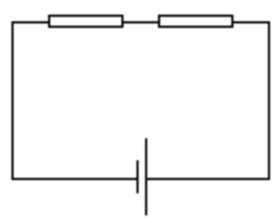
11. In which direction should current flow in order to recharge a secondary cell? Why?

Backwards through the cell – from positive to negative to reverse the chemical reaction within the cell

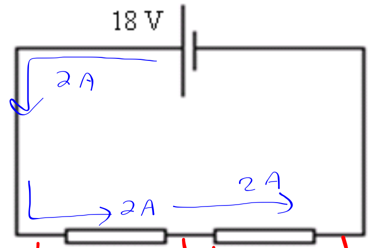
Series Circuits



Current	same everywhere	$I_T = I_1 = I_2 = \ldots$
Voltage	split up	$V_T = V_1 + V_2 + \ldots$
Resistance	adds up	$R_T = R_1 + R_2 + \ldots$
Power (brightness)	adds up	$P_T = P_1 + P_2 + \ldots$

Ratios: $\frac{P_1}{P_2} = \frac{V_1}{V_2} = \frac{R_1}{R_2}$ Control: $I_1 = I_2$

1. Determine the current through and the voltage drop across each resistor in the circuit below.



$R_T = 6\Omega + 3\Omega$
$= 9\Omega$

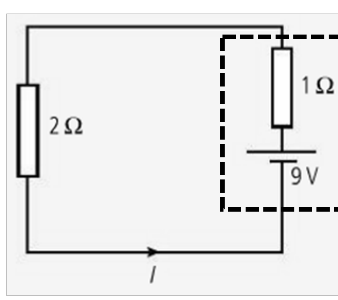
$I_T = V_T / R_T = 18V / 9\Omega = 2A = I_6 = I_3$

	I	V
3Ω	2A	6V
6Ω	2A	12V

6 Ω: $V = IR$
$= 2A \cdot 6\Omega$
$= 12V$

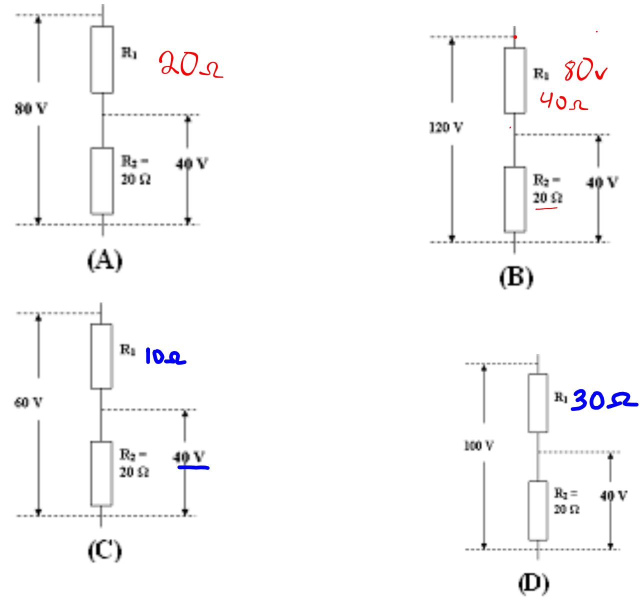
3 Ω: $V = IR$
$2A \cdot 3\Omega$
$6V$

2. A battery with an emf of 9 V and an internal resistance of 1 ohm is connected to a 2-ohm resistor as shown. How much current is in the circuit and what is the terminal potential difference?

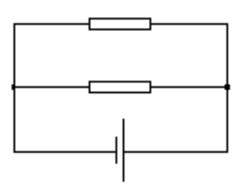


Potential Divider: Resistors in series act as a "potential (voltage) divider." They split the potential of the source between them.

3. A 20Ω device requires 40 V to operate properly but no 40 V source is available. In each case below, determine the value of added resistor R_1 that will reduce the voltage of the source to the necessary 40V for device R_2.



Parallel Circuits



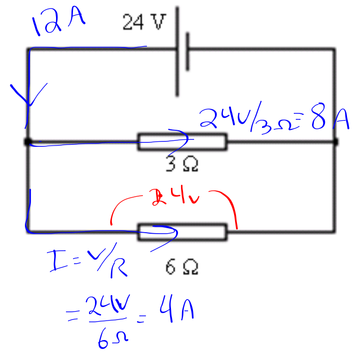
Current	split up	$I_T = I_1 + I_2 + \ldots$
Voltage	same everywhere	$V_T = V_1 = V_2 = \ldots$
Resistance	adds down	$1/R_T = 1/R_1 + 1/R_2 + \ldots$
Power (brightness)	adds up	$P_T = P_1 + P_2 + \ldots$

Ratios: $\frac{P_1}{P_2} = \frac{I_1 V}{I_2 V} = \frac{V^2/R_1}{V^2/R_2} = \frac{R_2}{R_1}$ Control: $V_1 = V_2$

4. Determine the current through and the voltage drop across each resistor in the circuit below.

$R_{eq} = \left(\frac{1}{6\Omega} + \frac{1}{3\Omega}\right)^{-1} = 2\Omega$

$I = V/R = \frac{24V}{2\Omega} = 12A$

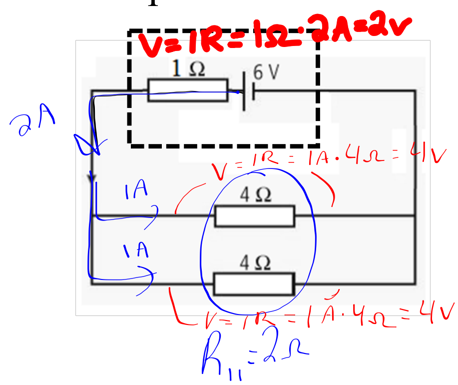


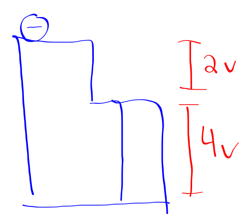
	I	V
3Ω	8A	24v
6Ω	4A	24v

5. A cell with an emf of 6 volts and an internal resistance of 1 ohm is connected as shown. Determine the total current in the circuit and the terminal potential difference.

$R_T = 1\Omega + 2\Omega$

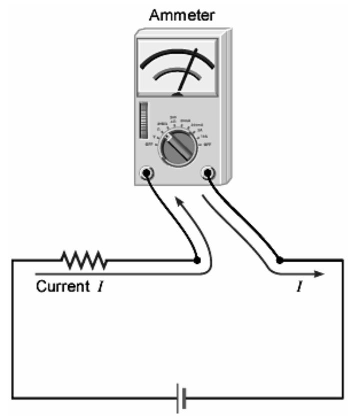
$I_T = V/R = \frac{6V}{3\Omega} = 2A$





	I	V
1Ω	2A	2v
4Ω	1A	4v
4Ω	1A	4V

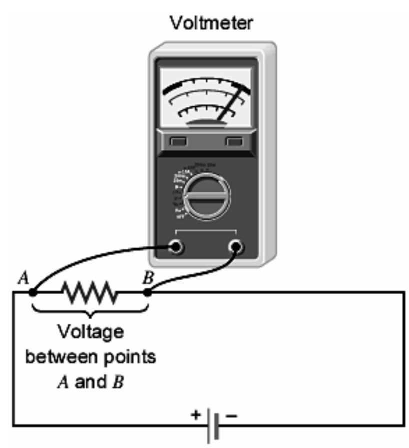
Ammeter: measures current



Placement: in series

Ideal ammeter: zero resistance

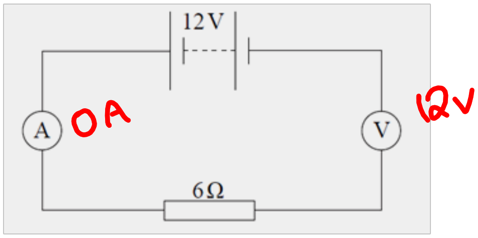
Voltmeter: measures potential difference

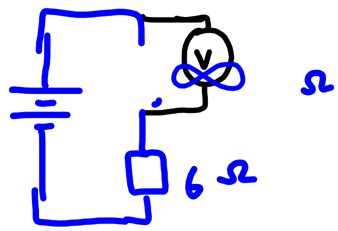


Placement: parallel

Ideal voltmeter: infinite

6. Which meter is improperly placed? What is the reading on each meter?





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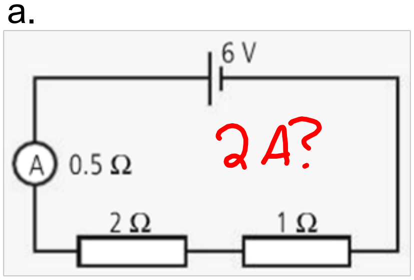
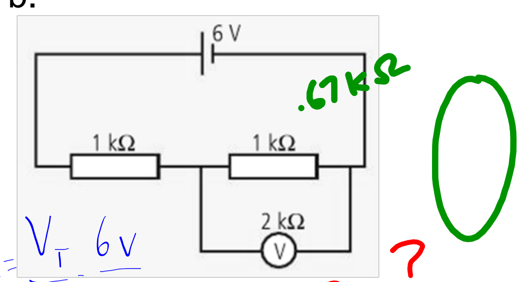
7. What is the reading on each of these non-ideal meters?

a.



$\frac{6V}{3.5\Omega} \sim 1.7A$

b.



$I_T = \frac{V_T}{R} = \frac{6V}{1.67k\Omega}$