

## Captains' Fight 1

FPT 2018  
9-10th February



1 Question

2 Solution

You have 2 minutes to solve the following question:

What is the number of Helium atoms necessary  
to lift up the Eiffel Tower ?  
(with a balloon that we suppose massless)

1 Question

2 Solution

One more slide for the solution !

- Ideal gas approximation: At fixed  $P$  and  $T$ , volumes of gas depend only on the number of particles, not the type.
- $M_{\text{air}} \simeq 29 \text{ g.mol}^{-1}$  and  $M_{\text{He}} \simeq 4 \text{ g.mol}^{-1}$  + Archimedes:  
 $\Rightarrow$  one mole of Helium lifts up 25  $\text{g}$ .
- $M_{\text{Eiffel Tower}} \simeq 10000 \text{ tons}$  and  $\mathcal{N}_{\text{Av}} \simeq 6 \cdot 10^{23} \text{ mol}^{-1}$ .

$$N_{\text{He}} \simeq \underbrace{\frac{10000 \cdot 10^6}{25}}_{\text{number of He moles}} \times \underbrace{6 \cdot 10^{23}}_{\text{atoms per mole}}$$

$$\Rightarrow N_{\text{He}} \simeq 10^{32} \text{ atoms}$$