MICHAUX
Matéo
TRAVERSIÉ
Thomas

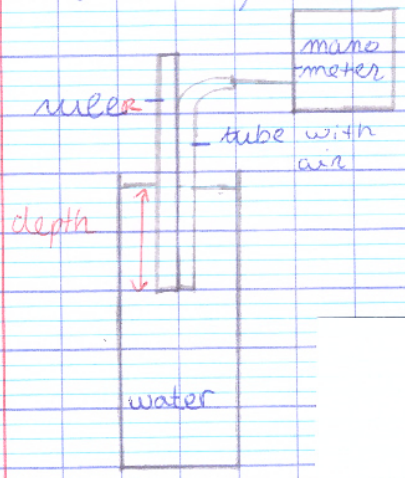
Scuba diving and pulmonary barotrauma

2nde 4

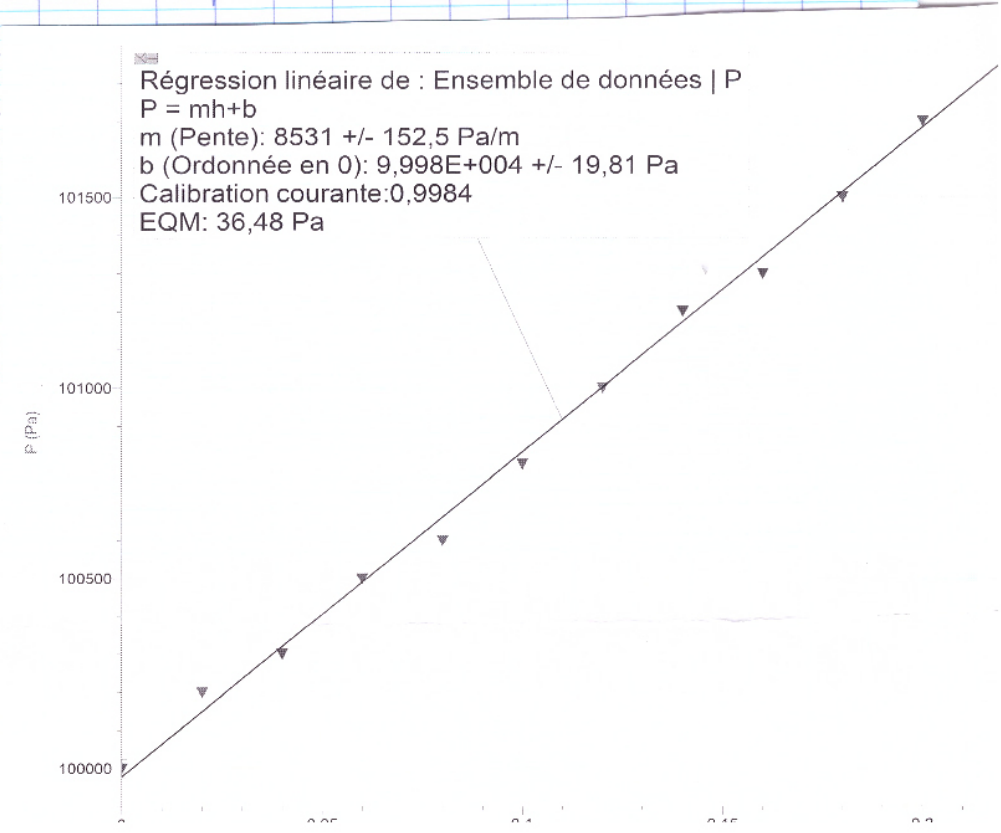
What are the causes of the pulmonary barotrauma?

- The weight of the water above the scuba diver increases the pressure by amount of 1bar every 10 m.

At the surface, the pressure equals 1 bar because of the atmospheric pressure that equals 1bar.
We study this with an experiment :



This experiment measures the pressure as a function of the depth.



So $P = a \times h + b$ with h the depth

$P = 8531 \times h + 9,998 \times 10^4$

We know that $\rho \times g = 1000\ kg/m^3 \times 9,8\ N/kg$

≈ 8531

and $P_{atm} \approx 1000\ hPa = 10 \times 10^4\ Pa$

$\approx 9,998 \times 10^4\ Pa$

So we can say that $P = g \times \rho \times h + P_{atm}$

with g the gravity, ρ the volumetric mass of water, h the depth, P is the pressure at the depth and P_{atm} is the atmospheric pressure.

So at the depth 10 m, $P = 10000 \times 10 + 100\,000$

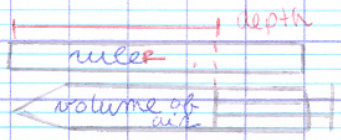
$P = 200\,000\ Pa$.

The pressure has increased by $200\,000 - 100\,000$ (because $100\,000 = P_{atm}$) $= 100\,000\ Pa$

$= 1\ bar$ /

So the pressure increases 1bar every 10 m. /

- We measure the volume of the air as function as the depth:



So we obtain:

$V\ (m^3)$	15×10^{-6}	20×10^{-6}	30×10^{-6}	35×10^{-6}	40×10^{-6}
$P\ (Pa)$	1860×10^2	1450×10^2	1180×10^2	864×10^2	757×10^2

We find that $P \times V = constant$ with P is the pressure because $15 \times 10^{-6} \times 1860 \times 10^2 = 2,8$ and V is the volume

$20 \times 10^{-6} \times 1450 \times 10^2 = 2,9$ of air

$25 \times 10^{-6} \times 1180 \times 10^2 = 2,9$

So the volume of the air in the lungs increases when we go up to the surface.

• The causes of the pulmonary baro trauma holding our breath are: when we go up to the surface ~~too fast~~, the lungs inflated because the pressure decreases.

To avoid this accident, we have to go up to the surface step by step and slowly and we need to blow the air of our lungs to empty it.

Because if we have 5 L at the pressure 4 bar, when we go to the surface (1 bar), the volume of air became $5 \times 4 = 1 \times V$ so our lungs burst.

$\Leftrightarrow V = 20\,L$

So we need to breathe out all the air of our lungs every step (10 m). With this method, we can avoid pulmonary barotrauma.

expression: A

description des expériences: A +

explication de l'accident: B

solution proposée: A

8,5/10