EXPERIMENTAL WORK 3

Subject. Measuring the size of the small objects

Theoretical data and practical advice

Sometimes the device's scale value does not allow measurement to be made with sufficient accuracy. For example, when the device's scale value is larger or comparable to the size to be measured. In this case, apply the string method. The row method allows us to determine only the mean value of a small object.

To determine the size d of a small object b with the string method, it is necessary:

1. Form the row, for example, lay the seeds in a row, close to each other;
2. Measure the length L of the row;
3. Determine the number n of objects or turns in a row;
4. Find the ratio: $d = \frac{L}{n}$.

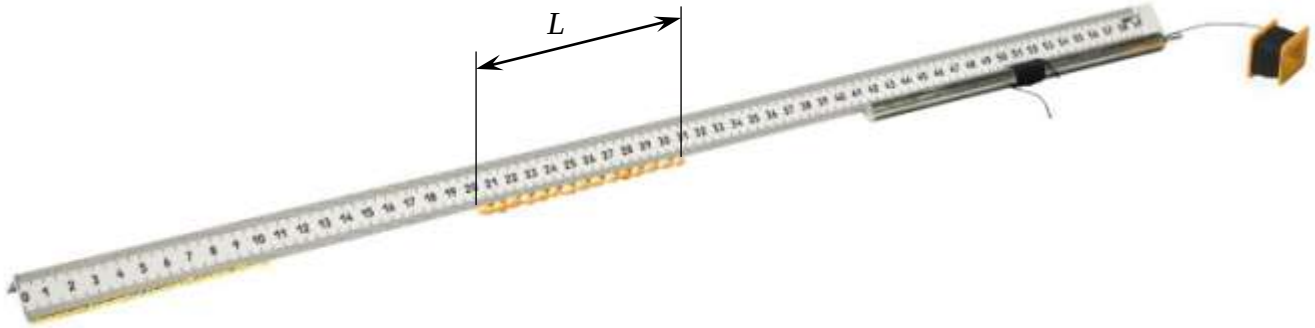

Figure 1

Subject. Measuring the size of the small objects.

Target: to determine the diameter of a pea, the diameter of millet grain, the thickness of the thread by the string method.

Equipment: ruler (treadmill), threads, a metal rod, glasses with peas and millet.

Execution

The results of the measurements I'm writing down into the table:

Table 1

No. of the experiment	Object	Length L of the row, mm	Amount n of objects (turns) in a row	Diameter (thickness) $d_{meas.}$, mm	Absolute error Δd, mm	Relative error ε, %
1						
2						
3						

1. I’m determining the scale division of the ruler (treadmill): $C_{rul.}$ = ——— = _____ mm.

Figure 2

2. I’m making a row of peas, measure the length L_1 of the row, amount n_1 of peas in a row and calculating d_1 the peas diameter: $d_1 = \frac{L_1}{n_1}$;d_1 = ——— = _____ mm.

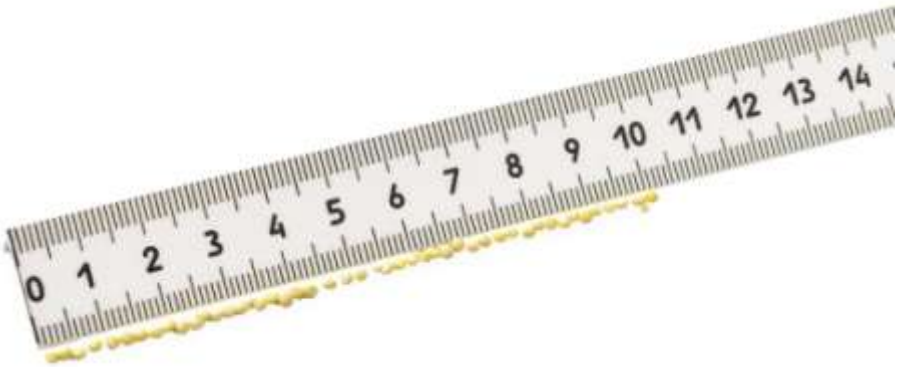

Figure 3

3. I'm making a row of millet grains, measure the length L_2 of the row, amount n_2 of grains in a row and calculate d_2 the diameter of a millet grains: $d_2 = \frac{L_2}{n_2}$; $d_2 =$ ——— = _____ mm.

Figure 4

4. In order to form a row, I wind the thread on the metal rod, measure the length L_3 of the row, number n_3 of turns and calculate the average thread thickness d_3: $d_3 = \frac{L_3}{n_3}$; d_3 = ——— = _____ mm.

5. I'm estimating the absolute error. in this case the absolute error is less, than the scale division by as many times as many objects (turns) in a row:

   $\Delta d_1 = \frac{1\text{ mm}}{n_1}$; Δd_1 = ——— = _____ mm; d_1 = _____ ± _____ ;

   $\Delta d_2 = \frac{1\text{ mm}}{n_2}$; Δd_2 = ——— = _____ mm; d_2 = _____ ± _____ ;

   $\Delta d_3 = \frac{1\text{ mm}}{n_3}$; Δd_3 = ——— = _____ mm; d_3 = _____ ± _____ .

6. I'm estimating the relative error of the measurement results:

   $\varepsilon_1 = \frac{\Delta d_1}{d_1}$; ε_1 = ——— = _____ %;

   $\varepsilon_2 = \frac{\Delta d_2}{d_2}$; ε_2 = ——— = _____ %;

   $\varepsilon_3 = \frac{\Delta d_3}{d_3}$; ε_3 = ——— = _____ %.

7. Analyzing the results of the experiment:

The work was done by the student_____of the _____ grade

The work was checked by the teacher _____