Lesson Title	Construction and Characterization of a Simple DC Motor
Length of Lesson	1 day
Created By	Jed Leggett
Subject	Physics
Grade Level	11-12 (Physics)
State Standards	Physics: 5c
DOK Level	DOK 3
DOK Application	Develop a logical argument, Explain phenomena in terms of concepts
National Standards	9-12: B (Physical)
Graduate Research Element	Use of a periodic light signal to measure physical motion

Student Learning Goal:
Have students build and investigate simple household circuits.

Mississippi State Standards:
Physics: 5. Apply an understanding of magnetism, electric fields, and electricity: (b) Analyze and explain the relationship between magnetic fields and electrical current by induction, generators, and electric motors.

National Science Education Standards of Content 9-12
B (Physical): Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. These effects help students understand electric motors and generators.

Materials Needed (supplies, hand-outs, resources):
D-cell batteries, 6 ft. of 22 gauge magnet wire per student. Paper clips, rubber bands, (kits can also be found that work nicely), light sensor, computer with data logging software

Lesson Performance Task/Assessment:
In this lesson, students will construct a simple DC motor from common materials. Students will then attach 2 small pieces of paper to their motor and use a light sensor to measure its revolutionary speed.

Lesson Relevance to Performance Task and Students:
Students often encounter electric motors in their daily life. In this lab, students learn about the concepts behind the construction of an electric motor. Students also learn how to use their light sensor to measure the rotational speed of their motor in a novel way.

Anticipatory Set/Capture Interest:
The teacher will construct an example motor and have it running as the students walk into class.

Guided Practice:
The teacher will explain two simple rules used to understand simple circuits: the need for a closed loop for current to flow, and Ohm's Law (V=IR). The teacher will then introduce 3 activities in which the students will investigate simple circuits using these rules.

Independent Practice:
First students will wire 2 light bulbs and a battery in both series and parallel. Students will compare the brightness of the bulbs in the two different circuits and measure the voltage drop across the bulbs in the 2 different circuits. Students will be asked to explain their observations in terms of Ohm's Law. Second, students will wire a single bulb, a battery, and a circuit breaker in series. Students will use a piece of wire to short across the bulb, and observe what happens to the breaker. Students will be asked to explain the importance of circuit breakers in household circuits. Finally, students will be given the schematic of a 3-way switch and asked to build it. Students must generate a valid logic table for the switch.

Remediation and/or Enrichment:
R: individual IEP; partner help throughout lesson; shorten parts of assignment; focus upon smaller elements of the process

E:

Check(s) for Understanding:
Why did we only shave one side of the wire on the axle? What would have happened if we had shaved both sides?

Closure:
Have students tweak their motors to obtain the highest possible rotational speed.

Possible Alternate Subject Integrations:

Teacher Notes: