



# You Have Safety Questions? We Have Safety Answers!

## The STAO Safety Committee

The STAO Safety Committee welcomes enquiries, with respect to safety issues, from STAO members. Please send your questions to the Safety Committee Chair ([ralph\\_chou@stao.org](mailto:ralph_chou@stao.org)). Your questions and the STAO Safety Committee responses may be published in Crucible, particularly if the information is deemed of general interest to other STAO members. Anonymity will be guaranteed.



*Curriculum Connection: Grade 9 Science, 11U and 12U physics.*

**QUESTION# 38:** One of our science teachers visited the STAO Conference in the fall and brought back an exercise on extracting a circuit from a disposable camera. He is keen for all of the grade 9 science students to complete the lab. However, several of the science teachers have expressed concerns that students may experience painful shocks during the activity. One of the teachers forwarded a website about some of the dangers of the activity. The website said that the circuit could store a voltage as great as 320 V and that it was recommended that students only use one hand to complete the activity in order to prevent the current from passing from one hand through the body (and heart) and to the other hand. I have noticed that this activity will be presented at our PD session at the Ontario Science Centre. Because three of our staff expressed safety concerns (and concerns about students experiencing unpleasant shocks) I spoke with our principal about the activity. He was concerned about safety issues and wanted me to ask you if you thought that this lab might be considered a “high risk” activity. Do you think that we need to send home permission forms to the parents just in case a student might have a medical condition that would make it dangerous for them to participate in the activity? We have discussed the possibility of having each student wearing rubber/latex gloves. What are your thoughts on this entire issue?

**RESPONSE:** The STAO Safety Committee has some concerns about the use of circuit boards salvaged from disposable cameras because of the presence of capacitors that may not be discharged. On page 17 of *Stay Safe!* it is stated that:

*“Capacitors are used to store electric charge. They may remain charged for long periods of time and can give an unpleasant electric shock which, although doing little direct damage, may lead to serious injury through an involuntary response. Before working on any circuit containing a capacitor, discharge it by shorting its terminals with an insulated wire or screwdriver.”*

It is also stated on the same page that:

*“Electricity supplies with voltages greater than 40 volts and capable of delivering more than 5 mA are regarded as potentially dangerous in schools.”*

Our concern is that if a capacitor discharges and creates a current across the heart of a student or teacher who is touching the circuit board, the consequences could be extremely serious.

Accordingly, we do NOT recommend that this should be a student activity, unless and until the teacher in question is fully aware of the procedure for this activity and how to



minimize the risk of harm. The teacher should therefore take advantage of the PD day session. It is also very important that the teacher leading the classroom activity maintain vigilant supervision to prevent injuries to student participants.

The Safety Committee concurs with the following comments provided by a teacher having experience with this activity:

*“Considering part of the experiment requires students to charge the capacitor and then reverse the circuit to discharge the capacitor, it will always be charged at some point. I know from experience with this experiment that the shock is noticeable. Most students are zapped at least once while doing this experiment and most view it as part of the fun. I do teach my students how to remove the circuit, discharge the capacitor, and how to work safely with capacitors, but a few always get a zap – some with enough force to cause pain in the hand touching the circuit but never any noticeable burns or lasting pain. The capacitors in disposable cameras can provide a high voltage (most seem to be 300-330 V~ 80-160  $\mu$ F max.). I have seen schematics for using this capacitor to make a taser-like device but that requires leads to be placed close together. The danger is not while working on it, since the students will never leave the circuit connected long enough for the*

*capacitor to gain nearly this charge, but that the device might be fully charged when taken apart (which is why the first step in the lab is discharging it!). One interesting thing I have found is to use a graphite pencil lead to discharge the capacitor since it is well-insulated and does not lead to the vaporized metal that can sometimes come from a screwdriver head used to discharge a capacitor. Another good tip is the old engineer’s trick of working with one hand in your pocket. I do this experiment regularly, but it is one that requires care so I only ever do it with grade 12 classes. My personal recommendation is that this is an acceptable lab, but only with a senior class. I agree that it should only be done if the teacher knows the correct procedures, both for working with capacitors and for correctly discharging the capacitor at the beginning of the experiment.”*

Given our member’s experience, it does not appear that there is a high risk to the health and safety of the students or teacher if the activity is carried out properly. If anything, most of them should enjoy it greatly. As for the question of having each student wear rubber/latex gloves while handling the circuits, there is the possibility that a few students may have previously undocumented latex allergies. An alternative might be that they wear nitrile gloves instead, if they wish to wear gloves.

