NAME: _____

DATE: _____

Use of Digital Meters, Series--Parallel Circuits

PURPOSE:

1. To obtain a familiarity with basic series and parallel circuits.
2. To obtain a familiarity with measuring voltage, current and resistance.
3. To investigate what “loading” a fuel cell will imply.
4. To investigate methods of connecting batteries together.

APPARATUS REQUIRED:

Device	QUANTITY	DESCRIPTION
Power Supply	1	Variable Power Supply
Meters	1 1	Digial MultiMeter(DMM) Load Box
Resistors	3 1	100 Ω 10 Ω
Leads	Assorted	Meter Leads and “Alligator” Leads
Batteries	2	1.5 volt dry cells

Series Circuits

1. Connect one 100Ω resistor to one of the DMM's being used as an Ohmmeter.

   Resistance Value ___100Ω____

   Measured resistance_____

2. Connect two 100Ω resistors in series and measure the total resistance.

   Resistance Value ___200Ω____

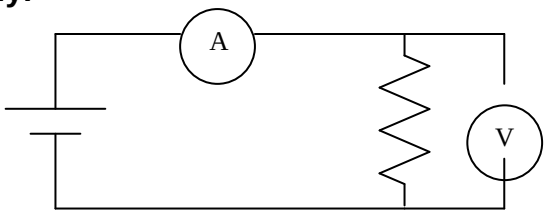
   Measured resistance_____

3. Connect three 100Ω resistors in series and measure the total resistance.

   Resistance Value ___300Ω____

   Measured resistance_____

4. Connect the circuit below. The ammeter and voltmeter are the meters marked **A** and **V**. Note that the Voltmeter is across the element for which the voltage is being taken. The ammeter must be placed in the circuit in order to measure the current flowing it. The resistance is 100Ω and the supply should be set for 10 volts DC. **Let the instructor check your connections before turning on the supply!**



Note: The supply represents how fuel cells will be utilized electrically.

5. From Ohm's Law the ammeter should read about 0.1 amp(10 volts/100Ω) and the voltmeter should read 10 volts DC.

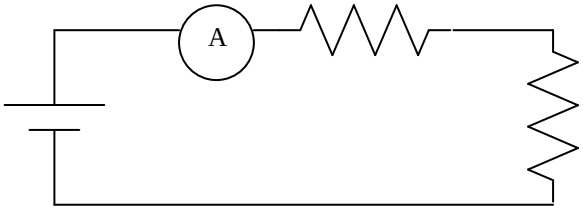
   Measured I _____

   Measured V _____

6. What is the Power Output of the supply? P=VI

   Watts _____

7. Connect the following circuit, again applying 10 volts:



8. What is the calculated total resistance?

R_T _____

9. From Ohm's Law, what should the current be?($I=E/R_T$)

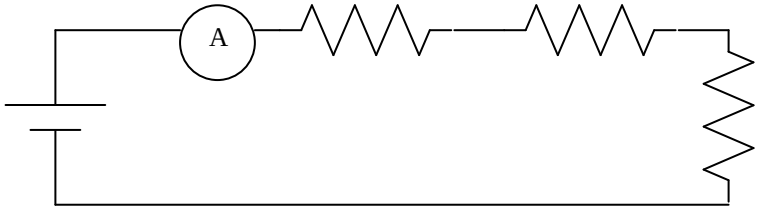
I calculated _____

I measured _____

10. What is the Power Output of the supply? P=VI

Watts _____

11. Connect the following circuit, again applying 10 volts:



12. What is the calculated total resistance?

R_T _____

13. From Ohm's Law, what should the current be?($I=E/R_T$)

I calculated _____

I measured _____

14. What is the Power Output of the supply? P=VI

Watts _____

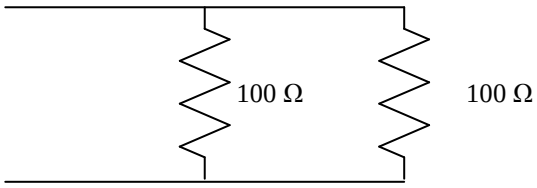
15. From the previous steps, fill in the following table for resistors in series:

Resistors	R Total	Voltage	Calculated Current	Measured Current	Watts
1					
2					
3					

16. What conclusions can you draw from series circuits?

Parallel Circuits

17. Connect two of the resistors in parallel as shown.

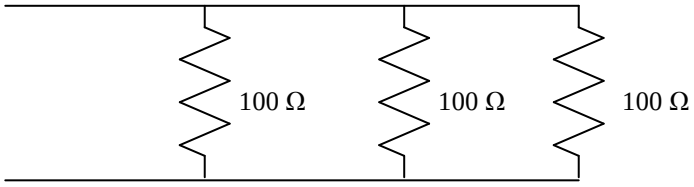


18. Calculate what the total resistance should be:

R_T _____

Measure R_T _____

19. Connect three of the resistors in parallel as shown.

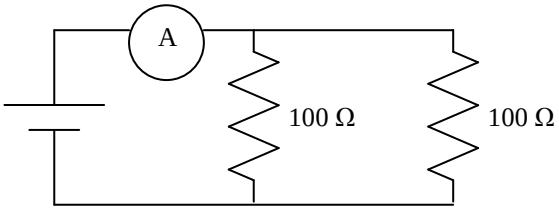


20. Calculate what the total resistance should be:

R_T _____

Measure R_T _____

21. Connect the following circuit, again applying 10 volts:



Let the instructor check your connections before turning on the supply!

22. From Ohm's Law, what should the current be?($I=E/R_T$)

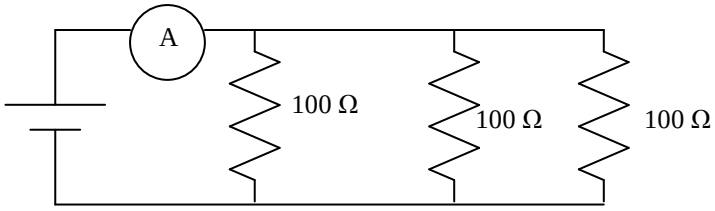
I calculated _____

I measured _____

23. What is the Power Output of the supply? P=VI

Watts _____

24. Connect the following circuit, again applying 10 volts:



25. From Ohm's Law, what should the current be?($I=E/R_T$)

I calculated _____

I measured _____

Resistors	R Total	Voltage	Calculated Current	Measured Current	Watts
1					
2					
3					

26. What is the Power Output of the supply? P=VI

Watts _____

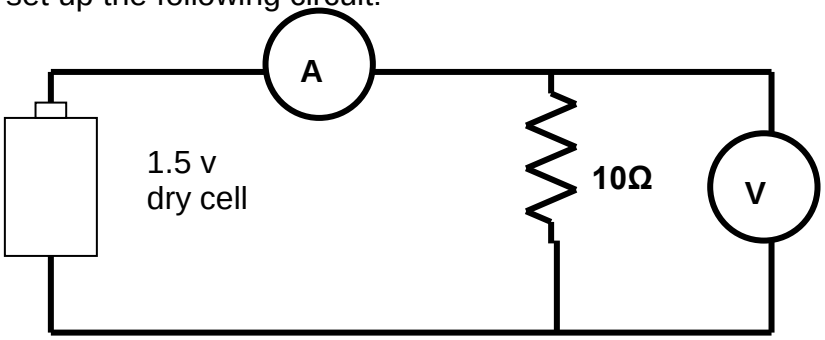
27. From the previous steps, fill in the following table for resistance in parallel:

Note: Remember from the lecture that this parallel exercise is more indicative of how supplies like fuel cells will be "loaded".

28. What conclusions can you draw from parallel circuits?

Since the voltage on a fuel cell is small, they are usually placed in stacks and connected in series and/or parallel. This will be simulated by using batteries in series and parallel.

29. set up the following circuit:



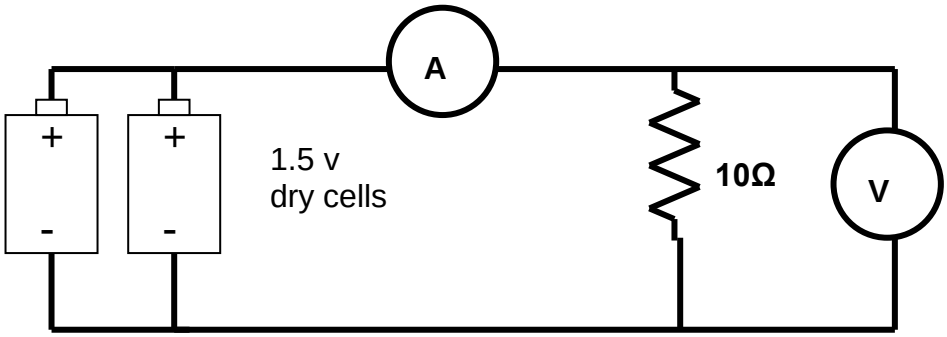
Measure the amperage and the voltage.

Measured I _____

Measured V _____

Measured Power VI _____

30. Set up the following circuit with two batteries in parallel:



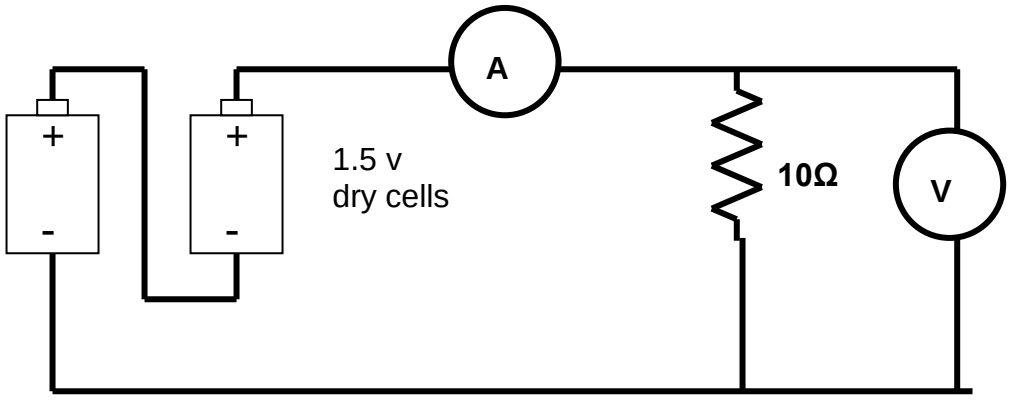
Measure the amperage and the voltage.

Measured I _____

Measured V _____

Measured Power VI _____

31. Set up the following circuit with two batteries in series:



Measure the amperage and the voltage.

Measured I _____

Measured V _____

Measured Power VI _____

32. Fill in the following Table with the values from the single cell, the two cells in parallel, and the two cells in series.

	Voltage volts	**Current amperage**	**Power watts**
Single Cell			
Parallel Cells			
Series Cells			

33. What conclusion can be drawn about series and parallel circuits?