NVON

Show the Physics

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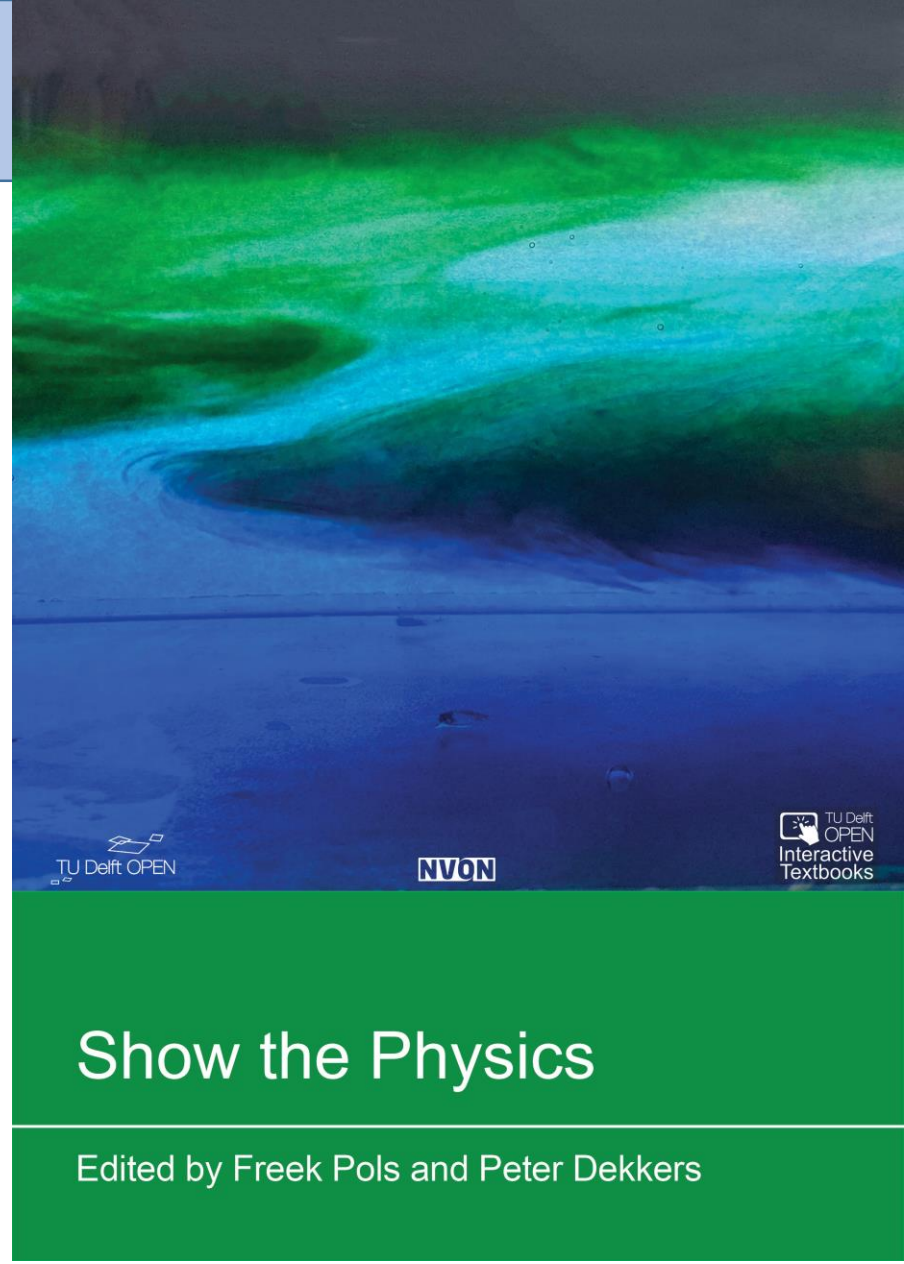


Kirsten Stadermann **Peter Dekkers** **Freek Pols** **Wim Sonneveld**

Outline

- Welkom / installeer Phyphox app
- Wim: didactiek in Show*de*fysica
  - PEOE / conceptcartoon
- Freek: online lesmateriaal / Show *the* Physics
  - Intro *Show the Physics* / magische momenten / staande golf en *E*
- Voorbeelden bij enkele didactische thema's
  - Peter: Aard van de wetenschap / Magic, trick or physics
  - Kirsten: Aard van de wetenschap / surfende paperclip
  - Broekzakdemo's
  - Freek: Data verzamelen en verwerken door leerlingen met Phyphox / zingende staaf en radioactief verval (applets in S*t*P)
- Suggesties, vragen, opmerkingen etc uit het publiek

Show*de*fysica 1

- Demo’s – functies
  - aandacht trekken
  - interesse wekken
  - visualiseren
  - verifiëren / aannemelijk maken
  - communiceren: theorie toetsen met exp
  - begripsontwikkeling ondersteunen
  - illustreren onderzoeksproces

- leerlingen allemaal actief → PEOE

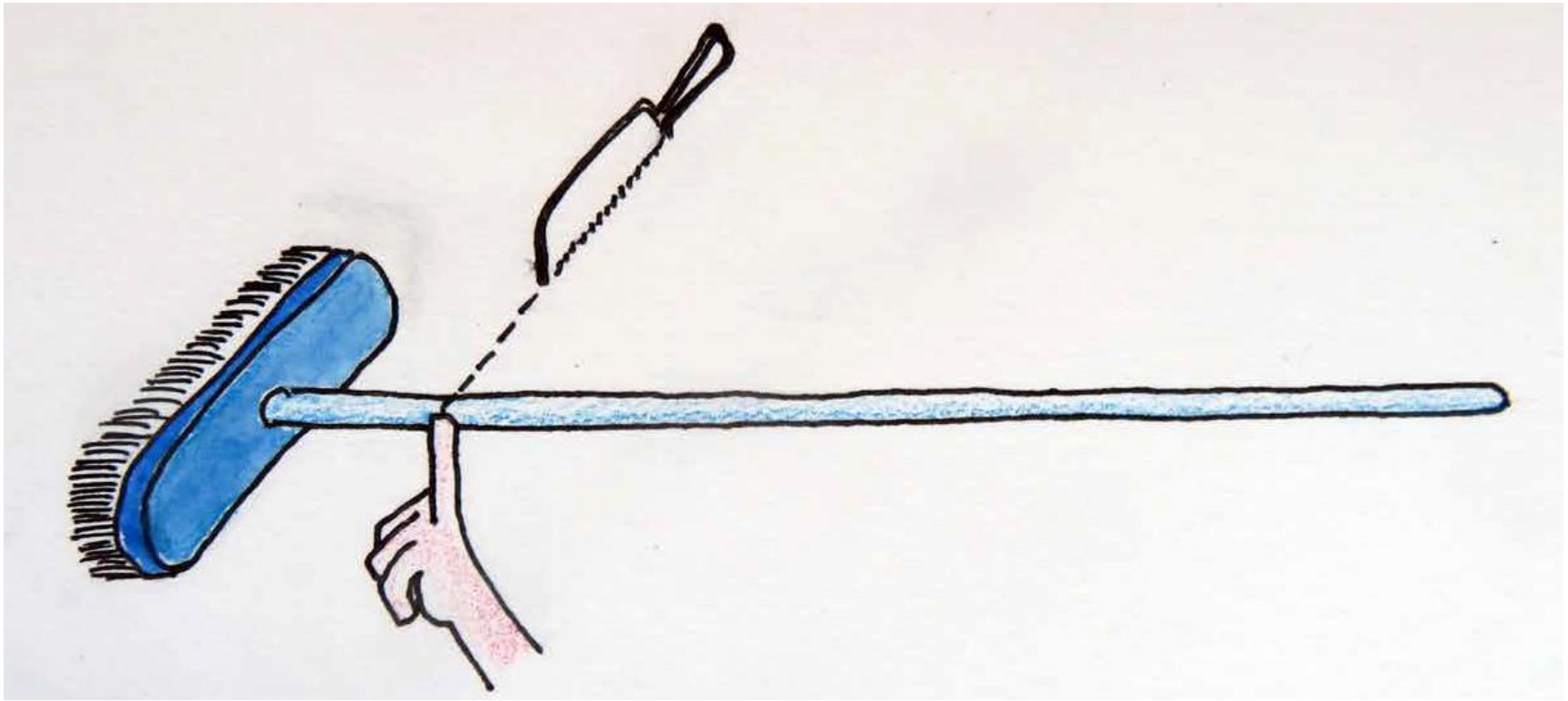
PEOE

- vraag (Hoe kan ik onderzoeken of ….. ? / Wat gebeurt er als ….. ?)
- **P**redict
- **E**xplain / inventarisatie
- **O**bserve / leerlingen schrijven
- **E**xplain
- discussie
- uitleg
- eventueel: vergelijkbare verschijnselen

Show*de*fysica 2

- Natuurwetenschappelijke vaardigheden
  - waarnemen
  - interpreteren
  - voorspellen
  - beschrijven
  - verklaren
- Conceptcartoon

Conceptcartoon

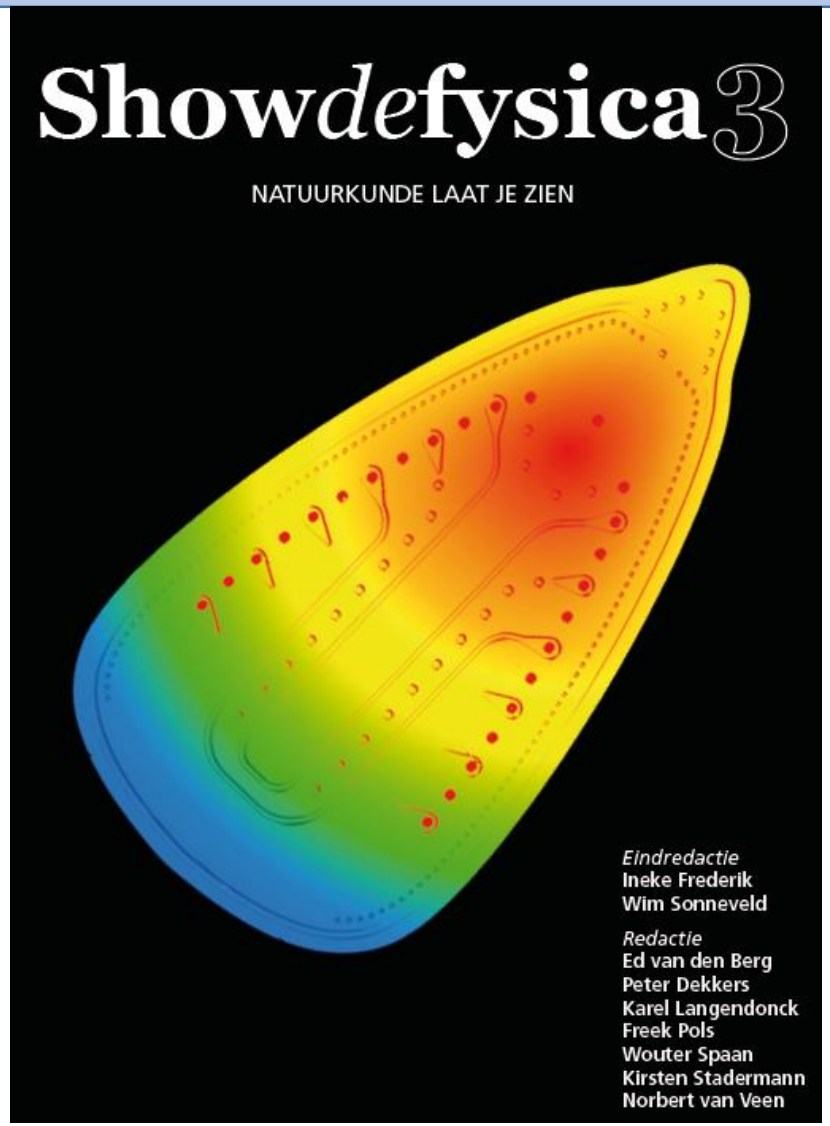


Leg de delen van de bezem op een balans; de balans zal:..

En wat zeg jij???

Show*de*fysica 3

- Heen-en-weer denken bij demo’s
- Argumentatie en overtuigingskracht
- Aard van de wetenschap (NoS)



Demo’s: Magische momenten

Show the Physics
NVON TU Delft

Search Ctrl + K

Introduction

1. Show the Physics
2. Foreword
3. Preface from the editor
4. About the authors
5. NVON
6. Python summary
7. Table of contents

Pedagogy

8. Introduction
9. Nature of Science
10. Argumentation
11. Thinking-Back-and-Forth
12. Predict Explain Observe Explain

Demos on Nature of Science

13. Demos on NoS

Demos on scientific inquiry

14. Demos on scientific inquiry

Demos for conceptual development

15. Waves, optics, quantum

Contents

8. Introduction

Physics demonstrations are fascinating, inspiring, and educational—they truly deserve to be spotlighted in our classrooms. However, they also require a significant investment of time. Gathering and coordinating materials, setting up components in such a way that the focus is on the key aspects, preparing the presentation—these are just the starting point. Engaging students and involving them deeply, sparking curiosity, building suspense, to ultimately unveil the phenomenon. All this effort is meant to ensure that your audience will never forget your demonstration! And, finally, all the cleaning up... Should you even bother doing demonstrations? **Absolutely!!!** But when you do, do it right! Make it memorable and impactful, turning a simple lesson into an unforgettable learning experience.

Where most books on physics demonstrations describe the experiments only, we provide thoughtful approaches and elaborate what is known about the pedagogy of demonstrations.

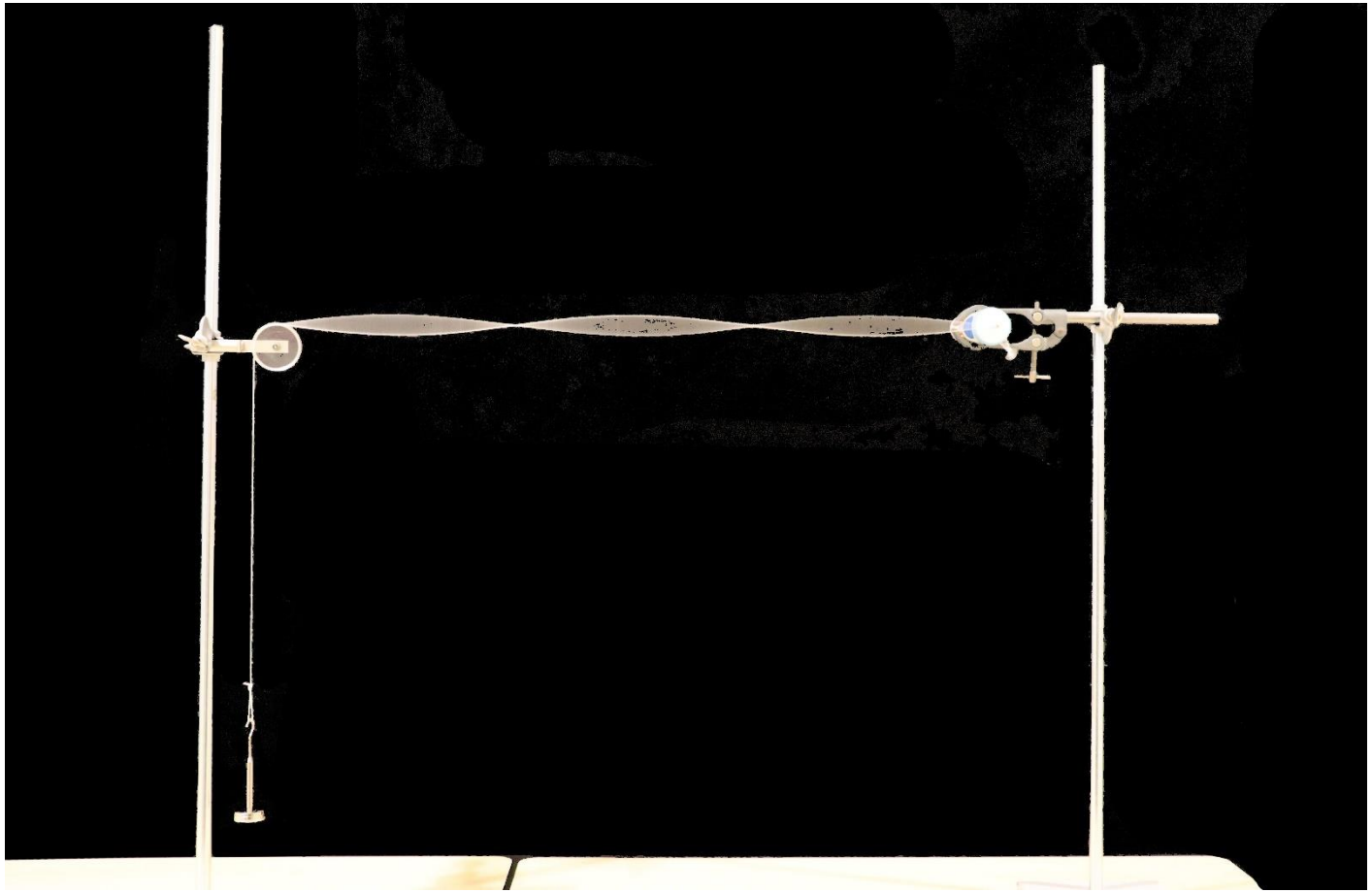
Fig. 8.1 A teacher demonstrating stability

8.1. What can demonstrations accomplish?

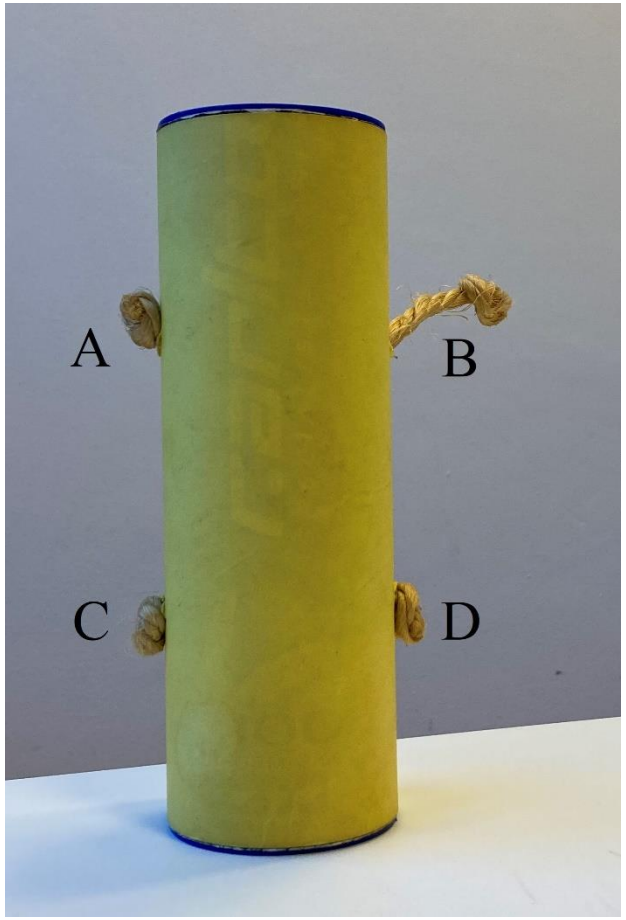
Almost everyone who is enthusiastic about STEM education remembers a great demonstration. One that sticks in the memory. One that you would like to share because you enjoyed it so much yourself. But did you learn anything from it? Do physics concepts become better anchored? An article in the *American Journal of Physics* states:

> Despite popular beliefs to the contrary, students learn little, if anything, from traditionally presented classroom demonstrations [Crouch *et al.*, 2004].

So... should we abandon those demonstrations? That at least would save time... a lot of time. Crouch *et al.* [2004] fortunately also report that you can significantly increase the learning effect of demonstrations. To do so, one important part of your demonstration may involve asking your students to predict the result. Meaningful predictions of the results (requiring some understanding of the phenomenon) followed by their observation is reported to lead to increased learning. They also show significantly more insight and understanding, which in



Cilinderpuzzel



Wat is Nature of Science (NOS)?

- NOS gaat over de aard van de wetenschap
- Wetenschap is veel meer dan feitenkennis
- NOS beschrijft
  - de principes,
  - methoden,
  - warden en
  - maatschappelijke aspecten

  van het bedrijven van wetenschap
- Met demo’s kunnen leerlingen kennis maken met NOS-aspecten

Leerdoelen bij NOS: Inzichten…

- Kennis is voorlopig (niet eeuwig en onveranderlijk)
- Gefundeerd in de empirie (gebaseerd op waarnemingen)
- Subjectief (door mensen bepaald en beinvloed)
- Deels het product van interpretative, creativiteit, fantasie
- Ingebed in sociale en culturele context

Magic tricks or physics

Magic tricks or physics

Leerdoelen bij NOS: Inzichten…

- Onderscheid natuurwetten, hypothesen en theorieën
- Bekend met historische ontwikkeling van wetenschap
- Onderscheid feiten en interpretaties, en het belang van beide
- In de morele en ethische consequenties van (gebruik van) wetenschap
- In de methodische en systematische werkwijze van de wetenschap

Surfende paperclip

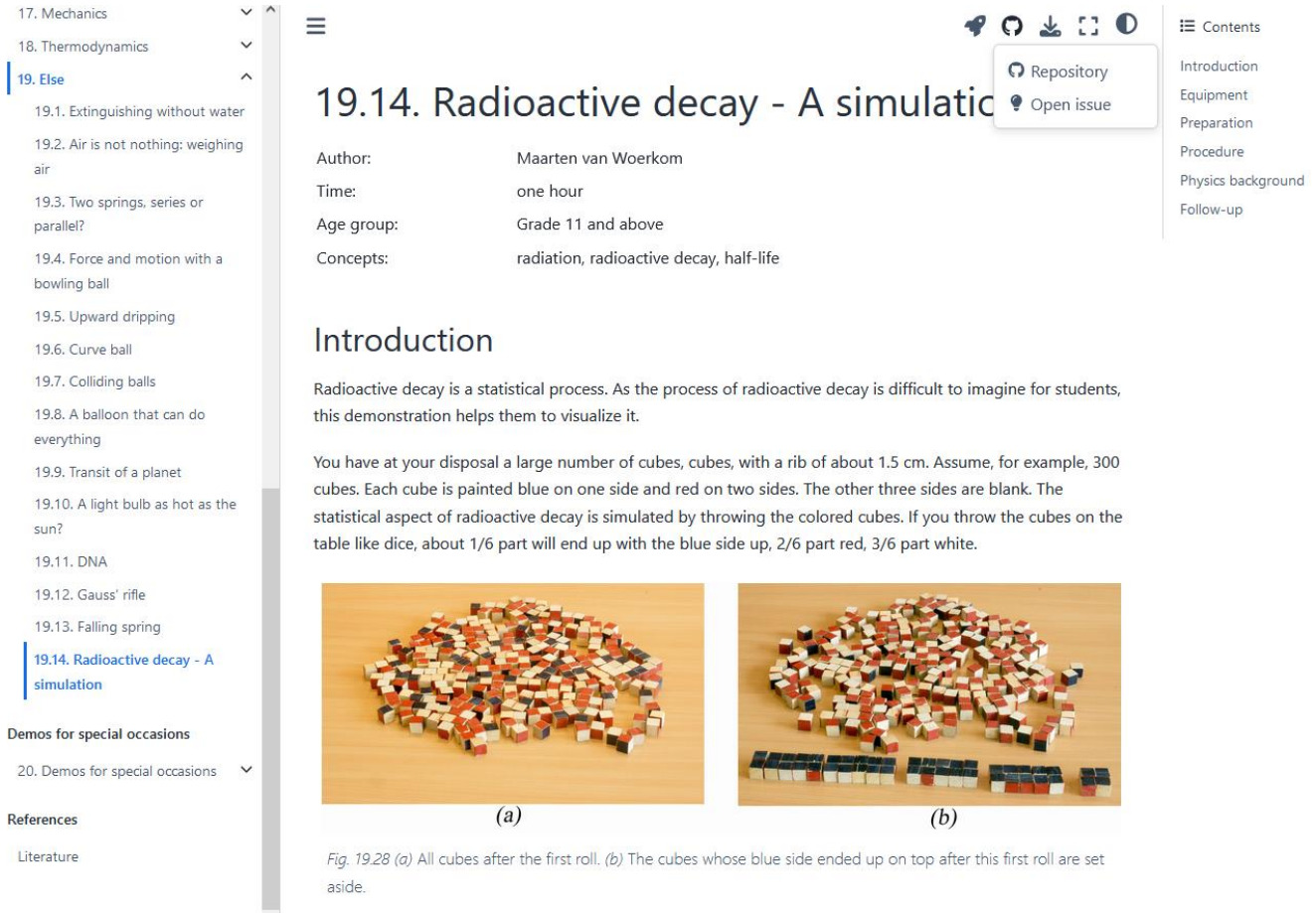
Broekzak experimenten

- Half- en kernschaduw
- Diepte zien 1
- Diepte zien 2
- Druk en oppervlak
- Wrijving en normaalkracht

Ed van den Berg

Twice as much isn’t twice as big

Contribute


17. Mechanics
18. Thermodynamics
19. Else
19.1. Extinguishing without water
19.2. Air is not nothing: weighing air
19.3. Two springs, series or parallel?
19.4. Force and motion with a bowling ball
19.5. Upward dripping
19.6. Curve ball
19.7. Colliding balls
19.8. A balloon that can do everything
19.9. Transit of a planet
19.10. A light bulb as hot as the sun?
19.11. DNA
19.12. Gauss' rifle
19.13. Falling spring
19.14. Radioactive decay - A simulation
Demos for special occasions
20. Demos for special occasions
References
Literature
Repository
Open issue
19.14. Radioactive decay - A simulatic
Author: Maarten van Woerkom
Time: one hour
Age group: Grade 11 and above
Concepts: radiation, radioactive decay, half-life
Introduction
Radioactive decay is a statistical process. As the process of radioactive decay is difficult to imagine for students, this demonstration helps them to visualize it.
You have at your disposal a large number of cubes, cubes, with a rib of about 1.5 cm. Assume, for example, 300 cubes. Each cube is painted blue on one side and red on two sides. The other three sides are blank. The statistical aspect of radioactive decay is simulated by throwing the colored cubes. If you throw the cubes on the table like dice, about 1/6 part will end up with the blue side up, 2/6 part red, 3/6 part white.
(a)
(b)
Fig. 19.28 (a) All cubes after the first roll. (b) The cubes whose blue side ended up on top after this first roll are set aside.
Contents
Introduction
Equipment
Preparation
Procedure
Physics background
Follow-up

Suggesties, vragen, opmerkingen, discussie

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Variabele lenssterkte