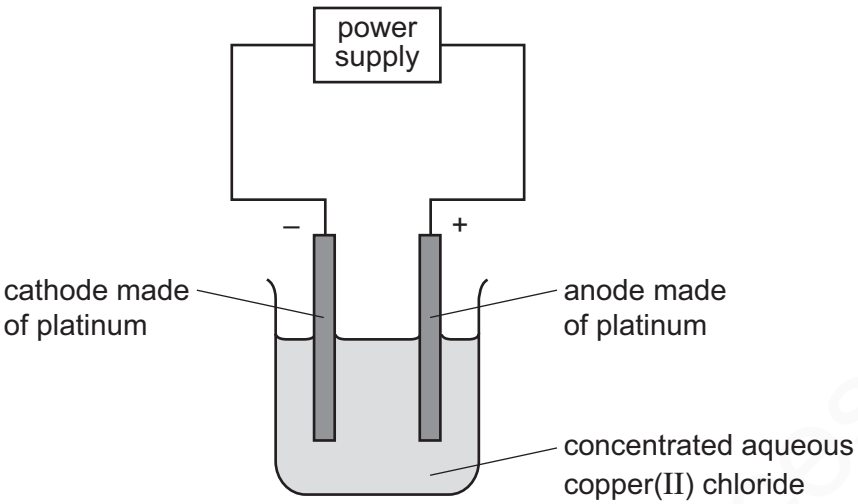
# ELECTROLYSIS OF CONC SOLUTIONS

**1** Solutions of ionic compounds can be broken down by electrolysis.

**(a)** Concentrated aqueous copper(II) chloride was electrolysed using the apparatus shown.




The ionic half-equations for the reactions at the electrodes are shown.

negative electrode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

positive electrode: $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$

**(i)** Platinum is a solid which is a good conductor of electricity.

State **one** other property of platinum which makes it suitable for use as electrodes.

.....

..... [1]

**(ii)** State what would be **seen** at the positive electrode during this electrolysis.

.....

..... [1]

**(iii)** State and explain what would happen to the mass of the negative electrode during this electrolysis.

.....

.....

..... [2]

**(iv)** The concentrated aqueous copper(II) chloride electrolyte is green.

Suggest what would happen to the colour of the electrolyte during this electrolysis.
Explain your answer.

.....

.....

..... [2]

**(v)** Identify the species that is oxidised during this electrolysis.
Explain your answer.

species that is oxidised .....

explanation .....

.....
[2]

## MARKING SCHEME:

| | | |
|---|---|---|
| (a)(i) | inert / unreactive / does not react with chlorine | **1** |
| (a)(ii) | bubbles / fizzing / effervescence | **1** |
| (a)(iii) | **M1** increases<br>**M2** (solid) copper deposited | **2** |
| (a)(iv) | **M1** colour fades / becomes pale(r) / becomes colourless / becomes lighter<br><br>**M2** copper (ions) removed (from solution) | **2** |
| (a)(v) | **M1** species oxidised: chloride (ions) / $Cl^-$<br><br>**M2** explanation: loss of electrons / increase in oxidation state | **2** |

**2** This question is about electrolysis.

**(a) (i)** What is meant by the term *electrolysis*?

.....

..... [2]

**(ii)** Name the type of particle responsible for the conduction of electricity during electrolysis in:

the metal wires .....

the electrolyte .....
[2]

**(b)** The table gives information about the products of the electrolysis of two electrolytes. Platinum electrodes are used in each case.

**(i)** Give **two** reasons why platinum is suitable to use as an electrode.

1 .....

2 .....
[2]

**(ii)** Complete the table.

| electrolyte | observation at the anode (+) | name of product at the anode (+) | observation at the cathode (–) | name of product at the cathode (–) |
|---|---|---|---|---|
| concentrated aqueous potassium chloride | | | bubbles of colourless gas | |
| aqueous copper(II) sulfate | bubbles of colourless gas | | | |

[6]

[Total: 12]

**MARKING SCHEME:**

<table>
<tr><td>(a)(i)</td><td>M1 breakdown of an ionic compound when molten or in aqueous solution<br>M2 (using) electricity / electric current</td><td>2</td></tr>
<tr><td>(a)(ii)</td><td>M1 electron(s)<br>M2 ion(s)</td><td>2</td></tr>
<tr><td>(b)(i)</td><td>M1 inert / unreactive<br>M2 conducts electricity</td><td>2</td></tr>
<tr><td>(b)(ii)</td><td>
<table>
<tr><td>observation at anode(+)</td><td>name of product at anode(+)</td><td>observation at cathode(–)</td><td>name of product at cathode(–)</td></tr>
<tr><td>M1 green / yellow bubbles</td><td>M2 chlorine</td><td></td><td>M3 hydrogen</td></tr>
<tr><td></td><td>M4 oxygen</td><td>M5 pink / brown solid</td><td>M6 copper</td></tr>
</table>
</td><td>6</td></tr>
</table>

**3** A sample of concentrated hydrobromic acid, HBr(aq), was electrolysed using platinum electrodes.
The concentration of the hydrobromic acid was 8.89 mol / $dm^3$.

**(i)** Calculate the concentration of the HBr(aq) in g / $dm^3$.

concentration of HBr(aq) = ..... g / $dm^3$ [1]

**(ii)** Explain why concentrated HBr(aq) can conduct electricity.

.....

.....

..... [2]

**(iii)** Magnesium is **not** a suitable material from which to make the electrodes.

Explain why.

.....

..... [1]

**(iv)** Predict the product formed at the anode when concentrated HBr(aq) is electrolysed.

..... [1]

**(v)** Write the ionic half-equation for the reaction occurring at the cathode.

..... [2]

**MARKING SCHEME:**

| | | |
|---|---|---|
| (i) | 720(.09) | **1** |
| (ii) | (it contains) ions (1)<br>(ions) are able to move (1) | **2** |
| (iii) | magnesium is not inert | **1** |
| (iv) | bromine / $Br_2$ | **1** |
| (v) | $H^+$ and $e^{(-)}$ on LHS (1)<br>fully correct, i.e.: $2H^+ + 2e^- \rightarrow H_2$ (1) | **2** |