The Smartphone Battery and Its Charging System

Student Handout

Directions: As you read the article, answer the following questions that are designed to enhance your comprehension and critical thinking skills.

1. Explain how a lithium-ion battery converts chemical energy to electrical energy. What role do lithium ions play in this process?

2. Why is it important for smartphone manufacturers to control the "state of charge" of a battery? What could happen if this charge is not managed properly?

3. Describe the three stages of charging a smartphone as outlined in the text. What occurs during each stage?

4. The text mentions that disturbances can affect the charging process. Provide two examples of these disturbances and explain how they impact the battery charging system.

5. What is a feedback loop, and how is it relevant to the charging process of a smartphone battery according to the article?

6. Why is it significant that smartphone batteries are designed to prevent overcharging? What are the potential consequences of overcharging a lithium-ion battery?

The Smartphone Battery and Its Charging System

Student Handout Answer Key

Student answers will vary.

1. A lithium-ion battery converts chemical energy to electrical energy through the movement of lithium ions from a negative electrode to a positive electrode. The lithium ions are essential as they indicate the energy available in the battery.
2. Controlling the "state of charge" is vital to prevent overcharging and total battery depletion, which could lead to battery capacity loss and potential hazards.
3. The first stage involves rapid charging to increase the charge rate; the second stage applies resistance to current flow as the charge reaches 80%; the third stage is "trickle charging," maintaining the charge at 100%.
4. Disturbances include an increased rate of battery energy depletion from usage while charging and fluctuations in current from the socket, which can affect the charging efficiency.
5. A feedback loop is a reactive model that measures the controlled variable (state of charge) and adjusts the manipulated variable (current flow) accordingly to maintain optimal charging.
6. Preventing overcharging is significant because it protects the battery from damage and potential hazards, such as overheating or fire.