1. 气垫导轨的水平调节

	Δt_1 (ms)	Δt_2 (ms)	$\frac{\lvert\Delta t_1-\Delta t_2\rvert}{(\Delta t_1+\Delta t_2)/2}$ (%)
左→右	19.21	20.25	2.63
右→左	17.53	17.93	1.13

2. 弹簧振子简谐振动周期与振幅的关系

周期数__3__, (振子) m_1= __220.00__g, (两个弹簧) m_s= __21.18__g。

次数 / 振幅 A (cm) / 时间 t (s)	18.00	20.00	22.00	24.00
1	4.5676	4.5696	4.5697	4.5680
2	4.5674	4.5673	4.5672	4.5668
3	4.5668	4.5675	4.5681	4.5671
4	4.5673	4.5676	4.5677	4.5681
5	4.5673	4.5674	4.5651	4.5680
6	4.5653	4.5680	4.5661	4.5669
$\bar{t}$ (s)	4.5670	4.5679	4.5673	4.5675
周期 T (s)	1.5223	1.5226	1.5224	1.5225
倔强系数 k (N/m)	3.867	3.865	3.866	3.865

弹簧振子简谐振动周期与振幅的关系为：__周期与振幅无关__。

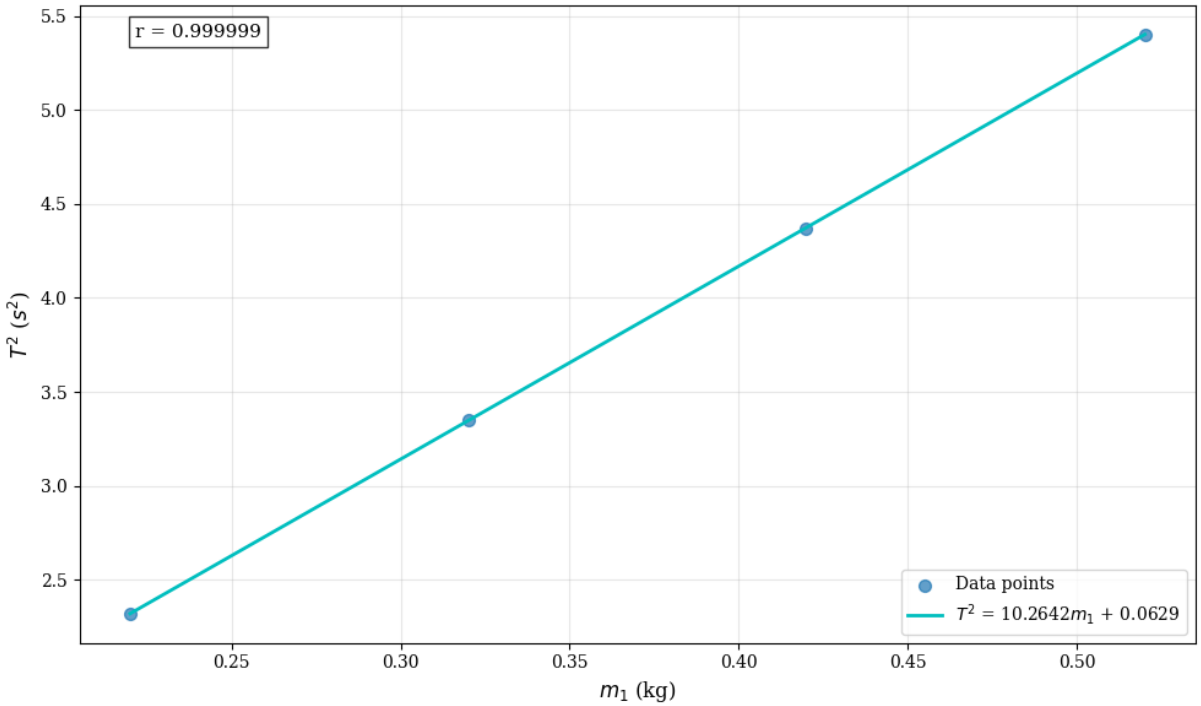
3. 弹簧振子简谐振动周期与振子质量的关系

(设定的振幅 A=__20__cm, 周期数__3__)

	m (g)	时间 t (s)		周期 T (s)	T^2 (s^2)
滑块	220.00	4.5676	4.5668	1.5229	2.3192
		4.5674	4.5673		
滑块 +2个骑码	320.05	5.4910	5.4927	1.8305	3.3507
		5.4949	5.4933		
滑块 +4个骑码	419.71	6.2714	6.2724	2.0906	4.3706
		6.2718	6.2711		
滑块 +6个骑码	520.15	6.9721	6.9729	2.3240	5.4010
		6.9720	6.9711		

数据分析

线性回归 $T^2 - m_1$:



$$\alpha = 10.2642 \text{ s}^2/\text{kg}$$
$$\beta = 0.0629 \text{ s}^2$$
$$r = 1.00000$$

计算:

$$T^2 = \frac{4\pi^2}{k} m_1 + \frac{4\pi^2}{k} m_0$$

,

1. 倔强系数 k:

$$k = \frac{4\pi^2}{\alpha} = \frac{4\pi^2}{10.2642} = 3.848 \text{ N/m}$$

2. 弹簧的有效质量 m_0:

$$m_0 = \frac{\beta}{\alpha} = \frac{0.0629}{10.2642} = 0.00613 \text{ kg} = 6.13 \text{ g}$$

3. 相对误差:

(a) 理论值 $m_{0,th} = m_s/3 = 21.18/3 = 7.06$ g

$$E_r(m_0) = \frac{|m_0 - m_{0,th}|}{m_{0,th}} = \frac{|6.13 - 7.06|}{7.06} \times 100\% = 13.2\%$$

(b) $\bar{k} = (3.867 + 3.865 + 3.866 + 3.865)/4 = 3.866$ N/m

$$E_r(k) = \frac{|k - \bar{k}|}{\bar{k}} = \frac{|3.848 - 3.866|}{3.866} \times 100\% = 0.47\%$$

结论: