CHAPTER 10 LAB ACTIVITIES

INVESTIGATION 10.1.1 A POTASSIUM IODIDE ELECTROLYTIC CELL
(Page 754)

Evidence
(a)

Before the cell was connected,

the solution was completely colourless and both litmus and halogen tests gave negative results.

After the cell was connected and in operation for a few minutes,

at the black (negative) electrode and nearby solution:

- many colourless gas bubbles were continuously produced,
- red litmus turned blue,
- the hexane layer remained colourless.

at the red (positive) electrode and nearby solution:

- a yellow-brown colour of solution and some black precipitate formed and settled to the bottom of the tube,
- litmus did not change in colour,
- the hexane layer was purple.

Analysis
(b) According to the evidence collected, a colourless gas and hydroxide ions were likely produced at the negative electrode. The observations strongly suggest the formation of iodine at the positive electrode.

Evaluation
(c) The design was mostly adequate to answer the question, except for the identification of the gas. An improvement would be to collect and test the gas produced. The presence of hydroxide ions could be further confirmed by an additional test such as a precipitation. The control tests were quite adequate to show changes.

(d) It was not possible to identify the gas produced because it could not be collected in the apparatus used.

(e) A Hoffmann apparatus could be used to conduct the electrolysis and collect the gas. (Alternatively, a test tube filled with solution and inverted over the electrode in a large beaker could be used.) A splint and matches should be provided to conduct the hydrogen and oxygen tests.

(f) The electrodes should not touch because this would short-circuit the cell. The electricity would flow directly from one electrode to the other without being forced through the solution and little or no reaction would occur. (This may also be dangerous because the current in the circuit may become high enough to melt some components or blow a fuse.)

(g) Iodine is formed at the positive electrode. Iodine solution and solid are more dense than water and therefore sink to the bottom of the tube.

(h) The quality of evidence is quite good, except for the identification of the gas. The litmus and halogen tests, compared with the control, clearly showed that a basic solution and iodine were formed as a result of the reaction.

INVESTIGATION 10.1.2 INVESTIGATING SEVERAL ELECTROLYTIC CELLS
(Page 755)

Prediction
(a) According to redox concepts and the table of half-reactions,

SOA	OA	OA
$Cu^{2+}_{(aq)}$	$SO^{2-}_{4(aq)}$	$H_2O_{(l)}$
		SRA

cathode $2\,[Cu^{2+}_{(aq)} + 2\,e^- \rightarrow Cu_{(s)}]$ $\quad E_r^\circ = +0.34\ V$

anode $2\,H_2O_{(l)} \rightarrow O_{2(g)} + 4\,H^+_{(aq)} + 4\,e^-$ $\quad E_r^\circ = +1.23\ V$

net $2\,Cu^{2+}_{(aq)} + 2\,H_2O_{(l)} \rightarrow 2\,Cu_{(s)} + O_{2(g)} + 4\,H^+_{(aq)}$ $\quad \Delta E^\circ = -0.89\ V$

minimum potential difference = +0.89 V