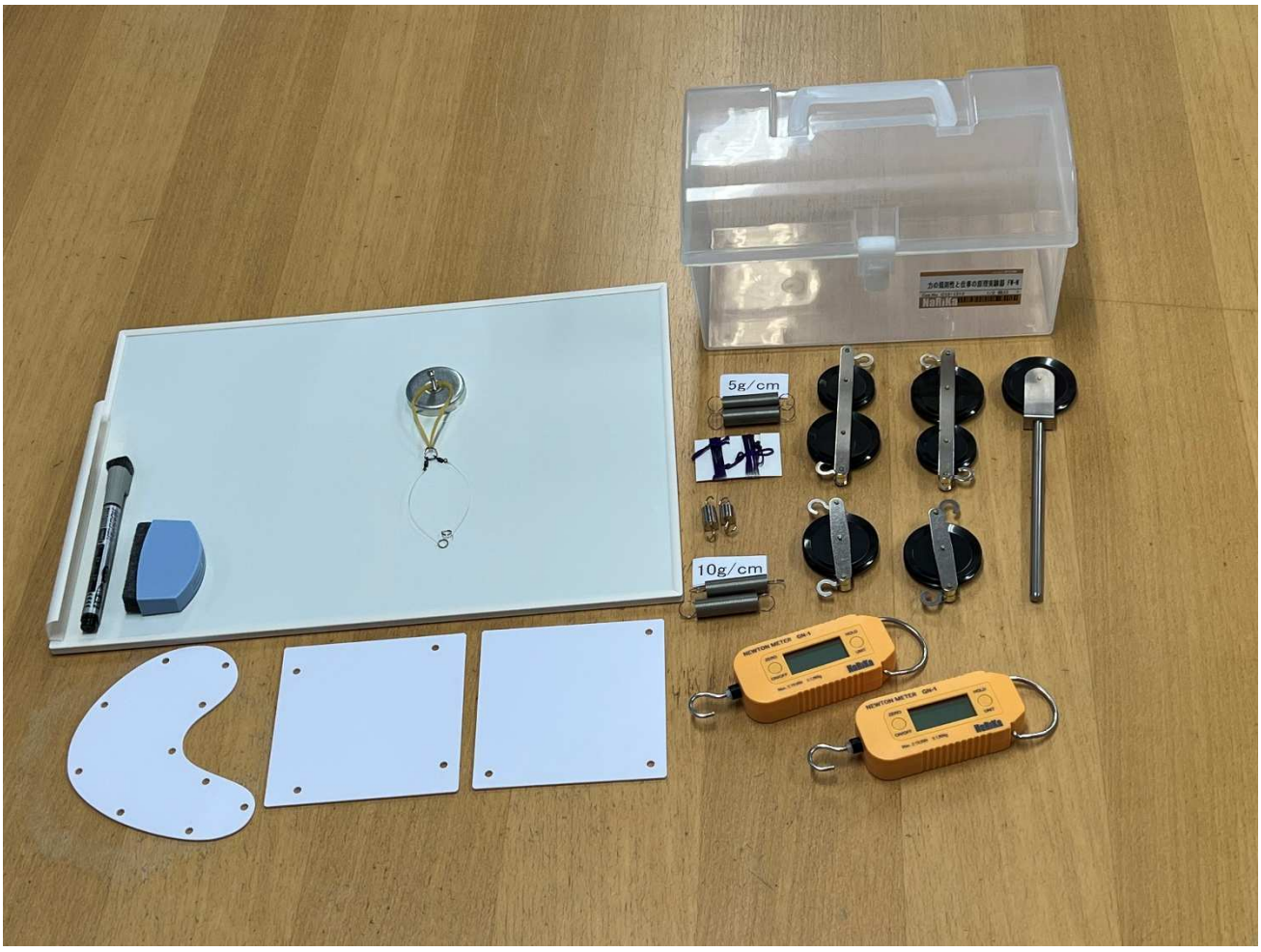
Moment of Force Experiments Set

Cat. No. C15-1313-W0



July 2022

Cautions

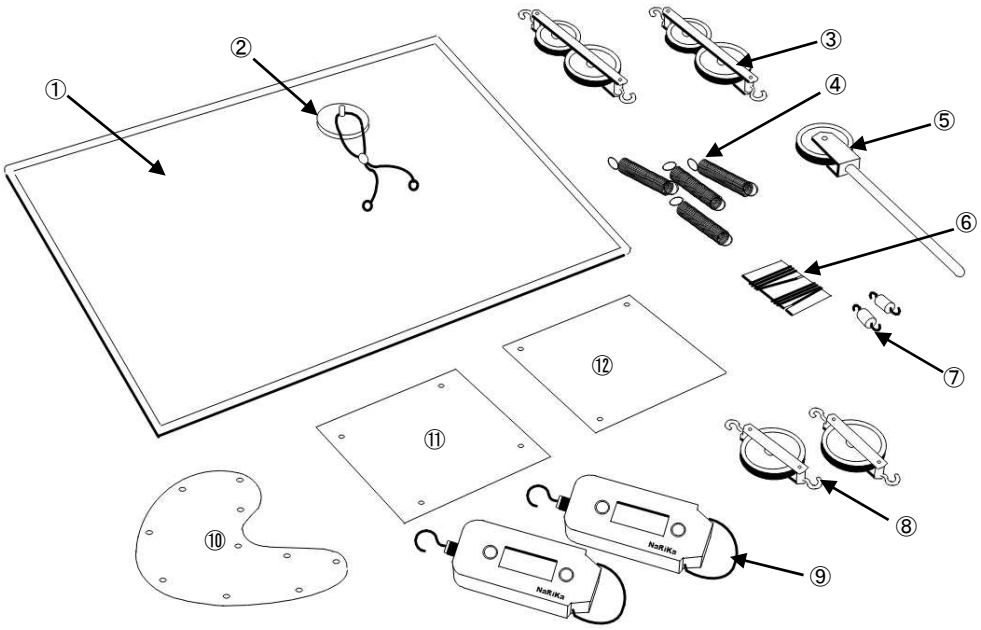
- Read all the instruction manuals that come with the set beforehand.
- After a long-term storage check the condition of each item, especially, the remaining battery level of Newton Meter.

Introduction

Easy to verify how the conditions for equilibrium of two forces applied to boards of different shapes vary by measuring those forces with the Digital Newton Meters (A05-4065) included in the product. Available not only for experiments of “moment of force” but also for “addition and resolution of forces” when drawing vector diagrams on magnetic whiteboard that comes with the product after converting values measured by the two Digital Newton Meters (A05-4065) to the corresponding values in the appropriate unit of length.

Versatile product suitable for various type of experiments including “Moment of a force”, “Conditions for equilibrium”, “Equilibrium of a rigid body”, “Pulley”, “Work done by a force act on an object” and “Addition and resolution of forces”.

Contents



①Magnetic Whiteboard (A3 size with eraser and non-permanent marker) x 1pc

②Magnet with pin x 1 pc

③Compound pulley x 2 units

④Spring (5 g/cm, 10 g/cm) x 2 pcs each

⑤Pulley with a supporting rod x 1 pc

⑥Strings

⑦Weight (10g, 8g) x 1 pc each

⑧Movable pulley (Simple pulley) x 2 pcs

⑨Newton Meter GN-1 x 2 pcs

⑩Amoeba shape board x 1 pc

⑪Square shape board “A” x 1 pc

⑫Square shape board “B” x 1 pc

* Not on the drawing, but included are:

AAA batteries for Newton Meters x 4 pcs

Plastic case for everything except the whiteboard x 1 pc

Experimental Examples

1. Experiment of Net force using Newton Meters.

1. What to prepare:

⑨Newton Meter GN-1 x 2 pcs, Wooden block (ca 100 g) x 1 pc

2. Purpose:

With two Newton Meters facing each other (see Fig. 1), push each side of the wooden block while measuring the strength of the pushing force applied to the block. Therefore, two learners in a pair are needed to use two Newton Meters for this experiment.

3. Procedure:

1. At first remove the hook attached to each Newton Meter.
2. Place one meter on one side of the wooden block and the other meter on the opposite side as shown in Fig.1.
3. Press the “ON/OFF” button of each meter for two seconds to turn the meter on. Check if the numeral “0” is shown on each screen. If not, press the button again.
4. Put both meters on a desk and press the zero-calibration button on each of them (keep the meters at a distance of 1 mm from the block).
5. As shown in Fig. 1, one person controls one of the two meters, while the other person controls the other meter.
6. Carefully and synchronously press the block with the meters.
7. Synchronously press the "Hold" button on each meter.

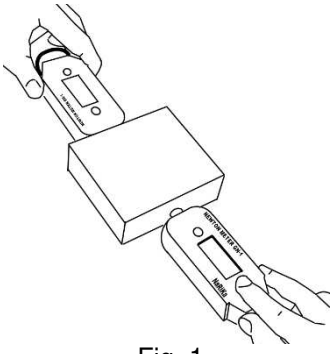


Fig. 1

4. Description:

In the topic of the balanced and unbalanced forces act on objects, students learn the scientific concepts of net force and resultant force. Experiments with two Newton Meters help students realize magnitude and directions of two forces act on an object. Above experiment shows a simple way of the practical activity with just two Newton Meters.

When two Newton Meters are pushed against each other, measured force values will be displayed as negative (-) values like in above experiment. When two meters are pulled against each other, measured force values will be displayed as positive (+) values. Check it by yourself as shown in Fig. 2.

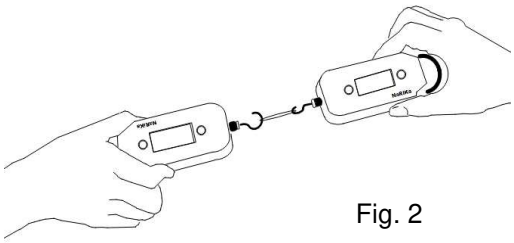


Fig. 2

Detailed experiment guides are available on Narika's website.

URL: https://global.narika.jp/product/054065

2. Experiment of equilibrium of forces using Newton Meters.

1. What to prepare:

⑨Newton Meters GN-1 x 2 pcs ⑩Amoeba shape board x 1 pc

⑪Square shape board “A” x 1 pc ⑫Square shape board “B” x 1 pc

⑥Strings

2. Procedure:

1. Press the “ON/OFF” button of each meter for two seconds to turn the meter on. Check if the numeral “0” is shown on each screen. If not, press the button again.

2. Put both meters on a desk and press the zero-calibration button on each of them.

3. Hook each meter to the holes of square shape board “A” or Amoeba shape board (see Fig. 3 and Fig. 4).

4. Pull both meters, press the "Hold” button on both meters and then read the measured force values displayed on the meters.

3. Description:

When an object (the board for experiments of force equilibrium) is pulled by two Newton Meters being hooked to any of the two holes on its periphery, two forces act on the object are balanced and in equilibrium. In this setting, the same amount of force is applied to each of the two holes. We can draw a straight line between these two holes that are point of action of force, and they are aligned. Using Newton Meters in combination with the boards helps students better understand the scientific concept of equilibrium of forces.

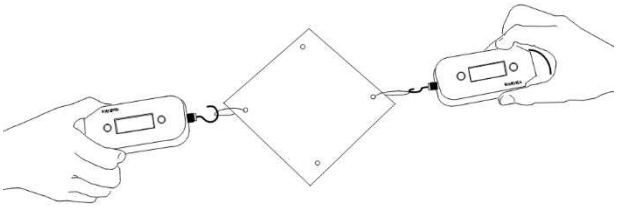


Fig.3

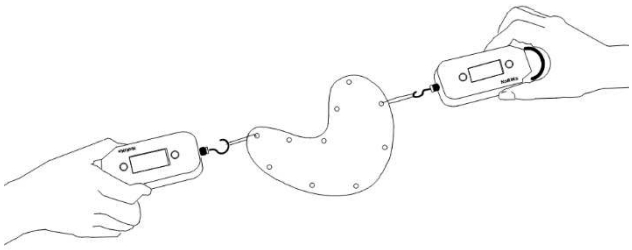


Fig.4

3. Experiment of resultant force using Newton Meters

1. What to prepare:

①Magnetic Whiteboard ②Magnet with pin x 1 pc

⑨Newton Meters GN-1 x 2 pcs

④Spring (5 g/cm or 10 g/cm) x 1 pc

Rubber band, Strings, Marker (ea. x 1 pc)

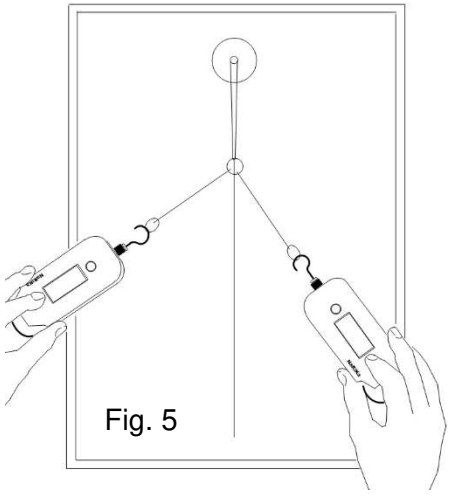


Fig. 5

2. Procedure:

1. Put a magnet on a magnetic whiteboard. Hook a rubber band (or a coil spring) to the magnet. Hook two rings of strings to the other end

of the rubber band (or the coil spring). Then, finally, hook each of two Newton Meters on the ring at the other end of each string (see Fig. 5).

2. Record the values of the force displayed on each of the two Newton Meters when pulling the rubber band (or the coil spring). Based on the two values, learners will understand a Resultant Force of two forces is represented by parallelogram completed with strength and directions of those forces using an appropriate scale.

Detailed experiment guides are available on Narika's website.

URL: https://global.narika.jp/product/054065

4. Experiment of Work using Newton Meter in combination with a pulley.

1. What to prepare:

⑤Pulley with a supporting rod x 1 pc ⑧Movable pulley x 1 pc

Weight (1 Kg) x 1 pc

Miscellaneous: a support stand with a universal clamp and a joint clamp

2. Procedure (1), Fig. 6

1. Attach a pulley with a rod to a support stand using a joint clamp (see Fig. 6).
2. Form a loop at each end of a string. Thread the string through the pulley to hang the weight from one end of the string.
3. Press the “ON/OFF” button of the Newton Meter for two seconds to turn the meter on. Check if the numeral “0” is shown on the screen. If not, press the button again.
4. Hook the Newton Meter to the other end of the string (see Fig. 6). Record a force value displayed on the screen when balanced.

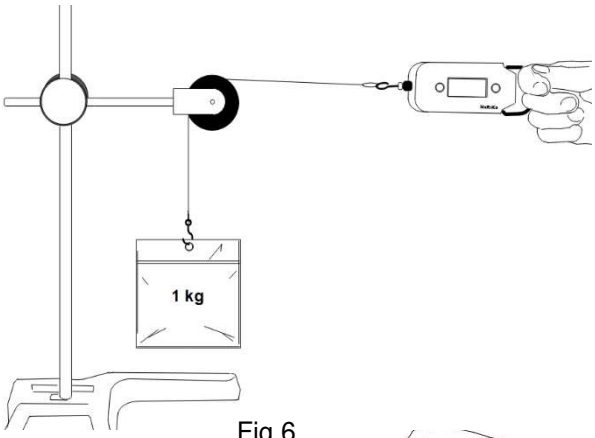


Fig.6

3. Procedure (2), Fig. 7

1. Attach a universal clamp and a joint clamp to a support stand (see Fig.7).
2. Form a loop at each end of a string. Hook one end of the string to the universal clamp. Thread the string through a movable pulley to hook a Newton Meter to the other end of the string (see Fig. 7).
3. Press the “ON/OFF” button of the Newton meter for two seconds to turn the meter on. Check if the numeral “0” is shown on the screen.
4. Hook the Newton Meter to the other end of the string (see Fig. 7).

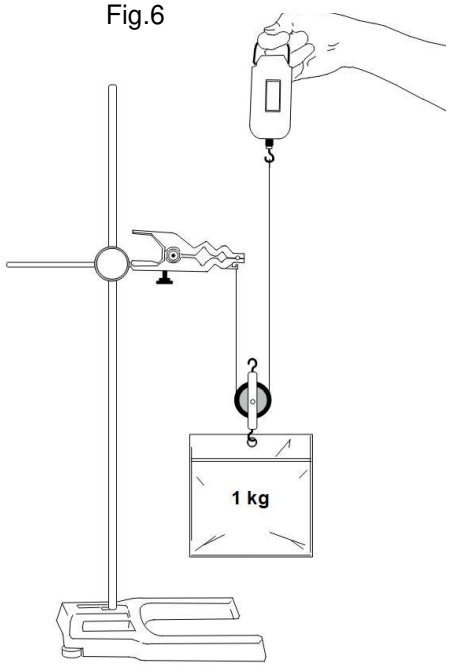


Fig.7

5. Hook a weight to the movable pulley.

6. Pull the weight up with the Newton Meter. When balanced, record a force value displayed on the screen.

4. Description:

Digital force values shown on Newton Meter help learners better understand the scientific concept of “making work easier” by comparing the efficiency of each work using a fixed pulley and a movable pulley respectively. Force value displayed on a Newton Meter indicates that using a fixed pulley when pulling up a weight has the same mechanical advantage as the one exerted when pulling up directly (without a pulley). Only the direction of the force can be adjusted to our convenience. It also indicates that using a movable pulley when pulling up a weight will double the mechanical advantage by showing just half the force value compared to the one displayed when using the fixed pulley.