Physics, experimental round, junior student

Investigation of pendulum oscillation (15 ponits).

Devices and stuff: Plasticine, thread, stopwatch, tripod, dowel, strap and graph papers.

Mechanical oscillation is the periodical movements of body with definite time intervals. The time of one cycle in periodical movement is called as oscillation period. Mathematical pendulum is the pendulum, which consists of weightless thread, and mass point concentrated at length *l*. In this problem you need to investigate the oscillation of complicated pendulum illustrated at figure 1, and analyze the dependence between oscillation period and *x*. The initial length of thread should be equal 70 cm (*l$_0$=70 cm.*).

Instruction: Follow the steps:
1. Describe your methodology.
2. Assemble the experimental equipment. Make the required measurements. Fill the collected data into data table.
3. Make the required calculations. Plot the dependence between oscillation period and *x* at graph paper.
4. Estimate the error of measurements.
5. The dependence between oscillation period and length of thread for mathematical pendulum is described by next formula: $T = 2\pi\sqrt{l/g}$, where *g* – is the acceleration of gravity. Derive such a dependence for complicated pendulum.
6. Make a conclusion.

Problem 1.
Finding specific thermocouple voltage (10 points).

Devices and stuff: Thermocouple, thermometer, multimeter, tripod, glass with hot water, glass with ice, empty glass, tweezers, glass bar, adhesive tape, graph papers. *Ice and hot water will be provided in accordance with your requirements.*

When the temperature of junctures of different metals, which form closed chain (such system called thermocouple) is being kept at different levels T_1 and T_2, then in the chain the electromotive force arises, this EMF called thermocouple voltage.

The thermocouple voltage depends on temperature difference $T_1 - T_2$, and dependence could be described by the following formula: $E = \alpha(T_1 - T_2)$.

The α - is called ***specific thermocouple voltage*** for given couples of metals. In this problem you need to experimentally define the value of α for a given thermocouple.

Instruction: Follow the steps.
1. Describe your methodology.
2. Assemble the experimental equipment. Be careful with thermocouple!
3. Make the required estimations. Fill the collected data into your data table.
4. Plot the dependence at graph paper.
5. Define the specific thermocouple voltage.
6. Estimate the error of measurements.
7. Make a conclusion.

Problem 2.
Finding wave-length of monochromatic light (10 points).

Devices and stuff: Source of light, two-dimensional diffraction lattice, tripod, strap and graph papers. Parameters for diffraction lattice are $d_1=0.06$ mm, $d_2=0.07$ mm.

Instruction: Follow the steps.
1. Describe your methodology.
2. Make the required estimations. Fill the collected data into your data table.
3. Process the collected data.
4. Estimate the error of measurements.
5. Make a conclusion.