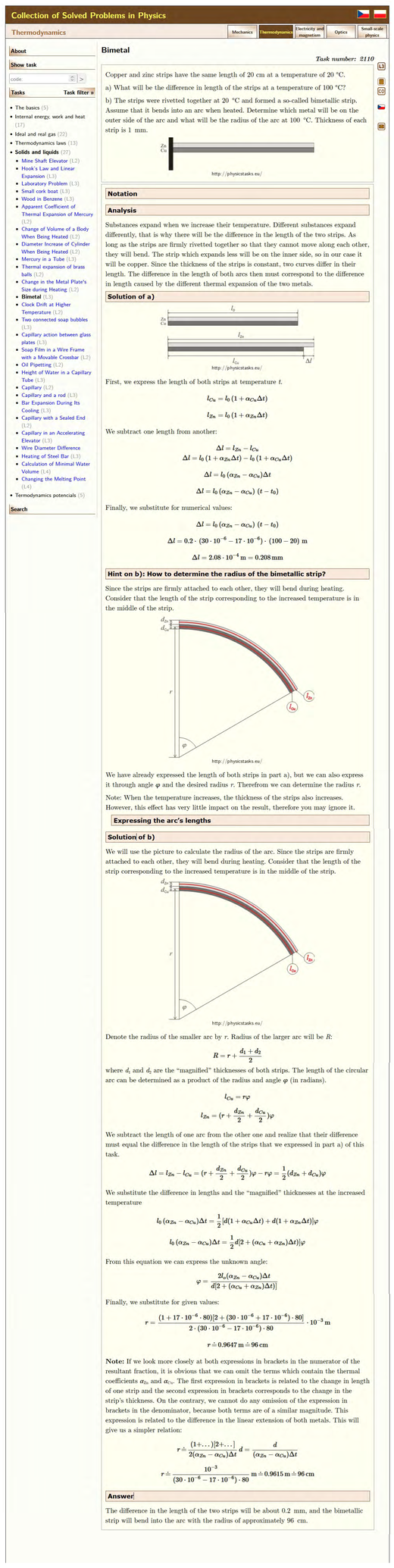
Electronic Collections of Solved Problems in Physics and Physics Experiments

Zdeňka Koupilová, Petr Kácovský, Marie Snětinová, Dana Mandíková

Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

Solved Problems



History

- started in 2006 as small-scale project
- nowadays published several hundreds of tasks
- 2015 new web interface
  started 2016, uses the same interface
- a significant increase in traffic during the lockdown periods in 2020–2022

Motivation

- assist students in self-study and during online education
- support teachers by qualite and verified materials
- lead to active and independent thinking
- help for weaker students, challenges for advanced students

Special designed structure

- detailed and structured solutions
  carefully tested procedures
- qualitative analysis of the problem
  sample results (graphs, photos, video shots)
- structured hints and their solution
  methodological and technical notes
- comments, cross-linking tasks and experiments

Sorting and filtering

Difficulty

- from lower secondary to university (4 levels)
  from nursery school to university (4 levels)

Type

- solution by reasoning, graphical tasks, unusual tricks, complex tasks
  qualitative or quantitative experiment

Cognitive processes

- analysis, synthesis, sorting, induction, deduction, transformation, proving, ...

Technical parameters

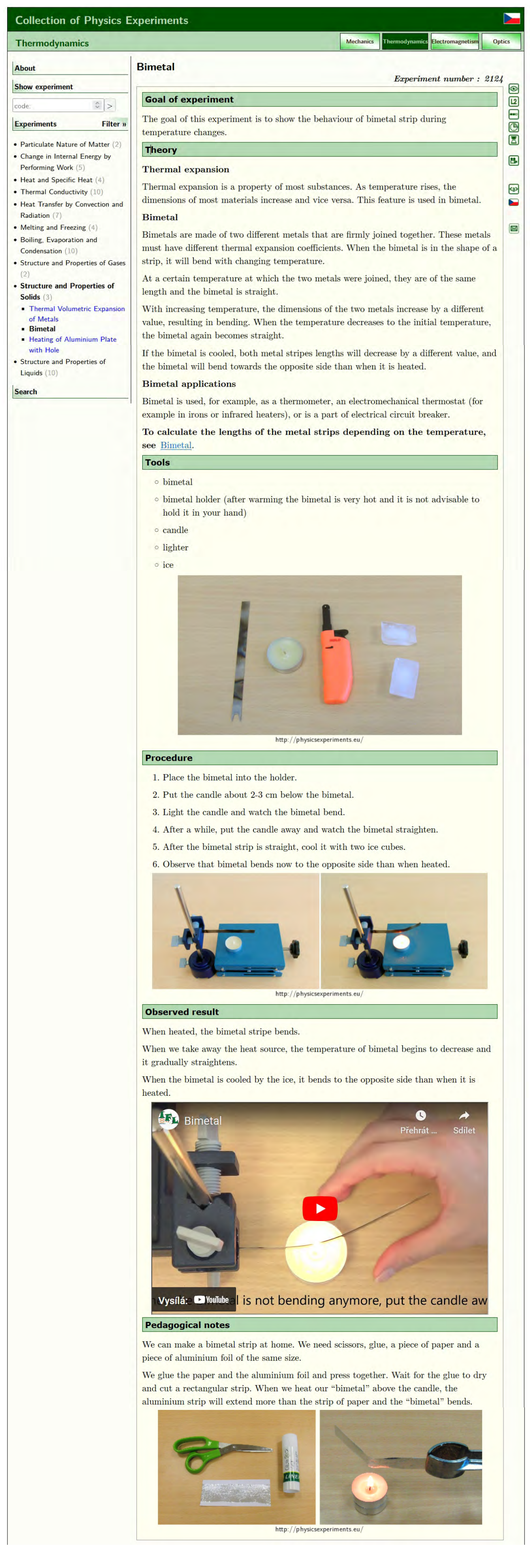
simple, common or special equipment
preparation: under 3 min, 3–10 min, above 10 min
duration: under 3 min, 3–10 min, above 10 min

Fulltext search

Content

	Problems		Experiments	
	CZ	EN	CZ	EN
Mechanics	235	108	7	1
Electromagnetism	282	93	52	13
Thermodynamics	158	84	75	55
Optics	67	26	30	12
Others	211		6	

Physics Experiments

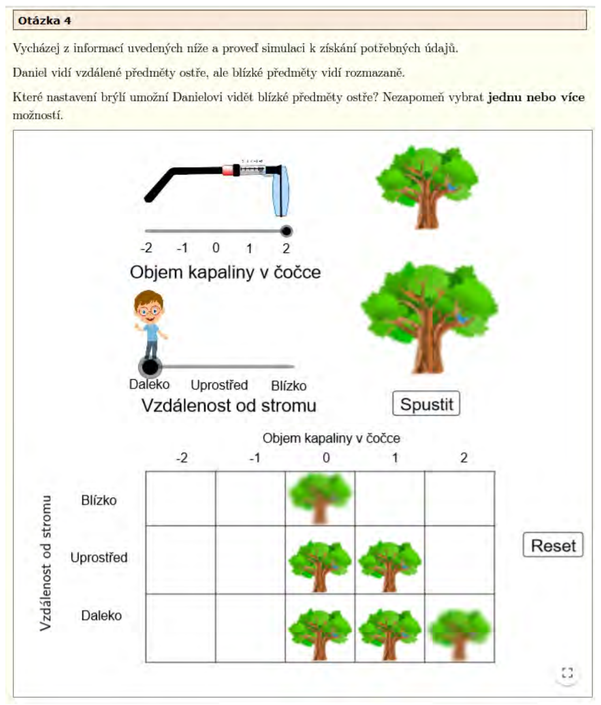


Short videos

- published at separate YouTube channel
- almost 400 short clips (usually not exceeding 90 seconds in length)
- provide teachers a quick understanding of what to expect in the experiment

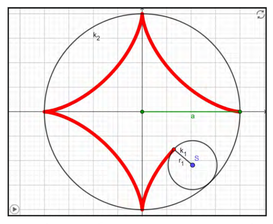
PISA problems

- science tasks used within the Programme for International Student Assessment (PISA)
- effort to make released tasks accessible to a wider range of teachers and students
- scientific literacy development, independent of content knowledge
- currently 27 tasks including 3 tasks with interactive elements

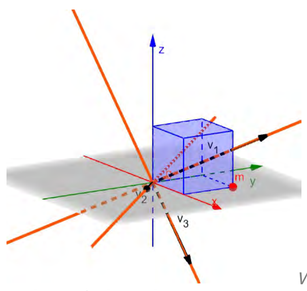


Interactive components

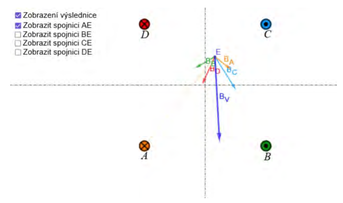
- prepared mainly in GeoGebra
- accompanied by small tasks
- show assignment setup
- deepen readers' understanding
- animate solution
- show result with different assigned parameters



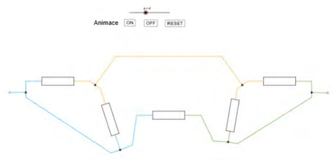
construction of the hypocycloid (interactive geometric model)



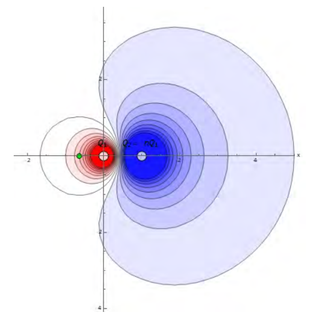
assigned situation (3D rotating geometric model)



adding magnetic induction of four wires with constant current (applet)



redrawing shape of DC circuit (animation)



equipotentials for two different charges (visualisation of more difficult situation)

Users per day