

## Electrical Cells as a Field of Pupils’ Investigations

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### Abstract

The part *Electrical cell* is one part of *Electrical current in liquids*. It is a field of pupils’ investigations. Pupils can investigate voltage, internal resistance, stored energy, and discharging curves. Contribution concludes description of some pupils tasks and problems. Pupils can use CBL for measurement and data processing.

### 1 Introduction

The part *Electrical cells* is in the Czech curriculum of physics in secondary schools. Pupils can do investigation with simple electrical cells with scientist methodology. Pupils are pleasure of discovering with this system of group work as a scientist team.

Pupils use a lot of electrical chemical cells – portable telephones, cars, a lot of toys use batteries.

Pupils have a lot of experiences. They give the questions – Which batteries are better?

Afterwards pupils can solve problems – retrieval a method how measure some attributes of cells.

The group competition in class motivates and improves knowledge and skills of pupils.

### 2 Experiences

The first step of pupils’ investigation is receiving knowledge about electrical cells. Pupils mention a lot of different attributes of cells. The discussion with pupils about desirable attributes of electrical cells is very important for their investigation. There are some of attributes of cells:

- Cell voltage
- Stored energy
- Internal resistance of cell
- Peak power output
- Sustained power output
- Inactive shelf live
- Operational life

Pupils investigate the construction of commercial electrical cells when they destroy these cells.

For measuring and comparison of some attributes are very useful computer with measuring instrument. CMC-S3 system was used. It was developed by ComLabSciTech project N° SI 143008 of Leonardo da Vinci.

Some primary or secondary cells – rechargeable cells – as commercial were used for school experiments:

- Zinc-carbon cells,
- Alkaline manganese dioxide cells,
- Lithium/manganese dioxide primary cell

Home – made cells are better for pupils’ investigation. e.g.:

- “Lemon cell“
- “Potato cell“
- “Other? cell“

This construction of cell makes possible to change electrodes, change distance of electrodes, change surface of electrodes, change electrolyte. Internal resistance these cells are high (kOhm).

Questions for pupils investigations:

- How depends internal resistance of cell on position of electrodes?
- Which potato is better for electrolyte – fresh or overripe?

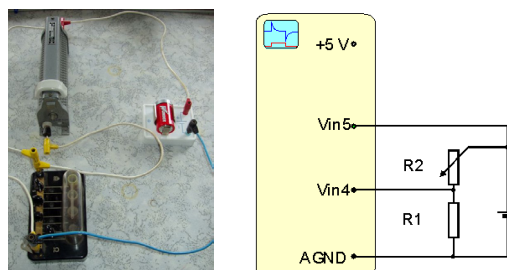


Fig. 1 Wiring diagram and scheme for measurement of internal resistance of cell.

Pupils need some small recommendation about setting of measurement equipment as:

R1 similar as  $R_i$ , R1 sharp resistor,  $R2 \gg R1$ ,

If  $R1 < 1 \text{ Ohm}$  we need R2 for big power dissipation.

Stored energy of cell is measured by computer. It is long time measurement voltage and current. Time dependence of voltage is a function of discharging.

### 3 Conclusions

With computer is easy measuring of internal resistance of cells. Computer aided experiments make easy possible measuring of voltage and current in long time measuring – time dependence of voltage.