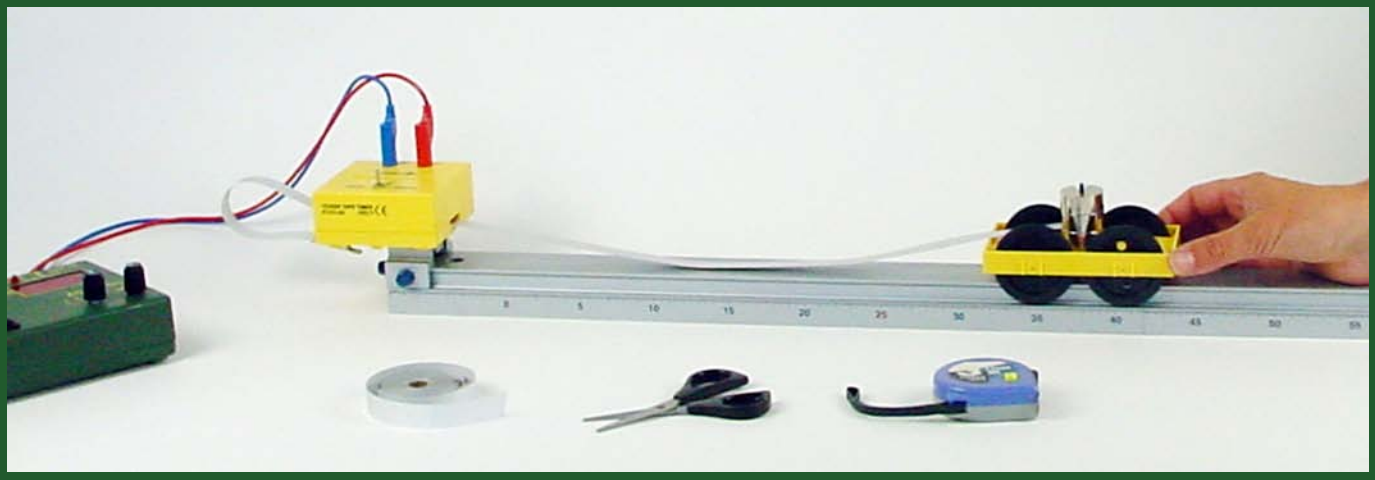
Student Experiments

Manual

DYNAMICS

P9160-4J



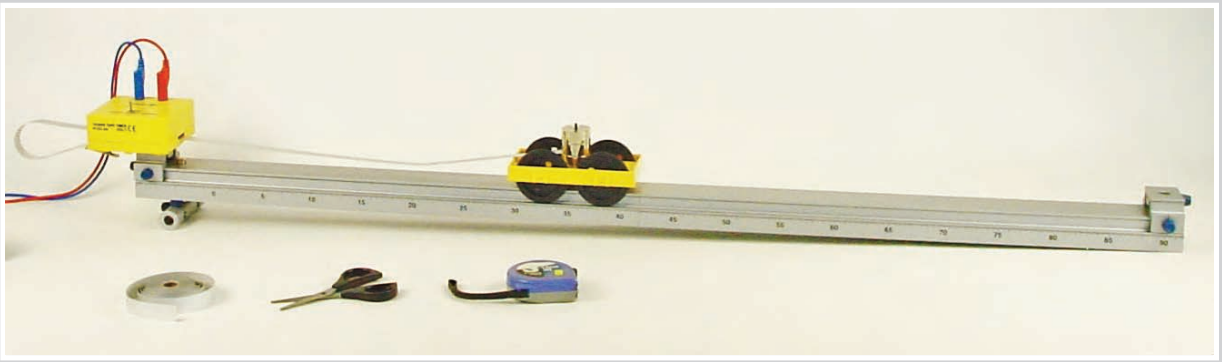
www.ntl.at

INDEX

UNIFORMLY ACCELERATED MOVEMENT

MES 5.4

Required Kit:
P9902-4J SEK Dynamics
P9901-4A SEK Stand rail material



Material:
1x Track and optical bench, 2x 50cm
1x Rail bond SE; universal
1x Support rod, round, L =100mm
1x Bosshead, round

1x Trolley with variable speed or
1x Dynamics Trolley

3x Slotted weight, 50g
1x Sliding saddle with setscrew

Additionally required:
1x Measuring tape
1x Pair of scissors
1x Ticker tape timer
1x Metallic paper roll
Power supply and connecting leads

UNIFORMLY ACCELERATED MOVEMENT

MES 5.4

The acceleration of the trolley on the inclined track is to be calculated and the formula of distance for the uniformly accelerated movement is to be found out.

Preparation: Arrange according to the illustration. The track is put on the table and the trolley (with 3 slotted masses) is placed on the track.The mass of the trolley is 200 g.
The 10 cm rod is fixed in the round bosshead. One end of the track is raised (about 6 cm) by means of the support rod. The ticker tape timer is attached to the raised end. The sliding saddle which will prevent the trolley from rolling off down is placed at the other end of the track. A strip of metal paper (about 1 m) is bent at one end for about 10 cm, this end is pulled through the ticker tape timer and fixed to the trolley by means of an adhesive label. the other end of the writing strip is attached to the alligator clip of the ticker tape timer. A source A.C. of 12 V is applied to the ticker tape timer. the tumbler switch has to be in the middle (turned off). The trolley is moved in a streight line to the ticker tape timer (with the ticker tape running through the ticker tape timer). A sliding saddle is placed on the track immediately in front of the trolley. This sliding saddle is pushed to the end of the track when the trolley is released.

1. Experiment: The sliding saddle in front of the trolley is pushed to the end of the track whilst the trolley is held. The tumbler switch of the ticker tape timer is brought in the „100 ms" position. The trolley accelerates on the inclined track. It is stopped at the end of the track by the sliding saddle.

Then the ticker tape timer is turned off (tumbler switch has to be in the middle) and the ticker tape is removed from its mounting. The distances between the reference marks on the ticker tape are measured and taken down. The distances correspond to the lengths of path in each tenth of a second. They increase uniformly.
Increase of length of path per tenth of a second: ..... mm = ... m
In order to obtain the acceleration, the following consideration has to be made. The increase of speed can be defined as the increase of length of path per time interval. One time interval is 0,1 seconds.
For the acceleration a the following holds true:

$$a = \Delta v/\Delta t = \Delta/\Delta t(\Delta s/\Delta t) = \Delta s/(\Delta t)2$$

$$(\Delta t)^2 = 0{,}1^2\ s^2 = 0{,}01\ s^2$$

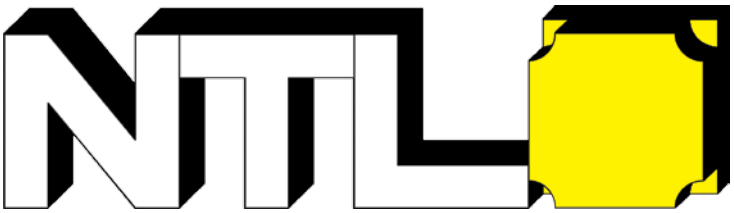
So the changed length of plath has to be divided by 0,01 or multiplied by 100.
The uniform acceleration was ..... m/s.

2. Experiment: The experiment is repeated, but this time the tumbler switch is set in the „10 ms" position. Thus a reference mark is obtained every hundredth of a second. At the beginning the marks are very close together. Try to count the first ten marks as exactly as possible (start with „1" because the first mark cannot be set exactly at the beginning of the movement but later!).
Then continue counting every tenth mark and thus indicate the lengths of path pertenth of seconds. The total length of path from the beginning is measured (e.g. 5, 19, 42, 84 mm, etc. first the values have to be converted into meters) and divided by the square of time (0,01; 0,04; 0,09 seconds etc.).

Do all ratios correlate with the acceleration?

time t (in s)	0,1	0,2	0,3	0,4	0,5	0,6	0,7
t^2 (in s^2)	0,01	0,04	0,09	0,16	0,25	0,36	0,49
total length of path							
(in mm)	...	...	...	...	...	...	...
(in m)	...	...	...	...	...	...	...
s/t^2	...	...	...	...	...	...	...

Conclusions:
The ratios s/t^2 equal half the acceleration.
The formula of distance is: $s = a/2 * t^2$



Student Experiments

NTL Manufacturer & Wholesaler

Werner von Siemensstraße 1
A - 7343 Neutal
Austria

www.ntl.at