A+ Unit One: Safety and Electrical

Student Name		Member of Team		Team Lead		AM/PM
Certifications	A+					

Learning Targets

1. Understand the basics of electricity.
2. Understand the difference between a conductor and a resistor.
3. Identify what makes an item a good or poor conductor.
4. Define volts.
5. Understand the relationship between current and voltage.
6. Understand the purpose of a switch in a circuit.
7. Understand how to measure current.
8. Understand the relationship between resistance and amps.
9. Describe what creates a magnetic field.
10. Build a circuit.
11. Build a circuit with a switch.
12. Draw a circuit with all parts appropriately labeled, including the flow of electricity.
13. Demonstrate the measuring of voltage and amperage with a multimeter
14. Identify the different resistors on a circuit board.
15. Identify what the colored bands mean on a resistor.
16. Using the Comptia troubleshooting method, rule out and identify power problems.
17. Document things I tried that did not work.
18. Document things I tried that did work.
19. Return computer to working order.
20. Identify dangers in testing a power supply.
21. Understand how to short out pins 15 and 16 to turn on Power Supply
22. Understand how to test the power supply connector with a multimeter
23. Understand how to test power supplies using a power supply tester
24. Identify the purpose of each of the power supply connector
25. Test resistance on a motherboard
26. Test resistance of the motherboard speaker
27. Understand the purpose of a capacitor.
28. Recognize the impact different capacitors have on control of flow of energy
29. Recognize the impact different resistors have on control of flow of energy

Turn in for this unit for a base grade (C+/B-)

		Time Allotted	**8 Days**
Labs	Lab Report	Team Lead Check Off	Teacher Check Off
1-1 Basics of Electricity			
1-2 Basic Electrical Circuits			
1-3 Power Troubleshooting			
1-4 Power Supply Protection			
1-5 Testing Power Supplies			
1-6 Testing capacitors			
1-7 Power supply facts			

Turn in for this unit for a base grade (B/A) for students looking for collect credit

✓ Customer Overview	
✓ List of current needs	
✓ List of future needs	
✓ Jargon	

✓ List of questions asked of customer	
✓ Written (at least 2 full page, double spaced) proposal that describes, in clear English, your solution.	
✓ Diagram of computer components	
✓ Worksheet from lab	
✓ Printout of spreadsheet showing complete cost of ALL computers and hardware and software	

CORNELL NOTES SHEET	Name: _____ Class: _____ Topic: _____ Date: _____/ _____/ _____
QUESTIONS	NOTES

SUMMARY: Write 4 or more sentences describing specific learning from these notes.

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CORNELL NOTES SHEET	Name: _____ Class: _____ Topic: _____ Date: _____/ _____/ _____
QUESTIONS	NOTES

SUMMARY: Write 4 or more sentences describing specific learning from these notes.

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LAB 1-1 BASICS OF ELECTRICITY

Learning Targets

When I get to the end of this lesson, I can do these things:

1. Understand the basics of electricity.
2. Understand the difference between a conductor and a resistor.
3. Identify what makes an item a good or poor conductor.
4. Define volts.
5. Understand the relationship between current and voltage.
6. Understand the purpose of a switch in a circuit.
7. Understand how to measure current.
8. Understand the relationship between resistance and amps.
9. Describe what creates a magnetic field.

Success Criteria

When I've finished this section, I will have completed these thing:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Answer all questions		Ready to be checked by Tory	Emerging Knowledge Comprehension Application
Demonstrated static electricity with balloon and EXPLAINED how it worked to second year.		Ready to be checked by Tory	Emerging Knowledge Comprehension Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	

Go to the following webpage and go through the interactive electricity lab for an overview of the basics of electricity.

http://ippex.pppl.gov/interactive/electricity/

- Before beginning, get a balloon from me.
- As you do the lab, answer the questions below.

1. What is an atom?	
2. What is the normal "charge" of an atom?	

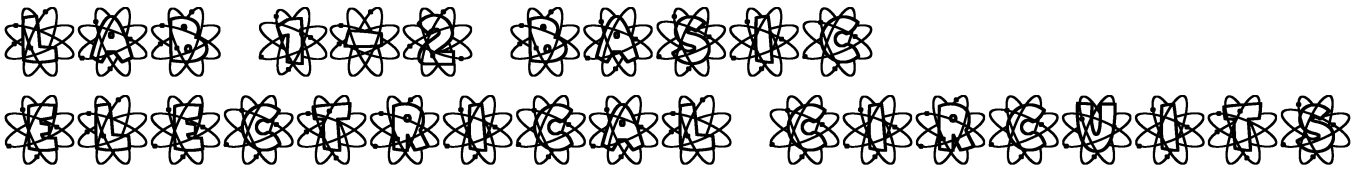
3. Define electricity.	

Before doing the balloon thing, get AWAY from the computers. Static electricity can kill the computer. When you rub a balloon on your head you literally create tens of thousands of volts! This voltage has no current and is literally waiting to be conducted to another source. Touching a good conductor, such as metal, moves the voltage from your body through to the grounded object you just touched. Scuff your shoes on the carpet and that's 10,000+ volts being built up. The more painful the shock, the higher the voltage!

That's why some physicists call static electricity high voltage electricity!

4. Why will a balloon rubbed against your hair or a wool sweater stick to a wall?	
5. Charge up your balloon and try to stick it to your neighbor's balloon. Does it stick? Why or why not?	
6. Since rubbing your hair against the balloon, or your feet on the carpet, creates a positive charge, why is it important to ground yourself before working on a computer?	
7. What happens during a storm that causes lightning?	
8. Describe how electricity flows through a wire.	
9. Define resistance	
10. A copper wire would have what kind of resistance?	
11. Why are plastic and glass good insulators?	
12. How do you get an atom or group of atoms to create electricity?	
13. Define volts	

14. What is the purpose of a switch in an electrical circuit?	
15. How can you measure the current passing through a wire?	
16. What is this measurement called?	
17. As resistance gets _____ amps get higher.	
18. As voltage gets higher, amps get _____.	
19. In magnetism, opposite poles _____ and similar poles _____.	
20. Describe a magnetic field.	
21. What is a simple way to make a magnet?	
22. Circling a magnet around a wire will produce what?	
Extrapolate from what you learned.	
23. Why is it important to keep small magnets away from computers?	
24. How come static electricity can fry a computer component?	
25. Why are there different wattage ratings for different power supplies?	



Learning Targets

When I get to the end of this lesson, I can do these things:

1. Build a circuit.

2. Build a circuit with a switch.
3. Draw a circuit with all parts appropriately labeled, including the flow of electricity.
4. Demonstrate the measuring of voltage and amperage with a multimeter.
5. Identify the different resistors on a circuit board.
6. Identify what the colored bands mean on a resistor.

Success Criteria

When I've finished this section, I will have completed these things:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Created circuit without switch and with switch. Explained how the switch modified the circuit.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Measured voltage of circuit correctly		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Measured amperage correctly.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Answered questions		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

Materials Required

- ⚡ _One 9-volt battery
- ⚡ _Electronic Playground and Learning Center
- ⚡ _Four pieces (two short, two long) of standard-grade electrical wire

ACTIVITY

Creating a circuit

1. Connect your 9volt Battery to the board.
2. Take your long wires.
3. Attach one end of one to LED2s first lead (3). To attach, bend the spring, slip the exposed end of the wire in between the springs.
4. Now attach the other end to 27.
5. Take the end of that wire and attach it to the first spring on the battery (26)
6. Now attach another wire between 4 and 26.

7. Finally attach another wire between 45 and 55.
8. What happens?

9. Why?

Creating a Circuit with a Switch

1. Disconnect your wires from the battery.
2. Connect one long wire from 3 to the 10kΩ connector. Notice that you see a little resistor there. A resistor **resists** or slows the flow of energy. Remember that.
3. Now connect one long wire from 4 to 26.
4. Take your two small wires. Connect one from 27 to 56. Push the button. What happens?

5. Why?

6. Where do you need to connect the other small wire to create a circuit controlled by the switch?

7. Not move your wires from the 10kΩ to the 1kΩ and push the switch.

8. Turn on the light and what happens? Is the light brighter, or dimmer?

9. Why?

10. Which of those resistors slows the flow of energy down more?

11. What do you think will happen if you attach the leads to the 100kΩ resistor?

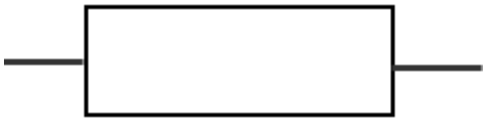
12. This is **Ohms Law** in action! Ohms law states that

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

Current= voltage divided by resistance…or the higher the resistance, the lower the current flows. If you have lower resistance, the faster the current can flow. Voltage is what makes the current flow. Lower resistance=brighter LED.

13. Look at each of your resistors very closely. What do you notice about them?

14. **Draw the following resistors and label the colors of their bands**

Resistor	Drawing
1kΩ	
10kΩ	
100kΩ	

The color bands tell you what the resistor is.

- The first ring is the first digit of the resistor's value
- Second ring is the second digit of the resistor's value
- Third ring tells you the power of ten to multiply by (or the number of zeroes to add)
- Fourth ring tells you the construction tolerance. Most have a gold band for 5% tolerance, which means that it is guaranteed to offer resistance within 5% of the marked value. (So a 100kΩ transistor with a gold band would offer resistance from 95 to 105Ω).

Color table

Color	Value
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

So a resister that had a bands, in order: red, violet, orange, gold would be translated as

$27X10^3$=27000Ω with a 5% tolerance.

10. **In the space provided below, draw a diagram demonstrating the flow of electricity in the circuit you have created. Be sure to note the direction of the current's flow**.

Measuring voltage

1. Configure your multimeter to measure the voltage of your circuit.
    a. Connect the red lead to the VΩmA jack
    b. Connect the black lead to the COM jack
2. Attach the +/- leads from your multimeter to the respective +/- sides of the battery (26 and 27). You can just touch the wires connected to those positions.
3. Turn the dial on your multimeter to the closest voltage measurement you expect to see (hint…this is a NINE volt battery).
4. What voltage do you see on the window (it'll change, but should settle within a few seconds)?

5. Now with the help from a friend, take the leads and touch the wires leading out of 3 and 4 by the light. Have someone push the switch. What is the voltage?
6. Why is it different from the answer you got above? What is between the battery and the LED?
7. Change the resistance from 10kΩ to 1kΩ. Now what is the voltage with the switch on?

Measuring amps (current)

1. Amps are measured with the current running, since it's a measurement of current.
2. Configure your multimeter to measure the amps of your circuit.
    a. Plug in the red wire to the VΩmA jack
    b. Plug in the black wire to the COM jack
    c. Turn the dial to the Amp area (see directions…hint, Amp starts with A) closest to the amperage you expect to find. If you don't know, set it to the highest one and change until you get a reading that seems reasonable.
3. Have a friend hold down the switch.

4. Touch the leads to 3 and 4. Record the amperage.
5. Now let go of the switch and what readings do you get? Why?

6. Now take and touch the leads (without pressing the switch) to the wires at 55 and 56. What happens?

7. Why?

Because of this you must be very careful when testing amperage in a live circuit because you CAN complete that circuit. Your multimeter must have a high enough rating to handle the current.

Review Questions

Circle True or False.

1. Resistance is measured in ohms. True / False

2. A switch can act as a break in a circuit. True / False

3. AC is the acronym for ampere. True / False

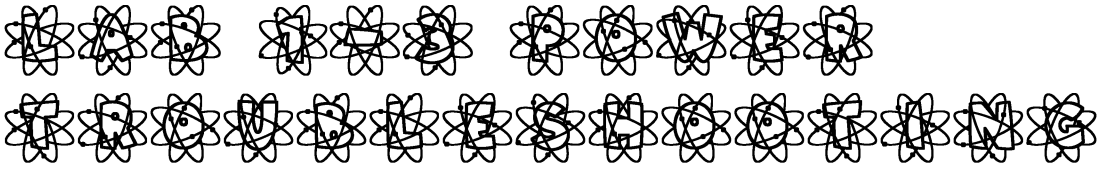
4. A multimeter can measure only voltage. True / False

5. In a circuit, amps and volts are always the same amount when measured. True / False

6. Describe the difference in multimeter placement for measuring volts and amps.

Research

- **What does AC mean?**
- **What are amps?**
- **What are volts?**
- **What is wattage?**
- **What are ohms?**



Learning Targets

When I get to the end of this lesson, I can do these things:

1. Using the Comptia troubleshooting method, rule out and identify power problems.
2. Document things I tried that did not work.
3. Document things I tried that did work.
4. Return computer to working order.

Success Criteria

When I've finished this section, I will have completed these things:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Tested computer initially to ensure that it worked. Labeled working computer for lab use.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Asked questions of team lead to learn what went wrong with computer.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Used Comptia Troubleshooting Model to identify and solve problem.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Resolved situation.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Documented steps taken to get solution.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Returned computer to previous stage, including putting case side on and returned to storage.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Answered questions		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

1. Get your team lead (second year) to find a working lab computer for you. Once it is set up and determined to be working, label that computer.
2. Now go away.

3. Second year will create some power problems on the computer.

You will use QUESTIONING and TROUBLESHOOTING to identify and resolve the issue.

Comptia Troubleshooting Model

1. Identify the problem.
2. Establish a theory of probable cause
3. Test the theory
4. Establish a plan of action to resolve the problem.
5. Verify full system functionality, and if applicable, implement preventable measures.
6. Document findings, actions, and outcomes.

RULES:

- ☐ Change only ONE thing at a time
- ☐ Swap suspected bad for known good
- ☐ Swap known good for suspected bad
- ☐ Do not test a suspected BAD power supply on a known good motherboard, however
- ☐ Solve only ONE problem at a time

Identify the Problem	
What is your theory of probable cause?	
Test the theory	
What is your plan of action to resolve the problem?	
Verify the full system functionality	
Document	

What was wrong with your computer?

What was your initial theory?

Were you right? If not, what did you change your theory to?

Were you right then?

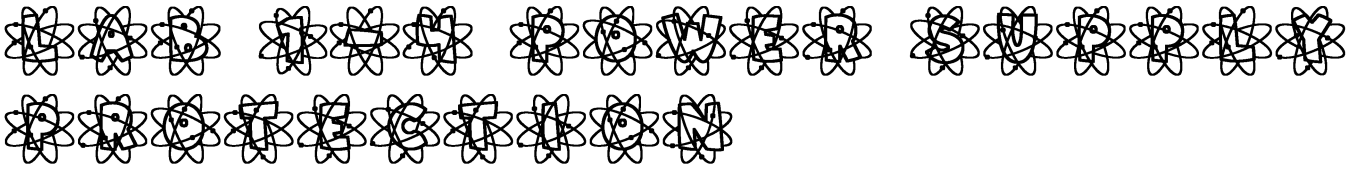
How did you confirm that you were right (or wrong)?

What did you do to resolve the problem?

Does the system work completely?

Why do you always document repairs to a system?

Fill out the lab report.



Learning Targets

When I get to the end of this lesson, I can do these things:

1. Identify the purpose of a UPS
2. Identify the purpose of a surge suppressor
3. Install a UPS
4. Install a surge suppressor
5. Set up two power plans for given scenarios

Success Criteria

When I've finished this section, I will have completed these things:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Install surge suppressor		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Install UPS		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Record results of loss of power		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Answer questions		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

Fill out lab report		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

Materials Required

- One computer
- One surge protector
- One UPS device of any type
- One power conditioner

Lab Setup & Safety Tips

- Always unplug the power cord and properly ground yourself before touching any component inside a computer.

ACTIVITY

Installing a surge protector

1. Power off your lab workstation.
2. Power off your monitor and any other peripheral devices.
3. Plug the provided surge protector into the wall outlet.
4. Plug each of your peripheral devices into the surge protector (this includes the system unit and monitor).
5. Power on the surge protector.
6. Power on your lab workstation.
7. Power on your monitor and other peripheral devices (this includes the system unit and monitor).
8. Verify that your PC is functioning properly.

Installing a UPS device

1. Power off your system unit.
2. Power off any additional peripherals that you want to be protected by the UPS device.
3. Unplug the system unit and the peripheral devices.
4. Plug the UPS device into the wall outlet.
5. Plug the system unit into the UPS device.
6. Plug the additional peripheral devices into the UPS.
7. Power on the UPS device.
8. Power on the system unit and the additionally protected peripherals.
9. Verify that the system unit and each additionally protected device are functioning properly.

Observing the functionality of a UPS device

1. Power on your system unit and allow it to boot into Windows 9x.
2. Power on your additional peripheral devices.
3. Unplug the UPS device.
4. Record the results.

Review Questions

Circle True or False.

1. An in-line UPS can provide continuous power without downtime for switching from AC to battery. True / False
2. A power conditioner will provide battery power for only five minutes in the case of an outage.
1. True / False
2. If a computer is protected by a standby UPS, the computer will most likely reboot if there is a power outage. True / False
3. An intelligent UPS can be controlled by software. True / False
4. Describe how a surge protector provides protection from power spikes.

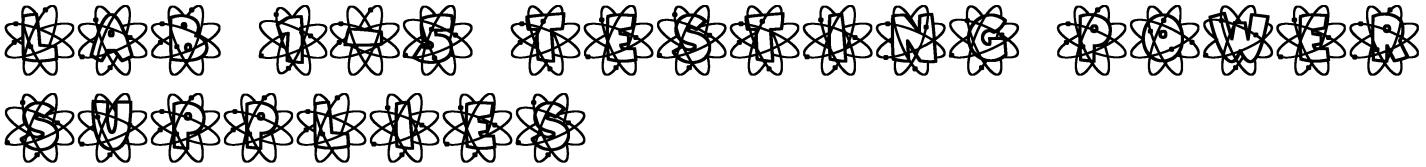
5. You are employed as a network administrator at Pictures, Inc. Your employer has asked you to assess the need for UPS devices for each of their 10 servers. After talking with the staff, you learn that seven of the servers are used for e-mail and bulletin board communications. The other three servers are used to maintain the company's accounting inventory databases. Pictures, Inc. has asked that you provide two proposals for them: the first should outline the ideal protection plan, and the other should outline the minimum protection requirements.

   Power Protection Plan A (ideal)

Power Protection Plan B (minimum requirements)

Research:

- **What is an in-line UPS?—**
- **What is a standby UPS?—**
- **What is an intelligent UPS?—**
- **What is a power conditioner?—**



Learning Targets

When I get to the end of this lesson, I can do these things:

1. Identify dangers in testing a power supply.
2. Understand how to short out pins 15 and 16 to turn on Power Supply
3. Understand how to test the power supply connector with a multimeter
4. Understand how to test power supplies using a power supply tester
5. Identify the purpose of each of the power supply connectors
6. Test resistance on a motherboard
7. Test resistance of the motherboard speaker

Success Criteria

When I've finished this section, I will have completed these things:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Test the pins on the 24-pin ATX connector		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Short out pins 15 and 16 and explain what you are doing and why it works.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Test the PSU connectors with a PSU tester		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Identify and test a resistor on a motherboard. Test the speaker for resistance.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Put lab computer completely back together with everything plugged in. Make sure it turns back on. Secure everything including screwing the case on.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Answered questions		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

- Identify some dangers involved in Power Supplies.
- Identify and diagnose common power supply problems.
- Test a power supply using a power supply tester.
- Test connectors on the power supply.

Materials Required

- Power supply
- Multimeter
- Piece of wire or paperclip
- Different connectors on power supply

Directions

1. Get your lab computer.
2. Turn OFF the power supply (plug it in to test to make sure it is turned OFF).
3. Unplug for extra safety.
4. Remove all hand jewelry. Tie your hair back. Roll up your sleeves.
5. NEVER WEAR A GROUNDING STRAP WHEN WORKING ON A POWER SUPPLY.
6. Open your case.
7. Unplug all of the power supply connectors from your motherboard.
8. Get a piece of wire or paperclip from me.
9. On your 24pin PSU plug locate the green pin put one end of the paperclip into that pin. This is the power switch pin.
10. Put the other pin into ANY black pin. Black is ground. It's easiest to use pins 15 (Black) and 16 (Green).
11. Plug in your power supply and turn it on. What happens?

12. Turn on your multimeter and turn the dial to VDC (voltage direct current) setting. Since it's probably not an auto multimeter, you're going to set it to 10v, since we're testing between 3.3 and 12 volts.
13. Connect the negative probe (black) to any ground wire on the 24-pin connector (any black pin except the one that has the paperclip in it).
14. Test each of the colored pins and write down the voltage you get by probing with the red probe. Fill out the table below.

1. Orange	13.Orange
2. Orange	14. Blue
3. Black	15. Black
4. Red	16. Green
5. Black	17. Black

6. Red	18. Black
7. Black	19. Black
8. Grey	20. White
9. Purple	21. Red
10. Yellow	22. Red
11. Yellow	23. Red
12. Orange	24. Black

If all voltages are within the approved tolerances, then this is a good power supply. If not, you need to have it replaced!

Now we're going to test the connectors.

1. Get a power supply tester from me (check it out).
2. Test each of the power supplies in the following manner
    a. Plug in the 24 pin ATX connectors
    b. Test each of the molex connectors
    c. Test the P4 connector, if present
    d. Test the SATA connectors
    e. Test the P6 connector, it present
3. Fill out the table below

Power Supply Brand	Wattage rating	# Molex connectors	Molex tests (pass/fail, note any that fail)	# P4 connectors	P4 test	# P6 connectors	P6 connectors tests

- If any of the power supplies completely fails, throw it away (ensuring that you've tested others first to make sure you're using the tester correctly).

- If any of the power supplies has bad connectors but the 24 pin ATX connector works, get a piece of tape and mark the bad connectors.

- If any power supplies has all of a specific kind of connector fail, throw it away

4. Now open up your lab computer, return your power supply tester, check out a multimeter.
5. The first step in using the multimeter to perform tests is to select the proper function. For the most part, you never need to use the current function of the multimeter when working with computer systems; however, the voltage and resistance functions can be very valuable tools.
6. In computer troubleshooting, most of the tests are DC voltage readings. These measurements usually involve checking the DC side of the power-supply unit. You can make these readings between ground and one of the expansion-slot pins, or at the system board power-supply connector.
7. It is also common to check the voltage level across a system board capacitor to verify that the system is receiving power. The voltage across most of the capacitors on the system board is 5V (DC). The DC voltages that can normally be expected in a PC-compatible system are +12V, +5V, –5V, and –12V. The actual values for these readings may vary by 5% in either direction.

WARNING

Normal practice is to first set the meter to its highest voltage range to make certain that the voltage level being measured does not damage the meter.

Testing Resistance

1. The second most popular test is the resistance test, or *continuity test*.
2. Failure to turn off the power when making resistance checks can cause serious damage to the meter and can pose a potential risk to the technician. Resistance checks require that you electrically isolate the component being tested from the system. For most circuit components, this means desoldering at least one end from the board.
3. The resistance check is very useful in isolating some types of problems in the system. One of the main uses of the resistance function is to test fuses. You must disconnect at least one end of the fuse from the system. You should set the meter on the 1 k ohm resistance setting. If the fuse is good, the meter should read near 0 ohms. If it is bad, the meter reads infinite. The resistance function also is useful in checking for cables and connectors. By removing the cable from the system and connecting a meter lead to each end, you can check the cable's continuity conductor by conductor to verify its integrity.

NOTE

4. An electrical short is a condition where electrical current is given a path of flow around a designated component. In some cases, the short may be a complete bypass to a ground point so that no components receive current to operate with. On the other hand, an open is a

condition that is created when no path for electrical current is present, such as when a connector comes loose or a component burns out.

5. Get one of our older motherboards.
6. Carefully locate a fuse and remove it.
7. Set the meter to 1k ohm and test it.
8. What is the reading?

Testing Speakers

9. You also use the resistance function to test the system's speaker.
10. To check the speaker, simply disconnect it from the system and connect a meter lead to each end. If the speaker is good, the meter should read near 8 ohms (although a smaller speaker may be 4 ohms). If the speaker is defective, the resistance reading should be 0 for shorts or infinite for opens.
11. **What reading did you get?**

Only a couple of situations involve using the AC voltage function for checking microcomputer systems. The primary use of this function is to check the commercial power being applied to the power-supply unit. As with any measurement, it is important to select the correct measurement range; however, the lethal voltage levels associated with the power supply call for additional caution when making such measurements. The second application for the AC voltage function is to measure ripple voltage from the DC output side of the power-supply unit. This particular operation is very rarely performed in field-service situations. We're not going to do it, lest we die.

Questions:

1. What does the green pin on the ATX 24-pin do?

2. What is the voltage on the orange pin?

3. What is the voltage on the blue pin?

4. What is the voltage on the red pin?

5. What does the black pin do?

6. How can you turn on a power supply when it is not attached to the motherboard?

7. What is the voltage of the purple pin?

Capacitors

Learning Targets

When I get to the end of this lesson, I can do these things:

1. Understand the purpose of a capacitor.
2. Recognize the impact different capacitors have on control of flow of energy.
3. Recognize the impact different resistors have on control of flow of energy.

Success Criteria

When I've finished this section, I will have completed these things:

Task	You Check When Completed	Project Mgr Check for Understanding	Tory Check for Skill Level
Identify capacitors on the electronic playground		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Create the circuit with the different capacitors. Explain the difference in LED brightness.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Identify the difference the resistors have on the flow of energy.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Answered questions		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application
Cleaned up station before Tory will come check off.		Ready to be checked by Tory	☐ Emerging ☐ Knowledge ☐ Comprehension ☐ Application

1. Get yourself an Electronic Playground.
2. Locate the capacitors on the kit and draw each of them below:

Rating	Drawing of capacitor

3. Get three long wires and one short wire from me.
4. Connect one wire between 3 and 42
5. Connect one wire between 4 and 26, and another between 26 and 37 (note, put wires on either side of 26, try not to let them touch)
6. Take another long wire and attach it ONLY to 36, leave the other end unattached.
7. Now let's "charge" that capacitor.
8. Take the loose wire and touch it to 27, the other battery spring.
9. BAM your capacitor just charged. Since there is no resistance, it's immediate.
10. Now touch the loose wire to the other side of the 3.3kΩ resistor and watch the LED.
11. What just happened?

12. Do it again…touch 27 then 43.
13. So what is the purpose of a capacitor on a motherboard?

14. Is it a very effective battery?
15. So why even have it?

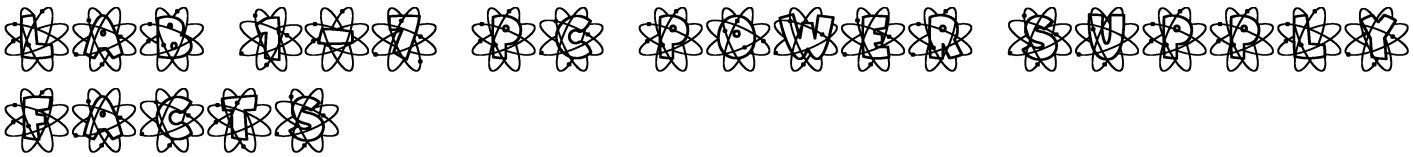
16. Try the other resistors and tell me what happens:

Resistor rating	What happens	Why do I think this happens?

17. Test the different capacitors, and tell me what happens.

Capacitor rating	What happens	Rate from 1-3 for effectiveness at holding a charge

18. What would the lower charge capacitors be used for?



Remove the cover from your home or lab PC and answer the following questions:

1. How many watts are supplied by your power supply? (It is usually printed on the label on the top of the power supply.)

2. How many cables are supplied by your power supply?

3. Where does each cable lead?

4. Is there a switch on the back of the power supply that can be set for 230 volts (Europe) or 115 volts (U.S.)?