

## An Introduction to Measurement Theory and Experiment Design

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## PROBLEMS

*In all the following problems state the variables or combination of variables that should be plotted to check the suggested variation and state how the unknown (slope, intercept, etc.) may be found.*

7. The fundamental frequency of vibration of a string is given by

$$f = \frac{1}{2\ell} \sqrt{\frac{T}{m}}$$

$f$ ,  $\ell$ , and  $T$  are measured variables. Determine  $m$ .

14. The linear expansion of a solid is described by

$$\ell = \ell_0(1 + \alpha \cdot \Delta T)$$

$\ell$  and  $\Delta T$  are measured variables.  $\ell_0$  is constant but unknown. Determine  $\alpha$ .

18. The force between electrostatic charges is described by

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}$$

$F$  and  $r$  are measured variables.  $q_1$  and  $q_2$  are fixed and known. How do you check the form of the function?

23. The wavelengths of the lines in the Balmer series of the hydrogen spectrum are given by

$$\frac{1}{\lambda} = R \left( \frac{1}{4} - \frac{1}{n^2} \right)$$

$\lambda$  and  $n$  are measured variables. Determine  $R$ .