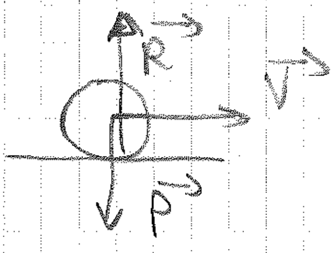
Mécanique du solide

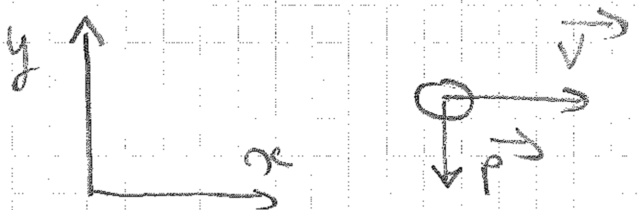
Exercice 1:



$\Sigma \vec{F} = \vec{0}$ Le principe d'inertie s'applique

la boule conserve sa vitesse en un mouvement rectiligne uniforme.

Exercice 2:



$\Rightarrow$ $\Sigma \vec{F}_{/x} = 0$ le principe d'inertie s'applique

le mouvement est rectiligne uniforme

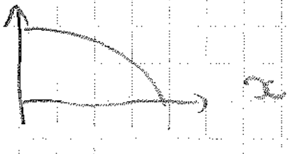
$\Rightarrow$ $|\Sigma \vec{F}_{/y}| = -P$, $-P = m\gamma$

$\gamma = \frac{-P}{m}$

alors la 2ème loi s'applique

la balle chute en un mouvement uniformément accéléré.

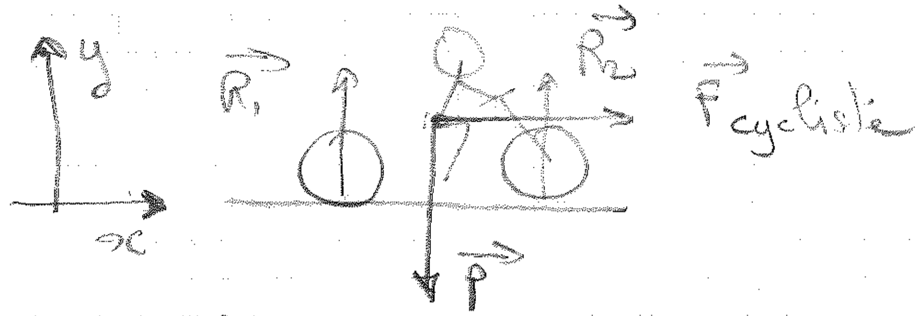
$\Rightarrow$ Les deux mouvements sont combinés. pour décrire la courbe



Exercice 3 :

La sonde n'est soumise à aucune force extérieure.
Le mouvement est rectiligne uniforme

Exercice 4 :

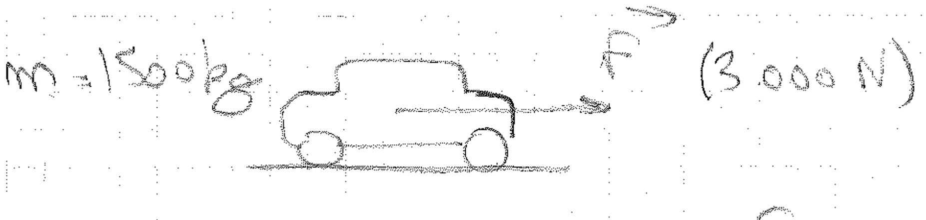


$\Sigma \vec{F_x} = \vec{F}_{cycliste}$ d'où $F_{cycliste} = m\gamma$
Le mouvement est uniformément accéléré
$\Sigma \vec{F_y} = \vec{0}$ Donc le cycliste est immobile
car $\vec{V_{y_0}} = \vec{0}$

Exercice 5 :

$F = m \cdot \gamma$
$F = 10 \times 5 = 50N.$

Exercice 6 :

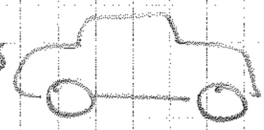


$F = m\gamma \qquad \gamma = \frac{F}{m} = \frac{3.10^3}{1,5.10^3} = 2 \ m.s^{-2}$

$\gamma = \frac{dV}{dt} \Rightarrow V_{(t)} = \gamma . t + \underset{\overset{\shortparallel}{0}}{k} \Rightarrow V_{(5)} = 2 \times 5 = 10 \ m.s^{-1}$
car $V_0 = 0$

Exercice 7 :

$m = 10^3 \, kg$



$V_1 = 10 \, m.s^{-1}$ à $V_2 = 20 \, m.s^{-1}$ en $t = 5s$.

calcul de $\gamma = \frac{\Delta V}{\Delta t}$ si $\gamma = C^{te}$.

d'où $\gamma = \frac{20 - 10}{5} = \frac{10}{5} = 2 \, m.s^{-2}$

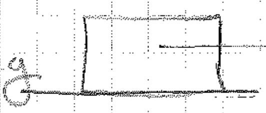
$F = m.\gamma$ d'où $F = 10^3 \times 2$

$F = 2000 \, N$

Exercice 8 :

$F = 20 \, N$.

$m = 12 \, kg$



$F = m \gamma$ et $V = \gamma . t$

A.N

$V = \frac{dx}{dt}$

$\gamma = \frac{F}{m}$ d'où

$\gamma = \frac{20}{12} = 1{,}6 \, m.s^{-2}$ $\quad x = \int v \, dt$

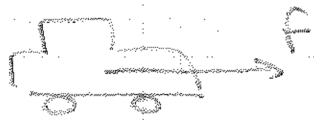
$v(2) = 1{,}6 \times 2 = 3{,}33 \, m.s^{-1}$ $\quad x = \frac{1}{2} \gamma t^2 (+ \underset{0}{x_0})$

$x = \frac{1}{2} \gamma . t^2 = \frac{1}{2} 1{,}6 \times \overset{2}{4}$

$x = 3{,}33 \, m$.

Exercice 9 :

m
1 tonne



$$\Delta V = \frac{10^2 \cdot 10^3}{3{,}6 \cdot 10^3} - 0 = 27{,}7 \ m.s^{-1}$$

$$F = m\gamma \qquad \gamma = \frac{\Delta V}{\Delta t} = \frac{27{,}7}{15} = 1{,}851 \ m.s^{-2}$$

$$F = 10^3 \cdot 1{,}851$$

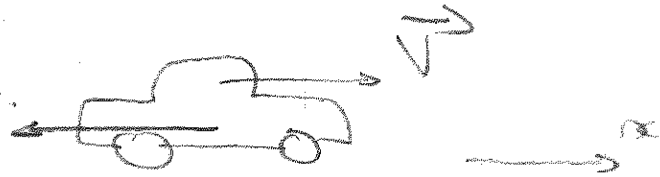
$$F = 1851 \ N$$

$$x = \frac{1}{2}\gamma . t^2 = \frac{1}{2} \cdot 1{,}851 \times 15^2$$

$$x = 208{,}3 \ m$$

Exercice 10 :

$m = 1500$ kg



$$\Sigma F_{/x} = m\gamma$$

$$= -f = m\gamma$$

$$\gamma = -\frac{f}{m}$$

$$= -\frac{4000}{1500} = -2{,}6 \ m.s^{-2}$$

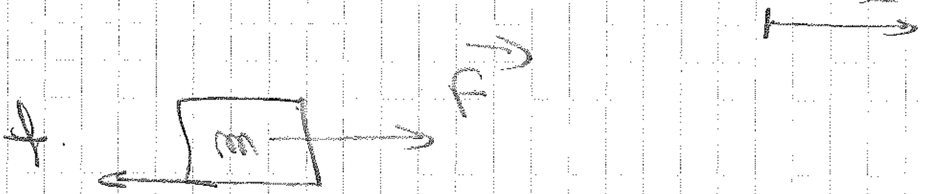
$$\frac{\Delta V}{\Delta t} = \gamma \Rightarrow \Delta t = \frac{\Delta V}{\gamma} = \frac{8-30}{-2{,}6}$$

$$\Delta t = 8{,}2 s$$

$$x = \frac{1}{2}\gamma t^2 + V_0 \times t = -\frac{1}{2} \cdot 2{,}6 \times 8{,}2^2 + 30 \times 8{,}2$$

$$x = 156 \ m$$

Exercice 11 :



($m = 10$ kg)

$$|\sum \vec{F}_{/x}| = -f + F = m.\gamma$$

$$= m.\frac{\Delta V}{\Delta t}$$

$$F = m\frac{\Delta V}{\Delta t} + f$$

$$= 10 \times \frac{(4-0)}{(2-0)} + 4$$

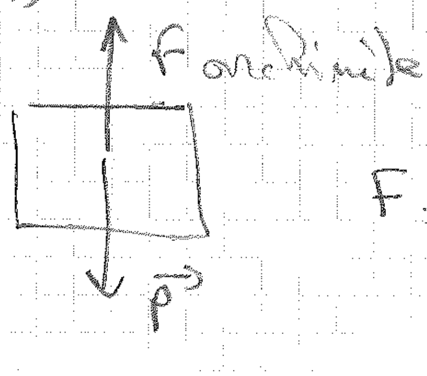
$$F = 10 \times 2 + 4 = 24\,N$$

Exercice 12 :

$$\rho_{beton} = 3.10^3\ kg\,m^{-3}$$

Poussée d'archimède :

" Un corps plongé dans un fluide reçoit une force dirigé vers le haut égale au poid du volume de fluide déplacé. "



$$F = \rho_{eau} \times V_{bloc}$$

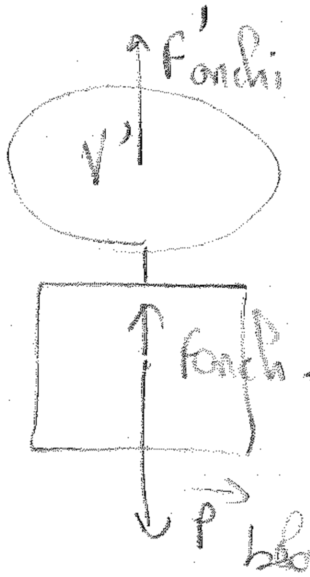
$$F = 1024 \times (2 \times 1,5 \times 0,5)$$

$$= 1024 \times 1,5 = 1536\,N$$

Le poid $P_{béton} = \rho_{béton} \times g \times V_{bloc}$

$= 3.10^3 \times 9,81 \times 1,5$

$= 44,145.10^3$ N.



Pour remonter le bloc, il faut déplacer un volume de

$F'_{arch} + F_{archi} = P$

$F'_{archi} = P - F_{arch}$

$= 44,145.10^3 - 1536$

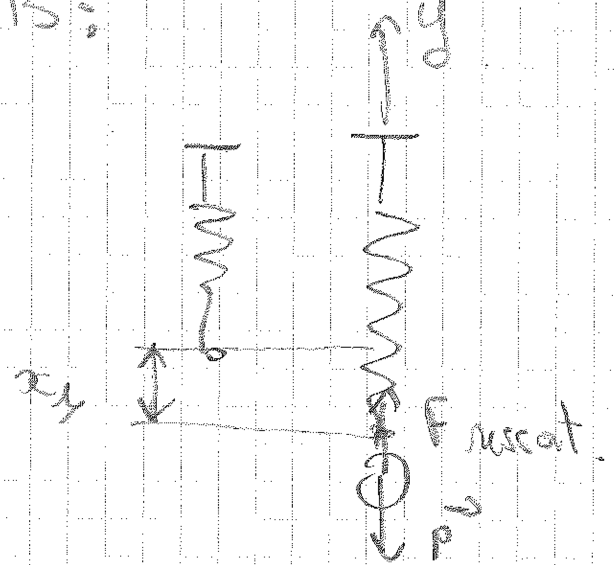
$= 42,609.10^3$ N.

$F'_{archi} = \rho_{eau\ de\ mer} \cdot V'$

$V' = \frac{42,609.10^3}{1,024.10^3} = 41,61\ m^3$.

Exercice 13 :

1)



en équilibre , $(\Sigma \vec{F}_{/y}) = \vec{0}$

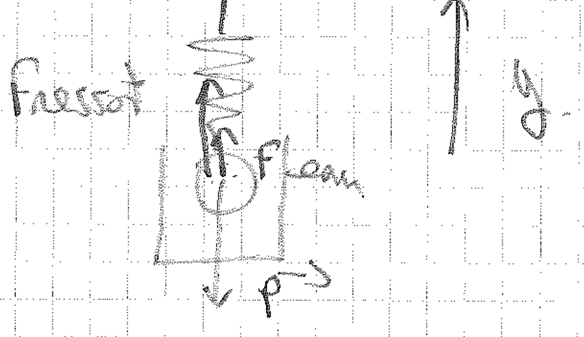
soit $F - P = 0$

$F = P = m.g$

$kx_1 = mg$

$x_1 = \frac{m.g}{k}$

2-)



Sur y : $F_{ressort} + F_{eau} - P = 0$

$F_{ressort} = P - F_{eau}$

$= m.g - \underbrace{\rho_{eau} V_s}_{m_{eau}} . g$

$F_{ressort} = m.g - m_e . g$

$= (m - m_e).g$

$k x_2 = (m - m_e) g \Rightarrow x_2 = \frac{(m - m_e) g}{k}$

$$x_1 = \frac{mg}{k}$$

3- alors $x_2 < x_1$ à cause de m_e

① $x_1 = \frac{mg}{k} = \frac{m_1 g}{k}$

② $x_2 = \frac{(m - m_{eau})g}{k} = \frac{m_2}{k} g$

② - ① $x_2 - x_1 = \frac{m_2 g}{k} - \frac{m_1 g}{k}$

$$x_2 - x_1 = (m_2 - m_1)\frac{g}{k}$$

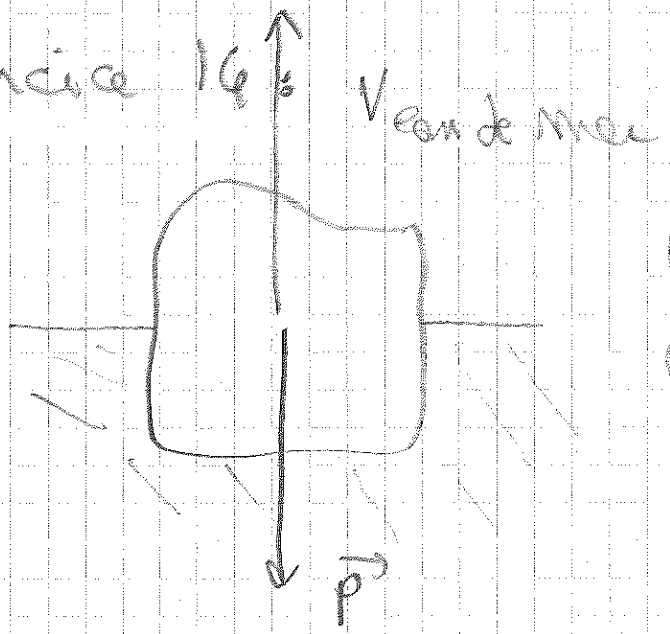
Soit $\left[m_2 - m_1 = (x_2 - x_1) \times \frac{k}{g} \right]$

4- et $m_2 - m_1 = \cancel{m} - m_{eau} \cancel{- m}$

Soit $m_{eau} = (x_1 - x_2) \cdot \frac{k}{g}$

Exercice 14 :

(1)



$\rho_1 = 910 \, kg\,m^{-3}$

$\rho_2 = 1024 \, kg\,m^{-3}$

(2) à l'équilibre

$P = F_{archi}$

$g \cdot V_t \cdot \rho_1 = V_i \cdot \rho_2 \cdot g$

$V_t \cdot \rho_1 = (V_t - V_e)\rho_2 \Rightarrow V_t \cdot \rho_1 = V_t\rho_2 - V_e\rho_2$

$V_t(\rho_2 - \rho_1) = V_e\rho_2$

(3) $V_t = V_e \dfrac{\rho_2}{(\rho_2 - \rho_1)}$

A.N. : $V_t = 600 \times \dfrac{1024}{(1024 - 916)} = 5389{,}5 \, m^3$

$m_t = \rho_1 \times V_t = 916 \times 5389{,}5$

$m_t = 4904$ tonnes

Exercice 15 :

m = 57 800 t.

$$\rho_{eau} \cdot V' \cdot \cancel{g} = m \cdot \cancel{g}$$

$$V' = \frac{m}{\rho_{eau}} = \frac{57\,800 \cdot 10^3}{1{,}028}$$

$$V' = 56{,}22 \cdot 10^6 \ m^3$$