

# Electrochemistry

in chemistry education

IYC Conference for nordic teachers 2011

# About

- the examples we use in education
- and very little about method

# Current electrochemistry

- Electrolysis in industry and science
- Battery technology
- Other uses, e.g. in electrochemical sensors
- Education

# Secondary school electrochemistry

- in Scandinavia
- Do we have similar practices?

## Content of textbooks

- Norway, Sweden and Denmark (Finland?)
- (American and English text-books for general chemistry)

## Content of textbooks

- Redox reactions
- Batteries (in general)
- Battery examples
- Fuel cells
- Electrolysis
- Corrosion

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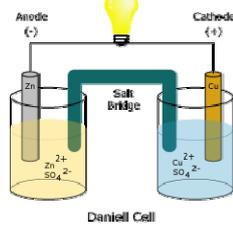
Batteries in general

## Content of textbooks

Batteries in general

A zinc-copper cell

In Norway a so-called «Daniell cell»

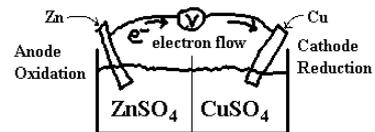


## Content of textbooks

Batteries in general

A zinc-copper cell

In Sweden also this one:



## Content of textbooks

Batteries in general

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In Denmark:

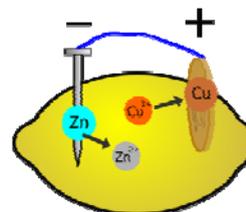
Models that resemble the above mentioned examples (but silver instead of copper)

## Content of textbooks

Batteries in general

A zinc-copper cell

introductory courses a lemon sometimes appears



What does this  
content mirror?

## Our choice of content

Contemporary examples

Educational traditions

Historical topics

## Our choice of content

Educational traditions

Historical topics

Contemporary examples

## Why do we teach this?

Is it relevant to our students?

Is it relevant to the rest of our society?

Is the theory of contemporary  
electrochemistry too difficult?

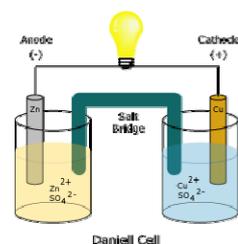
What do we want our students to  
know and understand?

## What is the justification for teaching chemistry? (Claes Andersson)

- Health
- Economy and use of resources
- Development of materials
- Knowledge about the structure and indestructibility of matter (sustainable development)
- (I would add history and current research)

## One example:

- The «Daniell» cell



## Another example

The dry battery (zinc - ammonium chloride)



## and some more..

- Mercury batteries
- Nickel cadmium batteries

Relevant?



Relevant?



Suitable models:

- Li-ion battery?
- Lead accumulator?
- Alkalic battery?
- Daniell cell and the voltaic pile?
  
- Lemon battery?

Suitable models:

- Li-ion battery
- Lead accumulator?
- Alkalic battery?
- Daniell cell and the voltaic pile as historical examples (but the real Daniell cell!)
- Lemon battery?

## Why is our choice of models important?

- To understand theory
- Context / Connection to everyday life
- Inspiration

## What are the basics of batteries?

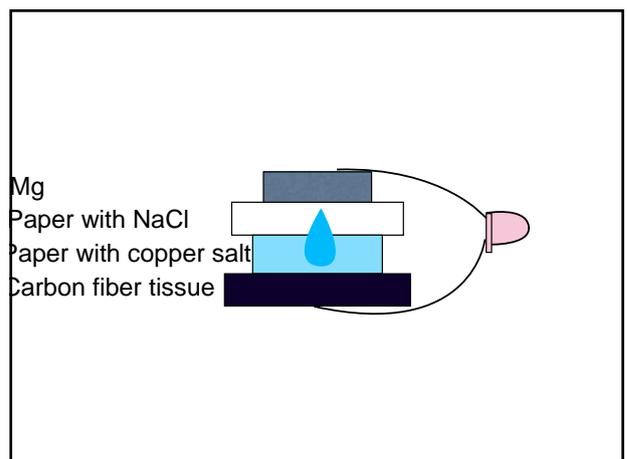
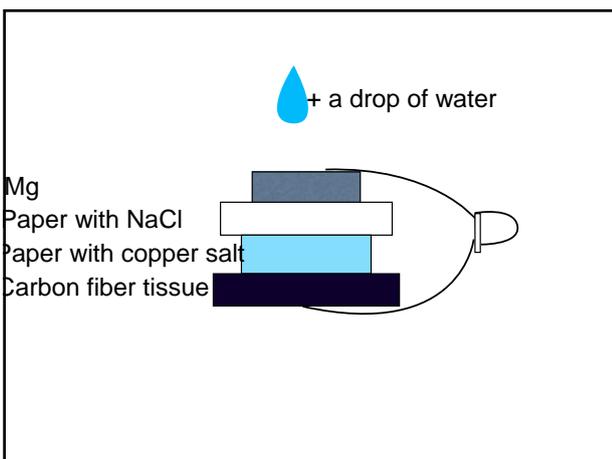
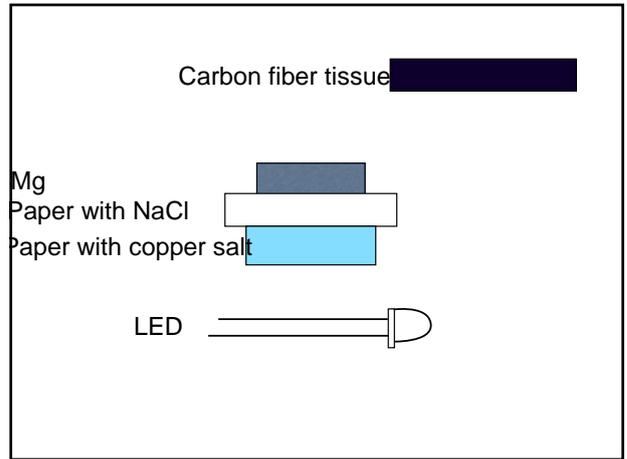
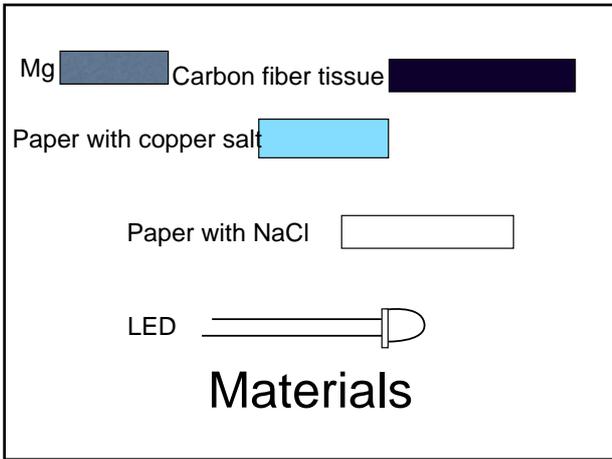
- Something is oxidized
- Something is reduced
- There is a membrane in between, transporting ions

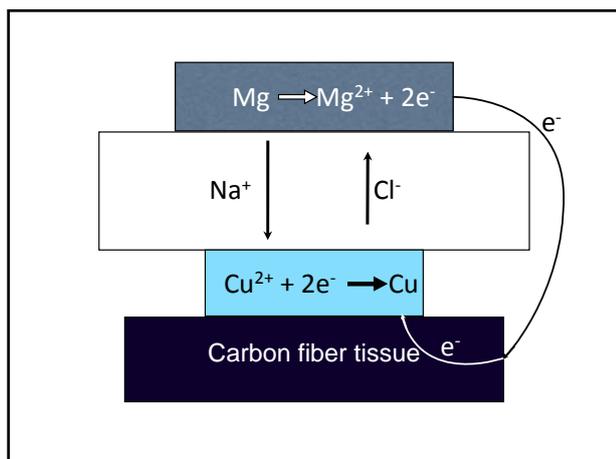
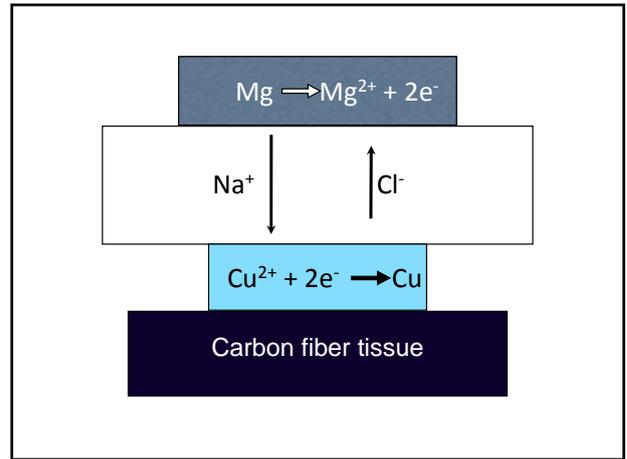
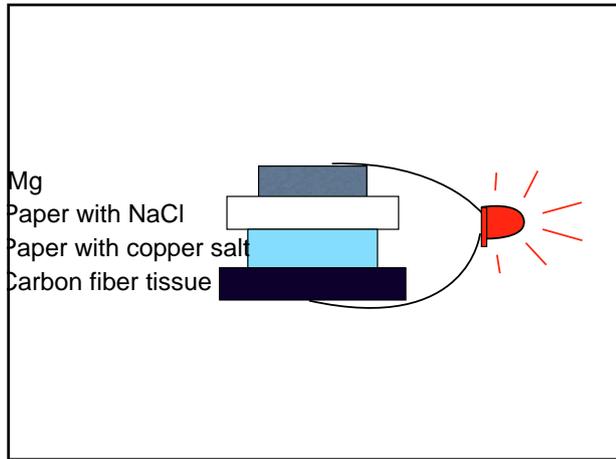
### What do we need to make a battery?

- Something that easily accepts electrons (is reduced) (e.g. silver- or copper ions)
- Something that easily gives off electrons (is oxidized) (e.g. zinc or magnesium)
- A membrane between them in which ions can move, but not electrons
- Electrode material (not mandatory)
- Something that shows us that it works

### Practical problem:

- Here you have something that is easily oxidized and something that is easily reduced
- and a membrane with ions
- (but there is something missing)
- + electrode material and a LED
- Can you make a battery from this?





### Li-based batteries as model in education

- Why not try?

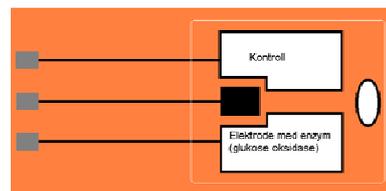
## Electrolysis

- Industrial processes
- Good traditional laboratory exercises
- What about everyday life?

## Sensors

- To advanced?

## Relevant electrolysis?



Measuring blood sugar  
by electrolysis of  $\text{H}_2\text{O}_2$

- Lysdioder: For eksempel Elfa 333HRC-3/H0 Best.nr. 75-018-69 (kr. 0,70 per stk/500stk)

Thank you!