

Lights Out!

Goal:

Uh-oh, the zombie apocalypse has begun, and whoever was working at the power station has become lunch for the undead. We need light, and it's not coming from plugging in a lamp, so what can you do? All you've got are some basic materials like batteries, tinfoil, plastic, an LED light, and some other stuff you'd find lying around the house. (Home Depot has been overrun by C.H.U.D.'s so you can't get any fancy stuff). It's up to you to create a functioning flashlight from these items.

Engineering Design Process:

Define the problem
Generate solutions
Choose a solution
Build prototype(s)
Analyze performance
Tweak and rebuild
... Present results

Note: All your work should be documented in your engineering notebook. Please set it up according to the Engineering Notebook Guideline.

Constraints:

- You may only use the materials that is provided or easily found in a house. You may not use any pre-constructed parts from a flashlight. (Check with your teacher if you are not sure about the materials you want to bring in.)
- The flashlight must be able to stay lit with one hand so you can also fight off the zombies if necessary.
- The flashlight must be able to be turned off and on.
- Meets the class generated "test" conditions.

Daily Log: (Please include Heading, dates, Notes for each day (the Do Now Questions), Your building documentation for each day, and answer to questions in the daily log.)
Make sure you leave room for initials and teacher stamp.

Day 1: Brainstorm, design, start building, documentation.

Day 2: Continue to build, test, refine the device, documentation

Day 3: Refine the flashlight and complete the documentation for individual and group poster

Day 4: Share your posters and flashlight design, evaluation, documentation.

Day 5: (this will be much later, after a short break from our flashlights) Redesign and extension questions.

Deliverables:

Individually:

- A. Documentation: In order to save others from becoming a midnight snack, you need to create some documents that will give others the information they need to create their own flashlights! The only way to accomplish that is by clearly and thoroughly documenting your solutions.

Group:

- B. A working flashlight that meets the goal and constraints.
- C. Poster that includes:
 - Blueprint – to scale, showing how the light was designed.
 - Label the insulators vs. conductors in your blueprint.
 - Explanation what parts constitute the Electrical system vs. Mechanical System in your blueprint. Explain how your group incorporated the two systems to make the final product.
 - Circuit (schematic) diagram
 - Paragraphs describing the thought and design process... (How did you end up with your final design?)
 - “First we wanted to ...”
 - “We thought the switch should be like x so we...”
 - Be sure to elaborate on *at least 3* specific design decisions
 - Identify and describe at least 2 obstacles you encountered and how you worked around them or fixed them. (When we tried x it didn’t work because..., so we tried y instead)
 - Consider and discuss how engineering is an *iterative* process, and not just trial and error. What do you think is the difference between iteration and trial and error?

Daily Objectives and Questions:

Day 1: Brainstorm, design, start building, documentation.

Physics Objectives:

- Recognize that electric charge tends to be static on insulators and can move on in conductors.

Engineering Objectives:

- Utilize the Engineering Design Process. Understand that design is an iterative process conducted within specified constraints to develop products or systems to satisfy human needs and wants.

Do Now Questions:

1. Draw one arrangement that you can connect one light bulb to one battery with one wire that makes the bulb stay lit.
2. How is current electricity different from static electricity?
3. What is a switch?

Class Notes / Discussion Questions:

1. Define the following terms: circuit, simple circuit, short circuit, terminal, open switch, closed switch
2. Draw the direction of electron flow in a simple circuit.
3. What kind of test will we run to rank the flashlights?

Engineering Challenge:

By the end of class, you should include the following in the engineering notebook:

- List of materials that are good insulators vs. good conductors to used in flashlight.
- List of materials that you like to bring in from home.
- Brainstorm at least three different designs to turn on / off the flashlight
- Document any test you did with materials today and what worked/what didn't
- Sign and get a stamp from your teacher in your engineering notebook.

HW:

1. Bring materials from home.
2. Read Ch 34.1-34.4 in your textbook. Use complete sentences to answer Review Questions (pg545-546) #1-10.

Day 2: Continue to build, test, refine the device, documentation

Physics Objectives:

- Analyze simple arrangements of electrical components a circuit.

Engineering Objectives:

- Recognize that a system is a group of interrelated components designed collectively to achieve a desired goal.

Do Now Questions:

1. What is the material that provide voltage source in your designed circuit?
2. What are two types of system you really need to worry about in designing a working flashlight?

Class Notes / Discussion Questions:

1. Define the following terms: voltage, current, resistance

2. Define electrical vs. mechanical system.
3. Why do engineers use different systems?

Engineering Challenge:

By the end of class, you should include the following in the engineering notebook:

- Document any test /work you did today and what worked and what didn't
- A sketch of your current design:
 - Label the components mechanical system that is used to hold the flashlight in-place.
 - Label the electrical system in your flashlight design.
- In your sketch, label where we can measure voltage, current, and resistance.
- Sign and get a stamp from your teacher in your engineering notebook.

HW:

1. Bring any other materials you might need.
2. Read: Schematic Symbols for Electric Circuit Diagram.

Day 3: Refine the flashlight and complete the documentation for individual and group poster

Physics Objectives:

- Recognize symbols and understand the functions of common circuit elements (battery, connecting wire, switch, fuse, resistance) in a schematic diagram.

Engineering Objectives:

- Utilize the Engineering Design Process. Understand that design is an iterative process conducted within specified constraints to develop products or systems to satisfy human needs and wants.

Do Now Questions:

1. Use the schematic symbols, draw a circuit consist of two batteries, one light bulb, and one closed switch that is connected with wire.
2. Use the schematic symbols, draw a circuit consist of one battery, one resistor, and wire connecting them with an open switch.

Class Notes / Discussion Questions:

1. What is the difference between blueprint and schematic symbol (circuit symbol)?

Engineering Challenge:

By the end of class, you should include the following in the engineering notebook:

- Finish documentation of any final changes to your design.
- Draw a blueprint of your final design.
- Draw a schematic diagram of your circuit.
- Sign and get a stamp from your teacher in your engineering notebook.

Begin working on group presentation poster.

HW:

1. Finish group presentation poster.

Day 4: Share your posters and flashlight design, evaluation, documentation.

Physics Objectives:

- Analyze simple arrangements of electrical components a circuit.

Engineering Objectives:

- Creating a visual model to represent in detail of an object or design.

Do Now Questions:

1. Finish any last minute work on your poster and / or flashlight.

Class Notes / Discussion Questions:

1. Define the following terms: source, load.

Engineering Challenge:

We will be evaluating and voting for the best flashlight by the end of class. To help with the process, make sure you include the following in your engineering notebook for THREE different groups:

- List three pros in their flashlight design.
- Use any of the following vocabulary in a complete sentence to describe why you think their design works well. (circuit, short circuit, voltage, resistance, switch, source, load).
- One recommendation for this group to consider
- Sign and get a stamp from your teacher in your engineering notebook.

HW:

1. Read Ch 34.5-34.8 in your textbook. Use complete sentences to answer Review Questions (pg545-546) #12-20

Day 5: (this will be much later, after a short break from our flashlights) Redesign and extension questions.

Physics Objectives:

- Develop qualitative and quantitative understanding of current, voltage, resistance, and the connection among them (Ohm's Law).
- Analyze simple arrangements of electrical components in series and parallel circuit.

Engineering Objectives:

- Utilize the concept of design, system, and model in an engineering solution.

Do Now Questions (in small groups, discuss):

1. Look back in your flashlight project, how would you change the design to increase the amount of current in the flashlight?
2. What if you have two LED lights? What are some ways you can connect them to your flashlight? Please explain the electrical system as well as the mechanical system.

Engineering Challenge:

By the end of class, you should include the following in the engineering notebook:

- Draw a model of how your new flashlight would look like if you want the MOST brightness while connecting two LED lights. Explain why you made this decision.
- Optional Challenge Question: Draw a model to demonstrate a new design that would allow you to use switches to turn on one light, another light, or both lights.

Rubric for how you will be assessed:

You will receive two grades for this project: individual and group grades.

Individual Grade:

(30 pts)

Working diligently each day

(10 pts total)

Engineering Notebook Documentation

(20 pts total)

Day 1

Day 2

Day 3

Day 4

Day 5

Group Grade:

(30 pts)

Working Flashlight

Works

(2 pts)

Turns on and off

(2 pts)

Stays lit with one hand

(2 pts)

Class designed test

(2 pts)

Poster

Blueprint

(2pts)

Conductors vs. Insulator

(2pts)

Electrical vs. Mechanical System

(2pts)

Circuit diagram

(2pts)

Engineering Design Process Explanation

(10 pts)

Obstacles

(2 pts)

Iterative vs. trial and error

(2 pts)

Old Rubric for each groups

Flashlight Project Rubric		Flashlight Project Rubric	
Members:		Members:	
Worked diligently in groups	/10	Worked diligently in groups	/10
Working flashlight		Working flashlight	
Works	/2	Works	/2
Turns on and off	/2	Turns on and off	/2
Stays lit w/ one hand	/2	Stays lit w/ one hand	/2
Sturdy	/2	Sturdy	/2
Able to change batteries	/2	Able to change batteries	/2
Circuit diagram	/5	Circuit diagram	/5
Blueprint	/5	Blueprint	/5
EDP	/4	EDP	/4
3 design decisions	/6	3 design decisions	/6
Obstacles	/3	Obstacles	/3
Iterative vs. trial and error	/2	Iterative vs. trial and error	/2
Total	/45	Total	/45
Learning targets:		Learning targets:	
0.2 – EDP		0.2 – EDP	
5.3b – Recognize symbols and understand the functions of common circuit elements (battery, connecting wire, switch, fuse, resistance) in a schematic diagram.		5.3b – Recognize symbols and understand the functions of common circuit elements (battery, connecting wire, switch, fuse, resistance) in a schematic diagram.	
Comments:		Comments:	
Flashlight Project Rubric		Flashlight Project Rubric	
Members:		Members:	
Worked diligently in groups	/10	Worked diligently in groups	/10
Working flashlight		Working flashlight	
Works	/2	Works	/2
Turns on and off	/2	Turns on and off	/2
Stays lit w/ one hand	/2	Stays lit w/ one hand	/2
Sturdy	/2	Sturdy	/2
Able to change batteries	/2	Able to change batteries	/2
Circuit diagram	/5	Circuit diagram	/5
Blueprint	/5	Blueprint	/5
EDP	/4	EDP	/4
3 design decisions	/6	3 design decisions	/6
Obstacles	/3	Obstacles	/3
Iterative vs. trial and error	/2	Iterative vs. trial and error	/2
Total	/45	Total	/45
Learning targets:		Learning targets:	
0.2 – EDP		0.2 – EDP	
5.3b – Recognize symbols and understand the functions of common circuit elements (battery, connecting wire, switch, fuse, resistance) in a schematic diagram.		5.3b – Recognize symbols and understand the functions of common circuit elements (battery, connecting wire, switch, fuse, resistance) in a schematic diagram.	
Comments:		Comments:	