Early E. C.:	/ 1
Total HW Points Unit 11:	/ 42
Total Lab Points Unit 11:	/ 74
Unit 11 Apps.:	/ 5
Late, Incomplete, No Work, No Units Fee? Y / N	

Unit 11 – Basic Electric Circuits

Essential Fundamentals of Electric Circuits

1. Ohm's Law governs relations between current, voltage, and resistance.

Add more here!

Equation Sandbox

In Unit 11, some of the following equations will be used. Practice isolating variables to prepare for it.

Possible 11.1 Pts:	**6**
Late, Incomplete, No Work, No Units Fee:	-1 - 2 -3
Final Score:	**/ 6**

11.1 Problems – Potential Difference, Batteries, & Direct Current
Section 17.1 of your textbook.

1. What is the total voltage across six 1.5-V batteries when they are connected
   A. In series,

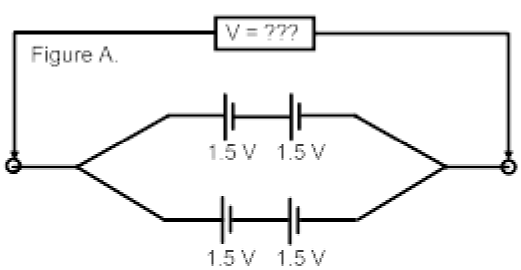
   B. In parallel,

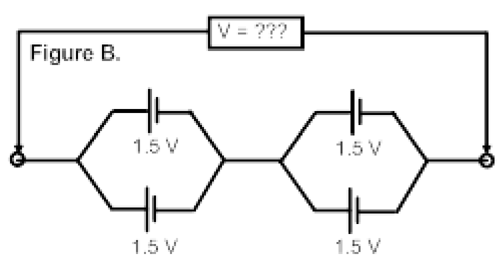
   C. Three in parallel with one another, and this combination wired with the other three which are in series?

2. Two 6-V batteries and one 12-V battery are connected in series.
   A. What is the voltage across the whole arrangement?

   B. What arrangement of these three batteries would give a total voltage of 12-V?

3. You are given four AA batteries that are rated at 1.5-V each. The batteries are grouped in pairs. In figure A, the two batteries in each pair are in series, and then the pairs are connected in parallel. In figure B, the two batteries in each pair are in parallel, and then the pairs are connected in series. What is the total voltages of each arrangement?





Possible 11.2 Pts:	7
Late, Incomplete, No Work, No Units Fee:	-1 - 2 -3
Final Score:	/ 7

11.2 Problems – Current
Section 17.2 of your textbook.

1. A net charge of 30. C passes through the cross sectional area of a wire in 2.0 minutes. What is the current in the wire?

2. A small toy car draws a 0.50-mA current from a 3.0-V NiCd (nickel-cadmium) battery in 10.0 minutes of operation.
   A. How much charge flows through the toy car?

   B. How much energy is lost by the battery?

3. A net charge of 20. C passes a location in a wire in 1.25 minutes. How long does it take for a net 30-C charge to pass that location if the current in the wire is doubled?

4. Car batteries are often rated in 'ampere-hours' or A•h. Answer the following questions.
   A. Unit analysis: show that the A•h has units of charge and 1.0 A•h = 3600 C.

   B. A fully charged, heavy duty battery is rated at 100. A•h and can deliver a current of 5.0 A steadily until depleted. What is the maximum time this battery can deliver this current, assuming it isn't recharged?

   C. How much charge (in Coulombs) will the battery deliver in this time?

Possible 11.3 Pts:	6
Late, Incomplete, No Work, No Units Fee:	-1 - 2 -3
Final Score:	/ 6

11.3 Problems – Resistance and Ohm's Law
Section 17.3 of your textbook.

1. A battery labeled 12.0 V supplies 1.90 A to a 6.00-Ω resistor.
   A. What is the terminal voltage of the battery?

   B. What is its internal resistance?

2. What terminal voltage must an ideal battery (no significant internal resistance) have to produce a 0.50-A current through a 2.0 Ω resistor?

3. A 0.60 m long copper wire has a 0.10 cm diameter at 20 °C. What is the wire's resistance?

4. The iron wire in a heating element of an electric stove burner has a 0.75-m effective length and a 2.0 E -6 m^2 cross sectional area.
   A. If the wire operates at 380 ^oC, what is its resistance?

   B. What is its resistance when the stove is off?

Possible 11.4 Pts: 7
Late, Incomplete, No Work, No Units Fee: -1 - 2 -3
Final Score: / 7

11.4 Problems – Electric Power
Section 17.4 of your textbook.

1. A DVD player draws 100.0 W of power at 120 V. What is its resistance?

2. The current in a refrigerator with a resistance of 12 Ω is 13 A. What is the power delivered to the refrigerator?

3. A resistor in a circuit is designed to operate at 120 V.
   A. If you connect the resistor to a 60-V power source, will the resistor dissipate heat at (1) 2, (2) 4, (3) ½, or (4) ¼ times the designed power? Why?

   B. If the designed power is 90 W at 120 V, but the resistor is connected to a 30-V power supply, what is the power delivered to the resistor?

4. A 120-V air conditioner unit draws 15 A of current. If it operates for 20.0 minutes:
   A. How much energy in kilowatt-hours does it use in that time?

   B. If the cost of electricity is $0.15/kWh, what is the cost (to the nearest penny) of operating the unit for 20.0 minutes?

   C. If the air conditioner initially cost $450 and it is operated, on average, 4.0 h per day, how long does it take before the operating costs equal the price?

Possible 11.5 Pts: 8	
Late, Incomplete, No Work, No Units Fee: -1 -2 -3	
Final Score: / 8	

<u>11.5 – Resistor Circuits</u>
Section 18.1 of your textbook.

1. What are the resistance of the following color coded resistors?
   A. Black – Red – Brown

   B. Green – Purple – Yellow

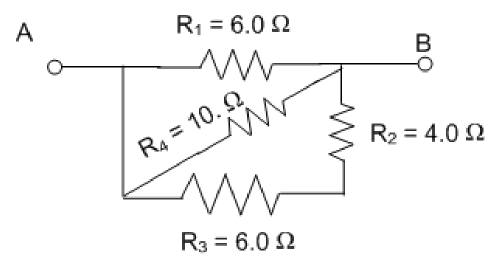
   C. Violet – Violet – Red

   D. Gray – White – Orange

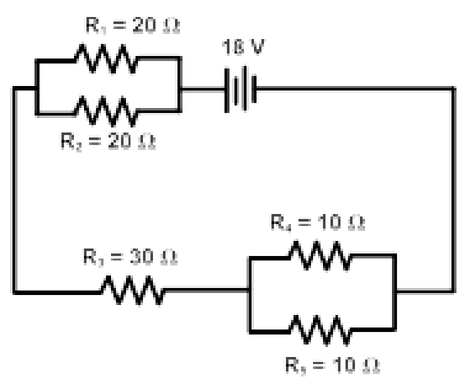
2. Two identical resistors (R) are connected in parallel and then wired in series to a 40-Ω resistor.
   A. Make a circuit diagram.

   B. If the total equivalent resistance is 55 Ω, what is the value of R?

3. What is the resistance between points A and B of the following diagram?



4. What is the resistance of the following circuit?

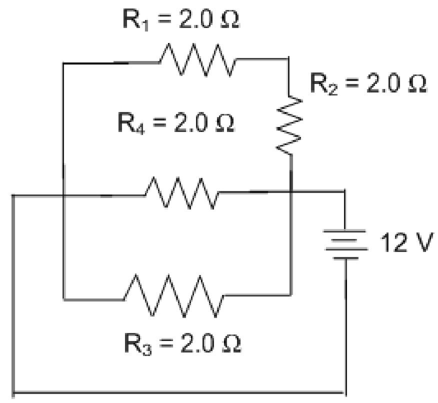


Possible 11.6 Pts:	8
Late, Incomplete, No Work, No Units Fee:	-1 - 2 -3
Final Score:	/ 8

11.6 Problems – Circuit Analysis

1. Suppose that the resistor arrangement in the following diagram is connected to a 12-V battery. What will be:

   A. The total resistance?



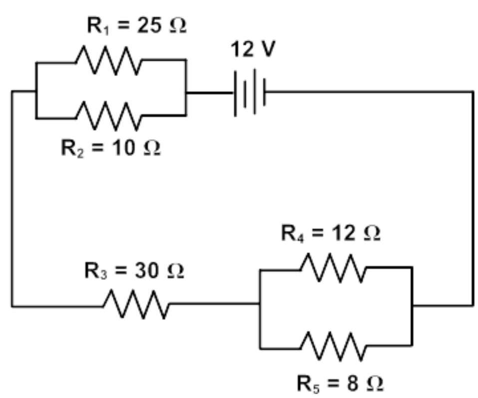
   B. The current in each resistor?

   C. The voltage drop across each resistor?

   D. The total power delivered?

2. For the following circuit:

   A. What is the total resistance?



   B. What is the total power delivered?

   C. What is the voltage drop across each resistor?

   D. What is the total current in the circuit?

AP Physics 1	Unit 11.1 Lab - Electrochemical Cells
Reminder: Update Table of Contents	Correction Credit: Half

Lab Overview.

Electrochemical cells derive their potential from chemical reactions. Oxidation – reduction (or redox) reactions between metals cause electrons to move through conductors in the cells, and during this process they are able to do work.

When one metal is oxidized (the anode), it changes from a neutrally charged solid to a positively charged ion, and goes into solution. This conversion to a positive ion causes it to lose one or more electrons, which travel through conductors to the other metal (the cathode). At the cathode, the opposite happens. Positively charged metal ions in solution adhere to the cathode, absorbing electrons from it as they do so, thus obtaining a neutral charge and becoming solid.

Different metals have different oxidation potentials, and that is why there are so many different types of batteries with different voltages. You have probably heard of alkaline (1.5 V), NiCd (nicad) (1.2 V), lithium (3 V), and lead-acid cells (2 V). These are commonly available power sources.

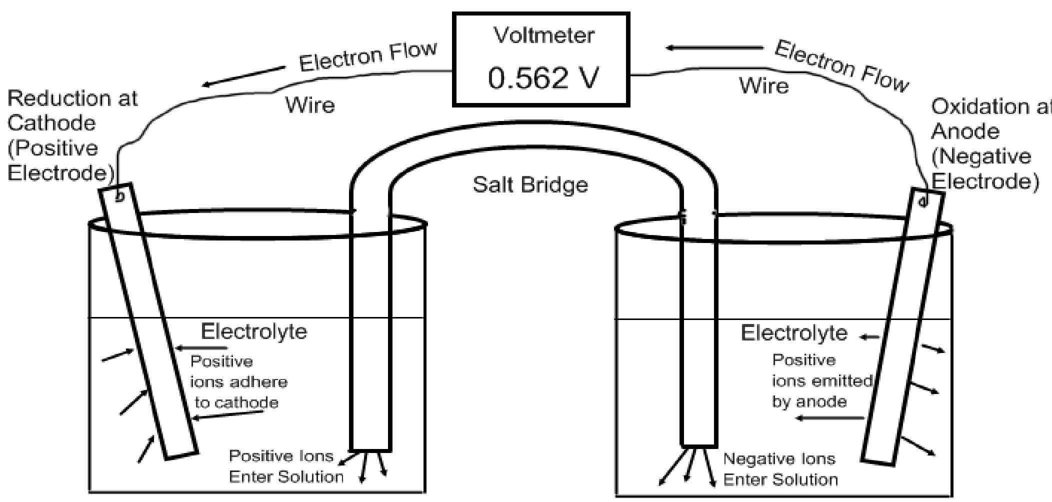
A battery is really a series of electrochemical cells, so in the last paragraph the lead-acid cell is usually coupled together in series with other identical cells, and their voltage is the sum of the individual cells – usually 6 or 12 volts for motorcycle or car batteries, respectively.

Electrochemical Cell Lab (11.1)		
Table of Contents, Title/Date, Complete Synopsis, Two Purposes		/ 2
Mission 1: Single Cell	Four Combinations of Metals & Voltage	/ 2
	Two Metals	/ 2
	Measured Voltage	/ 1
Mission 2: Multiple Cells Data Table	Metals of Each Cell	/ 1
	Individual Voltages	/ 1
	Mathematical Volage	/ 1
	Measured Volage	/ 1
Mission 3: Copper Sulfate Data Table	Anode Metal	/ 1
	Initial Voltage	/ 1
	Final Voltage	/ 1
Question 1: Mission 2 Analysis		/ 2
Question 2: Mission 3 Analysis		/ 2
Work Not Shown Fee:		-1 -2 -3
Late Lab Fee:		-4
Total:		/ 18

Materials:
4 Plastic cups
2 Salt bridges
Various wires
Voltmeter

Electrodes: Clean them.
Zinc (Zn)
Copper (Cu)
Brass (Cu/Zn)
Lead (Pb)
Square Sn/Pb/Zn Alloy
Iron (Fe)
Aluminum (Al)

Electrolytes
1.0 M NaCl
1.0 M $CuSO_4$



Electrochemical Cell Diagram

Apparatus.

In this lab, you will not be able to generate much power, but you will be able to observe how a series of electrochemical cells work. You will see how different electric potentials can be made using different metals in a conductive solution.

Set up a basic cell:

1. Fill two plastic cups halfway with NaCl electrolyte solution.
2. Place a CPVC salt bridge over the edges of the cups.
3. Choose any two of the electrodes and put one in each cup.
4. Connect wires from the electrodes to the probes of the voltmeter.
5. Check polarity – the voltage should read positive. If it doesn't, switch your probes. When the voltage reads positive, your cathode will be the POSITIVE (red) electrode, and your anode will be the NEGATIVE (black) electrode.
6. Report all voltage values to the hundredths of a volt.
7. Clean up – Pour salt and copper sulfate solutions back into their containers.

Mission 1: Single Cell

Set up a single cell, and test the potentials of any four combinations of different metals. Make sure your voltage is positive.

Make a data table that lists the two different types metals for each of the four cells, and corresponding voltages.

Find the combination of metals with the highest voltage. It may take some experimenting to find the highest voltage. Report the two metals and voltage in another data table.

Mission 2: Multiple Cells in Series

Make two cells and connect them in series. You might have to join forces with another group to do this. Watch your polarity – you will want to make the positive end of one cell connect to the negative end of the next cell. Measure the voltage of each cell separately, then the voltage of the series.

In a new data table, report the metals used (both anode and cathode) in both cells, the voltages of the single cells, the mathematical sum of the individual cells, and finally the measured voltage of both cells in series.

Mission 3: Copper (II) Sulfate Electrolyte

Use copper metal as your cathode, and any other metal as your anode. Hook your voltmeter up to the electrodes and record the voltage using the sodium chloride electrolyte solution. Next, replace the salt electrolyte container with a different container containing copper sulfate electrolyte ONLY to the solution containing the copper electrode. Record the new voltage. In your data table, report which metal your used, the initial voltage, and the voltage after switching the electrolyte to copper (II) sulfate.

When you are all done, clean up your lab station and save the solutions you used.

Questions: Rephrase and answer in complete sentences for full credit.

1. In Mission 2, how close is the mathematical sum of individual voltages as compared to the measured total of the two cells? What accounts for a difference, if there is one?

2. In Mission 3, what do you think caused the change in voltage? Be thorough here – you may need to do some research into electrochemistry to answer this.

AP Physics 1	Unit 11.2 Lab - Lightbulb Amazement!
Reminder: Update Table of Contents	Correction Credit: Half

Lab Overview:

In this group activity, you will be measuring the resistance of an incandescent light bulb, and calculating its power output.

You also will calculate the temperature of your bulb's filament, based on a couple assumptions, measurements, and calculations.

Lightbulb Lab (11.2) Scoring Guide		
Table of Contents, Title/Date, Complete Synopsis, Two Purposes		/ 2
Mission 1:	Circuit Diagram	/ 1
Mission 2: Bulb Measurements	Data Table	/ 1
	Cold Bulb Resistance	/ 1
	Expected Power	/ 1
	Measured Power	/ 1
	Measured Voltage	/ 1
Mission 3: Calculation	Temperature	/ 3
	No work fee:	-1 -2
Question 1: Differences between calculated and measured power		/ 2
Question 2: Is your temperature calculation reliable?		/ 2
Late Lab Fee:		-4
Total:		**/ 15**

Materials:
Multimeter
100 W Light Bulb
Lamp Fixture
Kill-A-Watt meter

Mission 1: Circuit Diagram

Draw a circuit diagram of a single light bulb connected to a 120V alternating current power source. Include a switch in your diagram, and label all parts.

Mission 2: Bulb Measurements

Record all measurements and calculations in a data table. Measure the bulb's resistance (when it's cold), then calculate the power output expected with a 120V AC power source (using $P = V^2/R$). Finally, use the Kill-A-Watt meter to measure the bulb's actual power rating when it is on, as well as the voltage.

Mission 3: Filament Temperature Calculation

Calculate the temperature of the light bulb's filament, assuming that the filament is made of tungsten (symbol = W). Show all your work and report the temperature.

Use the following equation:

$$R = R_O(1 + \alpha\Delta T)$$

R = resistance of your filament at high temperature (Calculate this using the measured power and voltage of the bulb during operation from one of your power equations).

R_O = resistance of your filament at room temperature (20° C) (measured in Mission 2).

α = coefficient of thermal resistivity for tungsten (Resources).

ΔT = Difference in temperature (add this to 20° C for the filament temperature).

Questions: Rephrase and answer in complete sentences for full credit.

1. Describe what accounts for the difference between the calculated and measured power output values for your bulbs in Mission 2.

2. Do you trust the temperature calculation you obtained for you filament? Research tungsten to answer this question completely.

AP Physics 1	Unit 11.3 Lab - Series Resistor Circuits
Reminder: Update Table of Contents	Correction Credit: Half

Lab Overview:

You and your team (four students max.) will build a series resistor circuit, measure resistance and voltage values, then compute current and power values.

Materials List:

- Solderless Breadboard
- 6 V Dry Cell Battery
- Jumper Wires

Six Different 1 W Resistors:

- 100 Ω (brown-black-brown)
- 390 Ω (orange-white-brown)
- 470 Ω (yellow-purple-brown)
- 5,600 Ω (green-blue-red)
- 8,200 Ω (gray-red-red)
- 10,000 Ω (brown-black-orange)

Series Circuit Lab (11.3) Scoring Guide		
Table of Contents, Title/Date, Complete Synopsis, Two Purposes		/ 2
Mission 1.A: Series Circuit - No Power	Circuit Diagram	/ 1
	Printed Resistance	/ 1
	Measured Resistance	/ 1
	Calculated Circuit Res.	/ 1
	Measured Circuit Res.	/ 1
Mission 1.B: Series Circuit - With Power	Measured Battery Voltage	/ 1
	Measured Resistor Voltages	/ 1
	Calculated Resistor Power	/ 1
	Calculated Circuit Power	/ 1
Question 1: Compare resistances in Mission 1.A.		/ 2
No Work Shown Fee:		-1 -2 -3
Late Lab Fee:		-2
Total:		/ 13

The Multimeter:

Check that your meter is set to exactly what you want to measuring, and n**ever measure resistance with the battery connected.** There's a chance of frying your meter.

Mission 1: Series Circuit - No Power

Design a series circuit with three resistors that uses a 6 V battery to power it in your lab booklet (with units). When you've drawn the circuit, build it on the breadboard, using jumper wires to connect resistors to each other and the battery.

Be sure the battery is disconnected before this step! Make a data table listing: the printed resistance of each resistor; the measured resistance of each resistor; the calculated resistance of the circuit; the measured resistance of your circuit.

Mission 2: Series Circuit With Power

Now hook up the battery. Make another data table listing: the measured voltage of the battery, the measured voltage across each resistor; the calculated power dissipated by each resistor (use $P = V^2/R$); the total power calculated from your battery's measured voltage and your circuit's measured resistance from Mission 1.A. Show all calculations for full credit.

Questions: Rephrase and answer in complete sentences for full credit.

1. In Mission 1, how does the measured resistance compare to the calculated (based on printed values) resistance of your circuit? What could account for differences?

AP Physics 1	Unit 11.4 Lab - Parallel Resistor Circuits	
Reminder: Update Table of Contents		Correction Credit: Half

Lab Overview:

You and your team (four students max.) will build parallel resistor circuits, then measure resistance and voltage values, and compute current and power values.

Parallel Circuit Lab (11.4) Scoring Guide		
Table of Contents, Title/Date, Complete Synopsis, Two Purposes		/ 2
Mission 2.A: Parallel Circuit - No Power	Circuit Diagram	/ 1
	Measured Resistance	/ 1
	Calculated Circuit Res.	/ 1
	Measured Circuit Res.	/ 1
Mission 2.B: Parallel Circuit - With Power	Measured Resistor Voltages	/ 1
	Calculated Resistor Current	/ 1
	Total Current	/ 1
	Total Power	/ 1
Question 1: Compare resistances in Mission 2.A.		/ 2
No Work Shown Fee:		-1 -2 -3
Late Lab Fee:		-2
Total		/ 12

Materials List:

Solderless Breadboard
6 V Dry Cell Battery
Jumper Wires

Six Different 1 W Resistors:

100 Ω (brown-black-brown)
390 Ω (orange-white-brown)
470 Ω (yellow-purple-brown)
5,600 Ω (green-blue-red)
8,200 Ω (gray-red-red)
10,000 Ω (brown-black-orange)

Mission 1: Parallel Circuit – No Power

Design and draw a parallel circuit with three different resistors that uses a 6 V battery to power it in your lab booklet (with units). When you've drawn the circuit, build it on the breadboard, using jumper wires to connect resistors to each other and the battery.

Be sure the battery is disconnected before this step! Make a data table listing: the measured resistance across each resistor (make sure they aren't in contact with each other for this part); the calculated resistance of the circuit based on the printed resistance values (show your work); the measured resistance across your three-resistor circuit (connect them now).

Mission 2: Parallel Circuit – With Power

Now hook up the battery. Make another data table listing: the measured voltage across each resistor; the calculated current through each resistor (Ohm's Law); the total calculated current; the power calculation for the circuit ($P = I^2R$).

Questions: Rephrase and answer in complete sentences for full credit.

1. In Mission 1, how does the measured resistance of your circuit compare to the calculated resistance?

AP Physics 1	Unit 11.5 Lab - Mixed Resistor Circuits
Reminder: Update Table of Contents	Correction Credit: Half

Lab Overview:

You and your team (four students max.) will build series resistor circuits, then measure resistance and voltage values, and compute current and power values.

You will also have an opportunity to practice soldering components together.

Mixed Circuit Lab (11.5) Scoring Guide		
Table of Contents, Title/Date, Complete Synopsis, Two Purposes		/ 2
Mission 3.A: Mixed Circuit - No Power	Circuit Diagram	/ 2
	Measured Resistance	/ 1
	Calculated Circuit Res.	/ 1
	Measured Circuit Res.	/ 1
Mission 3.B: Mixed Circuit - With Power	Measured Resistor Voltages	/ 1
	Measured Parallel Voltage	/ 1
	Measured Serial Voltage	/ 1
	Measured Circuit Voltage	/ 1
	Calculated Parallel Power	/ 1
	Calculated Serial Power	/ 1
	Total Power	/ 1
Question 3: Compare voltages in mission 3.B.		/ 2
No Work Shown Fee:		-1 -2 -3
Late Lab Fee:		-3
Total:		/ 16

Materials List:

Solderless Breadboard
6 V Dry Cell Battery
Jumper Wires

Six Different 1 W Resistors:

100 Ω (brown-black-brown)
390 Ω (orange-white-brown)
470 Ω (yellow-purple-brown)
5,600 Ω (green-blue-red)
8,200 Ω (gray-red-red)
10,000 Ω (brown-black-orange)

Mission 1 Mixed Circuit – No Power

Design a mixed circuit (parallel and series) with four different resistors that uses a 6 V battery to power it in your lab booklet (with units). When you've drawn the circuit, build it on the breadboard, using jumper wires to connect resistors to each other and the battery.

Be sure the battery is disconnected before this step! Make a data table listing: the measured resistance across each resistor (make sure they aren't in contact with each other for this part); the calculated resistance of the circuit based on the printed resistance values – show your work for this calculation; the measured resistance across your circuit (connect them now).

Mission 2 Mixed Circuit – With Power

Now connect your battery. Make another data table listing: the measured voltage across each resistor; the measured voltage over the parallel section; the measured voltage over the serial section; the measured voltage across the whole circuit; the power calculation of the parallel section ($P = V^2/R$); the power calculation of the serial section; the total power.

Questions: Rephrase and answer in complete sentences for full credit.

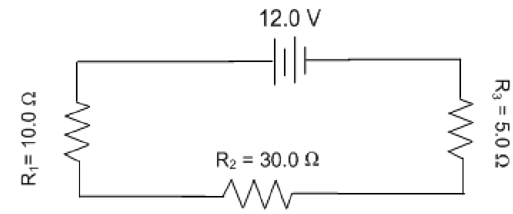
1. In Mission 2, how does the measured voltage across the entire circuit compare to the sum of measured voltages across the parallel and serial sections separately?

AP Physics 1	Unit 11 - Electricity				
Application Problems, AP Test Preparation Questions					
Presentation Points:	/ 5	Late Fee:	-2	Completion (Booklet Check)	/ 5

Your grade on this problem set depends on the presentation you provide for your assigned problems, and whether **all** problems are complete when you submit your Booklet at the end of the Unit.

Application Problems

1. For the following series circuit, calculate:

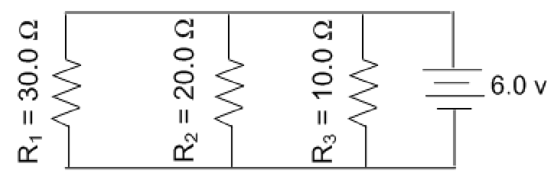


   A. the equivalent resistance,

   B. the total current,

   C. the total power.

2. For the following parallel circuit, calculate:

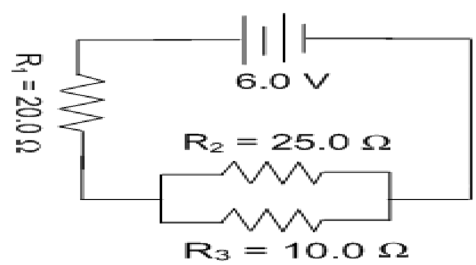


   A. the equivalent resistance,

   B. the total current,

   C. the total power.

3. For the following mixed circuit, calculate:



   A. the equivalent resistance,

   B. the total current,

   C. and the total power.

4. A length of wire with a resistance of R is cut into two equal lengths. These segments are then twisted together to form a conductor half as longs as the original wire.

   A. The resistance of the shortened conductor is (1) R/4, (2) R/2, (3) R. Explain your reasoning.

   B. If the resistance of the original wire is 27 μΩ, and the wire is instead cut into three equal segments that are twisted together, what is the resistance of the new shortened conductor?

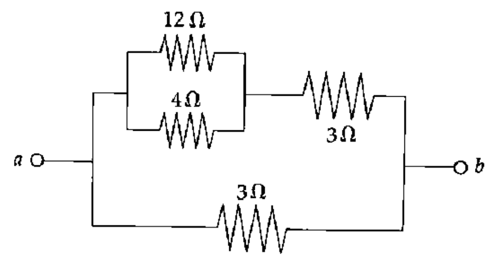
AP Test Questions

1. For an ohmic conductor, doubling the voltage without changing the resistance will cause the current to
   a) decrease by a factor of 4. b) decrease by t factor of 2.
   c) increase by a factor of 2. d) increase by a factor of 4.

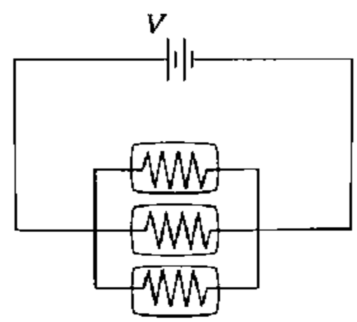
2. If a 60-watt light bulb operates at a voltage of 120 V, what is the resistance of the bulb?
   a) 2 Ω b) 30 Ω c) 240 Ω d) 720 Ω

3. A battery whose emf is 40 V has an internal resistance of 5 Ω. If this battery is connected to a 15 Ω resistor *R*, what will the voltage drop across *R* be?
   a) 10 V b) 30 V c) 40 V d) 50 V

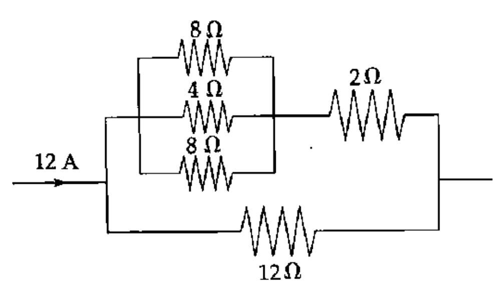
4. Determine the equivalent resistance between points *a* and *b*.
   a) 0.25 Ω b) 0.333 Ω c) 1.5 Ω
   d) 2 Ω



5. Three identical light bulbs are connected to a source of emf, as shown in the diagram. What will happen if the middle bulb burns out?
   a) The light intensity of the other bulbs will decrease (but they won't go out).
   b) The light intensity of the other two bulbs will increase.
   c) The light intensity of the other two bulbs will remain the same.
   d) More current will be drawn from the source of emf.
   e) The remaining bulbs will go out.



6. What is the voltage drop across the 12 Ω resistor in the portion of the circuit shown?
   a) 24 V b) 36 V c) 48 V d) 72 V

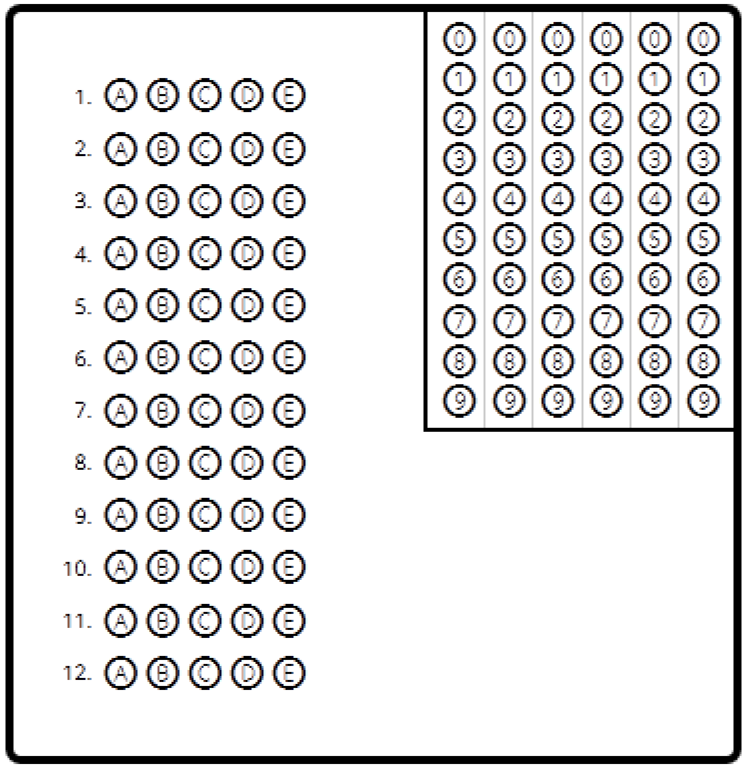


7. How much energy is dissipated as heat in 20 s by a 100 Ω resistor carrying 0.5 A?
   a) 50 J b) 100 J c) 250 J d) 50
   0 J

AP Physics 1	Unit 11 Review - Basic Electric Circuits						
Points:	/ 24	Late or Incomplete Fee:	-2 -4 -6	Correction Credit:		Final Score:	

Solve these problems here, THEN enter your responses in the bubble sheet provided.

Each question is worth two points.



1. You have three 1.5 V batteries. What is the voltage when they are connected in series?

A. 1.5 V B. 3.0 V C. 4.5 V
D. 0.5 V E. 0.0 V

2. You have three 1.5 V batteries. What is the voltage when they are connected in parallel?

A. 3.0 V B. 1.5 V C. 4.5 V
D. 0.5 V E. 0.0 V

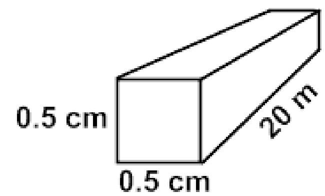
3. How long does it take for a charge of 3.50 C to pass by a point on a wire with a current of 0.57 A?

A. 3.28 s B. 4.50 s C. 9.44 s
D. 6.14 s E. 5.26 s

4. How much current is drawn from a 12 V battery when a 15 Ω resistor is connected to it?

A. 180 A B. 0.8 A C. 90 A D. 1.5 A E. 2.0 A

5. A mystery material is formed into a 20 m long rod with a square cross-section of 0.5 cm on each side. What is the resistivity of the material if a 100 V applied voltage produces a current of 5.0 A?



A. 1.2 E -5 Ω • m B. 2.5 E -5 Ω • m C. 3.8 E -5 Ω • m
D. 8.9 E -5 Ω • m E. 4.5 E -5 Ω • m

6. In a circuit consisting of a 12 V battery and a 15 Ω resistor, how much power is dissipated by the resistor?

A. 9.6 W B. 180 W C. 0.8 W D. 1.5 W E. 3.0 W

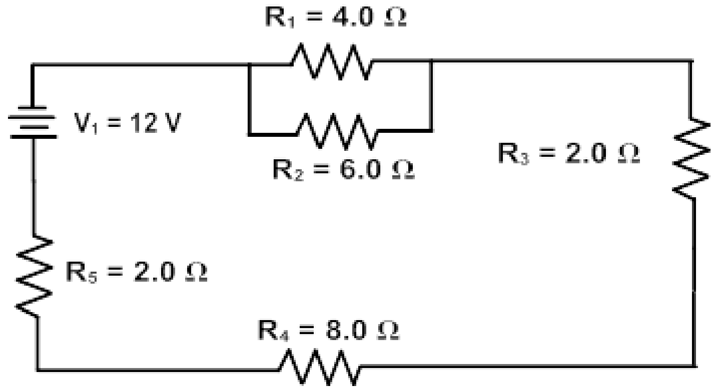
7. An electric water heater produces 50 kW of heat when connected to a 240 V power source. What is the current that it draws?

A. 4.8 A B. 116 A C. 120 A D. 208 A E. 150 A

8. An electric water heater produces 50 kW of heat when connected to a 240 V power source. What resistance does it have?

A. 1.15 Ω B. 0.86 Ω C. 2.66 Ω D. 3.16 Ω E. 1.5 Ω

For Questions 9 – 12, use the following circuit diagram:



9. What is the total resistance of the circuit?

A. 17 Ω B. 12.5 Ω C. 16 Ω D. 22 Ω E. 14.4 Ω

10. What is the current passing through R_4?

A. 0.71 A B. 1.0 A C. 0.83 A D. 0.75 A E. 0.55 A

11. What is the power drop over R_5?

A. 0.51 W B. 3.1 W C. 2.3 W D. 1.4 W E. 5.0 W

12. What is the total power dissipated by the circuit?

A. 14 W B. 5 W C. 10 W D. 15 W E. 20 W