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PW 1: INTRODUCTION TO PHYSICS PRACTICAL WORK

Experience : A scale repairer wants to replace a defective spring in a scale. The spring must have a stiffness constant $\boldsymbol{k} = (\mathbf{3.00} \pm \mathbf{0.05})\ \boldsymbol{N/m}$ and a negligible mass. In his workshop, he found a spring of negligible mass but its stiffness constant is unknown.

Using Hook's Law : $\boldsymbol{F} = \boldsymbol{k} \times \boldsymbol{d}$, where $\boldsymbol{F}$ represents the force applied to the spring, $\boldsymbol{k}$ the stiffness constant and $\boldsymbol{d}$ the elongation, he was able to calculate the value of $\boldsymbol{k}$. As a result, he hung different masses on the spring and measured its elongation. Hook's law simplifies to :

$$\boldsymbol{d} = \frac{\boldsymbol{g}}{\boldsymbol{k}}\boldsymbol{m} \qquad (1)$$

The measurements are reported in the table below.

Questions :

1- By comparing the physical equation (1) with the mathematical formula $\boldsymbol{y} = \boldsymbol{bx}$, establish the following identifications :

$$x = \qquad\qquad , y = \qquad\qquad , b =$$

2- Complete the table below :

i	$\boldsymbol{m_i}(\boldsymbol{kg})$	$\boldsymbol{d_i}$(m)	$\boldsymbol{m_i d_i}$ (...)	$\boldsymbol{m_i^2}$ (...)	$\boldsymbol{bm_i}$(...)	$(\boldsymbol{d_i} - \boldsymbol{bm_i})^2$(...)
1	0.010	0.03290				
2	0.020	0.06650				
3	0.040	0.13280				
4	0.060	0.19940				
5	0.080	0.26590				
n=....			$\sum_{i=1}^{n} \boldsymbol{m_i d_i}$ = ...	$\sum_{i=1}^{n} \boldsymbol{m_i^2}$ = ...		$\sum_{i=1}^{n} (\boldsymbol{d_i} - \boldsymbol{bm_i})^2$ = ...

3- Give the numerical values of the following quantities with their corresponding units :

$$\boldsymbol{b} = \text{.....} \quad ; \quad \Delta\boldsymbol{d} = \text{.....} \quad ; \quad \Delta\boldsymbol{b} = \text{.....}$$

4- On the same graph sheet, represent the experimental points $\boldsymbol{d} = \boldsymbol{f}(\boldsymbol{m})$, the error bars as well as the line of slope $\boldsymbol{b}$.

5- Calculate the spring stiffness constant and put it in the form $\boldsymbol{k} = (\text{..... ..... } \pm \text{ ... .})$ .....

6- Can the repairer replace the defective spring ? Explain. We give : ***g = 9.81 m/s²***