RATE OF ELECTROLYSIS

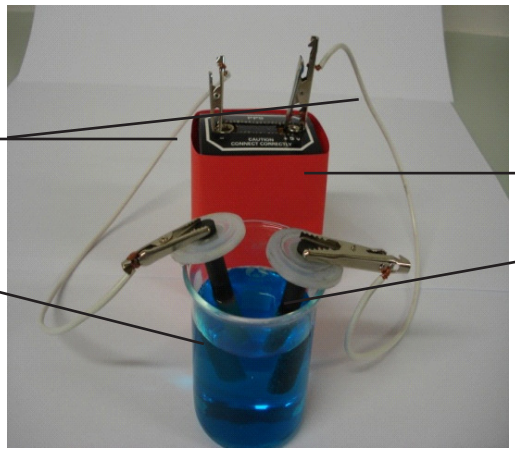
Instructions

- Read this investigation information.
- Watch the accompanying movie section by section as you answer the questions.
- Perform the investigation yourself.

Investigation information

Apparatus

- Carbon electrodes. You could get these from dismantled cells.
- Copper chloride solution in a beaker.
- A power supply (e.g. battery) and connective leads.



Background theory

Chlorine is a dense green gas with a characteristic sharp smell. It is a very strong oxidising agent, which makes it a powerful bleach and disinfectant. Chlorine can be produced by the electrolysis of chlorine-containing compounds. During electrolysis, a compound may be decomposed into its component elements. This happens as electrical energy is converted into chemical energy in an electrolytic cell. An electrolytic cell consists of an external power supply (e.g. battery) connected to two electrodes which are placed in an electrolyte. The electrodes are conductive rods. An electrolyte is an ionic solution which conducts electricity. When an electric potential difference is placed across the two electrodes, a redox reaction occurs at each electrode. This redox reaction decomposes the electrolyte into its component elements or into simpler component compounds.

Copper chloride solution ($CuCl_2(aq)$) contains chloride ions ($Cl^-(aq)$). These can be oxidised to chlorine molecules (Cl_2). This is seen by bubbles of chlorine gas forming at the positively charged electrode. The electrode where oxidation occurs is called the anode. Copper chloride solution also contains copper ions ($Cu^{2+}(aq)$). During the electrolytic process, these are reduced to copper atoms, which precipitate on the negatively charged electrode. The electrode where reduction occurs is called the cathode. The blue colour of the copper chloride solution becomes lighter in colour and the mass of the cathode increases as the copper ions in solution are reduced to copper which gathers on the cathode.

Electrolysis rate means the extent to which electrolysis occurs in a certain time. It can be measured by the change in reactants and / or products per time.

Questions

Planning possibilities

Watch the movie introduction about the planning possibilities of the investigation.

You want to investigate how various factors affect the rate of electrolysis.

1 Suggest various factors which might affect the rate of electrolysis and which you could alter in this investigation. These are possible **independent** variables.

_____

_____

_____

2 **Rate of electrolysis** is the **dependent** variable for this investigation.

Give possible **focus questions** for this investigation.

These can be written in the form:

How does [independent variable] affect [dependent variable]?

_____

_____

_____

3 Complete for three possible indicators of the dependent variable (rate of electrolysis).

Indicator of rate of electrolysis	If I see _____, I would deduce that the rate of electrolysis was **high**	If I see _____, I would deduce that the rate of electrolysis was **low**

Watch the rest of the movie.

Focus question

4 Give the focus question of the investigation performed in the movie.

How does _____ affect _____?
[independent variable] [dependent variable]

Treatments

5 Describe the treatments.

_____

_____

(give a general description of what is common between the treatments)

A: _____ B: _____

C: _____ D: _____

(list specific differences between the treatments)

6 In which variable do they differ from one another? (Choose.) [Dependent / Independent]

Controlled variables

7 List variables which must be the same between the different treatments for a fair test.

_____

_____

_____

_____

Results

8 Tabulate the results either shown in the movie, or, preferably, from your own experiment.

Raw data table:

	Electrode mass (g)		
	Initial	**Final**	**Change**

Processed data table:

	Change in electrode mass due to copper deposition (g)

Check. Have you: Tick if done:

- completed the table headings suitably? ☐
- headed the first columns with the independent variable? ☐
- given units, where appropriate, in the headings, not body, of the table? ☐
- filled in all treatment details in the first column? ☐
- filled in initial and final mass readings (processed data table) ☐
- correctly calculated and recorded mass change values (raw and processed data tables)? ☐

Graph

9 Represent the findings graphically.

Check. Have you: Tick if done:

- given a suitable graph heading? ☐
- plotted the independent variable on the x (___) axis? ☐
- plotted the indicator of the dependent variable on the y (|) axis? ☐
- labelled each axis and given units where appropriate? ☐
- accurately plotted data and drawn a smooth trend line ☐

Conclusion

10 Answer the focus question in your own words.

_____

_____

11 Complete for a shorter way of writing the conclusion.

Increasing _____ [increases / decreases / doesn't affect]
[independent variable]

_____ [dependent variable]

Discussion

12 Suggest a reason for your findings, referring to the background theory.

_____

_____

_____

_____

_____

_____