DATE: NAME: CLASS:

CHAPTER 13	Investigation 13.B: Electrolysis of Aqueous Potassium Iodide	BLM 13.3.3
HANDOUT		

When an aqueous solution is electrolyzed, the electrolyte or water can undergo electrolysis. In this investigation, you will build an electrolytic cell, carry out the electrolysis of an aqueous solution, and identify the products.

Question

What are the products from the electrolysis of a 1 mol/L aqueous solution of potassium iodide? Are the observed products the ones predicted using reduction potentials?

Predictions

Use the relevant standard reduction potentials from the table in Appendix G, and the non-standard reduction potentials you used previously for water, to predict the electrolysis products. Predict which product(s) are formed at the anode and which product(s) are formed at the cathode.

Safety Precautions

Materials

- 10 mL 1 mol/L KI
- 20 gauge platinum wire (2 cm)
- 1 graphite pencil lead, 2 cm long
- 1 drop 1% starch solution
- 25 cm clear aquarium tubing (Tygon®; internal diameter: 4–6 mm)
- 3 disposable pipettes
- 3 toothpicks
- 1 drop 1% phenolphthalein
- sheet of white paper
- 1 beaker (600 mL or 400 mL)
- 1 elastic band
- 2 wire leads (black and red) with alligator clips
- 9-V battery or variable power source set to 9 V

Procedure

1. Fold a sheet of paper lengthwise. Curl the folded paper so that it fits inside the beaker. Invert the beaker on your lab bench.

2. Use the elastic to strap the aquarium tubing to the side of the beaker in a U shape, as shown in the diagram on the following page.

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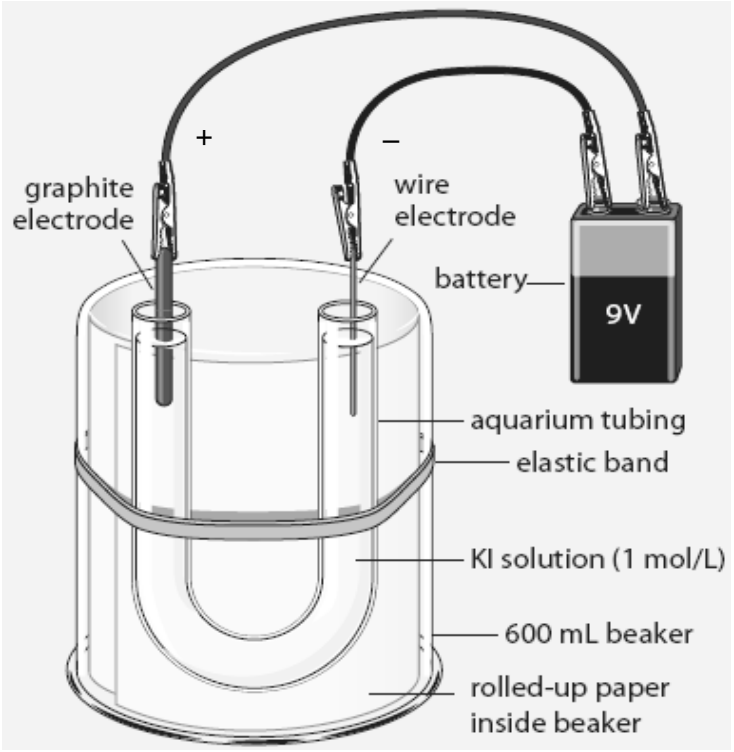
3. Fill a pipette as completely as possible with 1 mol/L KI solution. Insert the tip of the pipette firmly into one end of the aquarium tubing. Slowly inject the solution into the U-tube until the level of the solution is within 1 cm to 2 cm from the top of both ends. If air bubbles are present, try to remove them by poking them with a toothpick. You may need to repeat this step from the beginning to ensure there are no air bubbles.



4. Attach the black lead to the 2 cm piece of wire. Insert the wire into one end of the U-tube. Attach the red electrical lead to the graphite. Insert the graphite into the other end of the U-tube.

5. Attach the leads to the 9-V battery or to a variable power source set to 9 V. Attach the black lead to the negative terminal and the red lead to the positive terminal.

6. Let the reaction proceed for three minutes, while you examine the U-tube. Record your observations. Shut off the power source and remove the electrodes. Determine the product formed around the anode by adding a drop of starch solution to the end of the U-tube that contains the anode. Push the starch solution down with a toothpick if there is an air lock. Determine one of the products around the cathode by adding a drop of phenolphthalein to the appropriate end of the U-tube.

7. Dispose of your reactants and products as instructed by your teacher. Take your apparatus apart, rinse out the tubing, and rinse off the electrodes. Return your equipment to its appropriate location.

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(continued)

Analysis

1. Sketch the cell you made in this investigation. On your sketch, show:
(a) the direction of the electron flow in the external circuit
(b) the anode and the cathode
(c) the positive electrode and the negative electrode
(d) the movement of ions in the cell

2. Use your observations to identify the product(s) formed at the anode and the product(s) formed at the cathode.

3. Write a balanced equation for the half-reaction that occurs at the anode.

4. Write a balanced equation for the half-reaction that occurs at the cathode.

5. Write a balanced equation for the overall cell reaction.

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(continued)

6. Calculate the external voltage required to carry out the electrolysis. Why was the external voltage used in the investigation significantly higher than the calculated value?

Conclusion

7. What are the products from the electrolysis of a 1 mol/L aqueous solution of potassium iodide? Are the observed products the same as the products predicted using reduction potentials?

Applications

8. If you repeated the electrolysis using aqueous sodium iodide instead of aqueous potassium iodide, would your observations change? Explain your answer.

9. To make potassium by electrolyzing potassium iodide, would you need to modify the procedure? Explain your answer.