# Weight (Item No.: P0999000)

## Curricular Relevance

**Area of Expertise:** Physik
**Education Level:** Klasse 7-10
**Topic:** Mechanik
**Subtopic:** Kräfte, einfache Maschinen
**Experiment:** Gewichtskraft

| Difficulty | Preparation Time | Execution Time | Recommended Group Size |
|---|---|---|---|
| Easy | 10 Minutes | 10 Minutes | 2 Students |

**Additional Requirements:**

**Experiment Variations:**

**Keywords:**

## Task and equipment

## Information for teachers

## Additional Information

The students are to determine the weight which a mass experiences in the earth's gravitational field with a spring balance. They should know that force is measured in N = kg m/s$^2$ and recognize that weight is proportional to mass. The proportionality factor is the acceleration of gravity g in m/s$^2$. In a supplementary problem the students should determine the acceleration of gravity g from their measured values.

The term "(slotted) weight" is incorrect since we are dealing with a mass which becomes a weight (in reality "a weight-force") under the influence of the earth's gravity. The term "mass piece" used here is better.

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## Task and equipment

### Task

### How "heavy" is a mass?

With a spring balance the weight which different "mass pieces" experience at the surface of the earth is determined. The law that connects weight and mass is found.

## Equipment


| Position No. | Material | Order No. | Quantity |
|---|---|---|---|
| 1 | Support base, variable | 02001-00 | 1 |
| 2 | Support rod with hole, stainless steel, 10 cm | 02036-01 | 1 |
| 2 | Support rod, stainless steel, l = 600 mm, d = 10 mm | 02037-00 | 1 |
| 3 | Boss head | 02043-00 | 1 |
| 4 | Weight holder for slotted weights | 02204-00 | 1 |
| 5 | Slotted weight, black, 10 g | 02205-01 | 4 |
| 5 | Slotted weight, black, 50 g | 02206-01 | 1 |
| 6 | Spring balance,transparent, 1 N | 03065-02 | 1 |
| 7 | Spring balance holder | 03065-20 | 1 |


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# Set-up and procedure

## Set-up

Screw the splitted support rod together (Fig. 1). Set up a stand with the support base and the support rod as you can see in Fig. 2 and Fig. 3.

Fig. 1

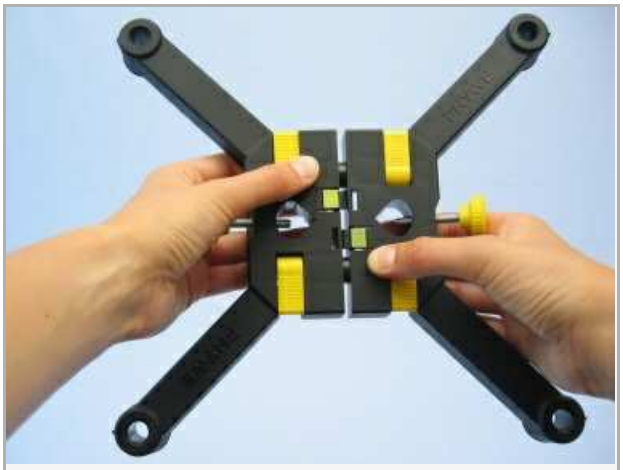


Fig. 2

Fig. 3

Insert the spring balance holder in the blind hole in the short rod (Fig. 4). Clamp this short rod in the bosshead (Fig. 5).

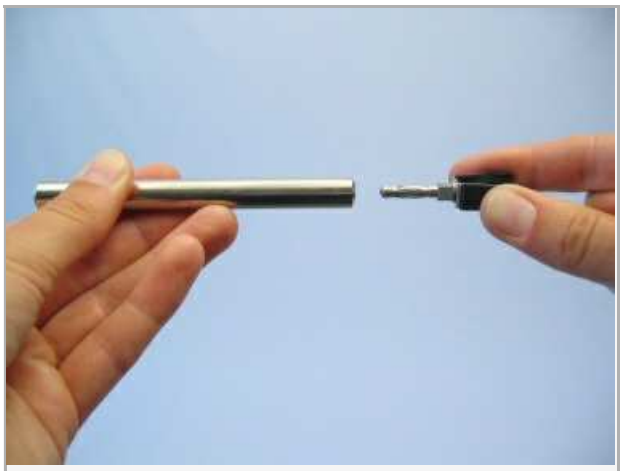


Fig. 4

Fig. 5

Clamp the spring balance vertically in the spring balance holder. If it is necessary, you should set the indicator of the spring balance to zero, by using the screw (Fig. 6).


Fig. 6

## Procedure

- Hang the weight holder (m = 10 g) on the spring balance and note its weight Fg (Fig. 7).
- Use the four 10 g and the 50 g weights to increase the weight by 10 g increments to 100 g and note the indicated value each time in Table 1 in the report.

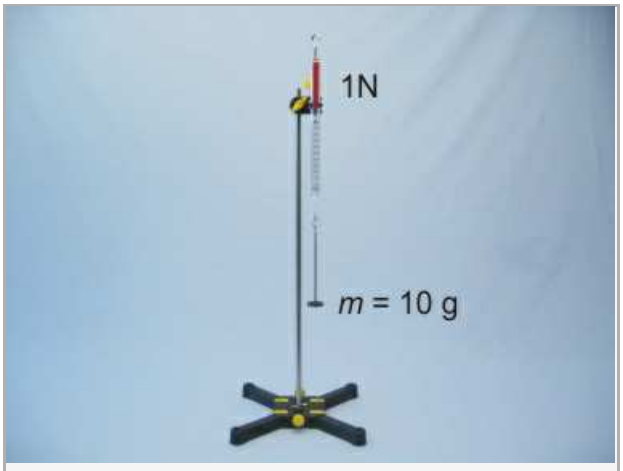



Fig. 7

For fixing the slotted weight to the weight holder, you should slip the slotted weight over the top end of the weight holder (Fig. 8).

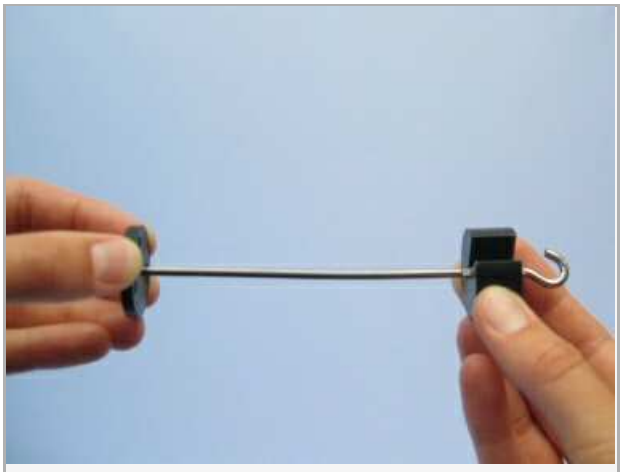


Fig. 8

In order to disassemble the support base you should press the yellow buttons (Fig. 9).

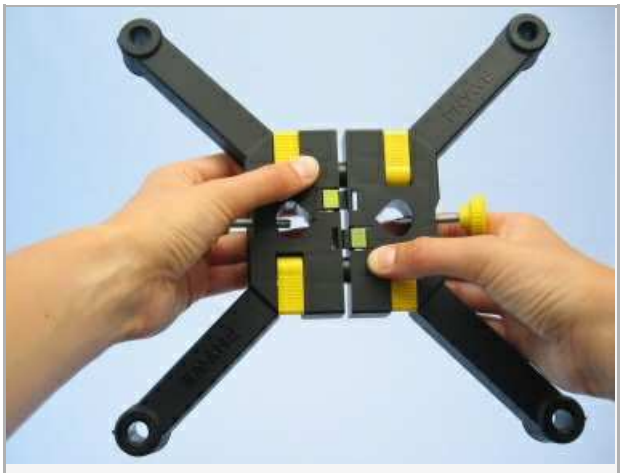


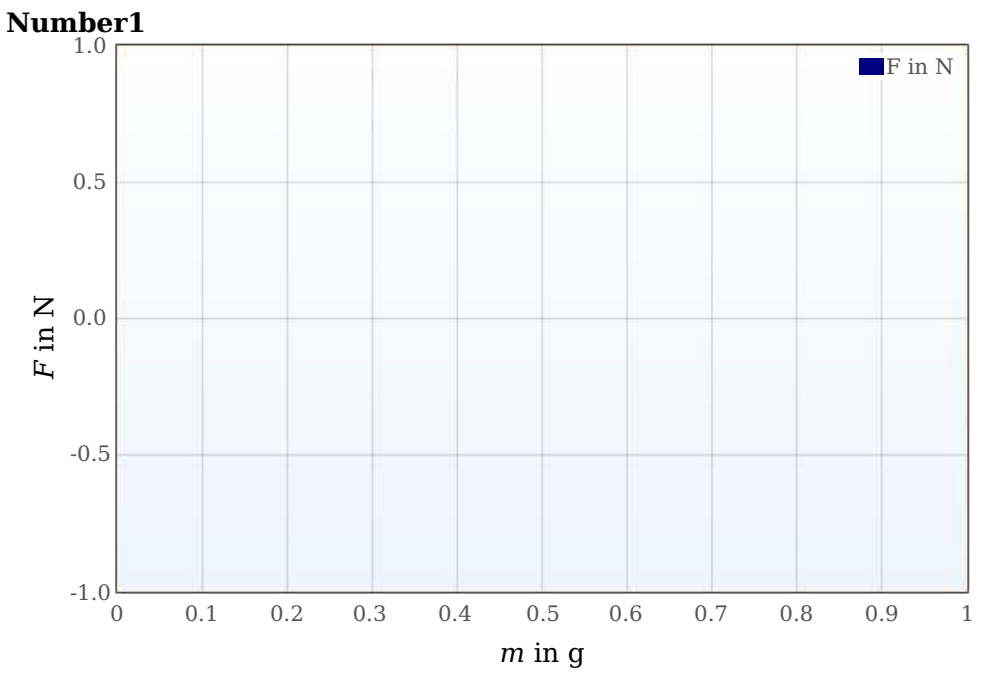
Fig. 9

# Report: Weight

## Results – Table 1

Record all the measured values in Table 1.

| *m* in g | *F* in N |
|---|---|
| 10 | 1 ±0 |
| 20 | 1 ±0 |
| 30 | 1 ±0 |
| 40 | 1 ±0 |
| 50 | 1 ±0 |
| 60 | 1 ±0 |
| 70 | 1 ±0 |
| 80 | 1 ±0 |
| 90 | 1 ±0 |
| 100 | 1 ±0 |





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## Evaluation – Question 1

What kind of curve do you obtain?

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## Evaluation – Question 2

Explain the correlation between the two quantities as a "the ... the" relationship.

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## Evaluation – Question 3

What is the mass of a 1 N weight?

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## Evaluation – Question 4

Determine the slope (the proportionality factor) $g$ from the graph in Table 1 according to $F_g = g \times m$.

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## Evaluation – Additional Task

Since, according to Newton, the following relationship is valid:
force = mass × acceleration, the proportionality factor $g$ in the graph in Table 1 is also an acceleration - the acceleration of gravity.

For the unit of force the following is true: 1 N = 1 kg m/s$^2$.

Determine the value of the acceleration of gravity $g$, which a mass $m$ experiences in the gravitational field of the earth: $g$ = ..... m/s$^2$.


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