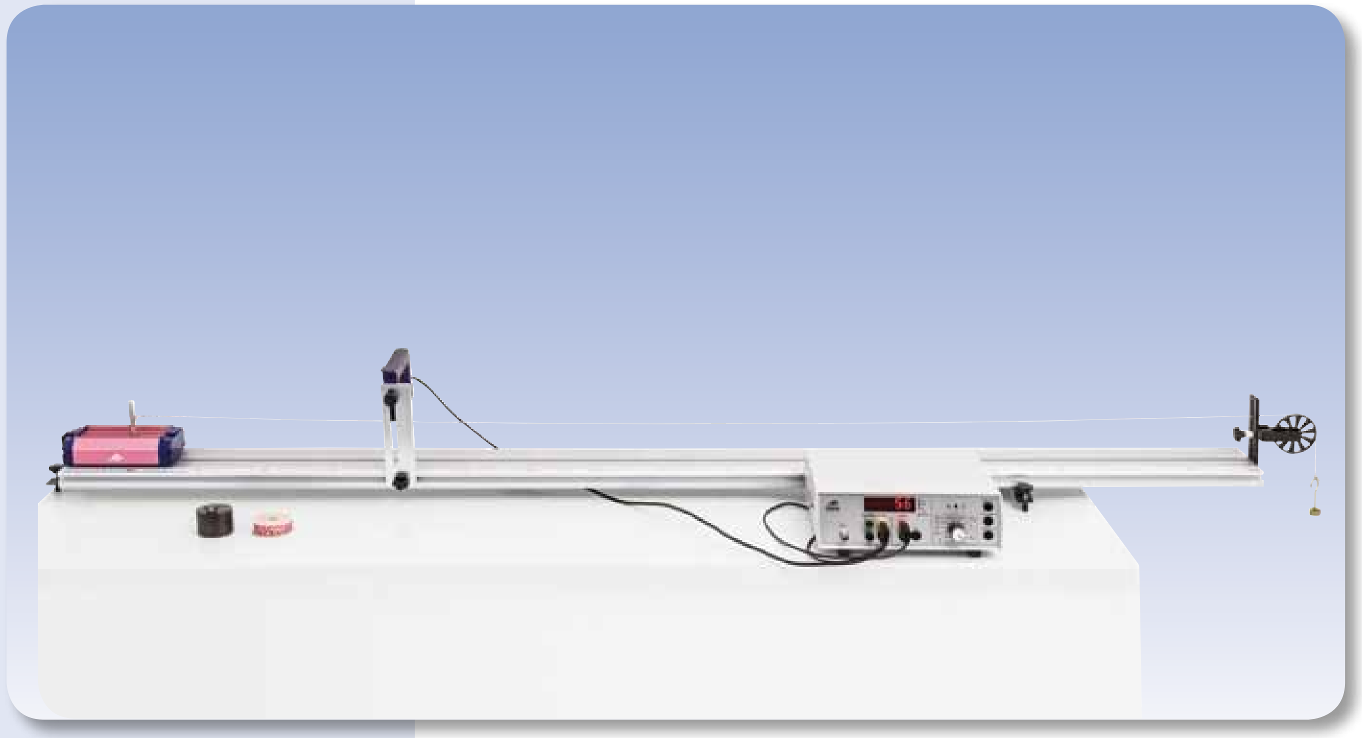
**UE1030250**

# UNIFORMLY ACCELERATED MOTION



## EXPERIMENT PROCEDURE

- **Investigate uniformly accelerated motion as a function of the accelerating mass.**
- **Investigate uniformly accelerated motion as a function of the accelerated mass.**

## OBJECTIVE

**Measurement of instantaneous velocity as a function of distance covered**

## SUMMARY

In the case of uniform acceleration, the instantaneous velocity increases as the distance covered becomes greater. The constant of proportionality between the square of the velocity and the distance covered can be used to calculate the acceleration. This will be investigated in an experiment involving a carriage rolling along a track. In order to measure the instantaneous velocity, a flag of known width attached to the wagon breaks the beam of a photoelectric sensor. The time for which the beam is broken is then measured by means of a digital counter.

## REQUIRED APPARATUS

| Quantity | Description | Number |
|---|---|---|
| 1 | Trolley Track | 1003318 |
| 1 | Photo Gate | 1000563 |
| 1 | Digital Counter (230 V, 50/60 Hz) | 1001033 or |
| | Digital Counter (115 V, 50/60 Hz) | 1001032 |
| 1 | Set of Slotted Weights, 10 x 10 g | 1003227 |
| 1 | Pair of Safety Experiment Leads, 75 cm | 1002849 |
| 1 | Cord for Experiments | 1001055 |

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## BASIC PRINCIPLES

**In the case of uniform acceleration, the velocity *v* and the distance covered *s* increase over the course of time *t*. Thus the velocity increases as the distance becomes greater.**

The instantaneous velocity after a period of time *t* is as follows:

(1) $$v(t) = a \cdot t$$

The distance covered is given by

(2) $$s(t) = \frac{1}{2} \cdot a \cdot t^2$$

This leads to the following conclusions:

(3) $$v(s) = \sqrt{2 \cdot a \cdot s}$$

and

(4) $$v^2(s) = 2 \cdot a \cdot s$$

The instantaneous velocity is given by the following:

(5) $$v = \frac{\Delta s}{\Delta t}$$

In order to measure the instantaneous velocity in this experiment, an interrupter flag of known width $\Delta s$ is attached to the carriage and breaks the beam of a photoelectric sensor as the carriage passes by it. The time the beam is broken $\Delta t$ is measured by means of a digital counter

## EVALUATION

Plotting the squares of the instantaneous acceleration for each run, calculated from the times for which the beam is broken, against the distances covered, it is to be expected that there would be a linear relationship in the case of uniform acceleration as described by Equation 4. The gradient of the straight line through the origin plotted is equal to twice the acceleration.

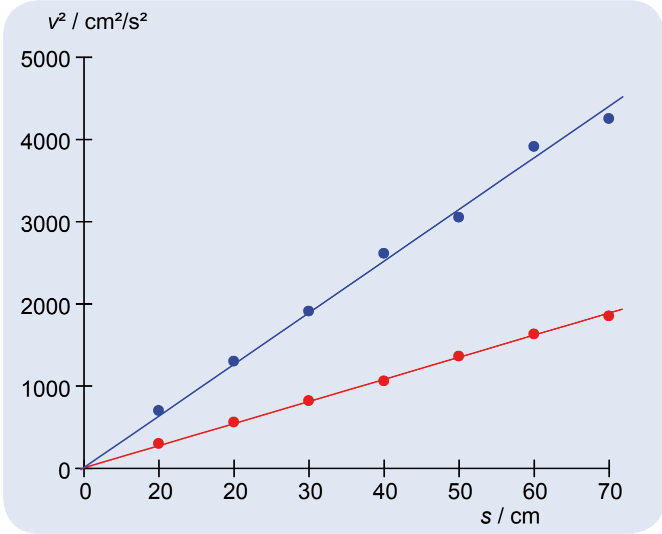


Fig. 2: $v^2$-$s$ plot for $m_2$ = 500 g. $m_1$ = 10 g (red), 20 g (blue)

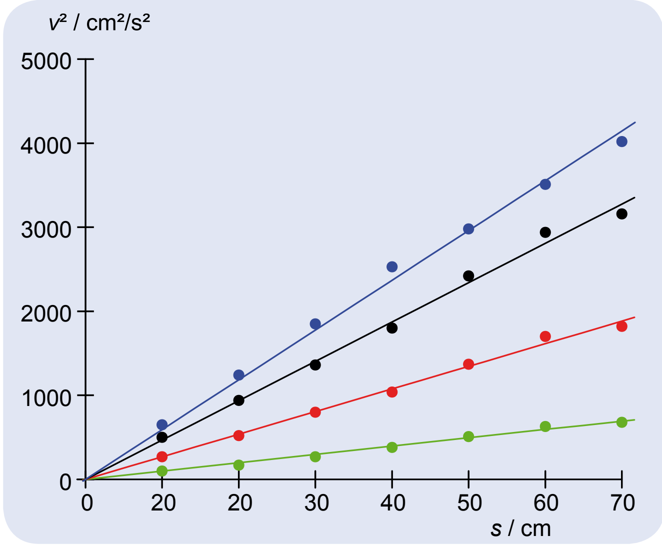


Fig. 3: $v^2$-$s$ plot for $m_2$ = 1000 g. $m_1$ = 10 g (green), 20 g (red), 30 g (black), 40 g (blue)


Fig. 1: Schematic representation