

**On-line Science Simulations - Electrolysis Teacher Instruction**

**Task 1**

The apparatus can be used to investigate the electrolysis of either sulphuric acid or hydrochloric acid. The concentration of the acid and the potential that is applied can be altered.

The graph shows the volumes of the gases produced at the positive electrode (red line) and at the negative electrode (blue line).

**Experiment 1**

- i) Select sulphuric acid and set the concentration to 5.0 mol/dm<sup>3</sup> and the potential to 30 volts.
- ii) Press the start button and record the ammeter reading in Table 1 below.
- iii) When the reaction has stopped, use the cursor to read the volume of the gases produced at each electrode after 100 seconds and record the volumes in Table 1.

Table 1

	concentration of acid /mol/dm <sup>3</sup>	potential /V	ammeter reading /A	volume of gas at positive electrode/cm <sup>3</sup>	volume of gas at negative electrode/cm <sup>3</sup>
Experiment 1	5.0	30	<b>7.5</b>	<b>47</b>	<b>94</b>
Experiment 2	2.5	30	<b>3.8</b>	<b>24</b>	<b>47</b>
Experiment 3	2.5	15	<b>1.9</b>	<b>12</b>	<b>23</b>

**Allow + or -1 for volumes**

- iv) Identify the gases produced at each electrode.

Gas produced at the positive electrode is .....**oxygen**.....

Gas produced at the negative electrode is .....**hydrogen**.....

**Experiment 2**

- i) Change the concentration to 2.5 mol/dm<sup>3</sup> but do not change the potential.
- ii) Press the start button and record the ammeter reading and when the reaction has stopped, read the volume of the gases produced at each electrode after 100 seconds and record the volumes in Table 1.

**Experiment 3**

- i) Leave the concentration at 2.5 mol/dm<sup>3</sup> but change the potential to 15 volts.
- ii) Press the start button and record the ammeter reading and when the reaction has stopped, read the volume of the gases produced at each electrode after 100 seconds and record the volumes in Table 1.
- iii) Using your results, what conclusions can you draw about the volume of the two gases produced during this experiment?

**The volume of oxygen is half the volume of hydrogen.**

## Experiment 4

Table 2

	concentration of acid /mol/dm <sup>3</sup>	potential /V	ammeter reading /A	volume of gas at positive electrode/cm <sup>3</sup>	volume of gas at negative electrode/cm <sup>3</sup>
Experiment 4					

### Any sensible values

- iii) Identify the gases produced at each electrode.

Gas produced at the positive electrode is .....**chlorine**.....

Gas produced at the negative electrode is .....**hydrogen**.....

### Task 2 (more demanding)

#### Experiment 1 & 2

See Task 1, Experiment 1

#### Experiment 3

- iv) By using your answer to the question above, what conclusion can you draw about the number of electrons required to produce one mole of the gas at the positive electrode compared to the number of electrons required to produce one mole of the gas at the negative electrode.

**Twice as many electrons are needed to form one mole of oxygen as are required to form one mole of hydrogen. (The number of electrons passing through each electrode must be the same and there is twice as much hydrogen as oxygen)**

- iv) By comparing the results of Experiments 1 & 2, suggest how the concentration of the acid affects the volumes of the gases produced during the electrolysis.

**The greater the concentration the greater the volume of gas produced or better the volume is proportional to the concentration.**

- vi) By comparing the results of Experiments 2 & 3, suggest how the potential affects the volumes of the gases produced during the electrolysis.

**The greater the potential the greater the volume of gas produced or better the volume is proportional to the potential.**

- vii) Suggest the volumes of the gases which would be produced at the two electrodes after 100 seconds if the experiment was carried out using the conditions shown in Table 2.

Table 2

concentration of acid /mol/dm <sup>3</sup>	potential /V	volume of gas at positive electrode/cm <sup>3</sup>	volume of gas at negative electrode/cm <sup>3</sup>
3.0	50	<b>47</b>	<b>94</b>