Question 1

Q1 : 22/40
Q2 : 42/60
Q3 : 47/50
Q4 : 16/50

A. 1. $dU = \vec{F}d\vec{r} = F\sin\theta\, dr$

$= 5\sin(180-120)\cdot 2\pi(0.15)$

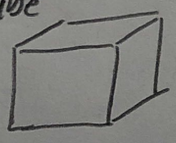
$= 4.08\ Nm$

II. $\vec{Imp}_{1-2} = \Delta\vec{L}$

comme le disque tourne constamment $\Sigma\vec{F} = 0$ donc il y a conservation de la quantité de mouvement donc $\vec{L}$ est constant $\Delta\vec{L} = 0$ ce qui implique que $\vec{Imp}_{1-2} = 0$

2/10

B. cube



$\bar{z}_{c2} = \frac{L}{2} + (b-d)$

$= \frac{0.2}{2} + (0.05-0.02)$

$= 0.13\ m$

c1

la masse volumique $= \frac{1.2}{(0.05)^2(0.08) - \pi(0.02)^2(0.02)}$

$= 6.86\times10^3\ Kg/m^3$

c2

$m_{c1} = 6.86\times10^3 \cdot \pi(0.02)^2(0.02) = 0.172kg$

$m_{cube} = 1.2 + 0.172 = 1.37kg$

$\bar{z}_{cube} = \frac{b}{2} = \frac{0.05}{2} = 0.025\ m$

$\bar{z}_{c1} = (b-d) + \frac{d}{2} = (0.05-0.02) + \frac{0.02}{2} = 0.04m$

$$\bar{Z} = \frac{m_{cube}\bar{Z}_{cube} - m_{c1}\bar{Z}_{c1} + m_{c2}\bar{Z}_{c2}}{1.2+0.3} = \frac{1.37(0.025) - 0.172(0.04) + 0.3(0.13)}{1.5}$$

$\bar{Z} = 0.044\ m$

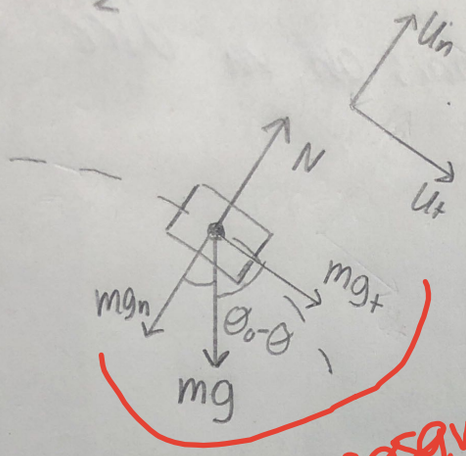
20/20

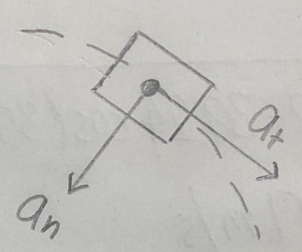
$x = 2.716\ m$

question 2

42/60

A.





composantes en pointillées ↪ ?

10/10

B. $\Delta E = 0$

$E_1 = E_2$ pourquoi ? -1

$\frac{1}{2}mv_0^2 + mgh_1 = \frac{1}{2}mv^2 + mgh_2$

$\frac{1}{2}m(1{,}54)^2 + m(9{,}81)\cdot 2 = \frac{1}{2}mv^2 + m\cdot 9{,}81\cdot 2\cos\theta$

$20{,}8058 = \frac{1}{2}v^2 + 19{,}62\cos\theta$

$20{,}8058 - 19{,}62\cos\theta = \frac{1}{2}v^2$

$$v = \sqrt{41.612 - 39.24\cos\theta}$$

14/15

C. comme le rayon est constant dans le parcours circulaire $V_n = 0\,m/s$

0/15

D. je n'ai pas trouver l'angle au C mais on va dire que c'est 35°

$$V = \sqrt{41.612 - 39.24\cos(35°)}$$
$$= 3.077 \text{ m/s}$$

Pour y

$$y = y_0 + v_i t - \frac{1}{2} g t^2 \qquad y_0 = 2\cos(35°)$$
$$= 1.638$$

$$0 = 1.638 + 3.077\cos(35°)t - 4.91t^2$$

$$t_1 = -0.375 \qquad t_2 = 0.889$$

Pour x

$$V_x = 3.077\sin(35°)$$
$$x_0 = 2\sin(35°)$$
$$t = 0.889$$

$$x = x_0 + Vt$$
$$= 1.147 + 1.765 \cdot 0.889$$

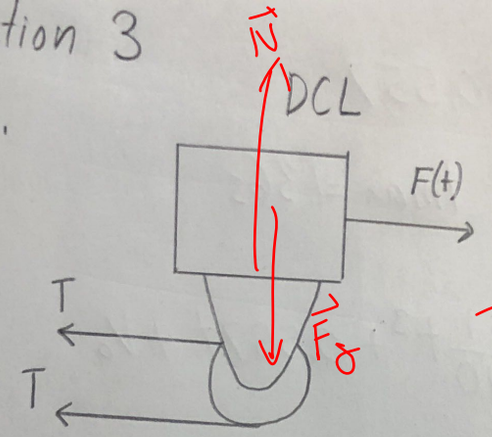
$$x = 2.716 \text{ m}$$

18/20

Question 3

47/50

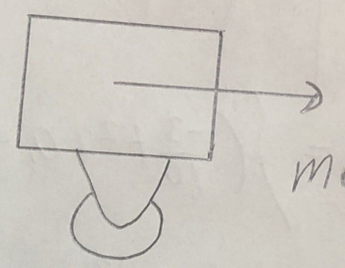
A. i.



-2

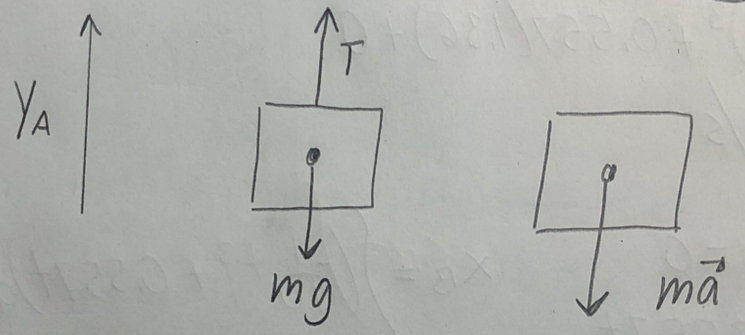
DCE

Δx ℓ ?



-1

ii)



7/10

B. $\Delta L_B = 2\Delta x_B$

$\Delta L_A = -\Delta y_A$

$\Delta L_A + \Delta L_B = 0$

$2\Delta x_B - \Delta y_A = 0$

$2\Delta x_B = \Delta y_A$

$\downarrow \frac{d}{dt}$

$2v_B = v_A$

$\downarrow \frac{d}{dt}$

$2a_B = a_A$ ✓

$\Sigma F = ma$

$F(t) - 2T = m_B a_B$

$70 - 6t^2 - 2T = 8a_B$ ✓

$T = 3(9.81 + 2a_B)$

$70 - 6t^2 - 2(3(9.81 + 2a_B)) = 8a_B$

$70 - 6t^2 - 6(9.81) - 12a_B = 8a_B$

$\boxed{a_B = \left(\frac{-3}{10} + 2 + 0.557\right) m/s^2}$

A: $\Sigma F = m_A a_A$ ✓

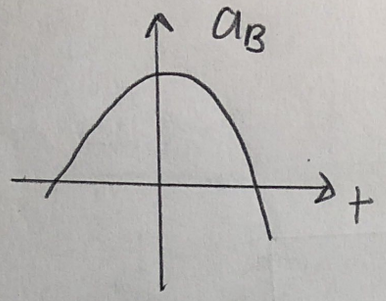
$T - mg = m_A a_A$

$T = m_A(g + a_A)$

$T = 3(9.81 + a_A)$

15/15

C.



$0 = \frac{-3}{10}t^2 + 0.557$

$t \approx 1.36 \quad t_{max} = 1.36s$ ✓

$V_B = \int \left(\frac{-3}{10}t^2 + 0.557\right)dt = \frac{-1}{10}t^3 + 0.557t + V_0$ ✓

$V_{max} = \frac{-1}{10}(1.36)^3 + 0.557(1.36) + 0$

$= 0.506\ m/s$

15/15

D. Rebrousse à $V_B = 0$

$0 = \frac{-1}{10}t^3 + 0.557t$

$0 = \frac{-1}{10}t^2 + 0.557$ ✓

$t_1 = -2.36 \quad (t_2 = 2.36)$

$x_B = \int \left(\frac{-1}{10}t^3 + 0.557t\right)dt$ ✓

$x_B = \frac{-1}{40}t^4 + \frac{0.557}{2}t^2 + x_0$

$x_{B\,max} = \frac{-1}{40}(2.36)^4 + \frac{0.557}{2}(2.36)^2 + 0$

$= 0.776m$ ✓

10/10 Bravo !

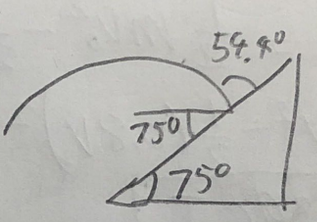
Question 4 16/50

il faut regarder les forces impulsives pendant l'impact

a) Non la quantité de mouvement avant l'impact en x est conservé car il n'y a aucune forces externes. Après l'impact sur l'axe x il n'y a pas de forces externes mais sur l'axe y, il y a des forces externe

2/10 NON

b) $0.8V\sin(75°) = V\sin\alpha$



$\alpha = 50.6°$

$\theta = 180 - 75 - 50.6$

$= 54.4$

3/20

$\vec{\theta}_x = -0.8V_b\cos(54.4°)$

$\vec{\theta}_y = 0.8V_b\sin(54.4°)$

$V_x = -0.8 \cdot 108\cos(54.4°)$

$V_y = 0.8 \cdot 108\sin(54.4°)$

$V_x = -50.3\vec{i}$ km/h

$V_y = 70.2\vec{j}$ km/h

$\vec{V} = (-50.3\vec{i} + 70.2\vec{j})$ km/h X

c) $\Delta L = m\Delta v$

$= m(v - 0.8v)$

$\Delta L = 0.2mv$ NON

$m = 0.058$ Kg

$V = \frac{108 \times 10^3}{3600}$ m/s

2/10

$\Delta L = \frac{0.2 \cdot 0.058 \cdot 108 \times 10^3}{3600} = 0.348$ kg/s

d) $\int_{t_2}^{t_1} F\,dt = \Delta L \qquad F = \frac{\Delta L}{\Delta t}$

$\Delta t = 30ms = 0.03$

$F = \frac{0,348}{0.03} = 11.6$

cohérent 4/5

e) $\Delta t = t_1 - t_2 = \frac{1}{2}mv_0^2 - \frac{1}{2}mv_f^2$

$= \frac{1}{2}mv^2 - \frac{1}{2}(0.8v)^2 = \frac{1}{2}mv^2(1-0.8)^2$

$\boxed{E = 9.396\,J}$

1

9,40J avec 3 chiffres significatifs

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