Captain's Fight 1

FPT 2019
February 8-9th

6th French Physicists' Tournament

Société Française de Physique

COMMISSION JEUNES
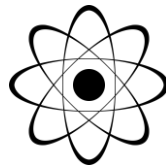
1) Question

2) Solution

You have 2 minutes to solve the following question :

As of May 20th of this year, four SI units (kg, A, K, mol) will be redefined based on Physics constants. What is then the introduced uncertainty on the newly measured IPK*, in kilogram ?

*IPK : International Prototype of the Kilogram

1) Question

2) **Solution**

* Source : <u>CODATA 2017 for the revision of the SI</u>

* Old Planck value : $h_{old} = 6.626070150(69) \times 10^{-34}$ kg.m^2.s^{-1}

* New Planck value : $h = 6.626070150 \times 10^{-34}$ kg.m^2.s^{-1}

* The second and the meter are exactly defined

$$\frac{\Delta IPK}{IPK} = \frac{\Delta h_{old}}{h_{old}} \Rightarrow \Delta IPK = \frac{69 \times 10^{-9}}{6.63}$$

$$\Rightarrow \Delta IPK = 1.4 \times 10^{-8} \text{ kg}$$

❀ Source : <u>CODATA 2017 for the revision of the SI</u>

❀ Old Planck value : $h_{old} = 6.626070150(69) \times 10^{-34}$ kg.m^2.s^{-1}

❀ New Planck value : $h = 6.626070150 \times 10^{-34}$ kg.m^2.s^{-1}

❀ The second and the meter are exactly defined

$$IPK = \frac{h_{old}}{h} = 1 \pm \frac{69 \times 10^{-9}}{6.626070150}$$

$$\Rightarrow \Delta IPK = 1.4 \times 10^{-8} \text{ kg}$$