Motions
Uniformly accelerated motion

Relationship between displacement and time -
Measurement using an electronic stopwatch

Objects of the experiment

1. Measuring the time *t* required by a body for covering a path *s*
2. Representing the relation between path and time in an s-t-diagram

Setup

Apparatus

1 Track, 1.5 m	337 130
1 Trolley	337 110
1 Additional weights, pair	337 114
1 Holding magnet for track	683 41
1 Holder for combination spoked wheel	337 463
1 Combination spoked wheel	337 464
1 Combination light barrier	337 462
1 Slotted mass hanger, 10 g	315 410
2 Slotted weights, 10 g	315 416
1 Electronic stop-clock P	313 033
1 Connecting leads 19 A, 50 cm, black, pair	501 451
1 Multi-core cable, 6-pole, 1.5 m	501 16
1 Fishing line, set of 2	309 48ET2

Carrying out the experiment

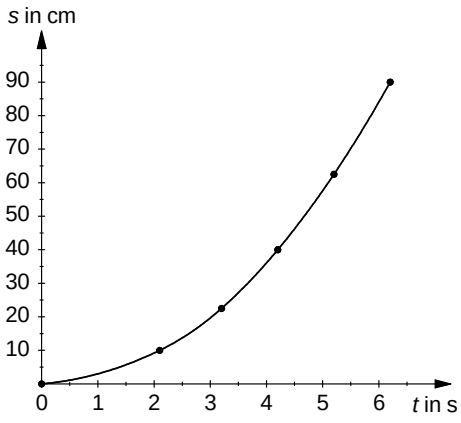
- Align the track horizontally.
- Adjust the voltage at the holding magnet so that the trolley is just held.
- Define the starting point with the movable interrupter flag on the trolley, and read it from the scale of the track.
- Position the light barrier at a distance of 10 cm from the starting point.
- Release the motion by pressing the START/STOP key at the stopclock.
- Wait until the interrupter flag passes the light barrier, and read the time from the stopclock.
- Reset the stopclock to zero by pressing the RESET key.
- Position the light barrier at distances of 22.5 cm, 40 cm, 62.5 cm, and 90 cm from the starting point.
- Repeat the measurement for each distance.

Measuring example

Path *s* in cm	Path *s* in cm	*Time *t* in *s*	Time *t* in s
10	$1^2 \cdot 10$	2.1	$1 \cdot 2.1$
22.5	$1.5^2 \cdot 10$	3.2	$1.5 \cdot 2.1$
40	$2^2 \cdot 10$	4.2	$2 \cdot 2.1$
62.5	$2.5^2 \cdot 10$	5.2	$2.5 \cdot 2.1$
90	$3^2 \cdot 10$	6.2	$3 \cdot 2.1$

* Time *t*: rounded mean value from three measured values

Evaluation



In uniformly accelerated motion, the path increases proportionally to the square of the time: $s \sim t^2$.

From the measured values the mean velocity $\bar{v}$ can be calculated:

$$\bar{v} = \frac{s}{t}.$$

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