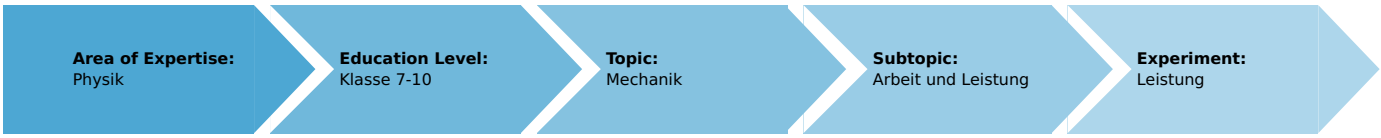
# Power (Item No.: P1001600)

## Curricular Relevance




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

**Additional Requirements:**

- Scissors

**Experiment Variations:**

**Keywords:**

## Task and equipment

## Information for teachers

## Additional Information

In this experiment the students should investigate the influence of time on power in a simple experiment. To facilitate comparison, work is held constant. In addition, the students should determine the work in a preliminary experiment.

## Remarks

In the interest of conclusive experimental results, the winding speed should be kept nearly constant. In the individual parts of the experiment the deviations should also be kept to a minimum.
Due to the chosen procedure, the sample answers given on the Results page can only be of an exemplarily nature: especially the height h and the time t cannot be stipulated.


Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

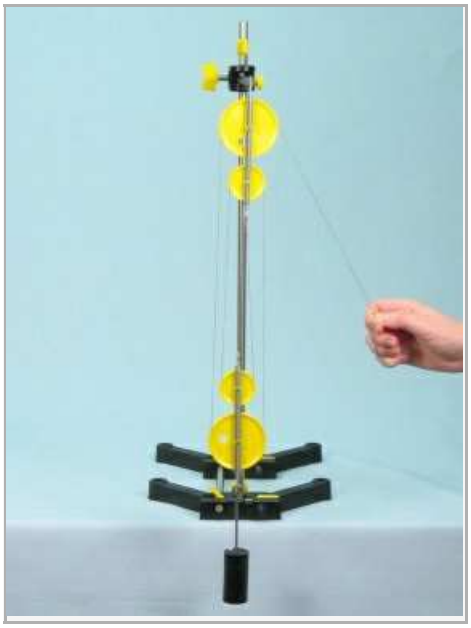
# Power (Item No.: P1001600)

## Task and equipment

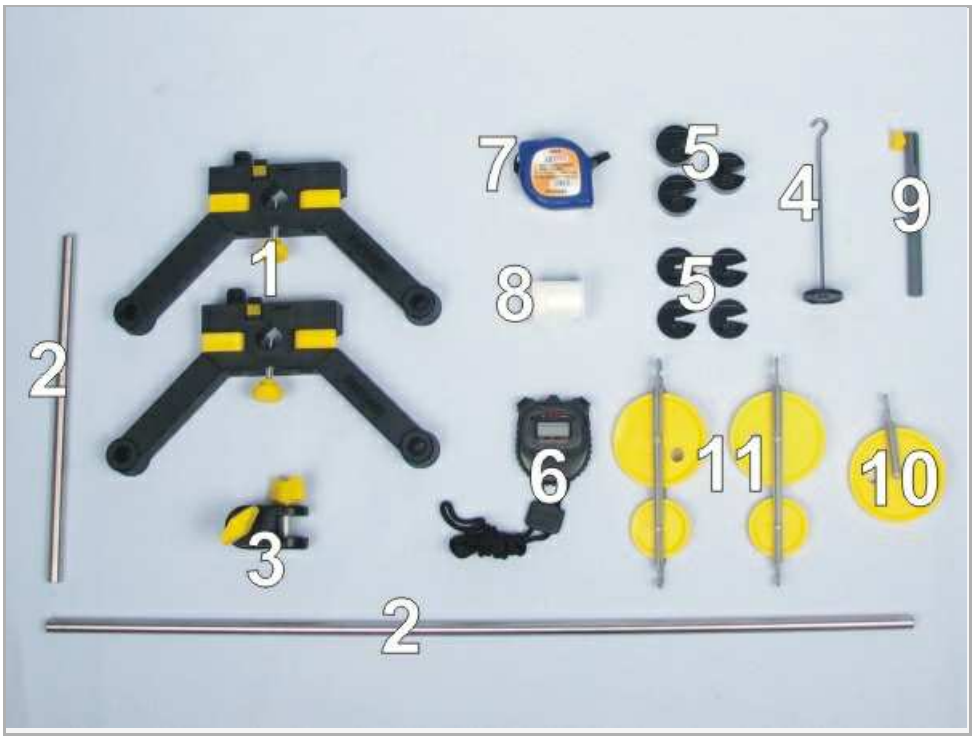
### Task

### What is the difference between work and power?

In this experiment you will investigate the influence of time on power.
You will lift a load a specific distance and determine the work required. Then you will lift the same load the same distance, but in different ways: first with a pulley, then with a block and tackle.



## Equipment




| Position No. | Material | Order No. | Quantity |
|---|---|---|---|
| 1 | Support base, variable | 02001-00 | 1 |
| 2 | Support rod, stainless steel, l = 250 mm, d = 10 mm | 02031-00 | 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 | 3 |
| 6 | Stop watch 4 | 03078-00 | 1 |
| 7 | Measuring tape, l = 2 m | 09936-00 | 1 |
| 8 | Fishing line, l. 20m | 02089-00 | 1 |
| 9 | Rod for pulley | 02263-00 | 1 |
| 10 | Pulley,movable,dia.65mm,w.hook | 02262-00 | 1 |
| 11 | Pulleys, double in line | 02266-00 | 2 |
| Additional material | | | |
| | Scissors | | |

## Set-up and procedure

- First screw the splitt support rod together (Fig. 1). Connect the two halves of the support base with the 250 mm support rod (Fig. 2). By moving the locking lever up, you will be locking the support rod to the suport base.
  Set the 600 mm support rod into one of the support base halves and fix it with the locking screws (Fig. 3).

Fig. 1

Fig. 2

Fig. 3

- Fix the pulley in the rod for pulleys (Fig. 4) and clamp it to the 600 mm support rod with the bosshead (Fig. 5).


Fig. 4


Fig. 5

- Using the pulley, lift a mass of 50 g and then a mass of 200 g from the floor to the table top (Fig. 6). Wind the fish line around your hand while doing this. Take care to wind the line at a speed which is as constant as possible. Measure the distance, and record it as the height *h* in table 2 in the report.
- Measure the time required. Record the measured values in Table 2 in the report.


Fig. 6

- Set up a block and tackle as shown in Fig. 7 to 10.

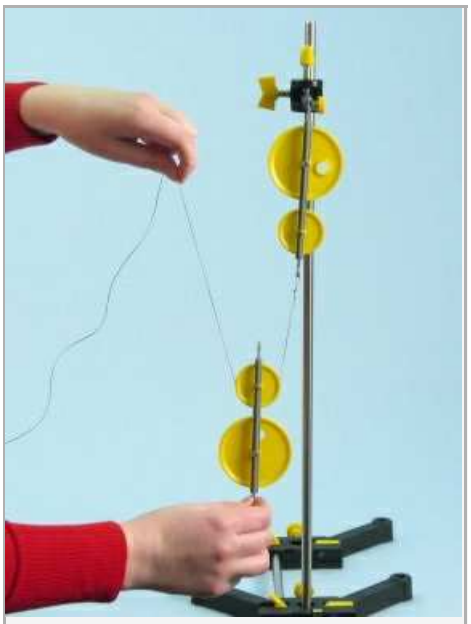


Fig. 7

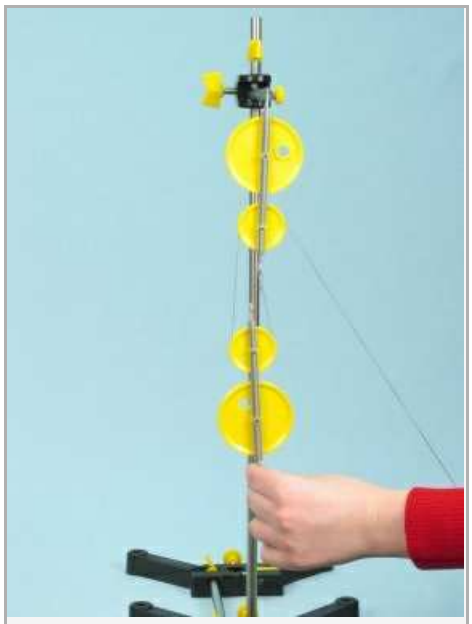


Fig. 8

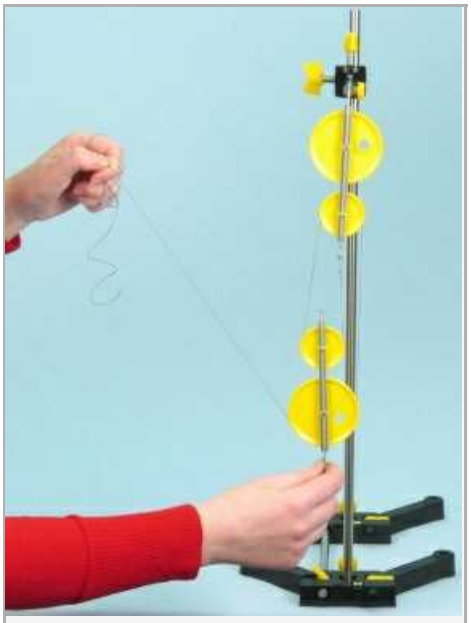


Fig. 9

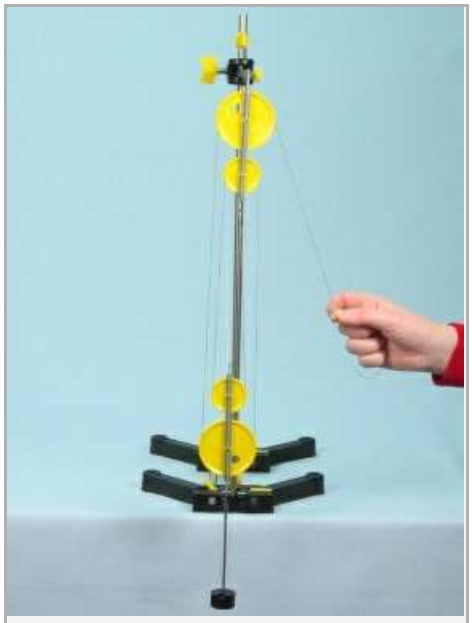


Fig. 10

- Pull the masses of 50 g and 200 g one after another from the floor to the table top by winding the line with approximately the same speed as before.
- Note that the mass of the lower double pulley ($m_p$ = 20 g) contributes to the total mass. Therefore the additional load should be 30 g respectively 180 g (including the weight holder).
- Measure the times and record them in Table 3 in the report.

# Report: Power

## Evaluation – Part 1

Enter the distance from the floor to the table top here:

$h$ = ..... cm

## Results – Table 1

**1. Lifting**

Calculate the weight (force) $F_g$ and the lifting work $W = F_g \times h$, and add the values to table 1.

| $m$ in g | $F_g$ in N | $W$ in Ncm |
|---|---|---|
| 50 | 1 ±0 | 1 ±0 |
| 200 | 1 ±0 | 1 ±0 |

## Results – Table 2

**2. Fixed pulley, $h$ = 75 cm.**

Record all the measured values in table 2. Using the values calculate the weight (force) $F_g$ and the lifting work $W$.

Divide these values by the measured times: $P = W / t$. Record the resulting values in table 2.

| $m$ in g | $t$ in s | $F_g$ in N | $h$ in cm | $W$ in Ncm | $P$ in Ncms$^{-1}$ |
|---|---|---|---|---|---|
| 50 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 |
| 200 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 |


Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

## Results – Table 3

**3. Block and tackle, *h* = 75 cm.**

Record all the measured values in table 3. Using the values calculate the weight (force) Fg and the lifting work W.

Divide these values by the measured times: P = W / t. Record the resulting values in table 3, too.

| *m* in g | *t* in s | $F_g$ in N | *h* in cm | *W* in Ncm | *P* in $Ncms^{-1}$ |
|---|---|---|---|---|---|
| 50 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 |
| 200 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 | 1 ±0 |

## Evaluation – Question 1

Compare the values for the lifting work in all three cases.

Are the values different for the same load? Can you give reasons for this?

.....

.....

.....

.....

## Evaluation – Question 2

For which part of the experiment have you done the most work: for 2. or 3.? Give the impression you got from the experiment.

.....

.....

.....

.....

## Evaluation – Question 3

Compare your assumption with the values for *P* in the tables. Does your assumption agree with the results?

.....

.....

.....

.....



Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

## Evaluation – Question 4

Rewrite the formula $P = W / t$ in terms of $m$, $g$, $h$ and $t$.

.....

.....

.....

.....

## Evaluation – Question 5

Power is denoted by $P$. State how power is defined.

.....

.....

.....

.....

## Evaluation – Question 6

Does the power for the same amount of work decrease when the time in which it is conducted decreases?

.....

.....

.....

.....