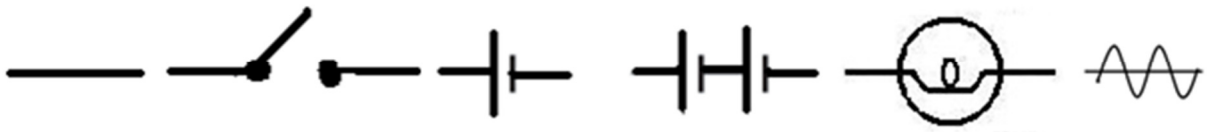
Key - Mr. Sudbury

Parallel Circuits Worksheet Name_____ Block_____ Date_____

Answer all the following questions about parallel circuits. When you have to draw schematic diagrams, use the proper circuit symbols (below), and when you have to calculate, use Ohm's Law:



$$I = \frac{V}{R}$$

Resistance in parallel circuits is the sum of the inverse of each resistor, and then the inverse of that sum

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$$

Rules for Parallel Circuits: 1) The voltage (V) is the same throughout every branch of the circuit. 2) The Current (I) splits into every branch of the circuit, depending on what resistance is in that branch (I=V/R). 3) The total resistance is the sum of the inverse resistances.

Part 1: Construct the following circuits out of the note cards parts. You have cards representing wires, light bulbs, switches, and dry cells (combine 2 or more to make a battery).

1. Create a circuit with 2 dry cells (a battery) together, two light bulbs in separate branches that have one switch that controls both bulbs simultaneously. I have to initial → Mr. S____

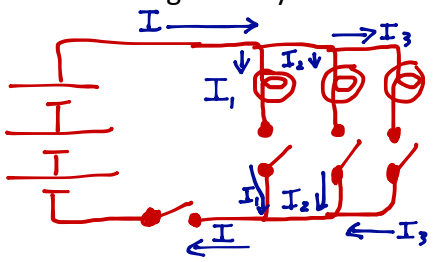
2. Draw the schematic diagram of your circuit using circuit symbols.

3. If the R_T (inverse sum of R_1 and R_2) is 2.5 Ohms and the total current is 10 Amps, what is the voltage provided by the battery?

$V = I \cdot R_T = 10\ \text{Amps} \times 2.5\ \text{Ohms} = 25\ \text{Volts}$

4. Construct, using the circuit cards, a circuit with a battery made from 3 dry cells. Your circuit should have 3 light bulbs with a separate switch that operates each bulb and then a 4th switch that turns all bulbs off at once. I have to initial → Mr. S____

5. Draw the schematic diagram of your circuit using the circuit symbols.



6. Use a different color pen/pencil to draw arrows showing each branch the current splits into. Label them I_1, I_2, I_3. ✓

7. The light bulb in branch 1 has 2Ω of resistance, the bulb in branch 2 has 4Ω of resistance, and the light bulb in the third branch has 6Ω of resistance. It may help you to label these on the schematic diagram. What is the total resistance (R_T) of the circuit?

$R_T = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{2\Omega} + \frac{1}{4\Omega} + \frac{1}{6\Omega} = 0.916$ now $\frac{1}{0.916} = \boxed{1.09\,\Omega}$

8. If the battery (sum of all the dry cells) provides 24-V of potential, what is the current in each branch?

Branch #1 $I = \frac{V}{R_1} = \frac{24v}{2\Omega} = \boxed{12A}$

Branch #2 $I = \frac{V}{R_2} = \frac{24v}{4\Omega} = \boxed{6A}$

Branch #3 $I = \frac{V}{R_3} = \frac{24V}{6\Omega} = \boxed{4A}$

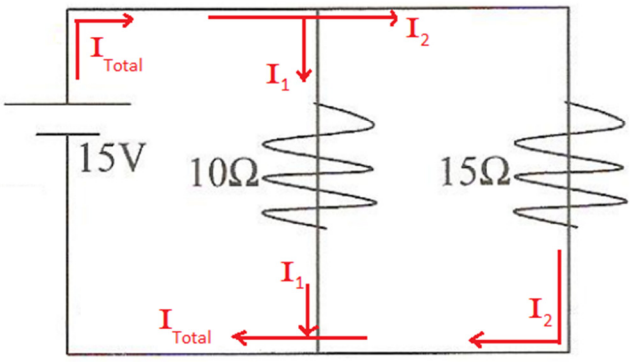
9. The total current for the circuit is the sum of all the branches. Using information from #8, what is the total current in the circuit?

$I = \boxed{22\,A}$

---

10. What is the R_T in the circuit to the right?

$R_T = \frac{1}{10\Omega} + \frac{1}{15\Omega} = 0.1\overline{6} = \frac{1}{0.16} = \boxed{6\,\Omega}$



11. What is the current in branch #1 (I_1)?

$I = \frac{V}{R_1} = \frac{15V}{10\Omega} = \boxed{1.5A}$

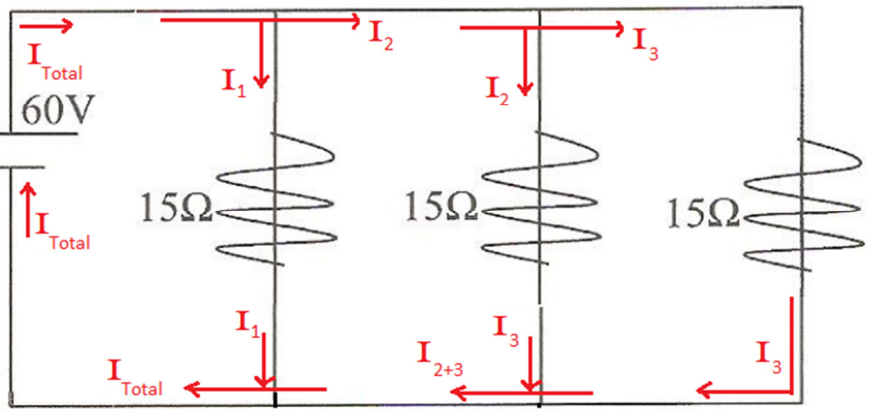
12. What is the current in branch #2 (I_2)?

$I = \frac{V}{R_2} = \frac{15v}{15\Omega} = \boxed{1A}$

13. What is the total current (I_{total}) for the entire circuit?

$\boxed{2.5A}$

14. What is the R_T in this circuit?



$R_T = \frac{1}{15} + \frac{1}{15} + \frac{1}{15} = 0.2$ so $\frac{1}{0.2} = 5\Omega$

15. Since each resistor is 15Ω, the current in each branch should be the same. What is the current in any single branch?

$I = \frac{V}{R} = \frac{60V}{15\Omega} = 4$ Amps

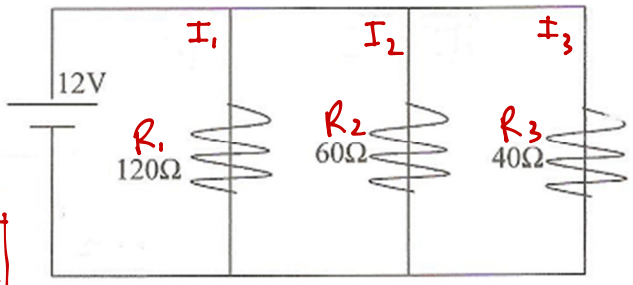
16. What is the total current in this circuit (the sum of all branches)?

12 Amps This can also be found by: $I = \frac{V}{R_T} = \frac{60V}{5\Omega} = 12A$

---

17. What is the current through the branch with the 60Ω resistor?

$I = \frac{V}{R_2} = \frac{12V}{60\Omega} = 0.2A$



18. What is the total resistance for the circuit?

$R_T = \frac{1}{120} + \frac{1}{60} + \frac{1}{40} = 0.05$ so $\frac{1}{0.05} = 20\Omega$

19. What is the total current? *(Hint: Use the V_T and the R_T and use Ohm's Law)*

$I_T = \frac{12V}{20\Omega} = 0.6A$

20. Which branch has the most current running through it? *(circle one)*

$I = \frac{V}{R}$ so the smallest "R".

a. The 120Ω branch b. The 60Ω branch c. The 40Ω branch

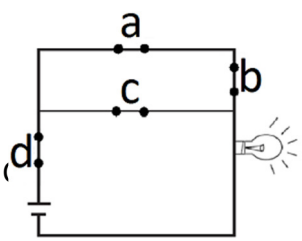
---

21. All the switches in the picture are "closed" so the bulb will light. Which switch, when open by itself, will turn off the light bulb?

switch D

22. If the wire containing switch C was removed, what type of circuit would remain?

Series circuit

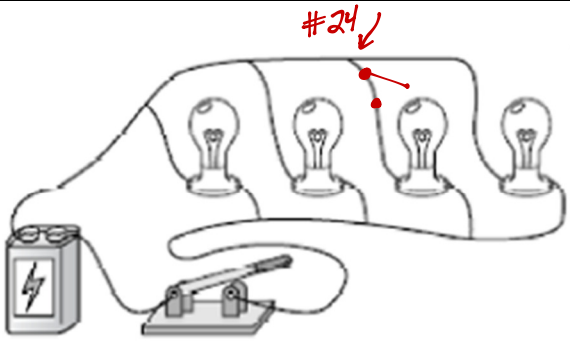


23. How many bulbs will the switch turn off or on simultaneously?

all four

24. Draw a switch into the circuit that switches on/off the third bulb ONLY.

✓



25. If each bulb has 5Ω resistance, and the battery provides 120 Volts of charge, what is the current in any 1 branch?

$I = \frac{V}{R} = \frac{120V}{5\Omega} =$ **24 Amps**

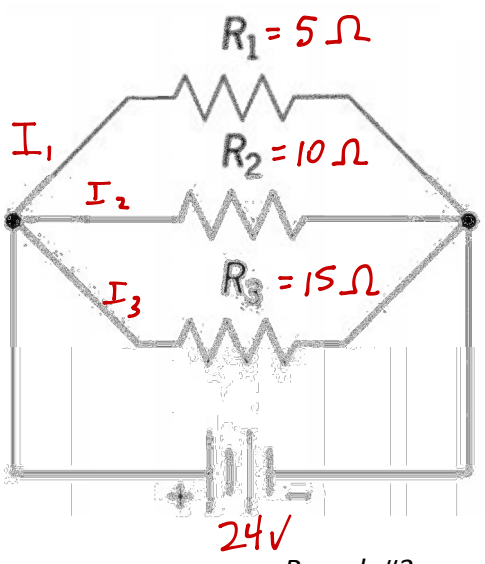
26. If each bulb has 5Ω resistance, and the battery provides 120 Volts of charge, what is the total current?

$R_T = \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = 0.8$ so $\frac{1}{0.8} = 1.25\Omega$

$I = \frac{V}{R_T} = \frac{120V}{1.25\Omega} =$ **96 A**

27. If R_1 = 5Ω, R_2 = 10Ω, and R_3 = 15Ω, what is the total resistance in the circuit.

$R_T = \frac{1}{5\Omega} + \frac{1}{10\Omega} + \frac{1}{15\Omega} = 0.3\bar{6}$ so $\frac{1}{0.3\bar{6}} =$ **2.7Ω**



28. If the total current is 8.88 amps, what is the voltage for the circuit?

$V = I \times R_T = 8.88A \times 2.7\Omega = 23.97$ or **24V**

29. We know the total current is 8.88 amps, but what is the current in each branch?

Branch #1

$I = \frac{V}{R_1} = \frac{24v}{5\Omega} =$ **4.8A**

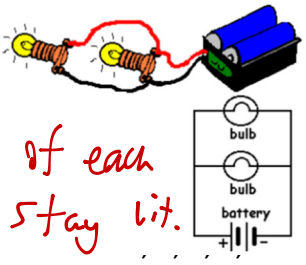
Branch #2

$I = \frac{V}{R_2} = \frac{24V}{10\Omega} =$ **2.4A**

Branch #3

$I = \frac{V}{R_3} = \frac{24v}{15\Omega} =$ **1.6A**

30. The circuit to the right is shown with both electrical components and the circuit diagram. If one bulb burns out or breaks, will the other bulb still light? Explain why or why not.



since they are parallel, both bulbs work independently of each other & if one burned out the other could stay lit.