}{m(0)-ut}\right) - gt$$

$$v(t) = 20 \cdot \ln\left(\frac{120}{120-200\cdot 0.3}\right) - 9.81 \cdot 0.3$$

$$\boxed{V_f = 10.9 \text{ m/s}}$$

D. $V_0 = 10.92$ m/s $\quad V_f = 0$ m/s

$\Delta V + \Delta T = 0$ conservation énergie mécanique

$$\frac{1}{2}\cancel{m}v_0^2 + \cancel{m}gh_1 = \cancel{m}gh_2$$

$$\frac{1}{2}(10.92)^2 + 9.81 \cdot 1.4 = 9.81\, h_f$$

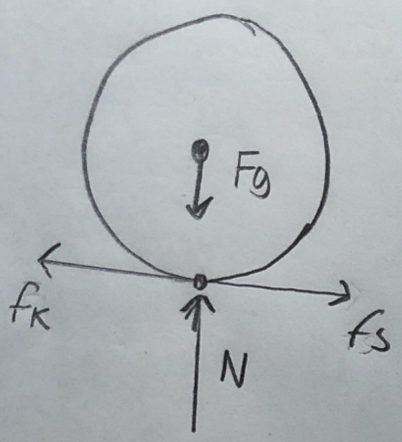
$$\boxed{h_f = 7.46\text{m}}$$

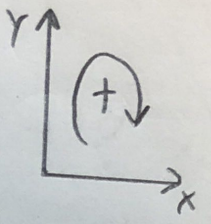
$h_f > 6$m Oui il va atteindre la plateforme

Question 4

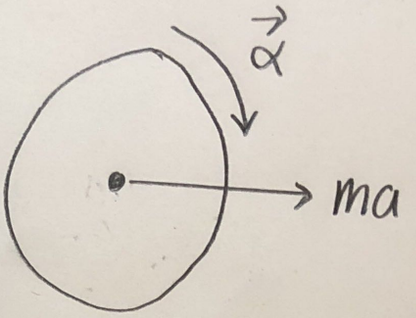
A.

DCL





DCE



B. $\Sigma F_x = ma$ $\quad \Sigma F_y = 0$

$f_s + f_k = ma$ $\quad 0 = N - mg$

Je pense le frottement statique va être responsable de l'accélération en translation $\Sigma M_{cm} = I\alpha$

et cinétique va causer α

C. Quand $f_s > f_k$ la roue va rouler et pas glisser

D. On va dire que $f_k = 19,62\ N$

$\mu_k \cdot mg = 0,5 \cdot 4 \cdot 9,81$
$= 19,62\ N$

$P = \vec{F} \cdot \vec{v}$
$= 19,62N \cdot 10 =$ **196.2 W**