

Carbon rod writing

Description

Students use a carbon rod attached to a power supply to oxidise iodide, 'writing' brown iodine patterns onto a piece of filter paper that is wet with colourless potassium iodide solution



Curriculum topics

- Chemical change
- Redox reactions
- Chemical bonding
- Electrolysis

Materials

For one group of students

- Potassium iodide, solid
- Distilled water
- 250 mL beaker
- Shallow dish, or a large lid with a lip.
- Filter paper (any size)
- Tongs or tweezers
- 12V DC power supply with alligator clips and wire leads
- 10 cm carbon electrode
- Plastic sheet or Paper towel

Safety



Potassium iodide

Warning - Harmful if swallowed, in contact with skin, can cause skin and eye irritation.

Waste – All solutions can be washed down the sink. The filter paper can be disposed of in the normal rubbish.



Procedure

Before the experiment

Pre-prepare the potassium iodide solution

1. Add 33g of potassium iodide to 200 mL distilled water in a 250ml beaker and swirl or stir until dissolved. Note that this solution oxidises upon standing and will go brown over the course of several days. Therefore, it is best to prepare the morning of the activity.

The experiment

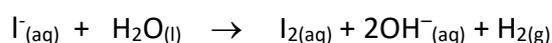
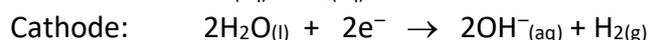
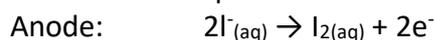
1. In a shallow dish (or lid with a lip) pour in a thin layer of the potassium iodide solution.
2. Soak a piece of filter paper in the potassium iodide solution. Lift the filter paper out using tongs, and hold over the solution for a few seconds to allow the excess liquid to drip off. Place the wet paper on a plastic sheet (alternatively, just place it on a piece of paper towel).
3. Connect the outer edge of the filter paper to the negative terminal of a 12V DC power supply set to 2V or 4V. Connect the positive terminal to one end of the carbon rod electrode.
4. Switch on the power supply. Holding the carbon rod like a pencil, 'write' on the paper.
5. (Optional) Try 'erasing' the writing by reversing the electrode polarities and tracing over the lines drawn earlier.

Teaching notes

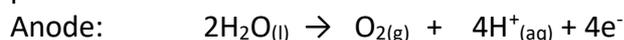
Students need to be careful not to rip the paper because it is wet. In our experience, erasing does not seem to work very well (they need to be patient), so this part of the activity can be seen as optional.

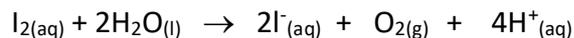
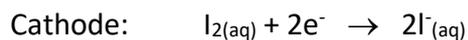
This is an example of electrolysis of potassium iodide (KI) solution. The filter paper soaked in potassium iodide solution forms one electrode of an electric circuit (attached to negative terminal of power source). For the other electrode, a carbon rod (carbon is electrically conductive) is used as a 'pen nib' to 'write' on the filter paper. When this electrode is made positive, the writing (brown iodine) is visible.

The chemical equations for the reaction are:



If you reverse the polarity, the writing disappears with a different set of reactions taking place.





The temptation of some students will be to increase the voltage of the power pack. The carbon rods will get quite hot, and so students should be cautious. However, an interesting inquiry-based activity would be to see if the concentration of the iodine produced (i.e. the darkness of the brown lines) increases with increasing voltage.

For students not studying redox or electrochemistry, this could be an interesting example of a chemical change, with the change of colour between iodide (colourless) and iodine (brown).

References

This activity was modified from

- Commons, C., Hogendoorn, B. (Eds) (1990). *Demonstrations for Secondary School Chemistry*, Chemistry Education Association, Melbourne, p 127-128 (Demonstration K9).
- Shakhshiri, B. Z. (1992). *Chemical Demonstrations: A Handbook for Teachers of Chemistry Volume 4*. The University of Wisconsin Press p 174-180.

