**EXPERIMENTAL EXAMINATION**

## Experimental problem 1

**Study the motion of a piece of wood inside a glass tube filled with oil.**

a. Find the smallest angle between the tube and the horizontal for which the piece rises through the entire tube without stopping.
b. For several angles of inclination, measure the corresponding speeds of the piece.

The theoretical relation between the inclination angle and the total resistive force $F_r$ on the piece when it moves at constant velocity is

$$F_r = (\rho_{aceite} - \rho_{madera})\, gV \operatorname{sen}\theta$$

where $\rho_{aceite} = 0{,}873$ kg.m$^{-3}$

$\rho_{madera} = 0{,}280$ kg.m$^{-3}$

Volume of the piece, $V = (5{,}0 \pm 0{,}2).10^{-6}$ m$^3$

g = 9,8 m/s$^{-2}$

$\theta$ = angle of inclination of the tube

c) Plot the measured speeds as a function of sen $\theta$.

d) Find the empirical relation between $F_r$ and speed.

e) Interpret each term in the empirical expression above.

## Experimental problem 2

**Determining the capacitance of a capacitor**

This experiment investigates the behaviour of an electronic circuit.

The circuit contains an integrated circuit, resistors, a light-emitting diode (LED), capacitors of known capacitance, and one capacitor of unknown capacitance.

When the circuit is connected to the power supply, the LED remains on. If one or more capacitors are connected between the black (negative) and red (positive) terminals, the LED flashes periodically.

The aim is to study the relation between the capacitance connected to the circuit and the LED flashing period.

**Caution:** before starting

1. Adjust the supply voltage so that the LED lights, but never exceed 5 V.
2. The capacitors provided are electrolytic, so observe their polarity.

**QUESTIONS**

a. Study the relation between the LED flashing period and the capacitance connected to the circuit.
b. Find the capacitance of the unknown capacitor.