1.3.23-01 Pendulum oscillations / variable g pendulum

**Principle:**
Investigate the oscillation behaviour of a pendulum (rod pendulum) by varying the magnitude of the components of the acceleration of gravity which are decisive for the oscillation period. The pendulum that is to be used is constructed in such a manner that its oscillation plane can be progressively rotated from a vertical orientation to a horizontal one. The angle \( \Phi \), by which the oscillation plane deviates from its normal vertical position, can be read from a scale.

**Oscillation period of the pendulum as a function of the slope \( \Phi \) of the oscillation plane.** The measured points are plotted above the corresponding theoretical curve (solid line). Upper curve: \( L = 270 \text{ mm} \); lower curve: \( L = 141 \text{ mm} \).

**Tasks:**
1. Measurement of the oscillation period of the pendulum as a function of the angle of inclination \( \Phi \) of the oscillation plane for two different pendulum lengths.
2. Graphical analysis of the measured correlations and a comparison with the theoretical curves, which have been standardised with the measured value at \( \Phi = 0 \).
3. Calculation of the effective pendulum length \( l \) for the acceleration of gravity, which is assumed to be known. Comparison of this value with the distance between the pivot point of the pendulum and the centre of gravity of the mobile pendulum weight.
4. On the moon’s surface the “lunar acceleration of gravity” \( g_m \) is only 16.6 % of the earth’s acceleration of gravity \( g \). Calculate the angle \( \Phi \) and set it on the device such that the pendulum in the laboratory oscillates with the same oscillation period with which it would oscillate on the moon in a perpendicular position. Compare the measured oscillation period with the calculated one.

**What you can learn about ...**
- Oscillation period
- Harmonic oscillation
- Mathematical pendulum
- Physical pendulum
- Decomposition of force
- Moment of inertia

**What you need:**
- Variable g-pendulum
- Holder for light barrier
- Light barrier, compact
- Timer 4-4
- Alternatively to 13605.99:
  - Timer 2-1
- Tripod base - PASS-
- Connecting cable, 4 mm plug, 32 A, red, \( l = 50 \text{ cm} \)
- Connecting cable, 4 mm plug, 32 A, yellow, \( l = 50 \text{ cm} \)
- Connecting cable, 4 mm plug, 32 A, blue, \( l = 50 \text{ cm} \)
- Complete Equipment Set, Manual on CD-ROM included

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