



PHYSICS – A CONSTRUCTIVE DESTRUCTIVE ELECTRICITY PERFORMANCE

Description: For **SPH3U** and **SPH4C**

Students individually dismantle a disposable camera (obtained from any camera store) as a summative task for the electricity and magnetism unit. A disposable camera is a common item of technology with a few basic components. Students require some instruction on safe dissection to avoid discharging the capacitor on their fingers. Wearing nonconductive gloves decreases the risk.

Student Activity: A Constructive Destructive Electricity Performance Task

Instruction Sheet

Safety: During the task please exercise safe procedures, including following all steps. There is a small risk that a student may receive a mild electrical shock. Students with a heart condition should use extreme caution while performing the lab or just observe. Dismantle the disposable camera cautiously, identifying circuit components before removal to ensure the capacitor is not accidentally discharged by your moist skin. The capacitors in the disposable cameras may have values up to 350V! Handle the circuit board by only touching the plastic parts. **Activate switches either using the alligator clip or by using an insulator such as your pencil.** Safety goggles will be available. Do not touch any items on the circuit board with your hands, use the alligator clip or pencil.

Background Information: Disposable cameras use some advanced electronics to take pictures in low light conditions – using the flash. There are **two** basic circuits within the camera; one ramps up the voltage and charges the capacitor using diodes, a LED flashes once the capacitor is charged. The second circuit discharges the stored energy in the capacitor through the flash generating an intense light.

Materials:

- (a) One disposable camera
- (b) One alligator clip
- (c) 1 AA battery
- (d) 1 plastic pen or wooden pencil
- (e) One small slotted screwdriver

Task: Take apart the disposable camera, extract the flash mechanism, and complete the circuits causing the camera to flash using your knowledge of electricity.

- i) Your first goal is to devise a method to open the camera and extract the circuitry with minimal, if any damage to the unused components of the camera.
- ii) Identify the charging and discharging circuits.
- iii) Identify correct polarity of AA battery and insert in camera circuitry, switch on 1st circuit (charging) and then the 2nd circuit (discharging) to turn the flash on. Once this has been completed call your teacher over to display the flash repeatedly **three** times.
- iv) Draw a neat circuit schematic illustrating how the camera flash works. Use proper schematic symbols to the best of your ability.
- v) Complete all of the components on the student answer sheet.

You will have the entire period to complete the task, use your time wisely. Good Luck!

Background Information on Flash Bulb

In lecture you learned that a transformer could be used to take a small AC signal and create a large one, or vice-versa. The Flash camera uses this property to create a large rectified AC signal to charge a capacitor to 320 volts. The energy from this cap is used to ignite the gas in the Xenon flash. Xenon is normally a good insulator, however when it is charged separately by another high voltage field it starts to become more of a conductor which then allows the field around it to become greater, which in turn makes it even more of a conductor. This avalanche effect eventually brings the resistance down so low (to around 1 ohm) that the large capacitor that was holding 320V discharges and causes a bright light. After all the current has dissipated, the Xenon gas acts like an insulator again and the process can start over again. The charge time for the capacitor is around 7 seconds.

Camera Background Information

The camera dates back over 400 years. The first "camera" was a pitch black room with a small hole in one wall. Light from outside came through the hole and formed an image on the opposite wall. This system was called camera obscura "dark chamber."

The camera obscura formed an upside-down image on the wall. The image was upside down because the light from the top of the outside scene went through the hole to the bottom of the wall. At the same time, the light from the bottom of the image went to the top. Even though this system produced an upside-down image, it was still a useful copying tool for artists.

In 1827, a Frenchman named Joseph Niépce took the first "picture." He put a metal plate covered with a chemical called bitumen in the camera box. The bitumen got hard on the parts of the plate exposed to the sun. When the plate was washed, a permanent picture remained. This faint picture took 8 hours to expose!

Since the 19th century many people have worked hard to improve the shape and design of the camera. In the 1890s, George Eastman's roll-film camera made it possible to load a camera once and take a series of pictures. Today, digital cameras make it possible to display a picture on the computer or television screen. A digital camera, records light on a charge-coupled device (CCD). The CCD makes it possible to create an electronic map of pictures. When the camera is connected to a computer, the images can be downloaded.

A. Optics Extra Task: Build a Microscope and Examine Lens in Camera

Remove the plastic lens in the main body of the camera. Looking through the double lens system, describe the image produced. Are the lenses concave or convex? How is the image different if you look through just one of the lenses? Experiment with it to create images and determine its focal length. Attach the lenses to a piece of cardboard. Can you determine the focal length on the lens? Mount your lens in an appropriate holder...in this case we have drilled a large hole in a bottle cap, and have used a bit of white glue to make a "loupe" (a form of simple microscope). It is great for looking at insects.



B: Learn AND Describe The Mechanics of The Camera Operation

A Constructive Destructive Electricity Performance Task




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Student Answer Sheet





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





1. Define the following electronic components and terms as applied to the camera circuitry to the best of your ability. [/6]
 - (a) Capacitor
 - (b) Diode
 - (c) LED
 - (d) Resistor
 - (e) Transformer
 - (f) Transistor
2. Care with which the camera is dismantled. [0 1 2]
3. Flash is properly operated **3** times consecutively. [0 5 10]
4. What happens if the battery is installed backwards? [/1]
5. What time duration is required to charge the capacitor? [/1]
6. Write a paragraph or two that could be included in a technical support manual for maintenance on the camera circuitry. Indicate how the circuitry is organized, how the flash operates and any special attention required while troubleshooting the camera. [/5]

7. Draw a neat circuit schematic illustrating how the camera flash works. Use proper schematic symbols to the best of your ability. [10]

Capacitor, General	
Cell	
Diode	

Diode, Light-Emitting	
Diode, Photosensitive	

Fuse		
Ground, Chassis		

Integrated Circuit	
Lamp, Incandescent	
Lamp, Neon	
Rectifier, Semiconductor	
Transformer, Iron-Core	
Transistor, Bipolar, npn	
Transistor, Bipolar, pnp	