

UNIT 5 ELECTROCHEMISTRY

ARE YOU READY?

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Knowledge and Understanding

- 4.5 V
 - 4.5 V
 - The bulb would glow more brightly.
 - The voltmeter is parallel to the circuit.
- Metals tend to **lose** electrons to form positively charged ions.
 - Nonmetals tend to **gain** electrons to form negatively charged ions.
- 1+
 - 2+
 - 3+
 - 1+
 - 2 +
- 1–
 - 2–
 - 3–
 - 1–
- $2 \text{K}_{(s)} + \text{Cl}_{2(g)} \rightarrow 2 \text{KCl}_{(s)}$
 - $\text{Mg}_{(s)} + 2 \text{AgNO}_{3(aq)} \rightarrow 2 \text{Ag}_{(s)} + \text{Mg}(\text{NO}_3)_{2(aq)}$
 - $\text{C}_3\text{H}_{8(g)} + 5 \text{O}_{2(g)} \rightarrow 3 \text{CO}_{2(g)} + 4 \text{H}_2\text{O}_{(g)}$
 - $2 \text{KClO}_{3(s)} \rightarrow 2 \text{KCl}_{(s)} + 3 \text{O}_{2(g)}$
 - $2 \text{Al}_{(s)} + 3 \text{CuCl}_{2(aq)} \rightarrow 3 \text{Cu}_{(s)} + 2 \text{AlCl}_{3(aq)}$
 - $4 \text{Fe}_{(s)} + 3 \text{O}_{2(g)} \rightarrow 2 \text{Fe}_2\text{O}_{3(s)}$
 - $\text{Fe}_2\text{O}_{3(s)} + 3 \text{H}_{2(g)} \rightarrow 2 \text{Fe}_{(s)} + 3 \text{H}_2\text{O}_{(g)}$
- $\text{A} + \text{B} \rightarrow \text{AB}$
 - (a) and (f)
- $\text{A} + \text{BC} \rightarrow \text{B} + \text{AC}$
 - (b), (e), and (g)
- $\text{Mg}_{(s)} + \text{Cu}^{2+}_{(aq)} \rightarrow \text{Cu}_{(s)} + \text{Mg}^{2+}_{(aq)}$
 - $\text{Al}_{(s)} + 3 \text{Ag}^{+}_{(aq)} \rightarrow 3 \text{Ag}_{(s)} + \text{Al}^{3+}_{(aq)}$
- $\text{Zn}_{(s)} + \text{CuSO}_{4(aq)} \rightarrow \text{Cu}_{(s)} + \text{ZnSO}_{4(aq)}$
 - $\text{Zn}_{(s)} + 2 \text{AgNO}_{3(aq)} \rightarrow 2 \text{Ag}_{(s)} + \text{Zn}(\text{NO}_3)_{2(aq)}$

Inquiry and Communication

- sulfuric acid or hydrogen sulfate
 - nitric acid or hydrogen nitrate
 - sodium hydroxide
 - nickel(II) hydroxide
 - sodium sulfate
 - calcium nitrate
 - lead(II) sulfate
 - copper(II) chloride
 - iron(II) sulfate
 - iron(III) hydroxide
 - carbon dioxide
 - sulfur trioxide
- MgCl_2
 - Ag_2S

- (c) Cr_2O_3
- (d) $\text{Cu}(\text{NO}_3)_2$
- (e) $\text{Ca}(\text{OH})_2$
- (f) PbSO_4
- (g) $\text{HCl}_{(\text{aq})}$
- (h) SO_2
- (i) CO

GETTING STARTED

TRY THIS ACTIVITY: MAKING MONEY

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- (a) $\text{CuSO}_{4(\text{aq})} + \text{Zn}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{ZnSO}_{4(\text{aq})}$
- (b) The procedure is a simple and quick way of coating zinc with copper. However, the copper coating appears rough and does not adhere well to the metal. Furthermore, this procedure consumes zinc, making the zinc strip thinner.

REFLECT ON YOUR LEARNING

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The following are typical student responses.

1. Oxidation is what happens when a substance reacts with oxygen in the air. OR
Oxidation is what happens when iron reacts with air to form iron oxide.
2. The chemicals inside a battery react to produce electricity.
3. The chemicals inside the battery are returned to their initial form by applying electrical energy.
4. Corrosion is the reaction of a metal with chemicals in the air. Corrosion can be prevented by rustproofing the metal (perhaps by covering it, to prevent it from reacting with other chemicals). OR
Corrosion is the slow oxidation of a metal.
5. Chemical reactions can, in some cases, be used to produce electricity. Conversely, electricity can be used to make some chemical reactions occur.

5.1 OXIDATION–REDUCTION REACTIONS

CAREER CONNECTION: FILM-PROCESSING TECHNICIAN

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- (i) Career #1: Photographer

Creative, technically skilled photographer wanted. The ideal candidate should be familiar with the latest equipment used to take pictures as well as to process them. Experience with the digital enhancement of pictures using state-of-the-art software is definitely an asset. The photographer should be prepared to work irregular hours on location or in the studio to match client schedules. The ideal candidate should have strong interpersonal and time-management skills. Salary ranges from \$30 000 to \$45 000, depending on experience.

Career #2: Scientific Photographer

A medical graphics company requires a highly skilled scientific photographer immediately. The ideal candidate should be familiar with the use of high-powered lenses and microscopes to create images of biological specimens such as tissue samples, bacteria, and viruses. The successful candidate will be familiar with the latest trends in camera technology and film processing techniques. He/she should also have a strong scientific background in the specific imaging techniques used in cell biology or medical technology. Experience in preparing biological samples for imaging is a definite asset. The ideal candidate should have the strong interpersonal and communication skills required to be an important member of a research team.