Parallel Circuits

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- In a parallel circuit there are multiple paths for the current.
- Total resistance for resistors in parallel is equal to the inverse of the sum of the inverses of the individual resistors.

$$R_T = \left(\frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \cdots} \right)$$ or $$R_T = \frac{1}{R_1^{-1} + R_2^{-1} + R_3^{-1} \cdots}$$ or

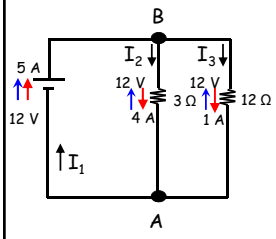
$$R_T = (R_1^{-1} + R_2^{-1} + R_3^{-1} \ldots)^{-1}$$

Kirchoff's Rules
Important Stuff for Circuits

- Loop rule (KVL):
  - The sum of the voltage around a closed loop is zero.
- Junction rule (KCL):
  - The sum of the current entering a junction is equal to the sum of the current leaving the junction

Sample Circuit

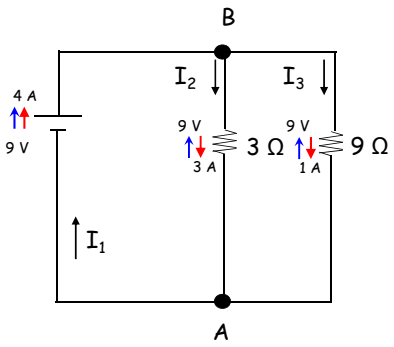
Known: V_{AB} = 12 V



1. Draw current and voltage arrows
2. Given V_{AB} = 12V
3. Determine the R_T
   - $R_T = (3^{-1} + 12^{-1})^{-1} = 2.4\Omega$
4. Determine I_1 ($V_{AB} = I_1 R_T$)
   - 12 V = I_1 (2.4 Ω) = 5 A
5. Use the loop rule (KVL) to determine the voltage at each resistor
6. Use V = I R at each resistor to determine I_2 and I_3
7. Junction rule (KCL)
   - For this circuit
   - $I_1 = I_2 + I_3$
   - 5A = 4A + 1A ✓

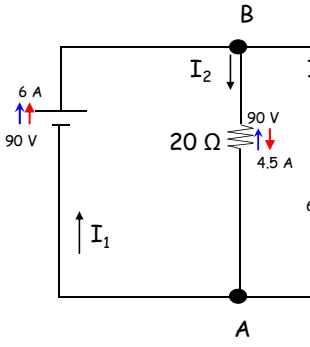
I_1 = 5 A
R_T = 2.4 Ω

Practice



I_1 = 4 A
I_2 = 3 A
I_3 = 1 A
R_T = 2.25 Ω
V_{AB} = 9 V

Practice



I_1 = 6 A
I_2 = 4.5 A
I_3 = 1.5 A
R_T = 15 Ω
V_{AB} = 90 V
V_{AC} = 60 V
V_{CB} = 30 V