

Light-House Project

The idea and student handouts for the Light-House project were generously shared by Bree Barnett Dreyfuss, who teaches physics at Amador Valley High School in California.

Building a house requires several steps and lots of responsibility. You must (1) design your house, (2) get the plans approved by the city, (3) determine your materials for construction and actually construct it. After your building is completed (4) a building inspector must approve of its construction and (5) a real estate agent will evaluate its design to prepare it for sale. Each step has specifics that you will have to meet in order to move on to the next step and earn full points. For this project, you will construct and wire a model building according to the requirements below. *Most materials are available from your teacher and excess should be returned.*

1. Building Design

Design your building with any school appropriate theme and in any way you like, *as long as it meets these minimum criteria:*

- Your building must have *at least* two rooms (or definitive spaces) connected by a doorway or passage and an outdoor space with a light.
- Your building must be *at least* 4" x 6" x 1' (close to the size of a shoebox)
- Your building must have the following circuits in these separate spaces:
 1. *A series circuit room:* two lights in series with a switch in one room
 2. *A parallel circuit room:* three lights in parallel with a switch in one room
 3. *A single outside light* with a separate switch

2. Approval of Building Plans (Circuit Diagram)

You must provide one diagram for the complete circuit in your building (all rooms). It must:

- be labeled and be complete including all electrical components for each circuit using accurate circuit symbols learned in class.
- be neat & drawn with a straight edge ruler and fill an entire piece of 8.5"x11" paper.

When your design is submitted to the City it will either be **approved or denied**. If it is denied, meaning it was not made correctly, you must **resubmit your design** *before* you begin construction. The City will use the following form to approve or deny the design:

The building plan (circuit schematic) must clearly show one room with two lights in series, one room with three lights in parallel and an independent outside light all operating from a single 9 V battery using three independent switches.		
Date submitted:	<input type="checkbox"/> Denied	<input type="checkbox"/> Approved
Resubmitted on:	<input type="checkbox"/> Denied	<input type="checkbox"/> Approved

3. Construction Phase

Upon approval of your building plan (circuit diagram) by the City (your teacher) you may begin the actual construction of your building. Structural materials can include but are not limited to: cardboard, foamboard, shoeboxes, etc. To earn *full credit*, each circuit mentioned above must be present and working in class when attached to a single 9V battery (or power supply set to 9V). How you construct your building is up to you as long as it still meets the requirements. There will be a few open build workshops after school if you need help. The following are building suggestions:

- Switches can be made from brads and paper clips.
- Your house will be powered by a 9V battery so make an obvious **two leads** to attach your battery to during testing if you do not supply your own battery.
- Each circuit must be able to work independently from the other but must all be able to be on at the same time *without moving the battery*.
- Insulated wire and lights from holiday lights will be provided.

4. Building Inspection

After your building is submitted, a Building Inspector will use the following checklist to make sure you have met all of the requirements. If your building fails to meet any of these inspection points you will have to pay a fine (a point deduction). In order for the Building Inspector to evaluate your construction, you must first conduct your own inspection and write a paragraph addressing the following requirements.

	Check	Fine
Series and parallel circuits work independently <i>Battery does not have to be moved</i>		-10pts
There is a switch in each room		-10 pts
One room has two lights in series wired correctly		-10 pts
One room has three lights in parallel wired correctly		-10 pts
One outside light works independently and is wired correctly		-10 pts
The house is at least 4" x 6" x 1' (close to the size of a shoebox)		-10 pts

5. Design Evaluation

Every building that is built must be sold in order to turn a profit. Decorating your building can help to insure a quick sale (and full points). Your building is to be decorated neatly, with care and:

- should reflect the purpose of the rooms (i.e. a refrigerator should not be in a bedroom)
- all inside surfaces of your building (walls, floors, etc.) must be covered or colored. Cardboard brown is *not* an appropriate design choice.
- some kind of 3D objects (tables, chairs, beds, etc) must be present in each room. Pictures of furniture is *not* 3D furniture.
- *you may not use premade furniture, toys, people, Legos, etc. Everything must be made for this project.* Suitable materials for furniture include origami, wood, modeling clay, plastic, etc.

In order to determine the design appeal of your building to help prepare it for sale, the real estate agent will use this rubric for evaluation:

Area evaluated:	Description		
<i>Décor</i>	The rooms are well decorated and it is obvious that care was taken to do so. The rooms have an obvious purpose. (10)	There has been some effort made to decorate but the result is not clean or care was not taken. The purpose of the rooms is slightly unclear. (5)	The rooms are sloppily or undecorated. The purpose is not clear. (1)
<i>Furniture & Structure</i>	The furniture appears to be well built and the structure of the building seems solid. (10)	The furniture is questionable or the structure seems of lower quality. (5)	The furniture appears poorly made or unsafe. The buildings structure appears poorly made or unsafe. (1)
<i>Blueprint</i>	The blueprints include a front elevation, side elevation, and floor plan. The drawing is neat, correctly scaled, and clearly labeled. (10)	One of the three required blueprints is missing or done incorrectly. The drawing is slightly messy, missing some labels, or incorrectly scaled (5)	Only one of the required blueprints was done correctly. The drawing is messy and most labels are missing. (1)

Point Value

Your building project will be worth a total of **100 points**. Each aspect of the process that is checked by the City, Building Inspector or Real Estate Agent will be worth points:

- Building Plans (circuit diagram) completed: **10 points**
- Building Inspection passed: **60 points** - any points in inspection fees
- Design Evaluation score: **30 points**