Force d'Archimède - exercices supplémentaires Corrigés

Y. Fracheboud

6 avril 2022

1 : $F_A = \rho_{eau} \cdot V \cdot g$; $V = 0.3^3 = 0.027\ m^3$

$F_A = 1000 \cdot 0.027 \cdot 10 = \underline{270\ N}$

2. $F_A = \rho_{eau} \cdot V \cdot g \Rightarrow V = \dfrac{F_A}{\rho_{eau} \cdot g} = \dfrac{1}{1000 \cdot 10} = \underline{1 \cdot 10^{-4}\ m^3}$

3. $\rho_{Pyrex} = 2320\ kg\ m^{-3}$; $\rho_{alcool} = 790\ kg \cdot m^{-3}$

$V_{bille} = \frac{4}{3}\pi \cdot \left(\frac{0.03}{2}\right)^3 = 1.4137 \cdot 10^{-5}\ m^3$

$P_{bille} = \rho_{Pyrex} \cdot V \cdot g = 2320 \cdot 1.4137 \cdot 10^{-5} \cdot 10 = 0,32798\ N$

$F_A = \rho_{alcool} \cdot V \cdot g = 790 \cdot 1.4137 \cdot 10^{-5} \cdot 10 = 0.11684\ N$

$P_A = P - F_A = 0.32798 - 0.11684 \approx \underline{0.216\ N}$

4. $V_{cube} = 0.05^3 = 1.25 \cdot 10^{-4}\ m^3$

$\rho_{fer} = 7870\ kg \cdot m^{-3}$

$P_{cube} = V \cdot \rho_{fer} \cdot g = 1.25 \cdot 10^{-4} \cdot 7870 \cdot 10 = 9.8375\ N$

$F_A = P - P_A = 9.8375 - 8.93125 = 0.90625\ N$

$\rho_{liq} = \dfrac{F_A}{V \cdot g} = \dfrac{0.90625}{1.25 \cdot 10^{-4} \cdot 10} = 725\ kg \cdot m^{-3}$

$\Rightarrow$ c'est de l'essence

5. a) $P_{H_2} = \rho_{H_2} \cdot V \cdot g = 0.082 \cdot 200'000 \cdot 10 = 1.64 \cdot 10^5 N$

$F_A = \rho_{air} \cdot V \cdot g = 1.293 \cdot 200'000 \cdot 10 = 2.586 \cdot 10^6 N$

$P_A = P - F_A = 1.64 \cdot 10^5 - 2.586 \cdot 10^6 = -2.422 \cdot 10^6 N$

$\Rightarrow$ il pouvait soulever $\frac{2.422 \cdot 10^6}{10} = 2.422 \cdot 10^5 kg$
$= 242.2 t.$

b) $P_{He} = \rho_{He} \cdot V \cdot g = 0.164 \cdot 200'000 \cdot 10 = 3.28 \cdot 10^5 N$

$P_A = P - F_A = 3.28 \cdot 10^5 - 2.586 \cdot 10^6 = -2,258 \cdot 10^6 N$

$\Rightarrow \frac{2.258 \cdot 10^6}{10} = 2,258 \cdot 10^5 kg = 225,8 t.$

6. $P_{bague} = 8.47 \cdot 10^{-3} \cdot 10 = 8.47 \cdot 10^{-2} N = 0.0847 N$

$F_A = P - P_A = 0.0847 - 0.0747 = 0.01 N$

$F_A = \rho_{eau} \cdot V \cdot g \Rightarrow V = \frac{F_A}{\rho_{eau} \cdot g} = \frac{0.01}{1000 \cdot 10} = 1 \cdot 10^{-6} m^3$

$\rho_{métal} = \frac{m}{V} = \frac{8.47 \cdot 10^{-3}}{1 \cdot 10^{-6}} = 8470 kg \cdot m^{-3}$
$\Rightarrow$ c'est du laiton !

7. $P = m \cdot g = 2.5 \cdot 10 = 25 N$

$F_A = P - P_A = 25 - 11 = 14 N$

$V = \frac{F_A}{\rho_{alcool} \cdot g} = \frac{14}{790 \cdot 10} = 1.7722 \cdot 10^{-3} m^3$

$\rho = \frac{m}{V} = \frac{2.5}{1.7722 \cdot 10^{-3}} = 1410.7 kg \cdot m^{-3}$

8. $V = \frac{4}{3}\pi r^3 = \frac{4}{3} \cdot \pi \, (0.5)^3 = 0.52360 \, m^3$

$F_A = \rho_{eau} \cdot V \cdot g = 0.52360 \cdot 1000 \cdot 10 = 5.2360 \cdot 10^3 \, N$

Elle flotte $\Rightarrow P = F_A = 5.2360 \cdot 10^3 \, N$

$m = \frac{P}{g} = 5.2360 \cdot 10^2 \, kg = 523.60 \, kg$

si elle était pleine $m = \rho_{acier} \cdot V = 0.52360 \cdot 7850 = 4110.3 \, kg$

m à enlever : $4110.3 - 523.6 = 3586.7 \, kg$

$\Rightarrow V_{vide} = \frac{m \text{ à enlever}}{\rho_{acier}} = \frac{3586.7}{7850} = \underline{0.457 \, m^3}$

9. $P = m \cdot g = 0.2 \cdot 10 = 2 \, N$

il flotte $\Rightarrow F_A = P = 2 \, N$

$V = \frac{F_A}{\rho_{eau\ de\ mer} \cdot g} = \frac{2}{1020 \cdot 10} = \underline{1.96 \cdot 10^{-4} \, m^3}$

10. $P = m \cdot g = 0.228 \cdot 10 = 2.28 \, N$

$F_A = P - P_A = 2.28 - 1.78 = 0.5 \, N$

$V = \frac{F_A}{\rho_{eau} \cdot g} = \frac{0.5}{1000 \cdot 10} = 5 \cdot 10^{-5} \, m^3$

$\rho = \frac{m}{V} = \frac{0.228}{5 \cdot 10^{-5}} = 4560 \, kg \cdot m^{-3} \Rightarrow$ titane

11. $P_{He} = \rho_{He} \cdot V \cdot g = 0.164 \cdot 1.2 \cdot 10^{-3} \cdot 10 = 1.968 \cdot 10^{-3} \, N$

$P = P_{ballon} + P_{He} = 1.5 \cdot 10^{-3} \cdot 10 + 1.968 \cdot 10^{-3} = 1.6968 \cdot 10^{-2} \, N$

$F_A = \rho_{air} \cdot V \cdot g = 1.293 \cdot 1.2 \cdot 10^{-3} \cdot 10 = 1.5516 \cdot 10^{-2} \, N$

$P_A = P - F_A = 1.6968 \cdot 10^{-2} - 1.5516 \cdot 10^{-2} = 1.452 \cdot 10^{-3} \, N$

$\Rightarrow$ non, il est trop lourd de $\frac{1.452 \, 10^{-3}}{10} \simeq 0.15 \, g$