INSTRUCTIONS FOR USE

MECAPRO case

DM233008

TWINSE

School Equipment for Science Education

Description

This case contains everything you need to do most statics experiments. All the components in the case can be used on a dry erase magnetic board for optimum visibility of the experiments. The magnets are equipped with a rubber backing to avoid slippage and scratching.

Contents

- 2 circular magnetic dynamometers 2N
- 2 dynamometer-spring balances 2N
- 2 dynamometer-spring balances 5N
- 4 magnetic holders for dynamometer-spring balances
- 1 23-hole graduated lever with magnetic axis
- 4 magnetic pulleys
- 2 magnetic hooks
- 1 magnetic inclined plane with 200 g roller
- 1 magnetic shape on a roller bearing with tabs
- 1 magnetic ruler
- 1 set of masses with hooks (2 x 200 g – 5 x 100 g – 5 x 50 g)
- 3 open coil springs of different stiffnesses
- 1 set of magnets (triangle-arrows)
- 1 magnetic graduation
- 1 spool of thread 5 m
- 10 hooks
- 1 plumb bob
- 2 dry erase marker pens

Some experiments

A. Measuring a force with a dynamometer

- Place the circular dynamometer on the board
- Place a mass on the hook

This demonstrates that the force applied by the weight is equal to the mass of the object (here 100 g then 200 g) multiplied by the acceleration due to gravity (9.81 N/kg)

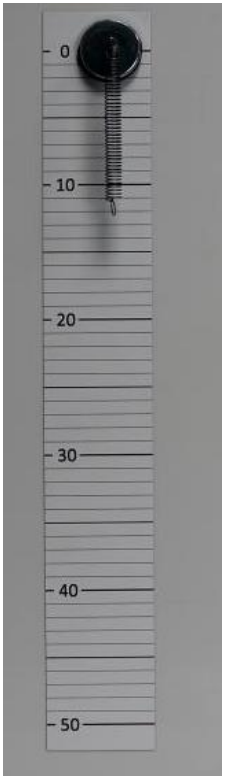
$$\boldsymbol{W = m \times g}$$

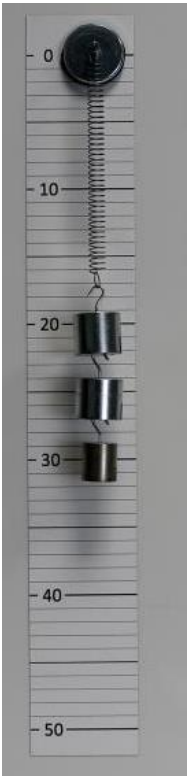
B. Hooke's law

- Place the magnetic graduation on the board along with a hook on a magnet
- Place one of the three springs
- Suspend different masses on the spring and measure its extension

This demonstrates that the extension X of the spring is proportional to the force applied by the masses. This proportionality constant k is called stiffness.

$$\boldsymbol{F = k \times X}$$





C. Law of action-reaction

- Place a dynamometer at the top of the board and another one at the bottom
- Connect the 2 dynamometers and move them apart so as to apply a force
- Whatever the position of the dynamometers, they indicate identical forces

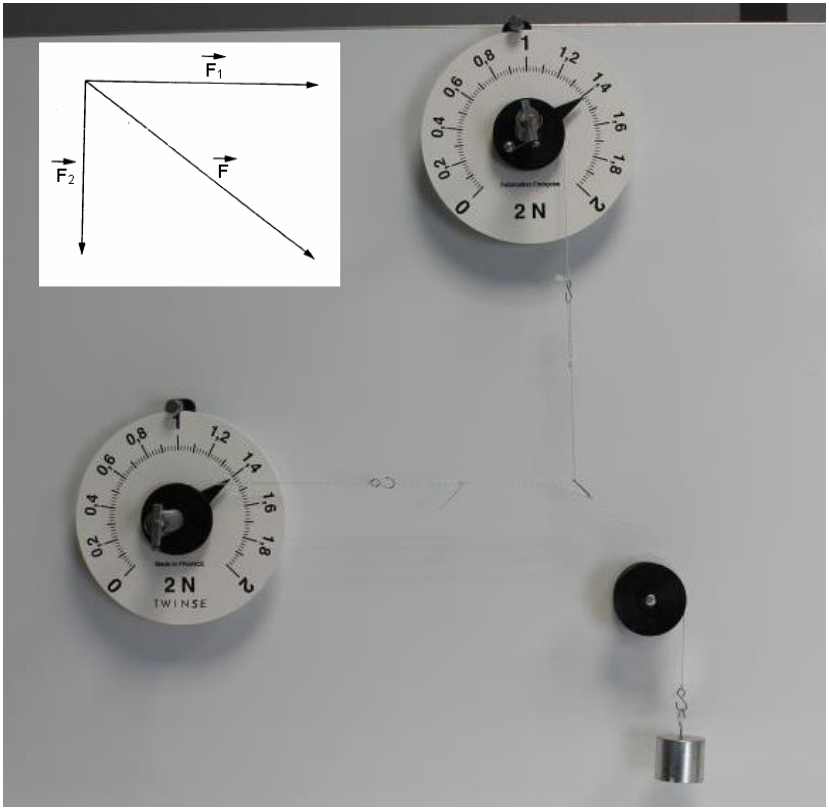
This demonstrates that when a force is applied to an object, it exerts an opposing but equal force.

D. Resolution of forces

- Place a dynamometer at the top of the board and another one on the left.
- Connect the 2 dynamometers with a thread
- Suspend a mass with a thread and a hook
- Place a pulley to give a direction to the force
- Move the dynamometers so that one is vertical and the other horizontal

This shows that each force can be resolved into two forces, one horizontal and one vertical

$$\vec{F} = \overrightarrow{F_1} + \overrightarrow{F_2}$$



E. Equilibrium of moments

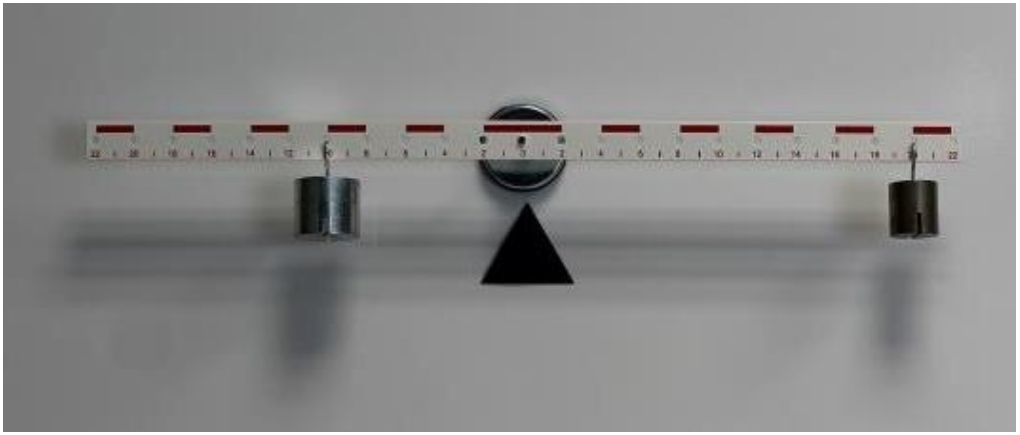
- Place the lever with its centre on the axis on a magnet
- Place different masses on the lever so that it remains horizontal
- Determine the force applied by the mass and the distance from the axis on each side

This demonstrates that when the force multiplied by the distance is the same on either side of the axis

$$\boldsymbol{F_1 \times d_1 = F_2 \times d_2}$$

The moment of the force M is equal to the force multiplied by the distance

$$\boldsymbol{M_1 = M_2}$$



F. Forces exerted on an inclined plane

- Place the inclined plane on the board at an angle defined using the protractor and the pendulum
- Connect the roller to a mass so that the system is in a state of equilibrium. To achieve this, adjust the masses or the angle of the inclined plane
- Then increase the angle as well as the suspended mass

This demonstrates that if we call the gravitational force of the mass F_m, the gravitational force of the roller F_c and the angle of the inclined plane α , we get:

$$\boldsymbol{F_m = F_c \times \sin \alpha}$$