Physical Experiments I

Pre-lab Assignment

Experiment Title

Measurement of the Young's Modulus of Wire by Elongating

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Score

Answers to Questions (20 points)

1.What's the instrument error for a vernier caliper with the smallest division of 0.02mm? What's its reading error?

The instrument error for the vernier caliper, which is a discontinuous reading instrument, is just its smallest division which is 0.02mm, so we get:

Instrument error = 0.02 mm.

The reading error for us about this instrument is 0, because we never get one step called estimate reading when we use this equipment. so we get:

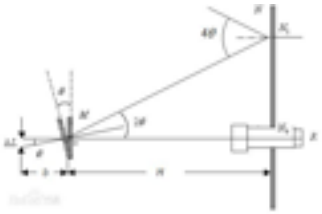
Answer error = 0.00 mm.

2.What's the definition of young's modulus? In this experiment, which questions will be measured in order to determine the young's modulus? In Eq(3.4-5), which quality is the most critical? Why?

young's models is the quantity used to characterize capacity of materials to resistance deformation, which is a constant that can describe the ratio of stress to strain for a material experiencing either tensile or compressive stress in elastic deformation.

E = Stress / strain

$$E = \frac{FL}{S\Delta L}$$



$\triangle L = b \cdot \tan\theta = b\theta$

$\theta = C / 4H$

$\triangle L = bC / 4H$

$$E = \frac{16FLH}{\pi D^2 bC}$$

- The force added on the metal string. F
- The cross section area. S
- The original length of the wire. L
- The difference of initial and final measure result on string. ΔL
- The distance between optical lever and telescope. H
- The diameter of the motel string. D
- The distance between optical lever and toe. b
- The difference of initial and final measure result on telescope. C
- The angel generated by the optical lever. θ

All the variables and quantities above are the figures that we need to measure during the experiment in order to determine the Young's modulus.

In my view, that D, which is dominated by the string we choose, is the most important figure, because it is under the square power, which means that if we change it (the experiment material) the Young's modules will change a lot.(It definitely will change a lot as we alter the material itself)

3.Describe the main functions of an optical lever in this experiment. What's the magnificent of the optical lever in Fig. 3.4-3?

The optical lever is a quiet tiny mirror but it helps us a lot.
Generally, $\triangle L$ is just a small quantity for most of the other materials. It is extremely difficult for us to measure it directly. Thus, the optical lever can be used to magnify the change of the length of the material when the force applied.
The magnification of the optical lever is achieved by the optical mirror which is just same as the lever. The magnifying power is 2H/b (the picture above), where H refers to the distance from the measuring scale to the plane mirror and b is the length of optical lever.