Aufnahme von Bewegungen (Item No.: P1004669)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 14-16
Topic: Mechanics
Subtopic: Linear motion
Experiment: Recording of movement mit SMARTsense

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

- Tablet

Experiment Variations:

Keywords:

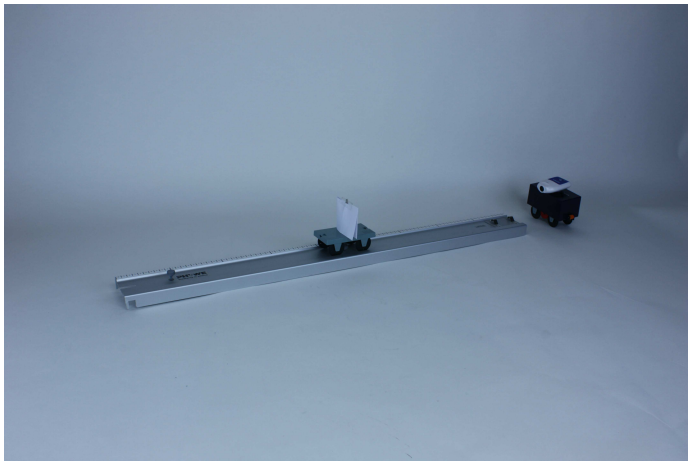
x-t-diagram, motion as change in distance, different kinds of motion

Information for teachers

Introduction

Application
Motion can be understood as change of place or distance to a reference object over time.

ICE 3 train in the Oberhaid forest (picture: Sebastian Terfloth)



Experiment set-up.

Educational objective
The aim of this experiment is to familiarise the students with the difference of accelerated and non accelerated motion. An important factor is to ensure that the students become increasingly experienced in interpreting time-distance-diagrams. This experiment shall be an introductory and give an intuitive understanding of time-distance-diagrams by live measuring and evaluating the motion of a cart.

Tasks

1. The students shall move the cart with constant velocity and then identify a linear curve.
2. Further on the cart shall be moved with constant velocity which is decreased after half of the track.
3. Now the cart shall be moved with constant velocity which is increased after half of the track.
4. The cart shall be stopped out of movement with constant velocity.

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5. The spead of the cart shall be increased evenly.
6. At the end the students have the chance to try out and record movements as they like.

Prior knowledge
The students should be familiar with the content of a time-distance-diagram
Principle
The cart gets moved by the students over the track per hand.
Note
The motion-sensor can only take up distances greater than 20 cm. Therefore the underly of the sensor should be placed 20 cm away from the beginning of the track.

Safety instructions

For this experiment, the general notes and instructions concerning safe experimentation in science classes apply.

Aufnahme von Bewegungen mit SMARTsense (Item No.: P1004669)

Introduction

Application and task

How do different movements behave in time-distance-curves?

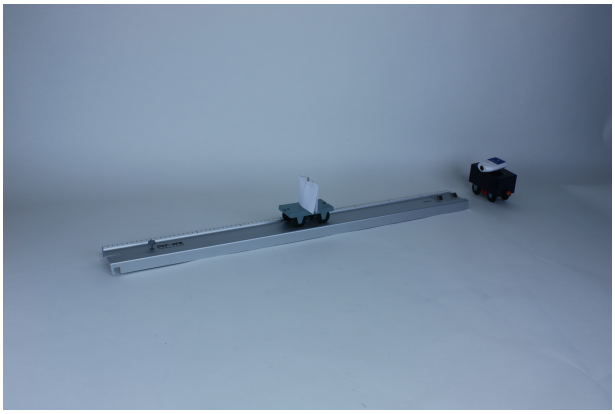
Introduction
How can you represent the motion of a vehicle in a clear, graphical form like the one that you might know from images in the sports section of a newspaper?
What kind of information is provided by such diagrams?

Application
Motion means changing location with time. A train is such at a different train station at a later point in time. For visualizing movements in a graph, in which one can read for example at which point in time a train was in which location on the track, time-distance-curves are used.

ICE 3 train in the Oberhaid forest (picture: Sebastian Terfloth)

Tasks

1. Move the cart by hand with constant velocity over the track and record a time-distance-diagram.
2. Now repeat task one but move the cart with a lower, constant velocity after half of the track.
3. Repeat task two but increase the speed after half of the track.
4. Move the cart again with constant velocity but stopp it in the middle of the track for a while. Then go on like before.
5. Now constantly accelerate the cart.
6. At the end record a movement of your own choice.



Experiment set-up

Material

Position No.	Material	Order No.	Quantity
1	Track, l 900 mm	11606-00	1
2	Meter scale, demo. l=500mm, self adhesive	03005-00	2
3	Retaining Bolt	03949-00	1
4	Cobra SMARTsense - Motion, 0,2 ... 2 m	12908-00	1
5	Cart for measurements and experiments	11060-00	1

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Set-up and procedure

Set-up

Place the Stecke Track on the table.
Then mount the retaining pin to the cart. With a sheet of paper and adhesive tape you can mount a screen on the retaining pin to enhance the visibility of the cart for the motion sensor (fig. 1).

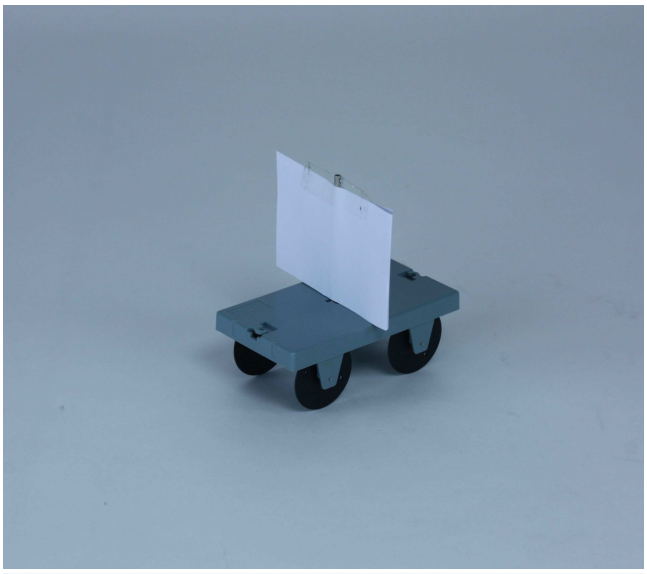

Fig. 1.

Set up a sufficient high underlay for the motion sensor approximately 20 cm away from the beginning of the track. The reason for that is the motion sensor which can only take up distances greater than 20 cm. So the maximum length of the track can be used. Place the sensor on the underlay (f.e. the motorised car or use the stand) and align it to the screen of the cart (fig. 2).

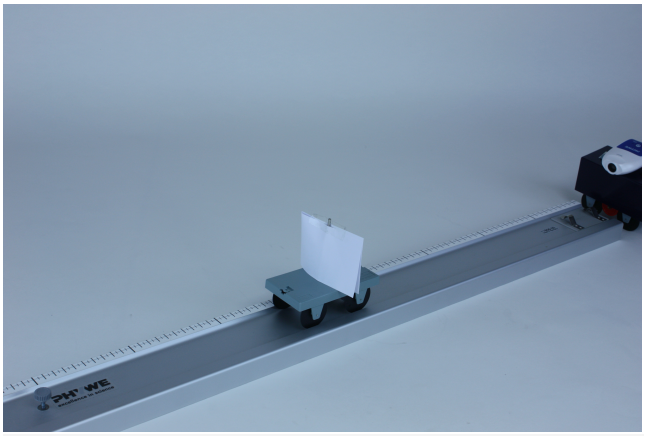

Fig. 2.

Switch on the motion-sensor and open measureAPP. By selecting the motion-sensor in the menu "Sensor" it can be connected to measureAPP. Check then wether the alignment of the sensor is correct by moving the cart over the track. If the distance measured agrees with that of the cart reliably the alignment is correct.

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Procedure

The measurement can be started by pressing on . In the graphical mode (see fig. 3) the distance of the cart can be, live, taken up and visualized. For each og the tasks start a measurement by clicking on , move tha cart accorfing to the description and stop the data uptake then with . To export the data and to visualize them later on again, click on the "file with an arrow" symbol next to the -button.
Then go on with the next task.

Tasks

1. Move the cart by hand with constant velocity over the track and record a time-distance-diagram.
2. Now repeat task one but move the cart with a lower, constant velocity after half of the track.
3. Repeat task two but increase the speed after half of the track.
4. Move the cart again with constant velocity but stopp it in the middle of the track for a while. Then go on like before.
5. Now constantly accelerate the cart.
6. At the end record a movement of your own choice.

An examplary curve of task one is given in fig. 3.

Fig. 3.

Evaluation:
After compleeting the different tasks one can compare the shape and effects of the time-distance-curves recorded, in dependency of conducted movements. Therefore open the menu "Manage" in the side bar and go to your recorded data.

Concentrate especially on the following questions:

1. What is the shape of a curve of constant velocity?
2. How does the shape change if the velocity gets smaller?
3. How does the shape change if the velocity gets greater?
4. What is the effect of a stagnating cart?
5. What are the differences in the curves for constant velocity and accelerated cart?