

## Knowledge Domain: Power Supply

### Unit: Batteries

#### Skill: Replacing batteries with wall transformer

#### Tools and Parts Required:

- 1) Device with battery pack\*
- 2) Digital Multimeter
- 3) Power supply (Wall transformer/Cell phone transformer)\*
- 4) Connecting wires
- 5) Insulating gloves

\*Power supply must match specifications of the battery pack.

#### Introduction

Batteries are often used to power electronic devices. Batteries provide the required current and voltage. Secondary batteries (rechargeable) have a limited capacity. Recharging batteries can be costly. Secondary batteries can only be recharged a few hundred times. After that, the rechargeable batteries will not accept recharging. When you cannot find replacement batteries, you can sometimes replace batteries by wiring a wall transformer or a cell phone charger to the device in place of the batteries. You must insure that the wall transformer or cell phone charger provides the same voltage and current the device requires.

#### Example



The pictures show a battery powered device. If needed, the batteries can be replaced with a wall transformer.

These pictures show the procedure to measure the maximum current used by the device and power up the device using a laboratory power supply.

#### Identification and Diagnosis

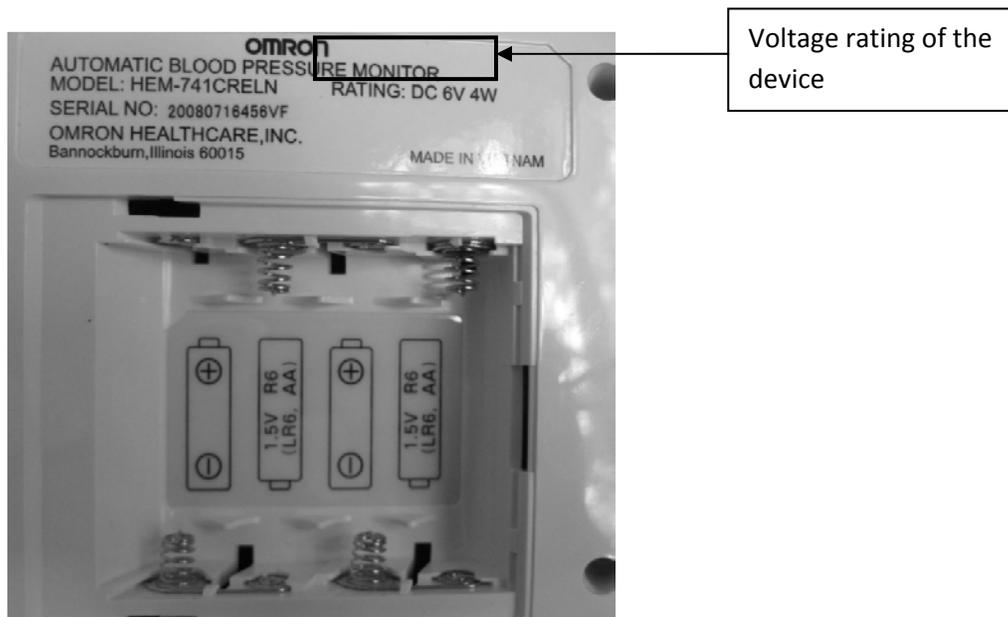
Each electronic device has a rating of current and voltage. These ratings are always written on the device. It is important to match voltage rating and the current required by

the electronic device to the ratings of the wall transformer. The wall transformer voltage should not exceed the maximum voltage levels allowed for the device. The wall transformer should provide at least the required current. Wall transformers with higher current output than what the device requires are acceptable substitutes.

## Procedure

Wear insulating gloves.

1. Identify the voltage rating (V) of the electronic device. The voltage rating is usually written on the device. Some devices may also identify how much current(A) they require.

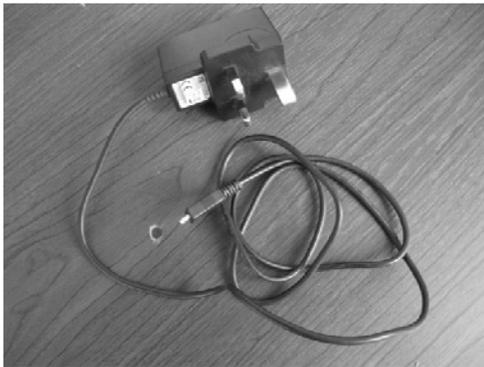


2. If the device does not indicate how much current it requires, you will need to measure the current required.
  - If a fresh battery pack is available, power the electronic device with a fresh battery pack.
    - If a fresh battery pack is not available follow the procedure to replace the battery pack with a modified wall transformer or cell phone charger.
  - Measure the current drawn by the device in all the possible modes. Use a digital multimeter and connecting wires between the battery and the device to measure the current.



Example of a multimeter

3. Select a wall transformer or a cell phone charger.
  - The current rating of the wall transformer (or cell phone charger) must be equal to or greater than the maximum current drawn by the electronic device.
  - The voltage rating of the wall transformer must be nearly the same as the rating of the device. The voltage rating of the wall transformer must be no more than 10% greater or 10% less than the device's required voltage rating.

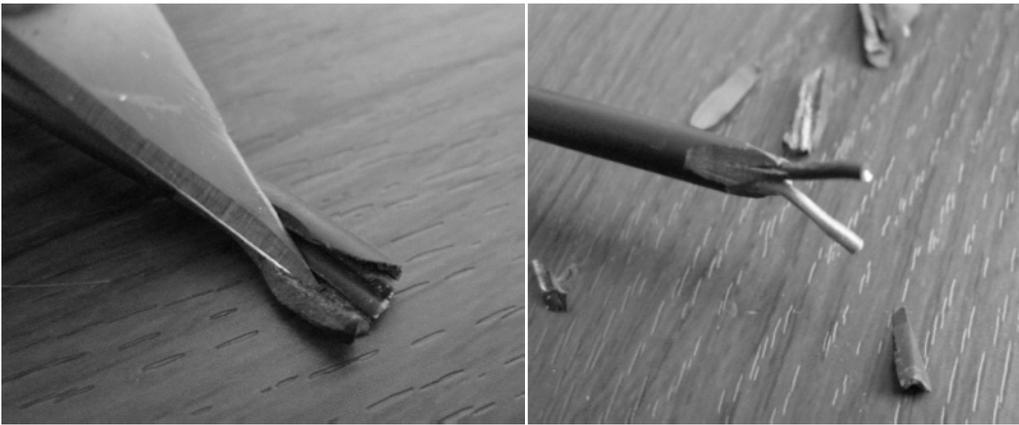


Two views of a usable cell phone charger

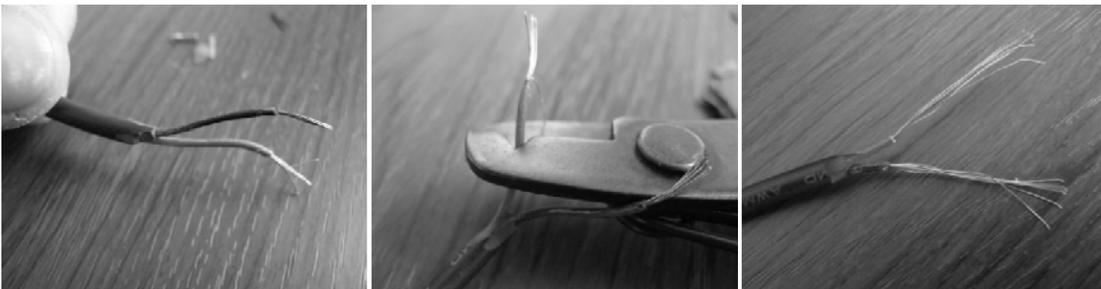
4. Expose the wires of the cell phone charger.



- Cut off the phone input end using wire cutters



- Use a knife to remove the outer insulation of the wire.



- Use wire strippers to remove the insulation from the inner wires

5. Determine which wire in the cell phone charger is positive and which is negative. By convention, a wire with red insulation is usually positive, and a wire with black insulation is usually negative. However, you should test the wires using the following method to be sure.

- Connect the wires to a multimeter. Set the multimeter to measure “DC Voltage.”
- When the wires and the multimeter are connected correctly, the voltage reading will be positive (not negative).



- The wire connected to the red probe of the multimeter is the positive wire. The wire connected to the black probe of the multimeter is the negative wire.

6. Connect the wires from the cell phone charger to alligator clips.

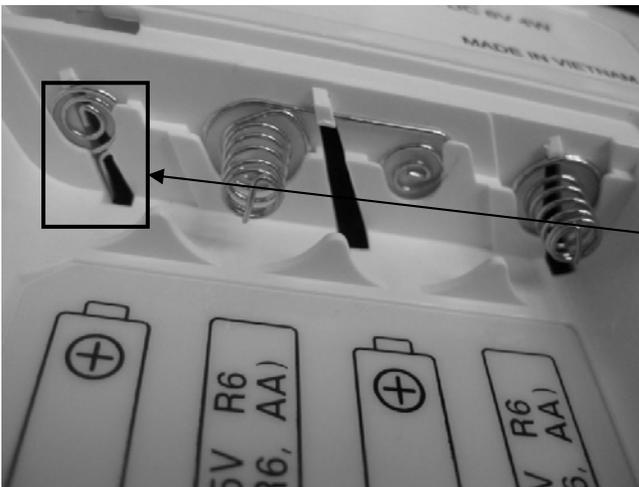


Example of an alligator clip

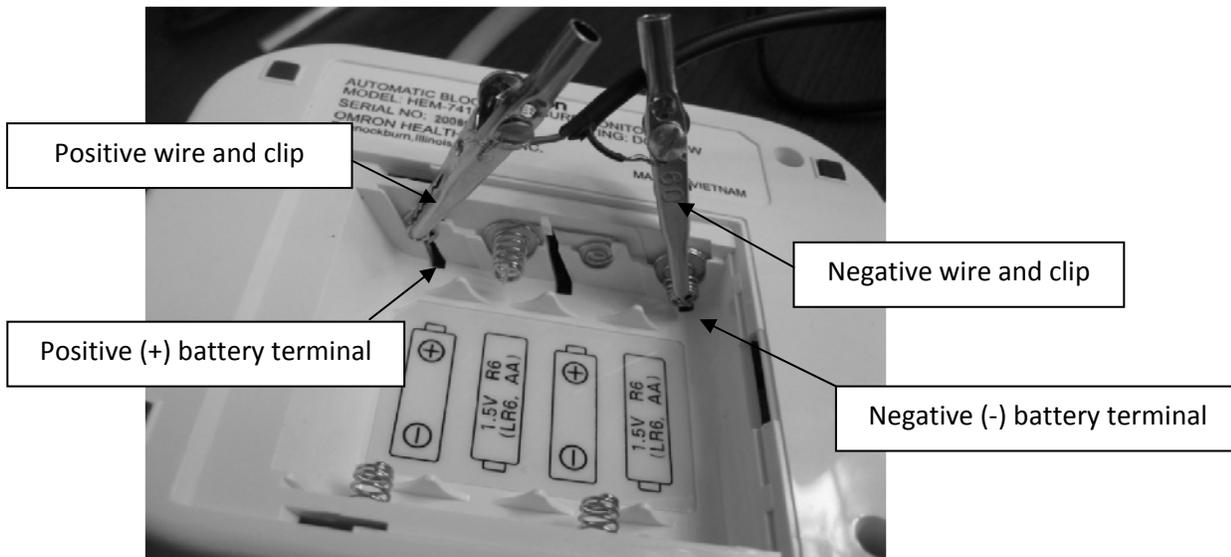


Insure that the wire is securely wrapped around the screw for a good connection

7. Connect the clips to the appropriate terminals on the battery powered device
  - Connect the positive wire of the power supply to the positive (+) terminal of the battery holder. Connect the negative wire of the power supply to the negative (-) terminal of the battery holder.



You should attach the clips only to terminals with a wire that goes back into the device. Do not attach clips to terminals that only connect to other terminals.



The above picture shows how you should wire a cell phone charger into a battery-powered device. Notice that the positive wire from the charger connects to the positive terminal of the battery slot. The negative wire from the cell phone charger is similarly connected to the negative terminal in the battery slot.

To make the replacement permanent, solder the alligator clips and wires in place or use electrical tape. Ensure that the adapter wires do not touch each other.

### **Exercise**

Your instructor will give you a battery powered device. Use an appropriate wall transformer or cell phone charger to replace the batteries. Your device should no longer be battery powered.

Your instructor must verify your work before you continue.

### **Preventative Maintenance and Calibration**

If you find that the same device is returned frequently to the maintenance department with dead batteries, consider replacing the batteries with a wall transformer or cell phone charger.

Always calibrate every medical device before returning it to use.