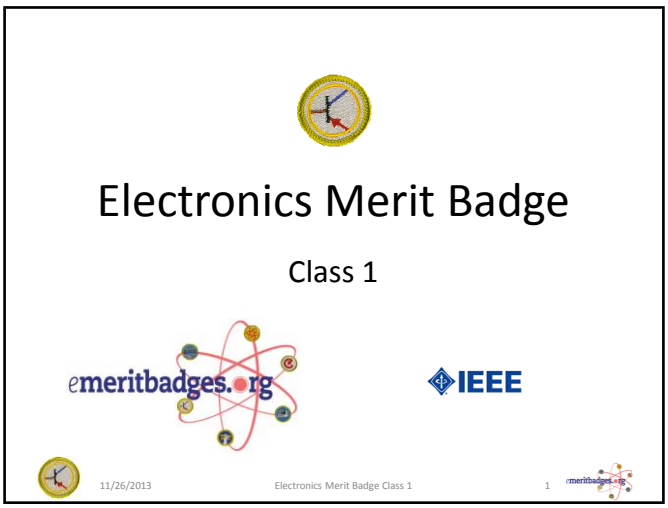
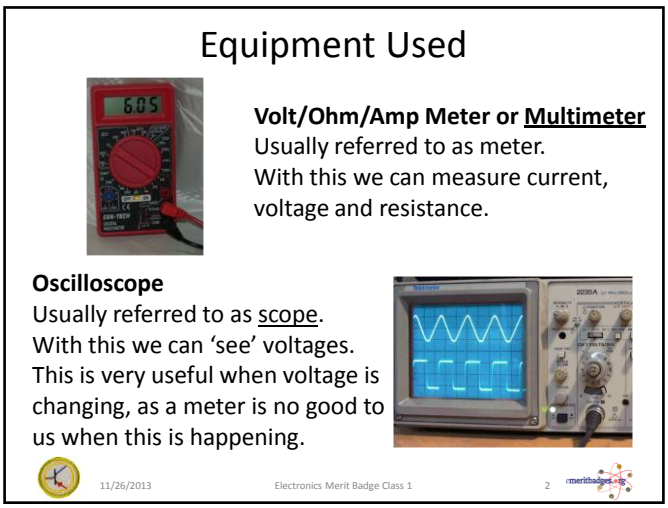
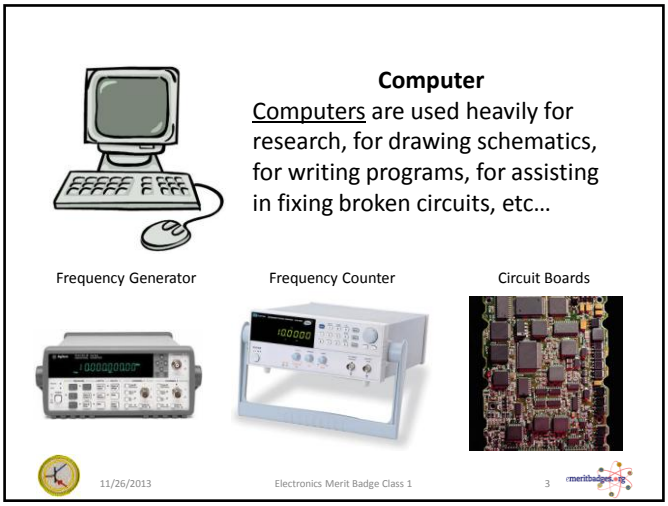
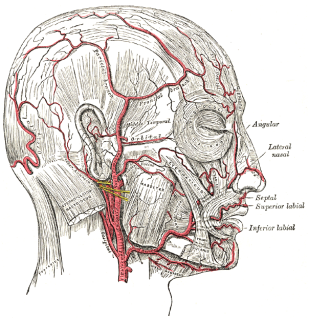
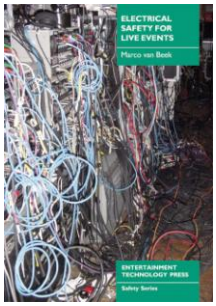
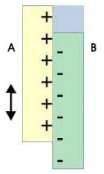
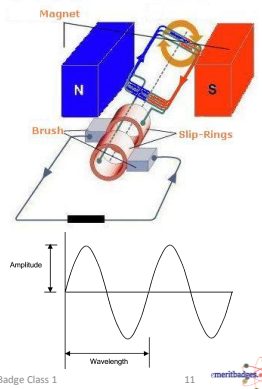
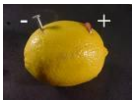
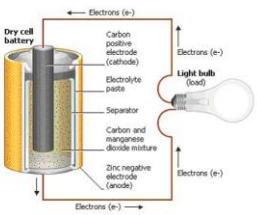
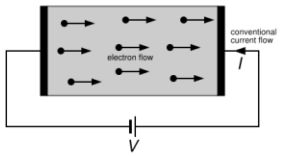
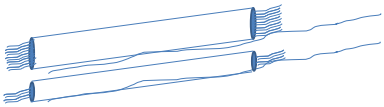
	SLIDE	TEACHER NOTES
1		This class covers a lot of information, and it is easy to spend too much time on it. You will need to pay close attention to time, and make sure you get to the activity at the end with enough time to do it. The activity is the fun part of the class. I go rapidly through the first few slides, spend a little more time on the snake, and spend more time with the current/voltage/resistance slides.
2		It is helpful to have examples of these 2 instruments in the class.
3		Computer is heavily used for every day electronics design. Engineers write software to support hardware work, and this is done with computers as well.

	SLIDE	TEACHER NOTES
4	Two of the most important kinds of equipment Your Brain A brain assistant.   11/26/2013 Electronics Merit Badge Class 1 4	Emphasis is on importance of education in order to pursue an engineering degree. Yes, of course it is difficult, but so what? Challenging career leads to enriched life. This is a difficult subject and requires hard work, but is well worth the effort. Engineering can provide a lifetime of continuous discovery and learning.
5	Safety with Electricity and Electronics   11/26/2013 Electronics Merit Badge Class 1 5	Does this look safe to you? Rightmost picture looks to be from Korea. What does that say about electricity safety in the US and other places?
6	Electricity Safety • High Voltage (120V AC or greater) – Safety mainly about not touching the wrong thing.    • Current kills – Only 16 volts can kill when enough electrons flow through the heart or head. • Ventricular fibrillation – Electrons passing through the heart causes muscles to seize, causing death. • If the shock doesn't kill you, you can still be badly burned from touching the wrong thing. 11/26/2013 Electronics Merit Badge Class 1 6	Shock can be avoided by being educated about potentially dangerous situations. Stay away from them!!!

	SLIDE	TEACHER NOTES
7	 How to avoid shock. • Turn power off before working on equipment. • Don't touch circuits that could have high voltage on them. • Do not allow electrons to flow through the heart. I don't think the snake knew about this detail.  11/26/2013 Electronics Merit Badge Class 1 7	The snake crawled under the fence. Once through the fence, it felt the shock from the electric fence, and turned to bite the fence. This passed current through either its brain or heart, and that was it. Its body made a connection from the fence to ground, and was being shocked. The snake felt the shock and responded by striking at the source of its pain… the fence. My guess is that once it bit the fence, it provided a better electrical path from the fence, though its heart, to ground.
8	Electronics Safety • Electronics generally uses lower voltages (less than 48 volts). You are usually working with DC voltage instead of AC voltage. • You are usually more concerned with sparks from connecting the wrong wires together, or burning yourself with a soldering iron, or some similar event. • Even when working with lower voltages, you may still receive an electrical shock from equipment you are using. 11/26/2013 Electronics Merit Badge Class 1 8	Emphasis here is that electronics is inherently safer than electricity, because the voltages are much smaller. This does not diminish the necessity for safety.
9	Personal Safety • Be aware of what you are doing, and where you are placing equipment and yourself. • Pay attention to hot soldering irons. Keep a good distance between you those next to you. • Know when you are working with high current and/or high voltage circuits. • THINK before you do something. • Wear safety glasses when soldering. 11/26/2013 Electronics Merit Badge Class 1 9	

	SLIDE	TEACHER NOTES
10	**Types of Electricity** Static Electricity Static electricity is usually created when materials are pulled apart or rubbed together, causing positive (+) charges to collect on one material and negative (–) charges on the other surface.. Sparks may result! Examples of static electricity: 1. Lightning. 2. Combing hair. 3. Walking across carpet and getting shocked. 4. Pulling out scotch tape.   Generation Of Static Electric 11/26/2013 Electronics Merit Badge Class 1 10	How to generate static electricity? Every strand of hair is repelling the next strand of hair, as they all have the same electrical charge. Run comb through hair. The comb will attract paper. Walk across a carpet and touch a doorknob. Lightning occurs when a large enough charge accumulates between the bottom of a cloud and the earth, such that an ionization path is created between the two, and electrons flow…
11	**Types of Electricity** Alternating Current (AC) The common form of electricity from power plant to home/office. Its direction is reversed 60 times per second in the U.S.; 50 times in Europe. Examples of AC usage: 1. Kitchens: Stoves, ovens, mixer, etc. 2. Computers (the plug) 3. Lights in house 4. Home air conditioners.  11/26/2013 Electronics Merit Badge Class 1 11	AC power is present in the home. Pay attention to safety around AC power. One idea to illustrate AC power is to get a scout to walk in one direction and then turn around and walk in the other direction. Each time he passes the instructor, he reaches out with his hand and pushes on the instructors hand. Though current flows in 2 directions, it is reasonably easy to see how it can be used to do electrical work.
12	**Types of Electricity** Direct Current (DC) Type of electricity used in most electronics we have today. Current only flows in one direction (not both directions, like AC). Examples of DC usage: 1. MP3 players 2. Radios 3. Electricity in cars. 4. Anywhere you use a battery for power.    11/26/2013 Electronics Merit Badge Class 1 12	We are talking batteries. Through a chemical reaction, batteries provide a flow of electrons --- current flow.

	SLIDE	TEACHER NOTES
13	**Basics of Electronics** • Current: Defined as "flow of electrons".  • Current: Units of current is AMPS. • Current: Electrical symbol for current is I (eye). 11/26/2013 Electronics Merit Badge Class 1 13	We will use positive flow, not electron flow when we talk about current.
14	**Current Flow – Water Analogy**  1. Water flows in the hose, entering at the top and exiting the bottom. 2. The water is the "current" ; the flow of electrons. 3. The more water flowing in the pipe, the more electrons are flowing in the wire. 4. Different pipe diameters illustrates different resistance to water flow, which correlates to different resistor values. 11/26/2013 Electronics Merit Badge Class 1 14	Get 1 scout to walk across the room. Now, get 2 scouts to walk across the room. The scout is an electron, and by walking, is equal to current flow. Two scouts walking are two electrons, and are doubling current flow. I know this is hokey, but can be used when it makes sense during the class.
15	**Voltage** • Volts is the electrical force that causes electrons (current) to flow. • Voltage can also be thought of as the electrical pressure that pushes electrons in a wire. • Units for voltage is VOLTS. • The symbol for voltage is E. • The schematic symbol for voltage is generally shown as a battery  11/26/2013 Electronics Merit Badge Class 1 15	

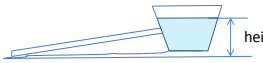
SLIDE

TEACHER NOTES

16

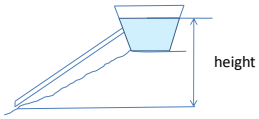
Voltage – Water Analogy

Small height = low voltage



1. Gravity provides the force for water (current) to flow.
2. This illustrates a small voltage, so electron flow is small.

Big height = high voltage



1. Gravity provides the force for water (current) to flow.
2. This illustrates a larger voltage, so electron flow is larger.

This is a very important concept to get across. Voltage, current and resistance are the basis for this class.

17

Resistance

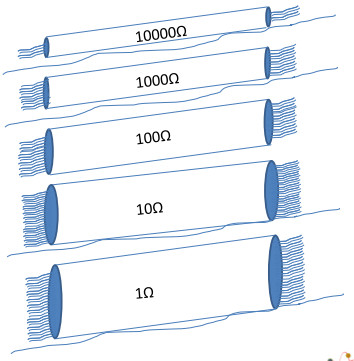
- Resistance is the electrical property of a substance to resist the flow of electrons (current).
- The units for resistance is OHMS (Ω).
- The symbol for resistance is R.
- The schematic symbol is
- The larger the resistance, the more resistance to current.

The larger the resistance, the less current, given the same voltage in the circuit.

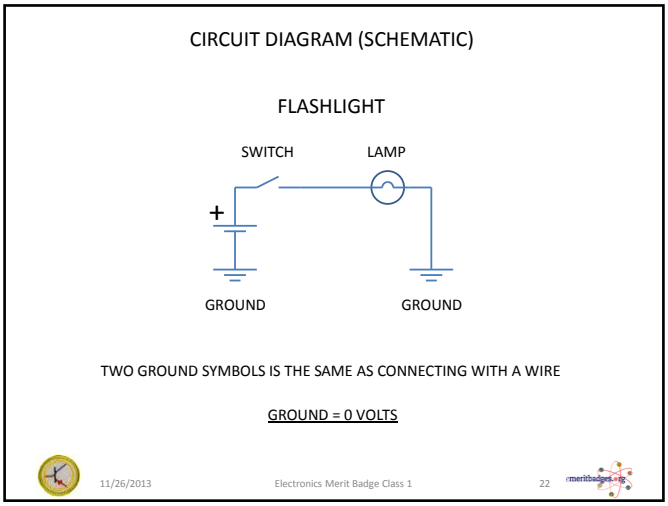
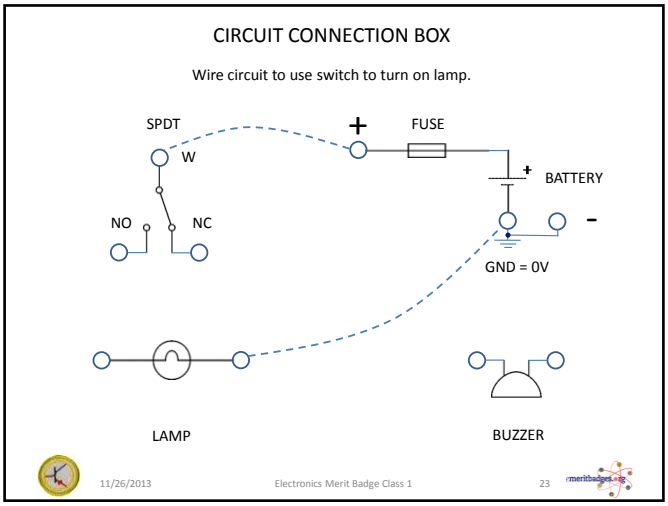
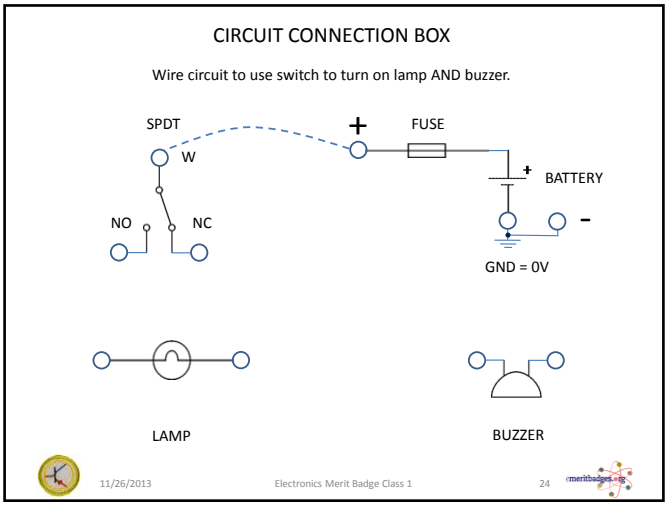
18

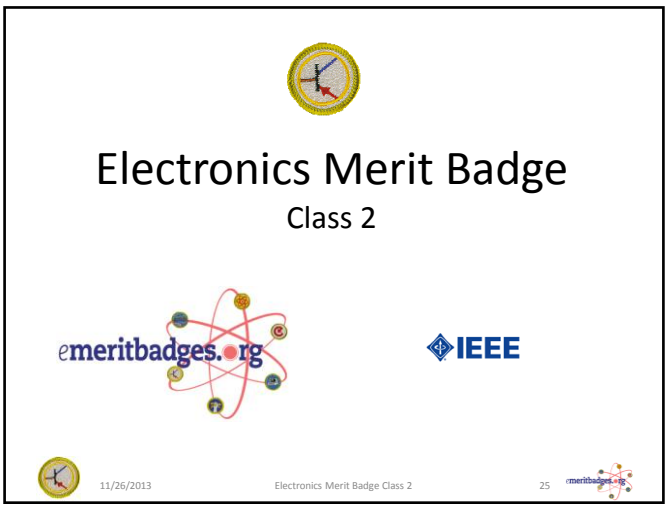
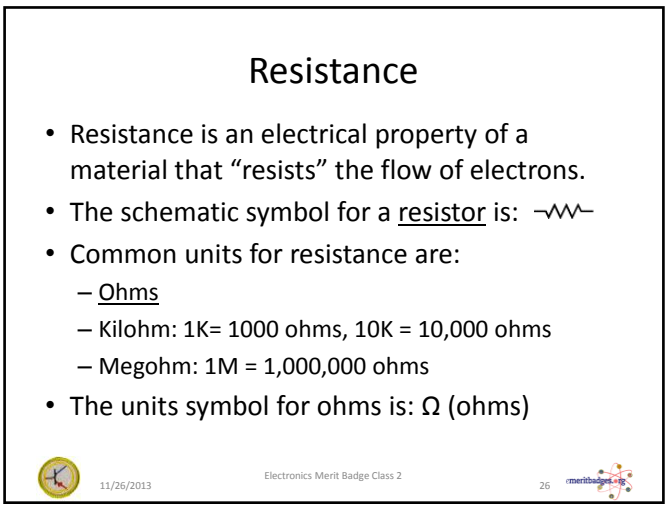
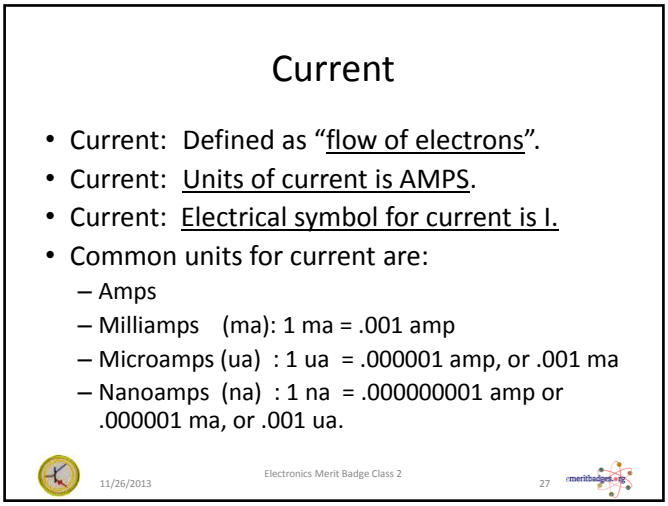
Resistance – Water Analogy

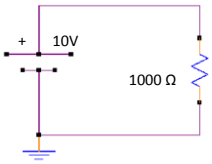
- Different pipe diameters represents different resistor values.
- The smaller the diameter of the pipe, the larger the resistance.



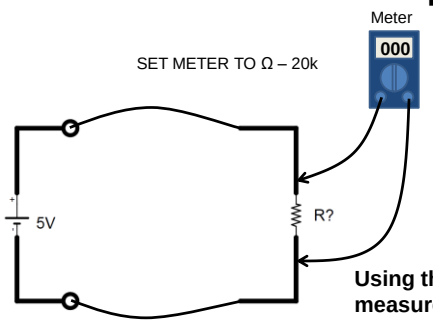
	SLIDE	TEACHER NOTES
19	**Power – Water Analogy** In electronics, power is equal to current X voltage. The units for power is WATTS. The symbol for power is W. In our water analogy, power is equal to water flow X pressure. You can see from the picture that more water flow will mean more force, and more pressure will mean more force. 	
20	**Ohms Law** • V = I x R : Volts = Current x Resistance • Units – Volts is in volts – Current is in amps – Resistance is in ohms 11/26/2013 Electronics Merit Badge Class 1 20	This is really, really important. If you understand ohms law, you have a really good understanding of basic electricity. Talk about how easy this equation is to remember and to use.
21	**Electronic Symbols** W NC NO Single Pole, Double Throw Switch (SPDT) + Battery Capacitor or Resistor Light Emitting Diode (LED) Buzzer Ground Fuse Lamp 11/26/2013 Electronics Merit Badge Class 1 21	These symbols will be used when drawing and wiring up the circuit we are going to do next.

	SLIDE	TEACHER NOTES
22		This simple schematic is the circuit of each flashlight. Place emphasis on ground, so that it is fully understood that ground = 0 volts.
23		WHEN INSERTING AND REMOVING THE WIRES, MAKE SURE THEY GRAB THE WIRES BY THE PLASTIC HOUSING, NOT BY THE WIRE ITSELF. Some of the connections on this example are already made, to show how to use the wiring kit. Draw the circuit before wiring it up. Talk about how the circuit works. SWITCH POSITION DOWN, IS NORMALLY OPEN. SWITCH POSITION UP, IS NORMALLY CLOSED.
24		SWITCH POSITION DOWN, IS NORMALLY OPEN. SWITCH POSITION UP, IS NORMALLY CLOSED. Draw the circuit before wiring it up.

	SLIDE	TEACHER NOTES
25		The main purpose of this class is to create an understanding about ohms law. This means there needs to be a good understanding of the concepts of current, voltage and resistance. The calculations done in this class can bog down unless you pay close attention to detail.
26		Units are important in engineering. These are very common terms that are used all the time when talking about these components.
27		It is important that emphasis be placed on units. Ma = milliamp = .001 amp. It is necessary to get this correct, as it will be used when we do the calculations later.

	SLIDE	TEACHER NOTES
28	**Voltage** • Volts is the electrical force that causes electrons (current) to flow. • Units of volts is VOLTS. • The symbol of volts is E or V. We will use V. • Common units for voltage are: – Volts – Millivolt (mv) : .001 volt. – Microvolt (uv) : .000001 volt, or .001 mv – Nanovolt (nv) : .000000001 volt, or .000001 mv, or .001 uv. 11/26/2013 Electronics Merit Badge Class 2 28	
29	**Ohms Law** • One of the most important laws in electronics/electricity. • V = I x R : Voltage = Current x Resistance • Volts is measure in VOLTS, current is measured in AMPS, and resistance is measured in OHMS. • 1 AMP, going through 1 OHM of resistance, generates a voltage drop of 1 VOLT. • 1 V = 1 A x 1 Ω. 11/26/2013 Electronics Merit Badge Class 2 29	Ohms's law is the purpose of this class. Clear understanding of current and voltage and resistance is key in making ohm's law comprehensible.
30	**More Ohm's Law** Different forms of Ohm's Law: V = I x R : Voltage = Current X Resistance I = V / R : Current = Voltage / Resistance R = V / I : Resistance = Voltage / Current  Volts = 10. Resistance = 1000Ω Compute current. I = V / R I = 10 / 1000 = .01A .01A = 10ma Question: what would the current be if the voltage was 1 V? How about 1000 V? 11/26/2013 Electronics Merit Badge Class 2 30	Make sure everyone understands this page. Make sure they understand that the units (decimal place) is extremely important when doing these calculations. Getting them to think about the alternative questions (1V and 1000V) is good – especially if they can understand the difference in current just by looking at the difference in voltage, (resistor is unchanged). Perhaps looking at the example, and asking about what the current would be if only the resistor was changed from 1000 ohms to 1 ohm, shows another way to look at this simple relationship.

	SLIDE	TEACHER NOTES
31	Ohm's Law Exercise • Using a meter, we will measure some resistors. • Then, using ohm's law, we will calculate the resistor's values. To do this, we will use the meter to measure current and voltage in a circuit. 11/26/2013 Electronics Merit Badge Class 2 31	Since the meter is used for measuring current and voltage, this would be a good time to talk about the meter some. I would show how we need to move the leads when measuring current, and then move them back when we are measuring voltage. Emphasize that if we measure voltage, when the meter is dialed to current and the leads are in the current locations, we will blow up the meter….
32	Ohms Law – Step 1 Meter 000 + - SET METER TO DCA -20m A 5V R? B **Using the meter, measure current.** **I = _____ amps**	
33	Ohms Law – Step 2 Meter 000 SET METER TO DCV - 20 5V R? **Using the meter, measure voltage.** **V = _____ volts**	

	SLIDE	TEACHER NOTES
34	**Ohms Law – Step 3** **Calculate resistance from your 2 measurements.** **Ohms Law : V = I x R.** **Therefore, R = V / I <- Use this equation.** **Note: you will be measuring current on the 20ma range, so a value of 2.5ma needs to be written as .0025A when using this equation.**	
35	**Ohms Law – Step 4**  **Using the meter, measure Resistance.** **R = _____ ohms** **How does this compare with your calculated value?**	
36	**Electronics Merit Badge** **Class 3** emeritbadges.org IEEE 11/26/2013 Electronics Merit Badge Class 3 36	In this class, we talk about binary and hexadecimal numbers. We have a teaching aid to assist in understanding how to count in these number systems. We show how a flip-flop works, and how they can be used to form a binary counter. We draw the kit schematic, in preparation for the last class – building the kit.

	SLIDE	TEACHER NOTES
37	**Decimal – Base 10** • In base 10, there are 10 unique digits (0-9). • When writing large numbers (more that 1 digit), each column represents a value 10 times larger than the previous column. • We say, how many 1's, how many 10's and how many 100's are there? 123 → 1s column, 10s column, 100s column There is 1 '100' and 2 '10's and 3 '1's, Making this number equal to one hundred and twenty three. 11/26/2013 Electronics Merit Badge Class 3 37	Everyone should already know this.
38	**Binary – Base 2** • In base 2 (binary) there are two numbers, 0 and 1. • When writing large numbers (more that 1 digit), each column represents a value 2 times larger than the previous column. • We say, how many 128s, how many 64s how many 32s, how many 16s, how many 8s, how many 4s, how many 2s and how many 1s are there? 1011 → 1s column, 2s column, 4s column, 8s column There is 1 '8' and 1 '2' and 2 '1', making this number equal to eleven. 11/26/2013 Electronics Merit Badge Class 3 38	This is a little more complicated than base 10, since they are not used to thinking this way, but I think it can be emphasized how easy it is to think in base 2. If they understand this isn't really that complicated, it makes them more open to understanding base 16.
39	**Counting to 16 in Binary** 11/26/2013 Electronics Merit Badge Class 3 39	

number	16	8	4	2	1	Binary
0	0	0	0	0	0	00000
1	0	0	0	0	1	00001
2	0	0	0	1	0	00010
3	0	0	0	1	1	00011
4	0	0	1	0	0	00100
5	0	0	1	0	1	00101
6	0	0	1	1	0	00110
7	0	0	1	1	1	00111
8	0	1	0	0	0	01000
9	0	1	0	0	1	01001
10	0	1	0	1	0	01010
11	0	1	0	1	1	01011
12	0	1	1	0	0	01100
13	0	1	1	0	1	01101
14	0	1	1	1	0	01110
15	0	1	1	1	1	01111
16	1	0	0	0	0	10000

SLIDE

TEACHER NOTES

40

Hexadecimal

- Hexadecimal represents numbers as base 16.
- It is easier to write and read a large number by describing it in hex rather than in binary.
- Each number column is a power of 16 higher.
- The digits for hexadecimal are 0-9, A,B,C,D,E,F.

123

1s column
16s column
256s column

There are 1 '256' and 2 '16's and 3 '1's, making this number equal to 291.

11/26/2013 Electronics Merit Badge Class 3 40

It is worth spending a little time making sure they understand this concept.

Base 16 is the language used by engineers and programmers when talking about binary. And, there are lots of discussions surrounding binary values.

41

Counting to 16 in Binary AND Hex

Decimal	16	8	4	2	1	Binary	Hex
0	0	0	0	0	0	00000000	0
1	0	0	0	0	1	00000001	1
2	0	0	0	1	0	00000010	2
3	0	0	0	1	1	00000011	3
4	0	0	1	0	0	00000100	4
5	0	0	1	0	1	00000101	5
6	0	0	1	1	0	00000110	6
7	0	0	1	1	1	00000111	7
8	0	1	0	0	0	00001000	8
9	0	1	0	0	1	00001001	9
10	0	1	0	1	0	00001010	A
11	0	1	0	1	1	00001011	B
12	0	1	1	0	0	00001100	C
13	0	1	1	0	1	00001101	D
14	0	1	1	1	0	00001110	E
15	0	1	1	1	1	00001111	F
16	1	0	0	0	0	00010000	10

11/26/2013 Electronics Merit Badge Class 3 41

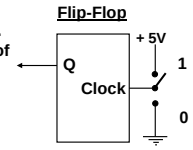
We'll use the binary tool kit a little later to reinforce binary, decimal and hexadecimal conversions.

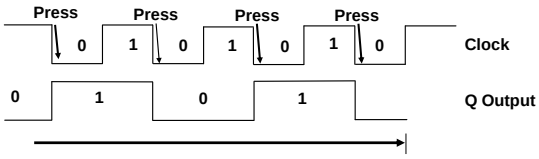
I have found that this is where some find it difficult to follow base 16 counting. I think it valuable to spend a little extra time on this for those that need it.

42

FLIP-FLOP

Press the switch, the clock goes to 0 volts (logical 0).
Release the switch, the clock goes to 5 volts (logical 1).
The output (Q) changes state on each 1 to 0 transition of the clock.
A flip-flop basically divides the clock by 2. It takes 2 clock transitions to make the output change once.





11/26/2013 Electronics Merit Badge Class 3 42

Here we start to blur the lines between voltages and logical values. 5 volts = logical 1, and 0 volts (ground) is logical 0.

This equating voltage levels with binary values helps in understanding how electronic circuits can be made to do counting and other 'math' functions.

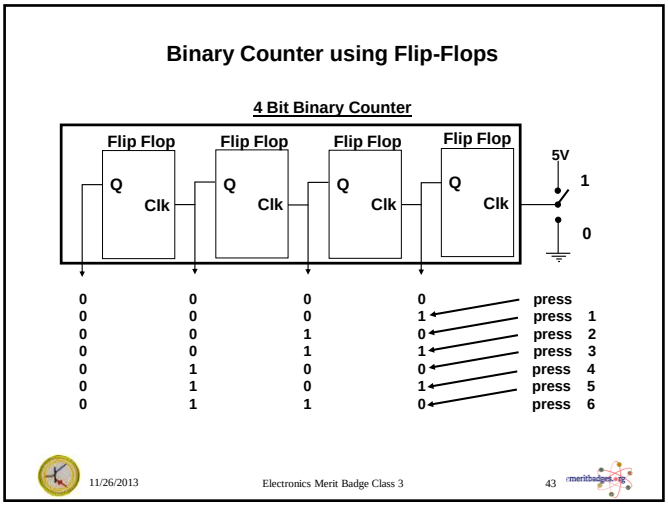
The flip-flop is a building block for many other complicated circuits.

A clock edge is a '0 to 1' transition, and a '1 to 0' transition.

SLIDE

TEACHER NOTES

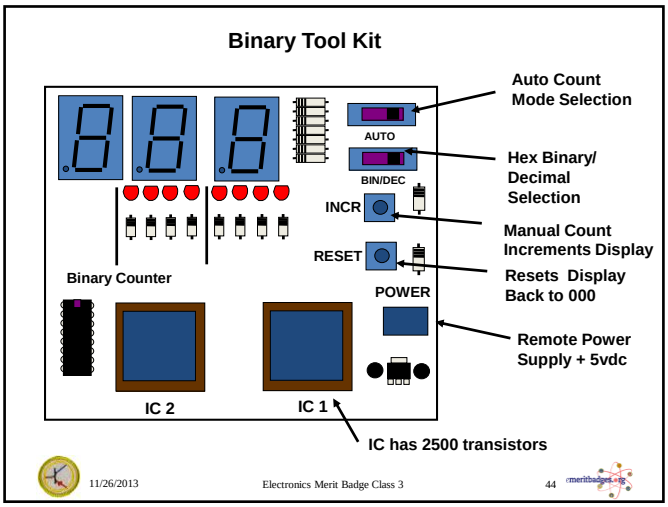
43



I have had success with the following activity. It also kind of wakes everyone up.

- Get 5 scouts to bring their chairs and sit up front. Have them face the room and sit shoulder to shoulder.
- The scout on the far left is the clock.
- The instructions are: every time the scout on your left sits down, you change state. If you are sitting, you will stand. If you are standing you will sit.
- Instruct the clock to stand up and then sit down. Enforce the rules. They have become a 4-bit counter…

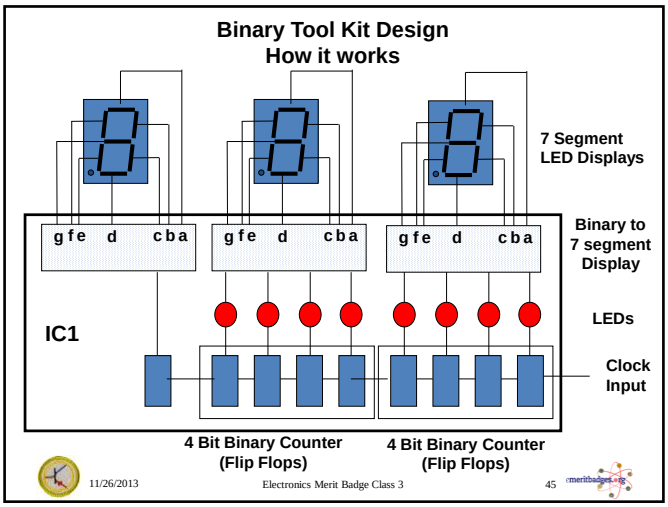
44



This diagram shows the original (older) counter circuit. There is a newer counter designed, and some of the scouts will have it instead of the old one.

The 2 circuit boards do equivalent things.

45



- Talk about 7 segment displays. Each segment is an LED. We only turn on the segment that we want to display a particular number.
- Even more interesting; we really only turn on 1 segment at a time, but do it so quickly that it looks (to the human eye) that each segment is always on. This is called multiplexing.
- Every time we press the INCR button, the electronics increments a counter, and then the newest count value is displayed in the 7 segment displays.

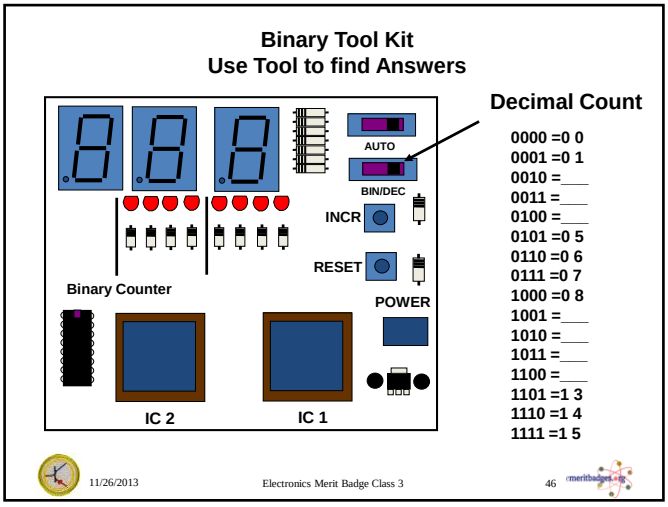
SLIDE

TEACHER NOTES

- The BIN/DEC (DEC/HEX on newer kits) switch selects how the counters are incremented.
- The 8 individual LEDs show us the binary representation of the current count.

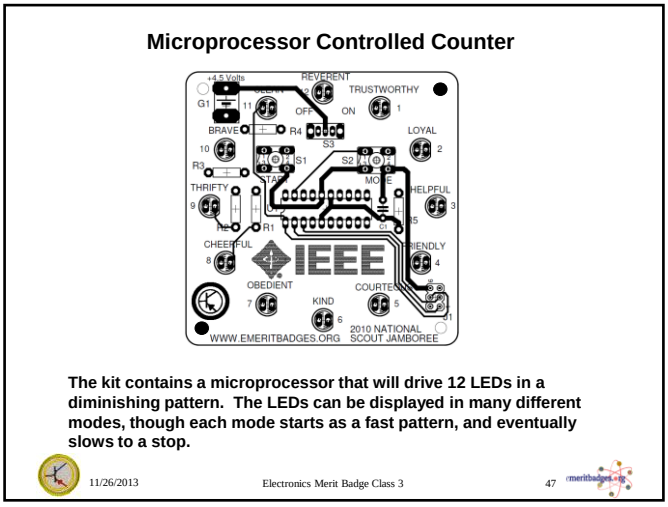
The newer circuit board operates in the same way, but is controlled by a microcontroller, and the program implements the counter and display functions.

46



Rather than have anyone write the answers on a piece of paper, it is better to just have everyone participate by voicing the answers.

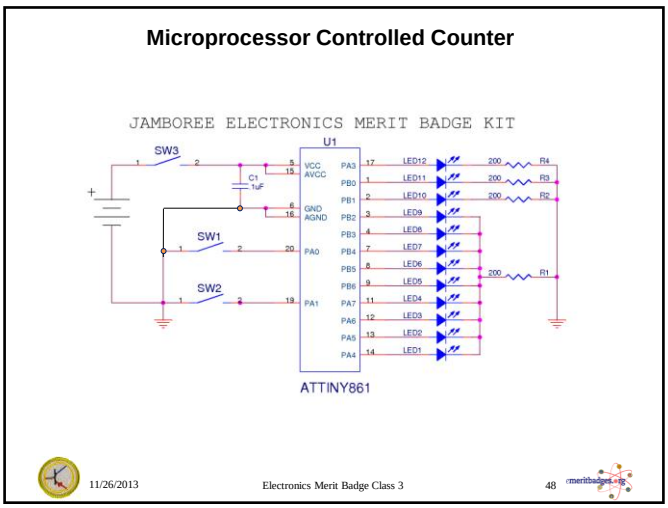
47



The scouts will build this kit (or one like it), but before they do, they must understand how it works, and they must draw the schematic.

48

SLIDE



TEACHER NOTES

Take a good look at this schematic. You (the scout) will be required to draw this schematic once we go to the next slide.

Spend a little time describing the elements of the circuit, and why they are connected as they are. If they can understand the 'why' a little, it will make drawing the schematic easier.

The battery provides power. The negative of the battery is GROUND, indicated by the ground symbol. The ground symbol means that that particular place in the schematic is connected to the negative of the battery. Notice where all the ground connections are.

The 2 switches provide the START and MODE signals to the microcontroller.

SW3 is the ON/OFF switch and when ON, connects the positive of the battery to the rest of the circuit.

The capacitor (C1), helps keep the battery voltage stable, which makes the circuit work more reliably.

The microcontroller performs the intended logic, and basically turns on each LED in the proper sequence, based on MODE and START.

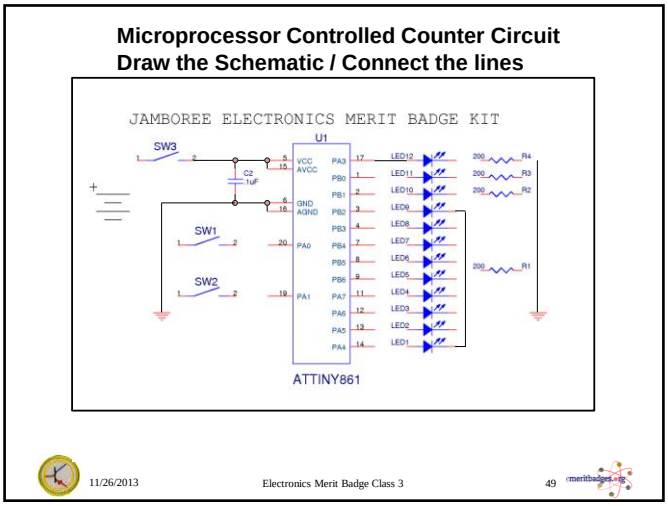
Note there are 4 resistors connected to the LEDs. The three individual resistors are needed when we are writing the program into the microcontroller.

When the circuit is operating in a normal fashion (NOT programming the microcontroller), the resistors control how much current flows through the LEDs, which controls how bright they get.

SLIDE

TEACHER NOTES

49



Some of the connections are provided, to help in remembering how the circuit is connected.

It would be best, if possible, to give assistance in the form of questions:

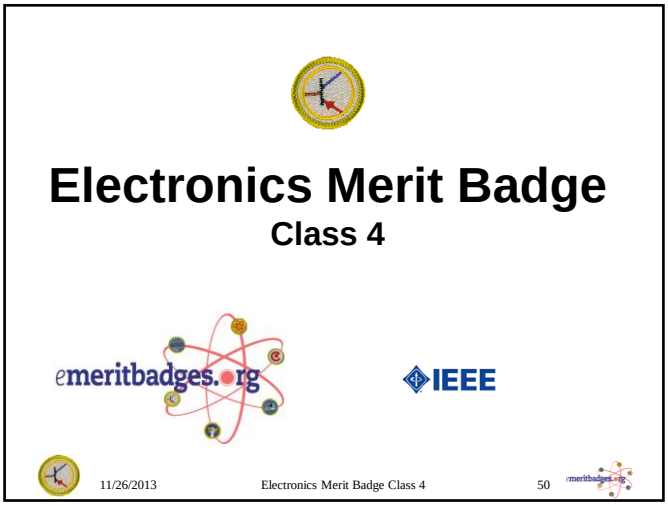
For example: Where does the negative of the battery connect (answer: ground).

Where does the positive of the battery go to?

What are the resistors used for (to help in remembering where they are connected).

All scouts MUST complete this drawing.

50

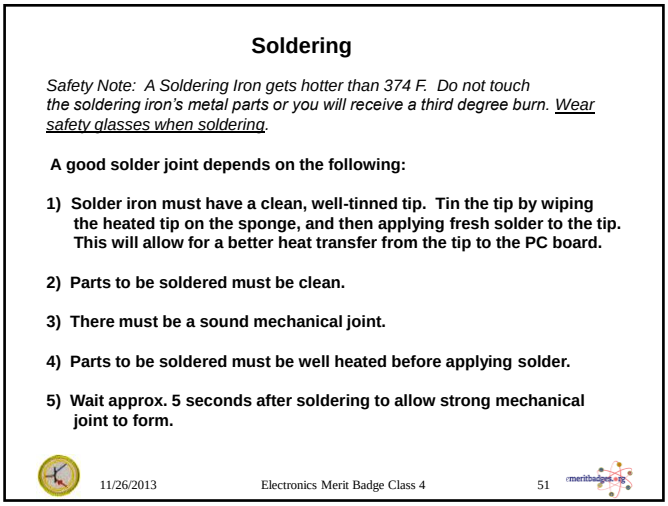


In this class we learn how to solder and unsolder.

We unsolder a component from a pc board.

We build the kit.

51



Emphasize safety.

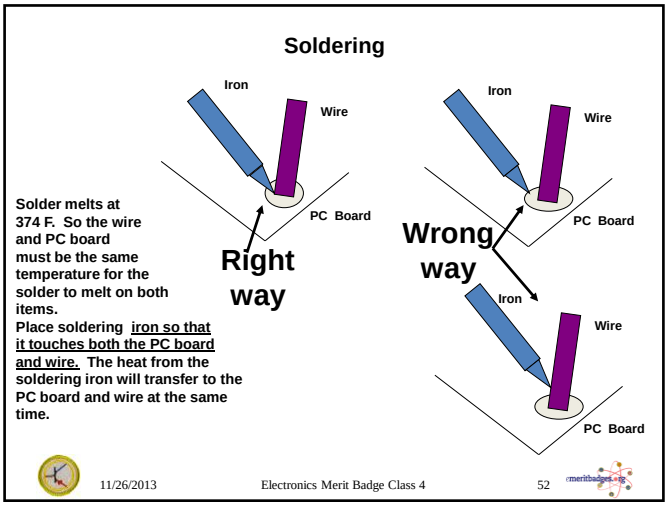
I always relate soldering to using a knife - maintain a safety circle around yourself when using a soldering iron.

Make sure you only grip the soldering iron by the handle. If you touch the iron itself, it WILL burn you.

SLIDE

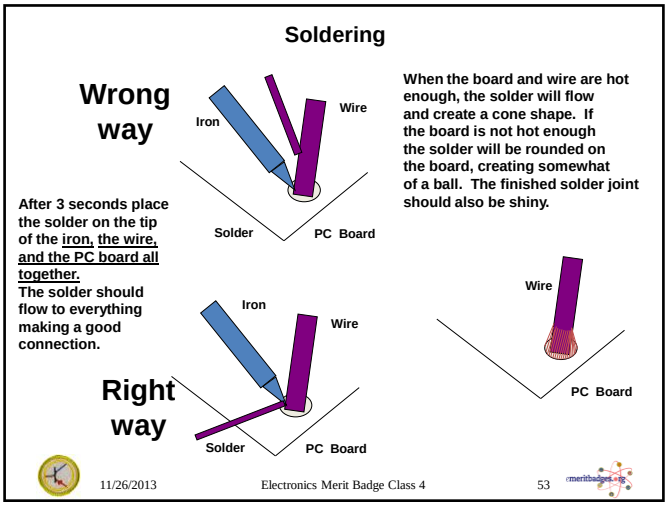
TEACHER NOTES

52



It is a good idea for the instructor to show how to do a good solder joint. Once you give them the kit to start building, it will be difficult to get their attention to show how to solder, so it is best to do it now.

53



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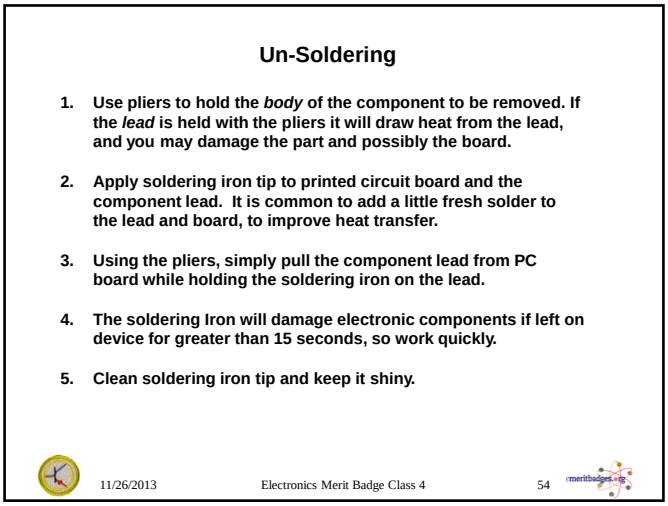


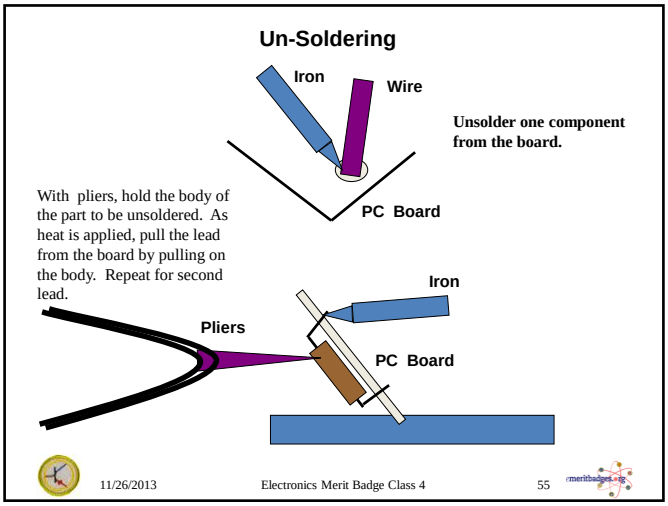
It is a good idea to show how to unsolder a component before turning them loose.

Note that this is where a good number of instructors/assistants can be very useful. Good supervision when learning to solder gives them feedback when they are most receptive to being taught. This is a highly teachable moment.

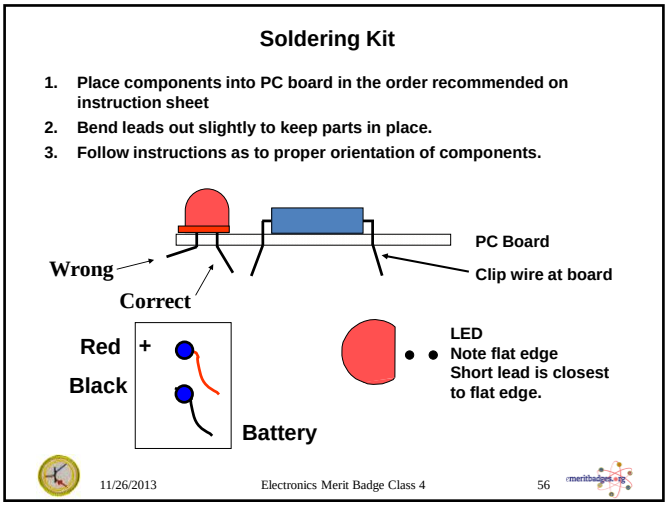
SLIDE

TEACHER NOTES

55

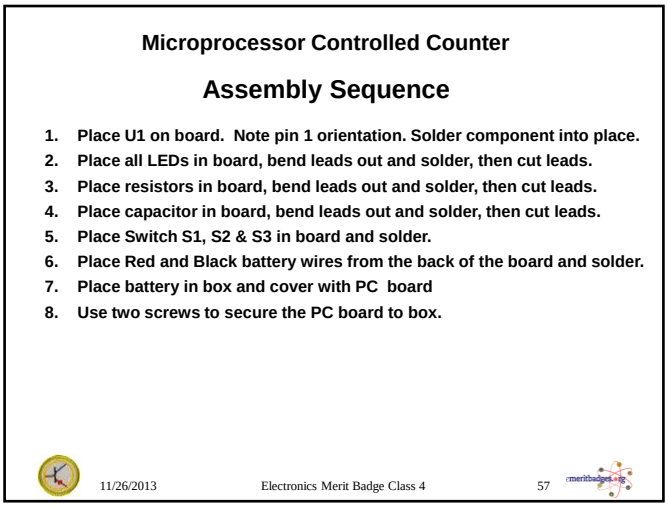


56



- Orientation of the LED is EXTREMELY important. Make sure the shorter LED lead is next to the flat side of the LED silkscreen. If this isn't correct, then you will be spending time removing the misoriented LED and resoldering it back down. This is not particularly fun.
- Also, orientation of the battery leads is CRITICAL. If these are not correct, then when you turn on the kit, the battery will get very hot, and U1 will be destroyed. Removing U1 is not particularly fun either.
- Orientation of the resistor or the capacitor is not important.

57

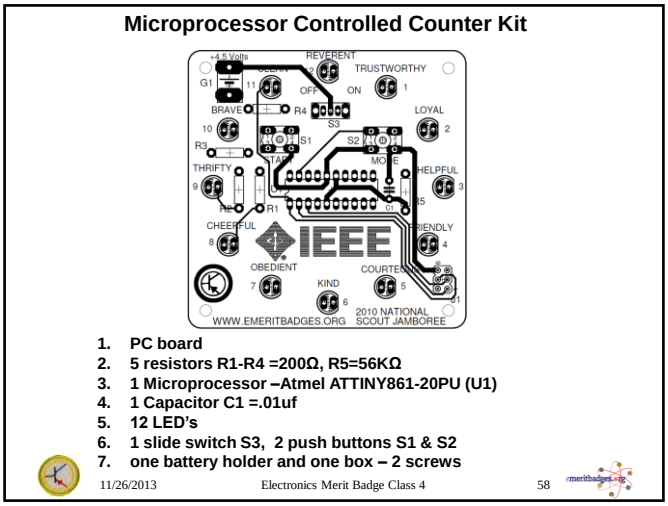


- To make the board look good, I solder only 1 LED lead initially, and then while heating that lead with the soldering iron, push the LED package flush with the PC board. THEN, turn the board back over and solder the second lead.
- Also, if there are multiple colors of LEDs, pay attention to which color LED gets placed where.
- Resistors can be treated in the same manner, but be a little more careful, as the resistor body will get pretty hot when heating up the one lead.

SLIDE

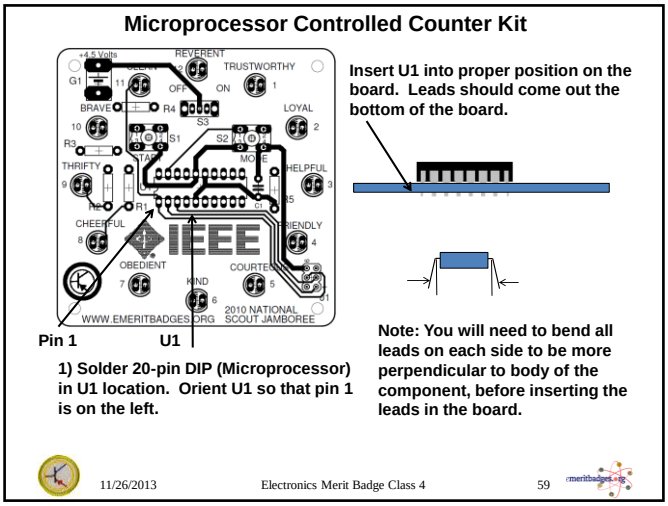
TEACHER NOTES

58



- The ON/OFF switch can also use a little extra attention. Solder only one of the leads, and then , while reheating that lead from the bottom, position the switch so that it is not leaning to one side or the other. Then, solder the rest of the leads.

59

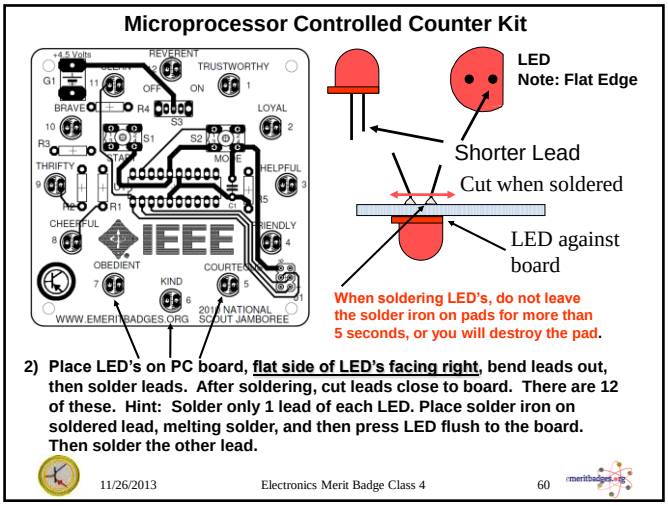


- You can straighten the leads of the component all at once, by holding one edge of the component against the table, and carefully pressing all the leads into a more vertical orientation. While you do this, be careful you are not bending any of the leads on the side of the component that is not against the table.
- Orientation of U1 is CRITICAL. If it is backwards, it will be damaged when power is first applied. To fix it, you will have to remove U1 from the board and solder a new U1 in its place.

SLIDE

TEACHER NOTES

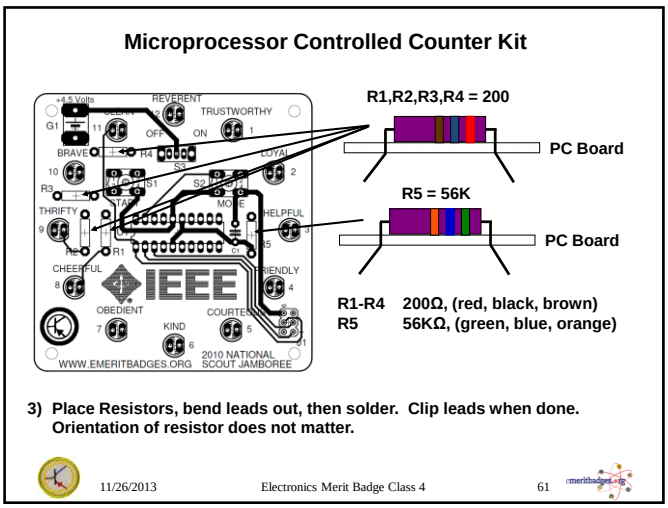
60



Orientation is critical.

The construction of the LEDs is such that there is a diagonal slot inside, between the 2 metal members of the LED structure. It is easy to notice if all the LEDs have been inserted correctly by making sure this diagonal slot points in the same direction.

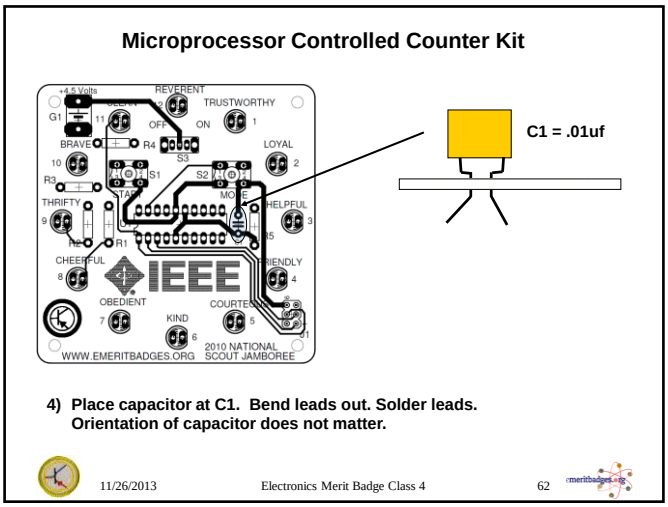
61



It is important to get the 200 ohm resistors in the R1,R2,R3 and R4 positions. Putting the 56K resistor in one of these locations will make at least 1, but possibly many more of the LEDs to not turn on.

For those who are color blind, instruct them to just find the 4 resistors that are the same, and those are R1-R4. The oddball resistor is 56K (R5).

62

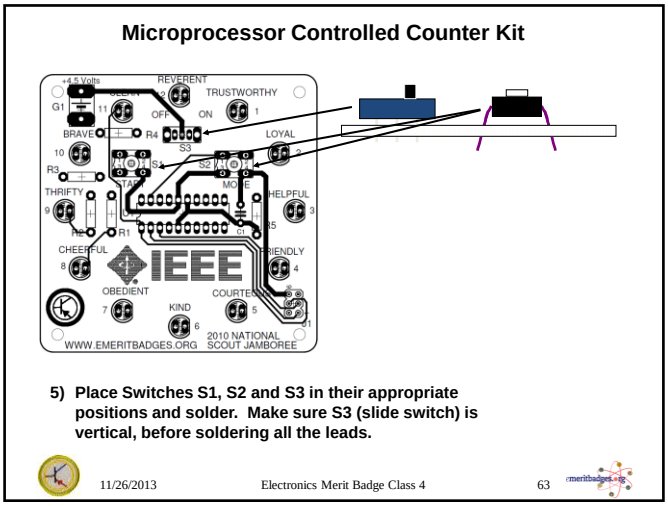


Orientation of the capacitor does not matter.

SLIDE

TEACHER NOTES

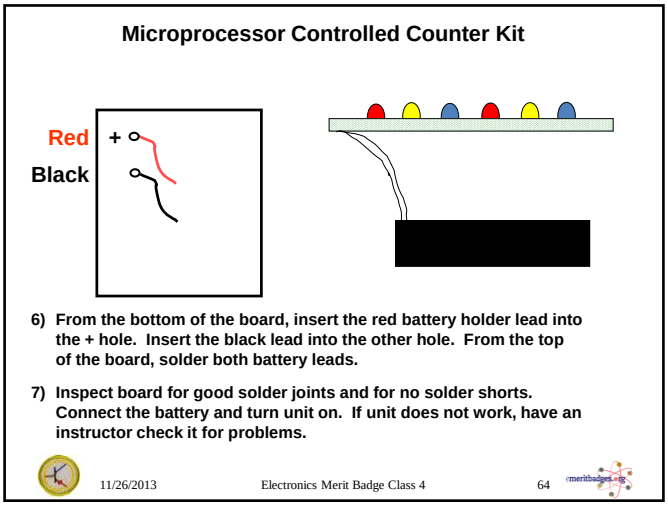
63



S3 is the ON/OFF switch. Orientation does not matter, but I would try and make sure the connector ends up vertically with respect to the pc board. This is just for looks.

S1 and S2, once inserted, will not fall out, so it is easy to install these guys. They only fit in one way (it's a rectangular part), so just insert it and then solder.

64

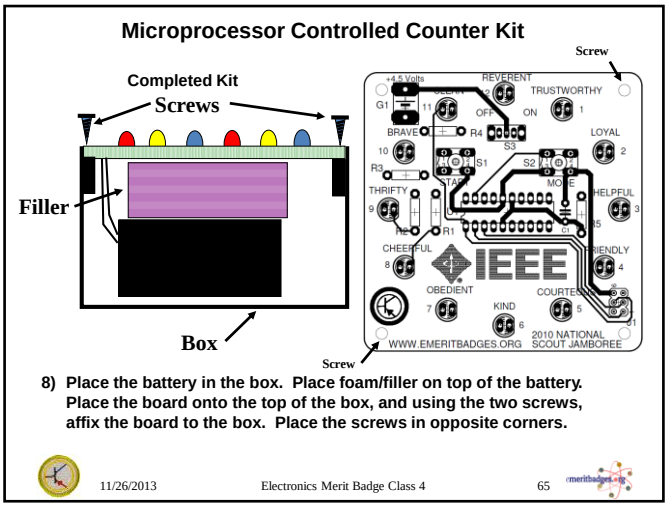


Experience has shown that it is best to have the board inspected before applying power. I would have either the instructor or an assistant, both who should know what to look for, check the board for obvious problems:

- Solder Shorts
- Opens connections; no solder.
- Cold solder joints.
- LEDs in backwards.
- IC in backwards.
- Resistors in the wrong position.
- Battery wires not in the correct place.

I think scouts really like it when their kit works the first time they power it on. That is why inspection is so important.

65



This talks about foam as a filler, but I have found that wadded up paper works just as well.