Molecular physics and thermodynamics

2.3 Archimedes´ Principle

THEORETICAL PREPARATION

In 3rd century b.c. an ancient Greek mathematician Archimedes formulated this principle:

A body immersed in a fluid is buoyed up by a force, which is equal to the weight of the fluid that the body displaces. For the buoyant force it applies: $F_{vz} = V \cdot \rho_k \cdot g$ where:

V ……..…volume of the immersed part of the body

ρ_k …… density of the fluid

g …… gravitational acceleration.

EQUIPMENT

Dynamometer PS-2189, USB link, notebook with DataStudio program, water, ethanol, metal stand, measuring cylinder, beaker, caliper, steel weights (of 100g), set of weights of the same volume but of different material.

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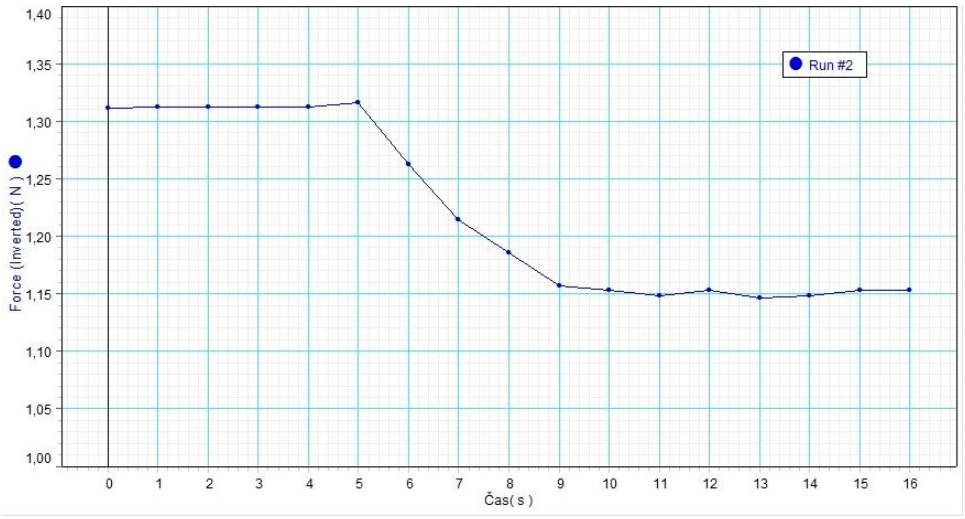
evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

PROCEDURE

1) Firstly execute an experiment - when submerging an object into the fluid fluently, the magnitude of the final force is declining, it means the buoyant force is getting greater with the rising volume of the submerged object.

Pour water into the beaker. Hang a weight on the dynamometer, which is fixed to the supporting stand. Connect the dynamometer with the notebook, use the USB link to do so. Measure the relationship of resultant of forces and time in DataStudio program. The weight is in the air and then it is fluently submerged into the water, so it is fully under the water surface. After that end the measurement.



2) Execute measurements of the buoyant force for the weights of the same volume but of different material.

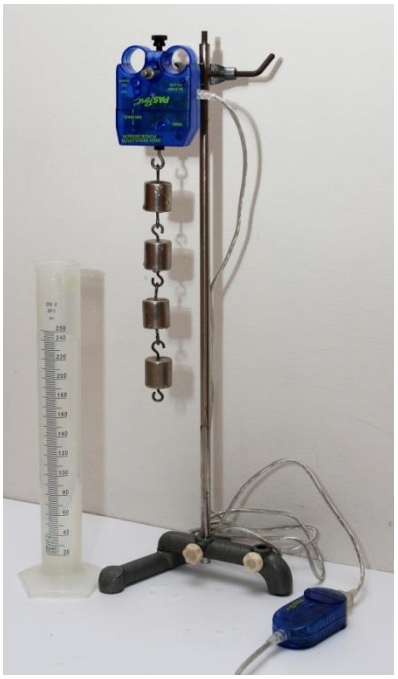
Use the form of Digits to view the force in all others measurements. We can set the accuracy according to the picture.

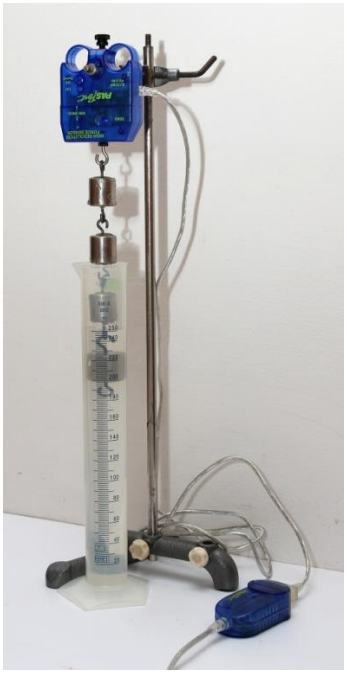
Write down the measured values of resultants and of gravitational forces. Calculate the values of buoyant forces from the Archimedes´ principle and from their difference.

3) Measure the buoyant force for the same weight submerged into water and into ethanol.

Write down the measured values of resultants and of gravitational forces. Calculate the values of buoyant forces from the Archimedes´ principle and from their difference.

4) Put together 4 weights (of 100g) hanged one under each other. Submerge this object into the water (one weight after other).





Write down the measured values of resultants and of gravitational forces. Calculate the values of buoyant forces from their difference.

5) Write summary to all measurements.