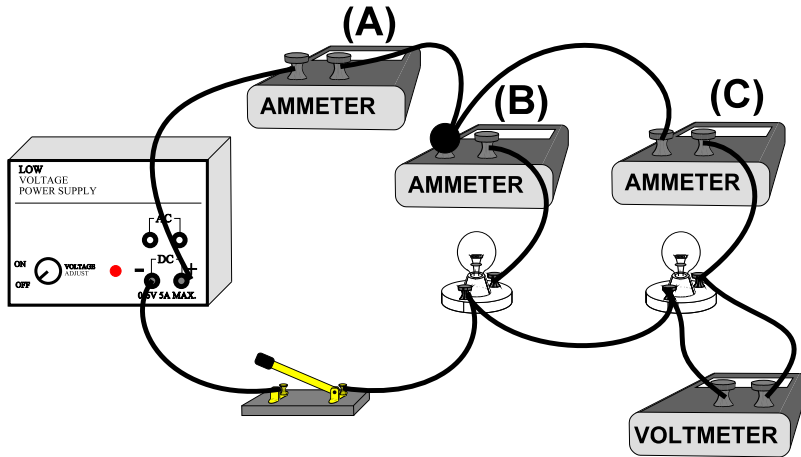


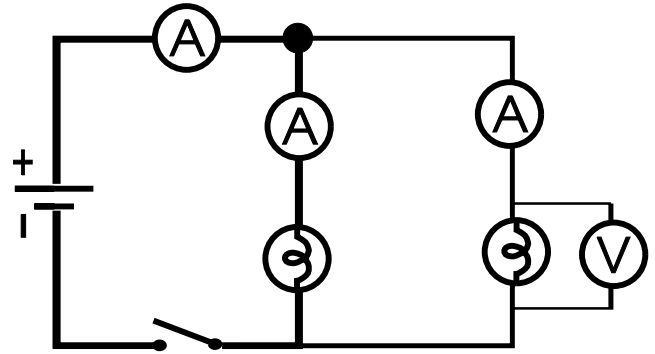
# Lesson 3: [||el+||el] Parallel Circuits

- 1) Connect the Circuit Picture with lines for wires using the Schematic Diagram. Locate the junction indicated with the large black dot on the Schematic Diagram with a large black dot on the Circuit Picture.

Circuit Picture



Schematic Diagram



- 2) When bulbs (or anything else) are connected side by side so that the current must divide at branch points, we call it a **parallel** circuit.
- 3) In the above circuit, if the voltage (potential) gain across the source is 1 Volt, what does our model predict about the voltage drop across the light bulb will be? Explain.

**All model predicts that the voltage (potential) drop across the light bulb will be 1 Volt. The Coulombs have to fall this distance to return to the battery.**

- 4) What does our model predict the voltage drop across the other light bulb will be? Explain.

**All model predicts that the voltage (potential) drop across the light bulb will be 1 Volt. The Coulombs have to fall this distance to return to the battery. The other light bulb in parallel makes no difference to the distance the Coulombs have to fall.**

- 5) If the voltage drop across the light bulbs is the same, what does our model predict the current through the bulbs will be? Explain.

**If the light bulbs are the same and the Coulombs give up the same amount of energy as they fall through the light bulbs, then the current will stay the same.**

- 6) Assume both bulbs are identical. In the above circuit, if the electric current through Ammeter (C) is one coulomb per second, then the current through Ammeter (B) will be one coulomb per second. What does our model predict about the electric current through Ammeter (A)? Explain.

**Because the light bulbs are identical to current through ammeters (B) and ammeter (C) will be the same. If both light bulbs and one Coulomb per second then, every second two Coulombs must be supplied through ammeter (A)**

- 7) If more bulbs are connected in parallel, what does our model predict about the brightness of each bulb? Explain

**Our model predicts the brightness of each light bulb will be the same. This is because the amount of energy each Coulomb loses as it falls to the bulb stays the same.**

8) If more bulbs are connected in parallel, what does our model predict about the current in the main circuit [Ammeter (A)]?

**The current in the main circuit will increase as it supplies Coulombs each second to more and more light bulbs.**

9) If more bulbs are connected in parallel, what does our model predict about the current in the branches [Ammeter (B) and Ammeter (C) or any additional ammeter ]?

**The current through each light bulbs stays the same because the Coulombs are falling the same distance (losing the same amount of energy) through identical light bulbs.**

10) As more bulbs are connected in parallel, what will happen to the number of paths for the current to flow?

**The number of paths increase because each additional identical light bulb adds another path for the Coulombs to flow.**

11) In a parallel circuit, if one light bulb burns out, what does our model predict will happen to  
A) the current in the main circuit [Ammeter (A)]?

**The main branch current will decrease .**

B) the current in the branch circuits [Ammeter (B) or (C)]?

**The current in the branch circuits will stay the same. They are unaffected by the other branches.**

C) the brightness of the remaining bulbs?

**The brightness of the remaining bulbs will stay the same because the current stays the same.**

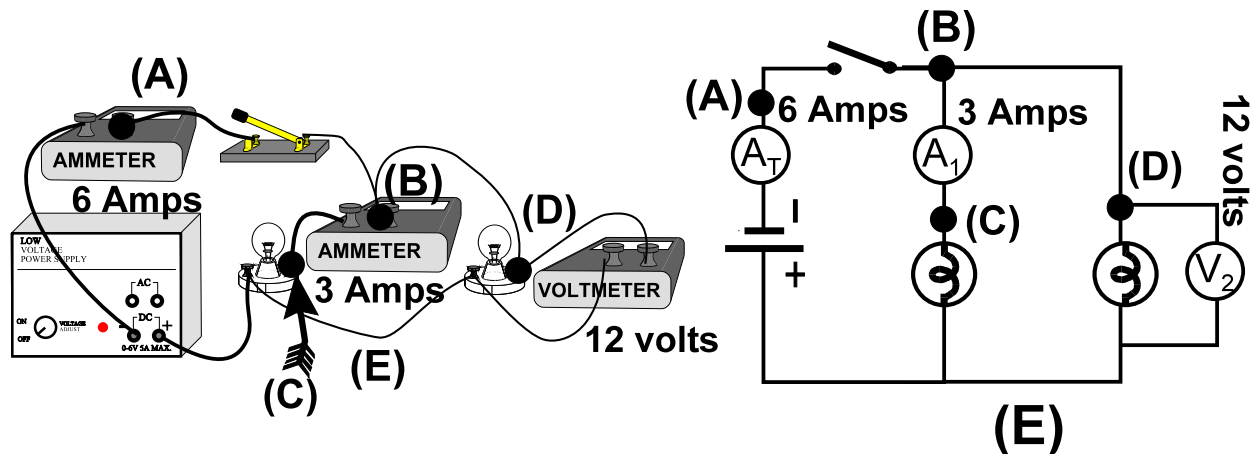
12) Is there ever any parallel circuit where one branch gets all the current and the other gets none ?"

**Hard question. -- The other branch could be an open switch, a broken wire, a really high resistance in one of the branches or the Voltmeter!**

## More Practice Connecting Circuits from Schematic Diagrams

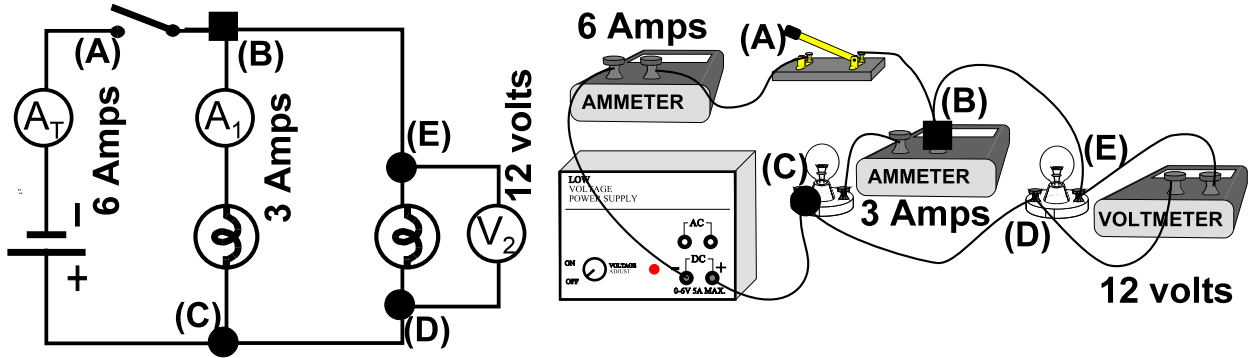
13)a) Label all the points indicated on the schematic diagram on the circuit picture.

b) Assume power supply produces 6 amperes and 12 volts, write the expected readings beside the each meter



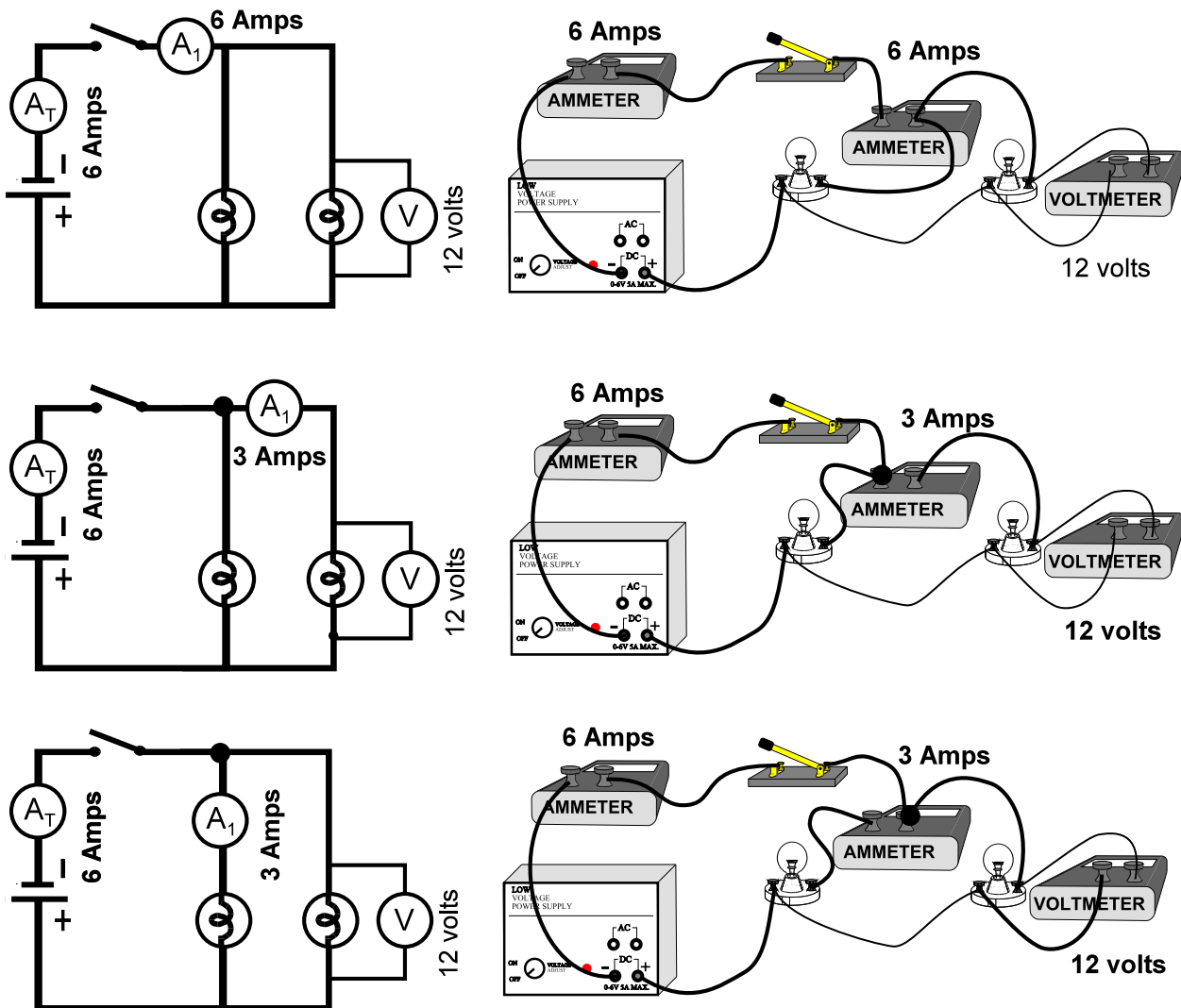
14)a) Label all the points indicated on the circuit picture on the schematic diagram.

b) Assume power supply produces 6 amperes and 12 volts, write the expected readings beside the each meter



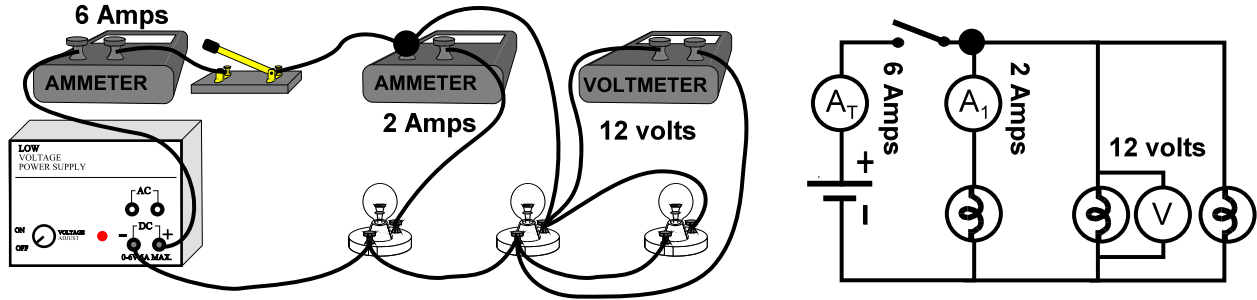
15)a) On the following three sets of diagrams, show where the Ammeters wired in the Circuit Picture, are on the Schematic Diagram **THIS QUESTION IS DESIGNED TO INTRODUCE A VERY COMMON WIRING ERROR BEFORE STUDENTS ACTUALLY WIRE IT**

b) Assume power supply produces 6 amperes and 12 volts, write the expected readings beside the each meter



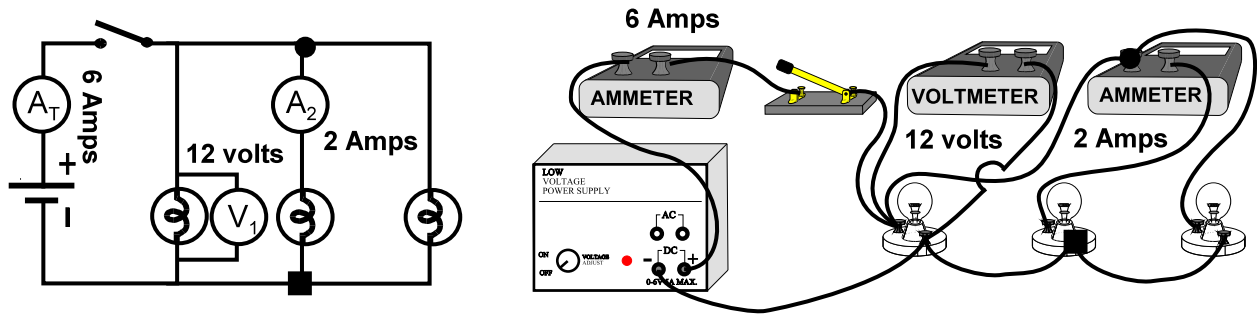
16)a) Draw lines to represent conductors on the Circuit Picture in order to complete the circuits shown the Schematic Diagram.

b) Assume power supply produces 6 amperes and 12 volts, write the expected readings beside the each meter



17)a) Sometimes its hard to physically place a meter in the same relative position (where it should be) Draw lines to represent conductors on the Circuit Picture in order to complete the circuits shown the Schematic Diagram.

b) Assume power supply produces 6 amperes and 12 volts, write the expected readings beside the each meter



# REALITY CHECK - Wiring Real Circuits

Wire the parallel circuits shown. Record the meter readings and compare bulb brightness. Note all meters do not have to be connected at once. Connect the meter in one particular position, take the reading, remove it and reconnect it in the next position.

Schematic Diagram	Voltage (Volts)		Current (Amperes)		Bulb Brightness	If one bulb is turned out:
	$V_T$		$A_T$	0.67 A	Normal Brightness	
	$V_1$	example 10 V	$A_1$	0.67 A		
	$V_T$		$A_T$	1.34 A	Same Brightness compared to the Normal	The other bulb Stays On
	$V_1$		$A_1$	0.67 A		
	$V_2$	example 10 V	$A_2$	0.67 A		
	$V_T$		$A_T$	2.01 A	Same Brightness compared to the Normal	The other bulbs Stay On
	$V_1$		$A_1$	0.67 A		
	$V_2$	example 10 V	$A_2$	0.67 A		
	$V_3$		$A_3$	0.67 A		

Use the results from your table to answer the following;

- In any parallel circuit, what can you say about the voltage drop across any bulb is about equal as the voltage gain across the source?
- In a circuit containing
  - ONE bulb, the current through the source is about = the current through the bulb.
  - TWO identical bulbs, the current through the source is about 2X the current through each bulb.
  - THREE identical bulbs, the current through the source is about 3X the current through each bulb.

Circle  $\uparrow$  for increase,  $\downarrow$  for decrease,  $\leftrightarrow$  for unchanged, and  $\rightarrow 0$  for goes to zero

3) Look at all three circuits;

As more bulbs are connected in parallel;

- A) the brightness of each bulb  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$
- B) the current in the main circuit  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$
- C) the current in the branches  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$
- D) the number of paths for the current  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$

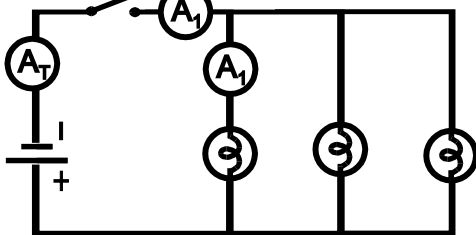
4) In a parallel circuit, if one light bulb burns out,

- A) the current in the main branch  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$
- B) the brightness of the remaining bulbs  $\uparrow$   $\downarrow$   $\leftrightarrow$   $\rightarrow 0$

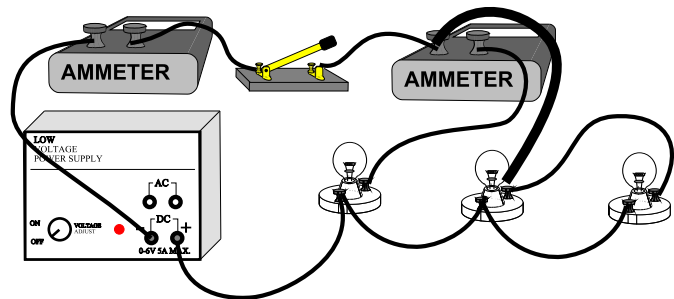
5) Voltmeters are connected in parallel to the rest of the circuit.

6) A student has used the schematic diagram below to wire the circuit picture shown. The ammeter ( $A_T$ ) at the source reads 6 Amps. The reading on ammeter ( $A_1$ ) should be 2 Amps. When the switch is closed, everything works as it should but the reading on the ammeter ( $A_1$ ) is three times what it should be. What is wrong?

$A_1$  was really wired here  $\rightarrow$

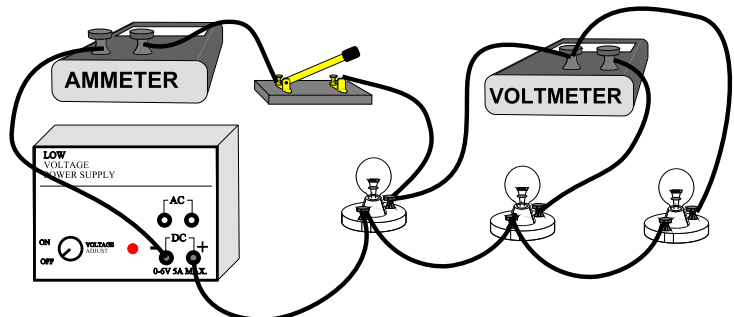
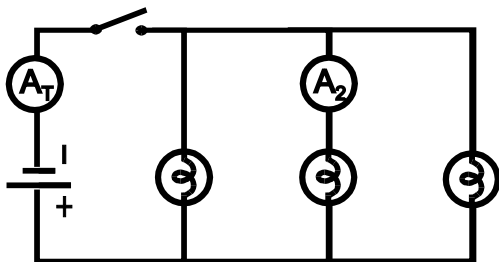


Bold wire was on wrong side of the Ammeter. The correction is shown



On the schematic diagram show where the ammeter ( $A_1$ ) is really wired. On the wiring diagram only one wire needs to be moved to correctly wire ammeter ( $A_1$ ). Draw in where the wire should be.

7) Another student has used the Schematic diagram below to wire the circuit picture shown. The ammeter ( $A_T$ ) at the source reads 6 Amps. The reading on an ammeter placed at  $A_2$  should be 2 Amps. When the switch is closed, the second light does not go on. The reading on the meter beside the second light is zero. What is wrong?



A voltmeter was mistakenly used at  $A_2$