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Building & Designing Batteries STEM Kit

Contains eight investigative activities that teach students how to use a multimeter to measure voltage and amplitude, calculate electrical resistance and electrode potentials, evaluate battery performance, assemble electrical circuits, and construct batteries. The kit includes enough materials for 40 students working in groups of 4, as well as a DVD with PDF Teacher and Student Guides and other digital content.

Item No.	Description
AISBAKIT	Building & Designing Batteries STEM Kit

Activity Summaries

Activity 1 - Building a Pile Battery Voltaic Cell

(GUIDED – MODEL EXPERIMENT)

Students review and practice using a multimeter to measure electrical quantities and validate their measurements using Ohm's Law; construct a pile battery and evaluate its energy characteristics and compare it to a commercial D cell. Student groups will then team up to construct an appropriate circuit that will produce enough current to light an LED lamp.

Activity 2 - Designing the Better Pile Battery

(OPEN – INQUIRY EXPERIMENT)

Students use their initial pile battery-building experience (from the MODEL experiment) to design, build, and test battery designs and evaluate how they meet minimal performance specifications of a design goal. Students must choose: metals, electrolyte, separator material, and battery shape.

Activity 3 - Building a LED Light Battery

(GUIDED – MODEL EXPERIMENT)

Students view a guide image of a "quarter battery" with an illuminated LED light. They will use this image as a design prototype to construct their own pile battery that lights a 3.5V (20mA) LED lamp using zinc and nickel planchets. They evaluate the electrical properties of their battery and validate these measurements using Ohm's Law. They then compare the energy density to that of a commercial D cell.

Activity 4 - Designing an Alkaline LED Light Battery

(GUIDED – INQUIRY EXPERIMENT)

Students design, build, test, and compare the power output and energy density of an acid to alkaline version cell at the same voltage.

Activity 5 - Building Earth & Microbe Batteries

(GUIDED – MODEL EXPERIMENT)

Students will set up an "earth battery" and record voltage readings under different soil types and conditions. In a long term (>30 days) student groups use aerated soils – from various sources (source of Shewanella spp.) – as an electrolyte in constructing a microbial fuel cell (MFC). They construct this microbe battery and evaluate its energy characteristics over time (about 1+ month).

Going Further

Activity 6 - Working with Earth Batteries

- Improving Electrode Design
  Students use suggestions in designing alternative earth electrode designs based on increased surface area.
- Improving Earth as an Electrolyte
  Students place earth battery electrodes in different combinations (series / parallel), and in different soil conditions (marsh, sand, loam, fertilized, high salt content, etc.) to optimize voltage output. Students also investigate the use of diatomaceous earth as an electrolyte.

Activity 7 - A Closer Look at Galvanic Corrosion

- Interpreting Experimental Results
  Students interpret a photograph of experimental results involving galvanic corrosion - solid copper wire was wrapped around the center area of an iron nail.

Activity 8 - Microbial Fuel Cell (MFC) Size & Performance

- Use 5-gallon plastic pails as MFC containers.
  Students use a current (US Navy) version and simple MFC construction tip videos as guides to upgraded designs.
- Improve MFC Performance Using Electrolyte" Microbial Enhancers"
  Students propose (hypothesize) fuel cell "enhancements" that increase power output; they also investigate some "improvement tips."Students place earth battery electrodes in different combinations (series / parallel), and in different soil conditions (marsh, sand, loam, fertilized, high salt content, etc.) to optimize voltage output. Students also investigate the use of diatomaceous earth as an electrolyte.

Skills/Concepts

- Experimental/Engineering Design
- Investigating
- Energy & Matter
- Scientific Method
- Measuring
- Data Analysis
- Spreadsheet Preparation
- Communication
- Technology
- Scientific Method

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