

Extreme Home Makeover: Electricity Edition

Overview: The goal of the Extreme Home Wiring Project is to help students see how science and experimenting can lead to knowledgeable predictions about how the world works. Students will create a diorama style house to learn how the electrical system of your house is wired. And, to gain experience in the following areas: creating physical circuits, drawing circuit diagrams, translating between physical circuits and a circuit diagram and visa versa.

Scope of Work: In teams of 2 or 3, students will create a diorama style house from cardboard and wire at least 6 lights and a fuse according to the requirements. First, however, the students will design and diagram their circuits before physically constructing them. They will then wire the house so that all 6 lights operate off switches and there have a safety fuse that will break the circuit if 4 lights are on at the same time.

Materials:

- Cardboard box and scrap cardboard for walls (provided by students)
- Battery or power supply
- 2 meters of wire (black/white, double stranded)
- 6 paperclips
- 12 brass clips
- 1 steel wool wire (for fuse)
- 6 xmas lights
- 1 meter of masking tape
- 0.5 meters of electrical tape

What You Will Deliver (and how much of the grade it will count for):

(50%) *Model House* – A cardboard house meeting all the requirements below and pass inspection. All additional features for additional credit will be provided by the students.

(30%) *Circuit/Wiring Diagrams* – A circuit diagram that accurately represents the wiring configuration of the house and correctly predicts the current through each loop.

(20%) *Self and Peer Evaluation* – Students will evaluate themselves and their teammates with regard to their contribution and the effort they put into the project.

Roles:

There are three roles available to team members. Each role corresponds to managing a certain area of the project. These roles DO NOT mean that the person in the role is responsible for completing the entire task. Rather, that person is responsible for making sure that the task gets done (that is why each role is referred to as a manager). The third role is only for groups of three.

1. **Structural Engineer** – This person is responsible for managing the design and production of the house's structure and floor plan. Remember, this does not mean designing and building it alone, just managing the design and building process.

Only the Construction Manager is allowed to collect construction materials and will likely manage these materials.

- 2. Electrical Engineer** – This person is responsible for designing and managing the production of the electrical system, wiring diagram and circuit diagram. Remember, this does not mean they build it alone, but manage the production process. Only the Electrical Engineer is allowed to collect electrical materials and will likely manage these materials.
- 3. General Contractor** – This person is responsible for making sure the group meets the deadlines and has a tracking system for peer evaluation. This may also include overseeing each day students evaluate each other and the team's progress.

Requirements:

Diagrams (all must be drawn NEATLY and close to scale on plain white paper):

1. Will have a **Floor Plan** for your house (must be completed to get construction supplies)
2. Will have an accurate **wiring diagram** superimposed over the floor plan of the house. This shows the *ACTUAL* routing of the wires, each circuit must be color coded. (must be completed to get electrical supplies)
3. Will have an accurate **Circuit Diagram** that represents the circuits in your house (this shows the *SIMPLEST* representation of the electrical connections, voltages and resistances labeled) .
4. Will specify the battery voltage, the actual resistance of each electrical device, the current through each circuit, and the total current draw of the house when 1, 3, and 5 lights are turned on.

The Diorama House:

1. Will be built out of cardboard, and wired as if it were a real house.
2. Will have a minimum of 6 lights, all of which will be on switched circuits.
3. Will have all lights wired in parallel.
4. All wiring will be behind or between walls and be insulated (no bare wire!).
5. Will have at least one switch that controls 2 or more lights.
6. Will have a fuse made from steel wool wire that will break the circuit if 4 lights are on at the same time.
7. Can have extras, which may be added for bonus points. Some possibilities include:
 - a. 3-way switches (2 switches operate the same light)
 - b. dimmer switches
 - c. other electrical devices (fans, radios, etc.). These must be integrated into the house's wiring, not be independently powered by separate batteries.
 - d. Solar or wind generated electricity (Go green baby!)

The Self and Peer Evaluation must:

1. Be fair and based on performance.
2. Divide up a total of 20 points per team between the 2 or 3 group members.

Aragon Building Inspector – Final Inspection

*Staple this form on top of your diagrams and submit it to the building inspector upon final inspection

Engineers on Site (your names): _____

Date: _____

Points	<u>Category</u>	<u>Criteria</u> √ = satisfactory, √+ = excellent, √- = not satisfactory	<u>Comments</u>
/14	House - Structural	<input type="checkbox"/> House has some level of complexity and shows pride in building (not just an empty box) <input type="checkbox"/> House is structurally sound (walls won't fall over in a minor earthquake)	
/36	House - Electrical	<input type="checkbox"/> Minimum of 5 operational switches <input type="checkbox"/> Minimum of 6 lights <input type="checkbox"/> All lights in parallel <input type="checkbox"/> One switch operates 2 lights <input type="checkbox"/> Wires are safe (still has outer casing, bare ends are taped) <input type="checkbox"/> Fuse functions properly <input type="checkbox"/> Extras? (specify)	
/8	Diagrams – Floor Plan / Wiring Diagram	<input type="checkbox"/> Accurately depicts layout of house, rooms are labeled <input type="checkbox"/> Accurately shows lights, switches and electrical connections <input type="checkbox"/> Color coded circuits	
/7	Diagrams – Circuit Diagram	<input type="checkbox"/> Accurate and simplest representation of the entire house circuit(s) <input type="checkbox"/> Includes current and resistance calculations	
/10	Self/Peer score		
/50	Total score		