

1. Free-Fall Acceleration

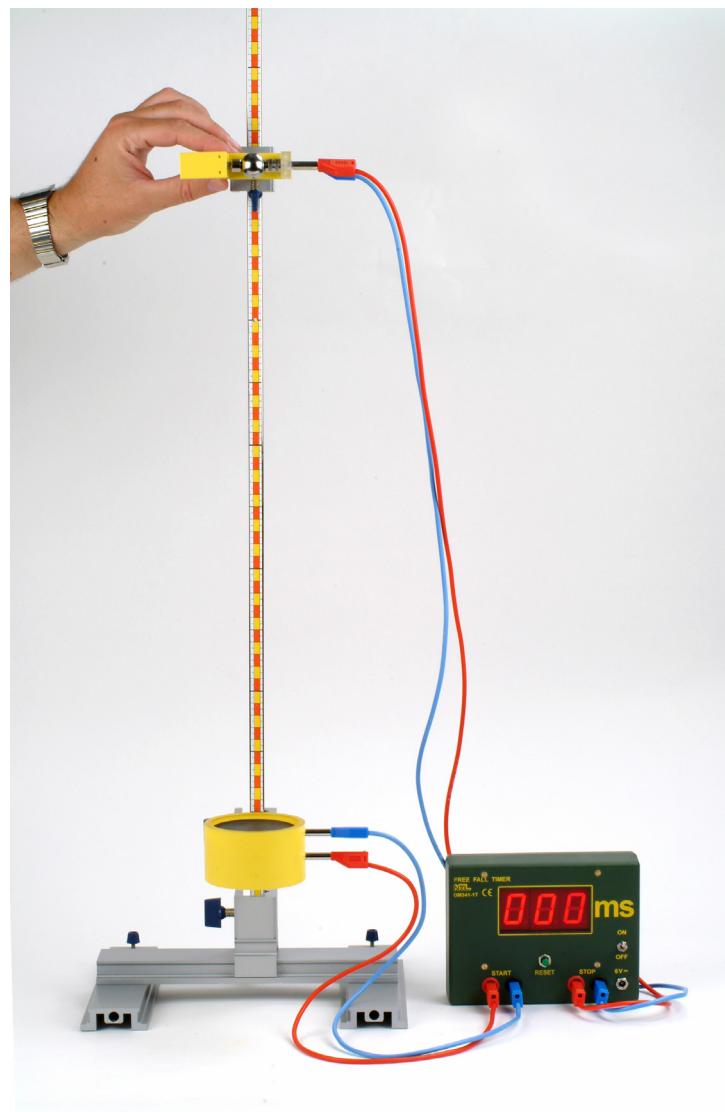


Illustration 1

Equipment for both experiments:

DS100-1H	1	Support base, NTL, H-shaped
DS140-1R	1	Slider stand, vertical
DS400-1K	2	Bosshead, right-angle type
DM220-00	1	Rod, square, with scale, 1000mm
DM340-1F	1	Falling body apparatus consisting of release unit, receptor unit, and 2 steel balls
DM341-1T	1	Timer for falling body apparatus
P3310-5A	2	Connecting lead 100 cm, red, SE
P3310-3B	2	Connecting lead 50 cm, blue, SE

Purpose of the experiment:

- 1- Illustrate that free fall is a uniformly accelerated type of movement.
- 2- Calculate free-fall acceleration (g).

Set up as in the illustration above:

A vertical slider stand is mounted on an H-shaped support stand base. With the aid of the slider stand a rod with scale is mounted on the base, and the ball holder is fastened to the rod using the boss head. The receptor unit is fastened to the rod precisely below the ball holder using the second boss head. The ball itself is clamped into the holder and fixed into place with the knurled-head screw. The release unit and the receptor unit are then connected to the timer using the connecting leads included in the set in the way shown in the illustration.

Note:

For measurement purposes the height from which the ball is dropped is set to exactly 80 cm. This height is defined as the distance between the bottom surface of the ball and the tripping device in the receptor unit. Counter movement while fixing the ball into place is of no significance. Push the RESET button before doing the measurement.

Experiment:

The fall is timed for a height of 80 cm, afterward the procedure is repeated at half the height and the results are compared.

Result:

The time of the fall is not halved, as an accelerated type of movement is involved.

Measurement results:

Time of fall at 0.8 m: $t = 0.404$ s; at 0.4 m: $t = 0.290$ s

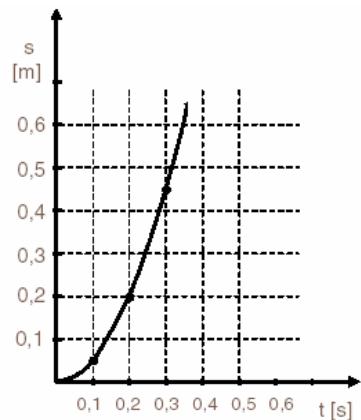
Experiment:

The times for falls from 80 cm, 40 cm, 20 cm and 10 cm are investigated assuming uniform acceleration: $s = (g / 2) * t^2$. It is recommended that the experiment be repeated two or three times and that average values be used in order to avoid calculation errors.

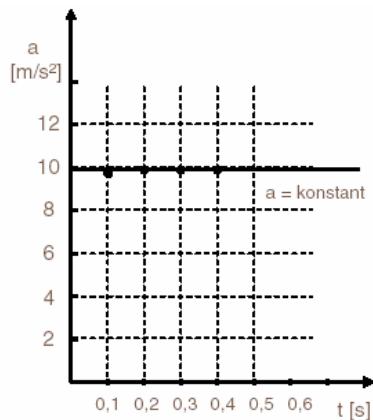
Distance [m]	0. 80	0.40	0.20	0.10
Time of fall [s]	0.404	0.290	0.202	0.144
$g = 2 \times s / t^2$ [m/s²]	9.802	9.510	9.802	9.645
$v = g \times t$ [m/s]	3.96	2.76	1.98	1.39

Evaluation:

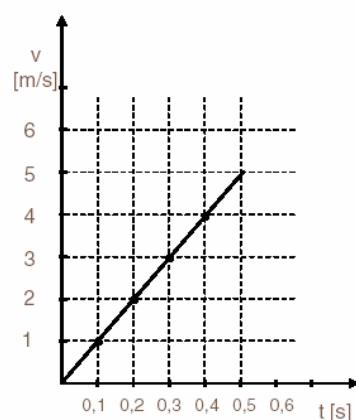
Distance-time diagram



Acceleration



Velocity-time diagram



2. Principle of Independence

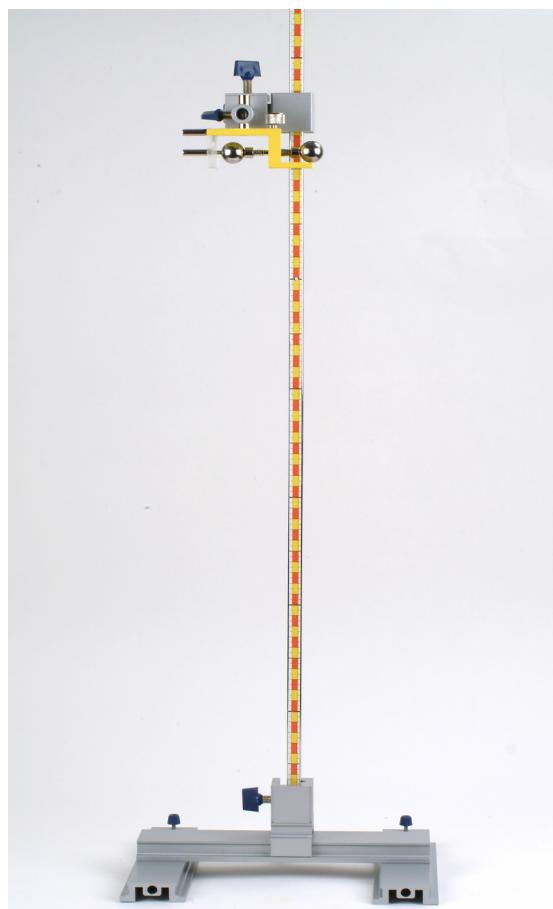


Illustration 2

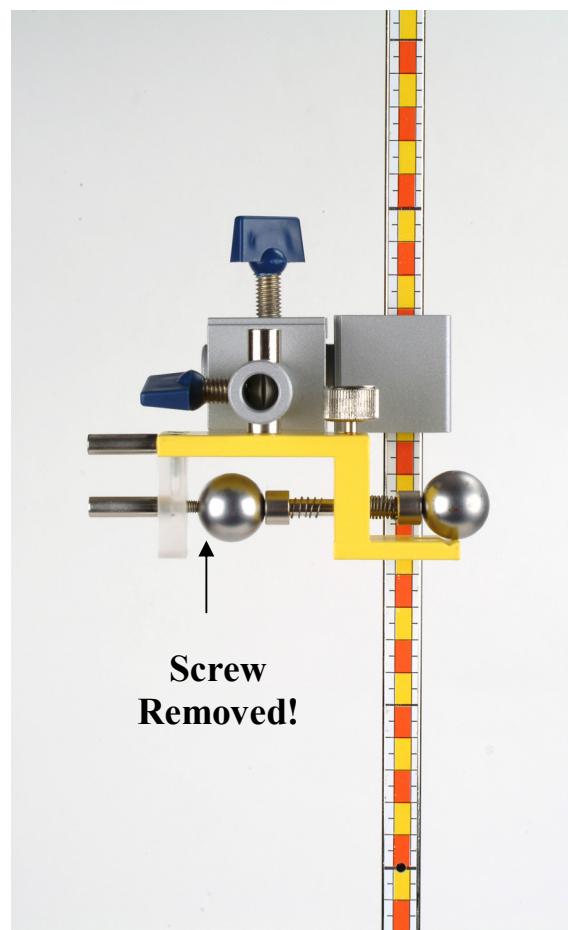


Illustration 3

Purpose:

Demonstrate that a body in free fall is independent of its horizontal movement.

Set up as in the illustration above

A square slider stand is mounted on an h-shaped support stand base. With the aid of the slider stand a rod with scale is mounted on the base, and the ball holder is fastened to the rod using two sleeves.

The two balls are clamped into the holder and fixed into place with the knurled-head screw.

Experiment:

Once the release unit has been loaded, the two balls are released simultaneously by loosening the screw holding them. This causes one of the balls to be accelerated sideways. The two balls begin to fall.

Result:

Even though the second ball moves horizontally as well as falling, both balls reach the bottom at the same time.

Evaluation:

Simultaneous movements of a body in different directions do not influence each other.

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