Investigation into the factors affecting the current through an electrolysis cell

Having looked at methods of mineral extraction we saw that one method involves electrolysis. To control the products of electrolysis we may need to control the speed of the reaction. A measure of this is the current of flow of electricity.

Preliminary Work:

We conducted preliminary tests in order to become familiar to the method we were to use in the final experiment. The results we gathered gave us an idea on the results and their range to enable us to draw appropriate graphs with correct scales. Equipment was chosen and we were to use the same in our main tests. So the preliminary tests would give us time to figure how to work them. This is done so the main experiment could be set up and completed successfully.

Possible Variables:

From the preliminary tests and results we found a number of possible variables we could have used to investigate the factors affecting the current through an electrolysis cell. These are:

- The applied voltage
- Concentration
- Amount
- Type of electrode
- Size of electrode
- Distance between electrodes

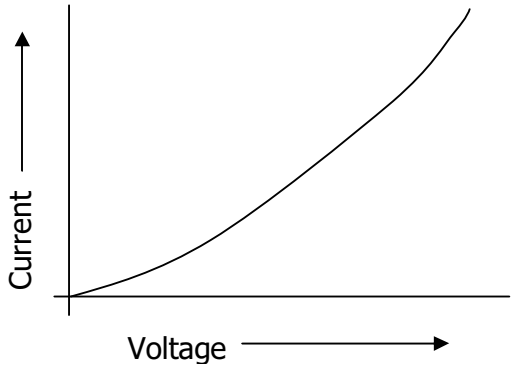
My chosen variable is the applied voltage. Working with voltage would not only help us with chemistry and electrolysis, but with physics and other subjects. Through other subject we have gained knowledge about voltage that would help us with the experiment also. We will set the voltage to certain, rounded numbers on the power pack, but using a volt meter will give us exact readings. These readings on the voltmeter will be used in the results instead of the rounded settings on the power pack. The range on the power pack is:

- 12 volts
- 10 volts
- 8 volts
- 6 volts
- 4 volts
- 2 volts

T*hese are not exact*, *an*d *the exact voltages* (w*hich to vary*) *are in* m*y results ta*b*le*.

Prediction:

The preliminary results and basic knowledge have helped me to predict that when the voltage increases, so will the current. As George Ohm says: 'The current flowing through a metal wire is proportional to the potential difference (voltage) across it. I predict that my graph will look like this:



If my line of best fit on my graph is flat, the resistance through the electrolysis cell is high, if the line is steep, the resistance is low.

The Voltage across an electrolysis cell is the amount of energy delivered to the cell by each coulomb of charge passing through it. Therefore, the higher the voltage, the higher amount of energy delivered to the cell, and thus, the current increases.

Fig.1 shows that there are a greater amount of electrons at the anode and cathode when the voltage is higher. The greater amount of electrons, the greater amount of current.

Method:

Apparatus:

- Electrolysis cell
- Power pack (max: 12v)
- Voltmeter
- Ammeter
- Clamp Stands
- Leads

Diagram:

- Set up apparatus as above, making sure that the voltmeter is connected in parallel, and the ammeter in series
- Fill electrolysis cell with 100ml of potassium nitrate
- Set power pack to certain voltage
- Turn power on for short amount of time and note the real voltage and current
- For better results, replace potassium nitrate solution after every reading
- Do this for each voltage listed in the variables section
- Repeat three times and take averages for best results

Results:

Constants: 100% 100ml Potassium Nitrate

#	**Voltage (V)**	**Current (I)**
1	9.37	2.57
	7.99	1.89
	6.15	1.30
	4.96	0.71
	3.59	0.23
	1.63	0.01
2	9.40	2.53
	7.63	1.87
	6.29	1.24
	4.77	0.69
	3.36	0.20
	2.99	0.00
3	9.33	2.44
	8.05	1.86
	6.47	1.20
	5.12	0.67
	3.67	0.20
	2.57	0.01
Average	**9.37**	**2.51**
	7.89	**1.87**
	6.30	**1.25**
	4.95	**0.69**
	3.54	**0.21**
	2.40	**0.01**

A graph will be made of the *averages*, which is the data in **bold type**.

Analysis:

From the results I have found that when the voltage increases, so does the current. This is because voltage is proportional to current. So if the voltage doubled, so would the current. This is because the Voltage across an electrolysis cell is the amount of energy delivered to the cell by each coulomb of charge passing through it. This relationship between current and voltage shows why they are proportional to each other.

Also, from the results, we can work out the resistance through the electrolysis cell:

$$R = V/I$$

The resistance affects the current through the cell, as the more resistance, the less electrons that get through the cell, meaning less current. Without working out the resistance you can see if it is high or not by looking at my graph: if my line of best fit is flat, the resistance through the electrolysis cell is high, if the line is steep, the resistance is low.

The current varies in proportion to the voltage from 0.01A to 2.51, while the voltage goes from 2.40V to 9.37, showing that the resistance through the cell is high.

Fig.2 shows what I predicted in my prediction. When the voltage is low, the current is low, when the voltage is high; the current is proportionally high, taking into account the resistance.

Evaluation:

The experiment was conducted well and fairly. All measurements were taken accurately using a syringe or measuring cylinder.

Although the results were reasonably accurate, and they supported what I said in my prediction, there was one slight anomaly. As you can see in my graph, the current apparently starts to rise at around 2.40/2.5V. This is not correct because voltage and current are proportional, and this means that they should both start at 0 in a graph. The most probable reason for this mishap is the accuracy of the ammeter, the readings were probably two small for it to read, or they were jumping around a lot, and this results in incorrect readings.

If I were to repeat this experiment, I would obtain a more accurate ammeter, and also use a rheostat, so I can achieve rounded voltages, that are the same for every repeat. This would make the experiment fairer, and the results more accurate.