

# Electronic Collections of Solved Problems in Physics and Physics Experiments

Friday 8 September 2023 11:15 (30 minutes)

The ability to solve quantitative problems is a fundamental skill in physics. Nonetheless, re-search as well as our teaching experience has shown that students often neglect the qualitative aspects of problem-solving and jump straight into mathematical equations, which hinders their understanding of science [1]. Considering this, we have developed an electronic collection of solved physics problems with a specially designed solution structure that promotes active thinking and problem-solving skills development since 2006. There are more than 900 (in Czech), and 320 (in English) fully solved problems covering all main areas in physics. Moreover, in selected problems interactive elements are published. They are prepared in GeoGebra or Wolfram Mathematica mainly. Their aims are various, e.g., they help to create a correct geometric view of the problem; they show time development of the process; they simulate a mental process involved in solving of the problem; they graphically show the solution for other values than those specified; they allow to simulate various alternatives. These elements are designated for readers' free-play and exploration as well as they are accompanied by tasks that lead readers to a deeper understanding of the solved problem. The Collection of Solved Problems in Physics is used by university students from various study programmes and universities, as well as upper secondary school students and their teachers.

The Collection of Physics Experiments has been developed as a counterpart to the Collection of Solved Problems since 2015. This Collection is intended mainly for teachers at the lower and upper secondary school level. The primary goal of the Collection is to gather physics experiment ideas and process them in a unified way. The emphasis is placed on selecting experiments that are feasible in a classroom setting while engaging students. Experiment descriptions typically include sections such as the experiment's goal, theory, tools, procedure, sample results, technical notes, and pedagogical notes. The latter two sections are particularly important, as they are based on the author's own experience with the experiment and can greatly assist teachers in their work. We emphasize that the successful execution of the experiment should be shown as clearly as possible. For this reason, many experiments' descriptions contain video sequences showing sample experiment setting and/or procedure. There are approx. 170 experiments in Czech and 80 experiments in English published in the Collection.

Both Collections utilizes the same technological solutions, and the two Collections are linked to each other. Moreover, some problems refer to experiments dealing with the same physics phenomenon and vice versa.

## References

- [1] Harper, KA. Student Problem-Solving Behaviors. *The Physics Teacher*. 2006; 44(4):250–251.
- [2] Collection of Solved Problems in Physics [Internet]. Department of Physics Education, MFF CUNI; n.d. [cited 2023 May 30]. Available from: <https://physicstasks.eu/>
- [3] Collection of Physics Experiments [Internet]. Department of Physics Education, MFF CUNI; n.d. [cited 2023 May 30]. Available from: <http://physicsexperiments.eu/>

## Contribution categories - primary focus

Primary and secondary school

## Contribution categories - type

Application (shared experience, activity suggestions)

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**Session Classification:** Poster session