Motion and average speed with Cobra DigiCart

Physics > Mechanics > Dynamics & Motion

Difficulty level	Group size	Preparation time	Execution time
medium	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/5f45adc39a658b00033e0383

PHYWE

Teacher information

Application

PHYWE

Coal production

The uniform straight-line movement is found in technology, e.g. on conveyor belts: Here an object moves in a constant direction at a constant speed on the belt. By using two light barriers it is possible to determine the average speed that an object has between the two barriers. This measuring method is used for example in traffic monitoring.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/2)

PHYWE

Prior knowledge

This experiment does not require any prior knowledge.

Scientific principle

Speed is one of the basic concepts of the theory of motion. It indicates how fast an object is moving in space and is measured in the unit meter per second. The concept of speed is based on the average speed. Designated $\triangle x$ the change of the position in a period of time $\triangle t$ so you can talk about$\bar{v} = \frac{\triangle x}{\triangle t}$ the average speed $\bar{v}$ calculate.

Other teacher information (2/2)

PHYWE

Learning objective

In this experiment the students learn about the physical meaning of speed. They also learn about the concept of average speed.

Tasks

Record a place-time diagram via the app. Select the measuring range and let it calculate the average speeds within the sections for each of the four given intervals (sections).

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

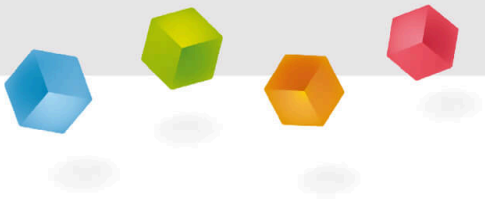
info@phywe.de
www.phywe.de

Safety instructions

PHYWE

The general instructions for safe experimentation in science lessons apply to this experiment.

PHYWE



Student Information

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

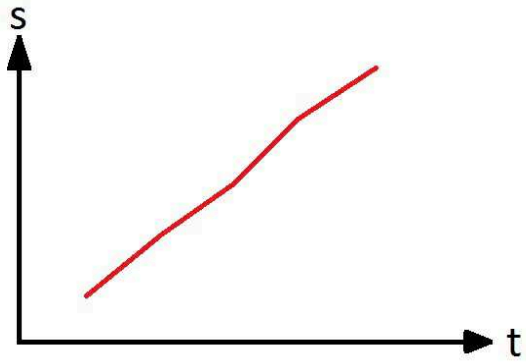
Motivation

ICE 3 in the Oberheider Forest

Everything in the world is in motion. It is therefore worthwhile to take a closer look at speed.

In this experiment you will learn something about the physical meaning of speed. You will also learn about the concept of average speed.

Task



Place- Time Diagram

- Record a place-time diagram via the app.
- Select the measuring range and calculate the average speeds within the sections for four specified intervals (sections).

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

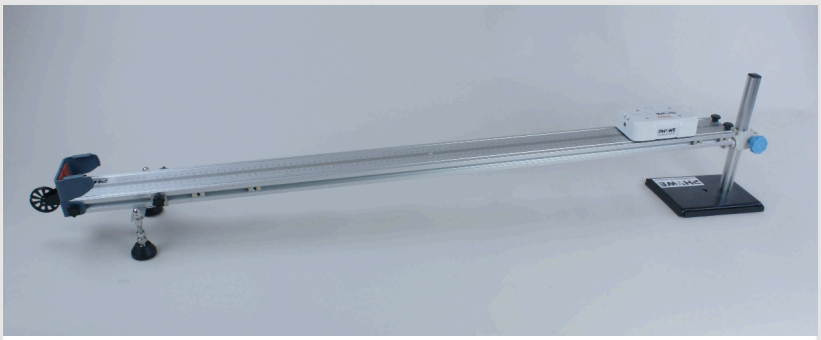
Equipment

Position	Material	Item No.	Quantity
1	Cobra DigiCart Basic Set	12940-77	1
2	Cobra DigiCartAPP	14582-61	1

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Set-up (1/2)

PHYWE

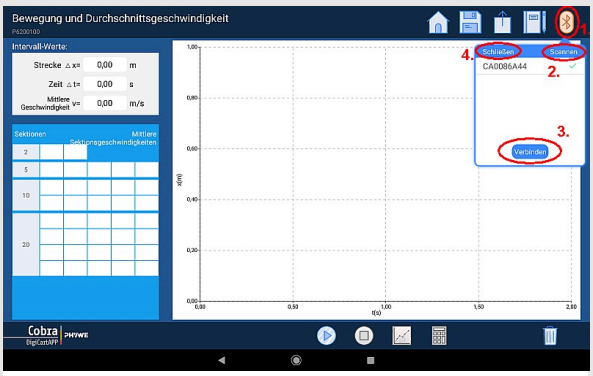


Overview test setup

- Bring the track into a horizontal position.
- Now raise one end of the track by about 10 cm with the help of the height-adjustable holder.
- The track is now inclined so that the DigiCart can roll down.
- Start the DigiCart App.
- Select experiment 1 from the overview. The measurement window opens.

Set-up (2/2)

PHYWE



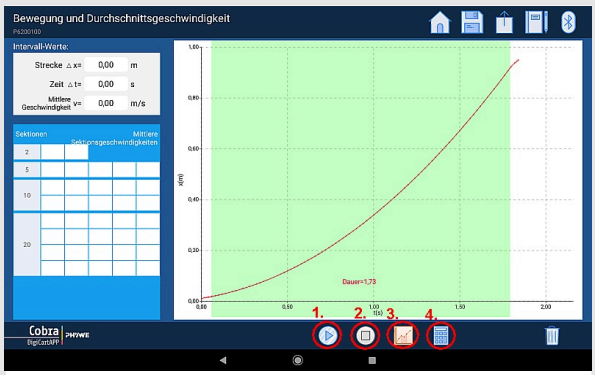
Connection to the DigiCart

- Connect the DigiCart to the app. Two steps are necessary. First, the ON switch on the DigiCart must be pressed for at least 3 seconds.
- Then open the connection window in the app via the Bluetooth symbol (1.). The DigiCart should now be displayed there. If not, you can update the list by clicking on Scan (2.).
- Now tap the DigiCart from the list once and establish the connection with the Connect button (3.). The window can now be hidden again with the close button (4.).

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Procedure (1/4)

PHYWE

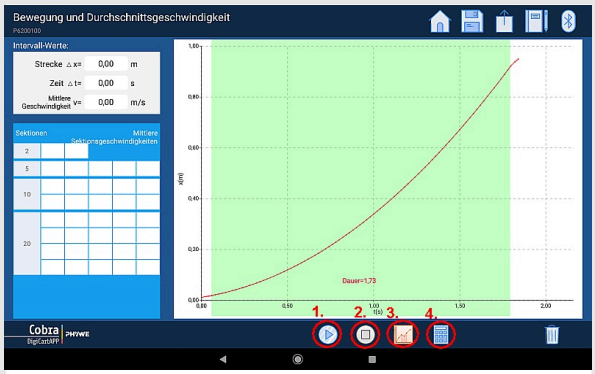


Procedure for the measurement

- The figure shows the steps for the measuring procedure.
- The DigiCart is positioned and held in the raised area of the track.
- Start the measurement by clicking on Start measurement (1.).
- Let the DigiCart roll down the track.
- Stop the measurement by clicking on End measurement (2.) as soon as the DigiCart has reached the bottom.

Procedure (2/4)

PHYWE



Procedure for the measurement

- Click on Select measuring range (3.) to select a time interval in the local time diagram within which the DigiCart has moved undisturbed.
- The selection is made by sweeping the interval with your finger.
- Then click on the memory icon (4.).
- By clicking the memory icon a new menu appears automatically at the bottom of the screen.

PHYWE

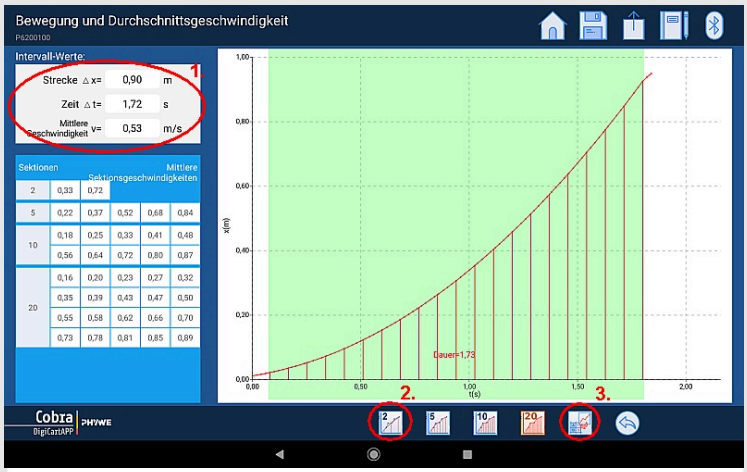
Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure (3/4)

PHYWE

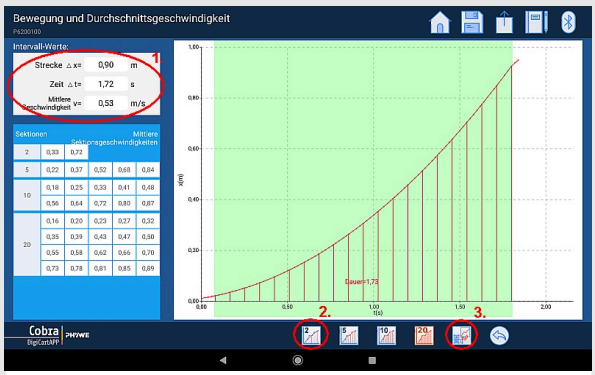


Procedure for the evaluation

- The interval values are calculated and displayed automatically (1.).
- Tap the button with the number 2 to divide the selected measuring range into two sections of equal size (2.).

Procedure (4/4)

PHYWE



Procedure for the evaluation

- Click on the Save button.
- The average speeds within the two sections are calculated and entered in the table on the left (3.)
- Repeat the last two steps for the buttons with the numbers 5, 10 and 20.
- The table should then be completely filled with values.

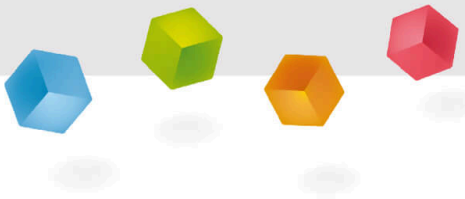
PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

PHYWE



Report

Task 1

PHYWE

Drag the right words into the gaps!

If you pick a case with a certain number of sections (for example 10), you will see that the calculated average speeds are not _____. Rather, there is an _____ in the _____. This observation is _____ on the number of sections. With a higher number of sections, however, the jumps between the individual sections become _____.

independent
increase
smaller
speed
constant

Check

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Task 2

PHYWE

Now fill in the gaps yourself!

The statement of the average speed is particularly questionable if a movement is composed of both [ ] and [ ] speeds (i.e. forward and backward movements). An extreme example: The S-Bahn train leaving Zurich 06:43 for Pfäffikon is 08:16 back in Zurich. Average speed between 06:43 and 08:16? [ ], because the difference in location between the starting and end point is [ ], i.e. $\triangle s = 0$. You can see that you have to be careful with the average speed!

Check

Task 3

PHYWE

When a body travels on an inclined path, the component of gravity acting on it parallel to the path causes it to experience

- a constant acceleration
- an inconstant acceleration
- a uniformly decelerated movement

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Slide	Score / Total
Slide 17: Observation speeds	0/5
Slide 18: Average speed	0/4
Slide 19: Connection Movement	0/4

Total amount 0 / 13

Solutions Repeat

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de