ELASTIC IMPACT

MED 08.13

Material

Item-no.	Qty.	Description
DS101-3B	1	Stand rail with scale, L=1000 mm
DM300-2A	1	Dynamics trolley, demo, 50 g
P1312-2A	1	Car body for trolley SE
P1311-2D	1	Spring bumper
P3120-2Z	1	Universal timer "inno"
P3120-5B	1	S-shaped assembly platform
P1320-4A	1	Light gate "demo" 04
P1321-3K	2	Block for light gates
DS103-1H	1	Holder for guide rail
DM362-1E	1	Baffle block
DM344-1S	1	Projectile launcher 02

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Purpose
To demonstrate an elastic impact against a rigid object.

Preparation
Position the two blocks for light gates at a distance of 90 cm on the table and place the light gate in between the blocks as shown on the image to the left.

Place the stand rail with scale on the blocks for light gates.

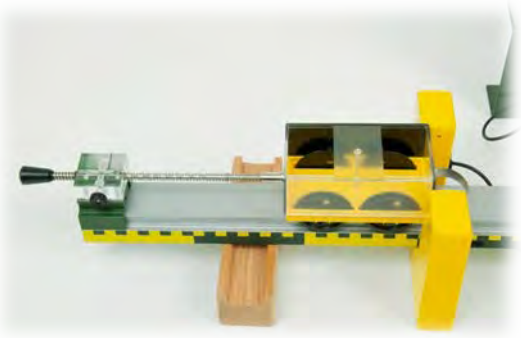
Mount the projectile launcher on the left end of the stand rail. Afterwards mount the holder for guide rail at the 60 cm mark of the stand rail and fix the baffle block on the holder

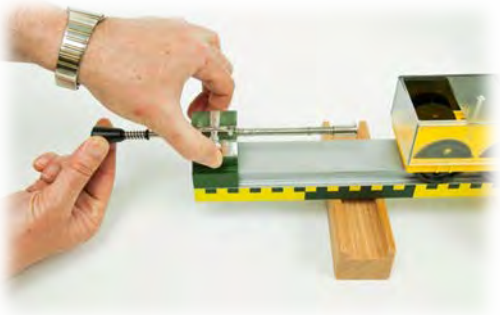
Place the car body on the dynamics trolley; make sure that the small rod of the trolley points through the hole of the car body.

Mount the spring bumper at the front of the Dynamics trolley.

Initially the launching piston of the projectile launcher is fully extended; place the dynamics trolley at the end of the launching piston.

Position the light gate so that the diodes of it are just in front of the dynamics trolley (approximately at the 35 cm mark).





Push the launching button of the projectile launcher in and pull up the launching piston, fix the piston at the 4th notch.

Place the universal timer on the S-shaped assembly platform.

Connect the light gate with the “L1”-socket of the universal timer and set the switch on the universal timer to “L1 Gate”.

Move your finger through the light gate to check if it is working properly.
When passing through with the finger the red LED has to flash up – this time of darkening is measured by the timer. In case that this is not working properly the luminosity has to be adjusted (check at the end of this experiment how this can be done).

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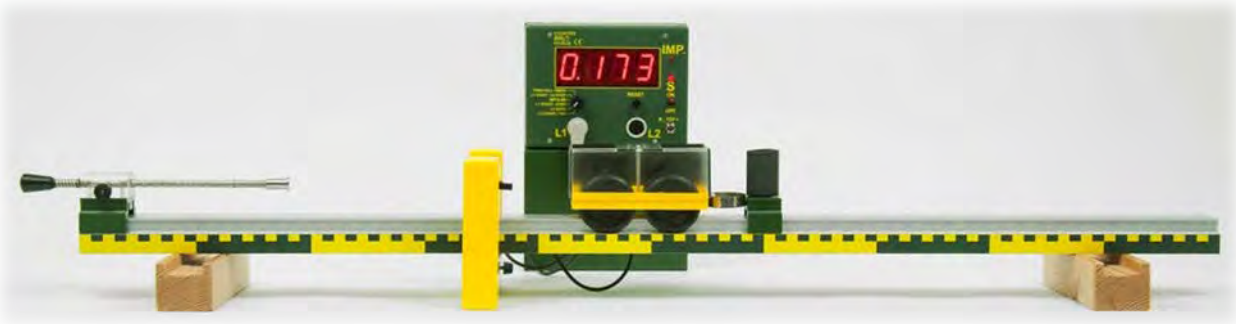
Experiment

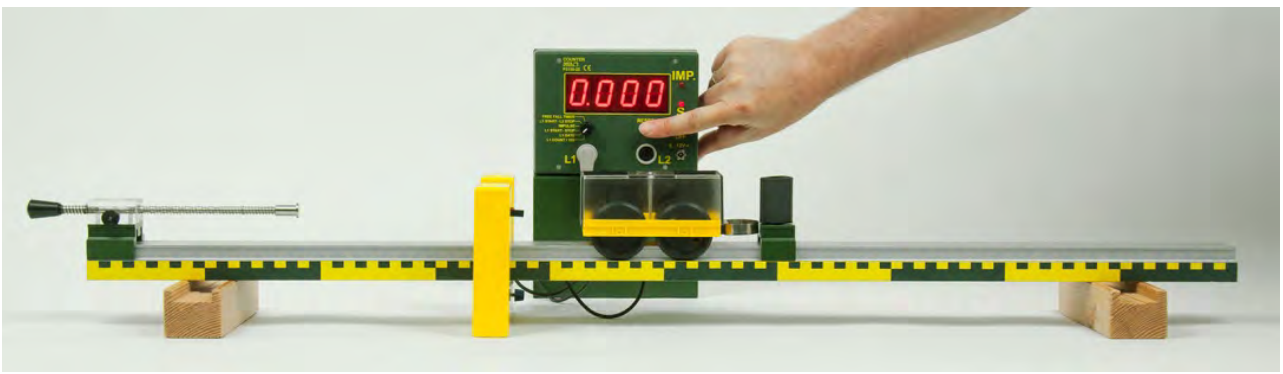
Push the „Reset“-button on the timer; afterwards push the dynamics trolley completely against the launching piston. By pressing the launching button the dynamics trolley gets pushed away.

The universal timer measures the "darkening time" - the time in which the trolley moves through the laser barrier of the light gate.



Once the trolley has passed the light gate a fast reaction is required:

If a time is displayed on the universal timer memorize this value and push immediately the „Reset“-button again. This has to happen in the time frame when the trolley hits the baffle block and before it passes the light gate again.



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When the trolley is moving back the „darkening time“ is measured again.

Based on the length of the dynamics trolley (125 mm) and the darkening time the current speeds of the dynamics trolley can be calculated:

V_1 = 0.125 m / ..... s = ... m/s

V_2 = 0.125 m / ..... s = ... m/s

Result

The force of the spring gives the car kinetic energy and a momentum

In the case of an elastic impact against a rigid object, the kinetic energy in the deformed spring is “temporarily stored” as potential energy and “returned” to the trolley when the spring is released.

We will find out that the reversing speed is slightly lower - this loss is due to the friction of the trolleys and the conversion into other energy during the impact.

If you are unable to quickly reset the time during the impact you can split the experiment into two parts:

In the first attempt only the first darkening time is measured.

In the second attempt both darkening times are measured, these are added up by the counter.

If we then subtract the first time from the total time, we get the darkening time of the second passage of the car.

Note

Please do not generate too high energies with the projectile apparatus to protect the spring.