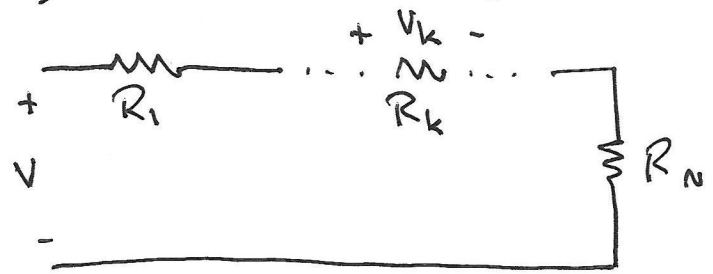
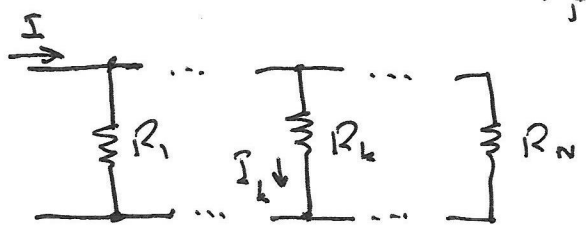
Stuffle.website

Voltage Divider (series resistors)



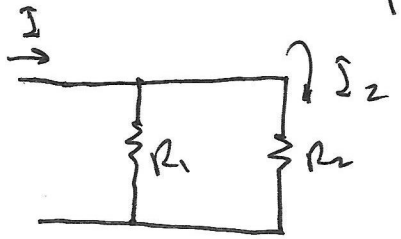
$$\frac{V_k}{V} = \frac{R_k}{R_1 + \cdots + R_k + \cdots + R_N} = \frac{R_k}{R_{eq}}$$

Current Divider (parallel resistors)



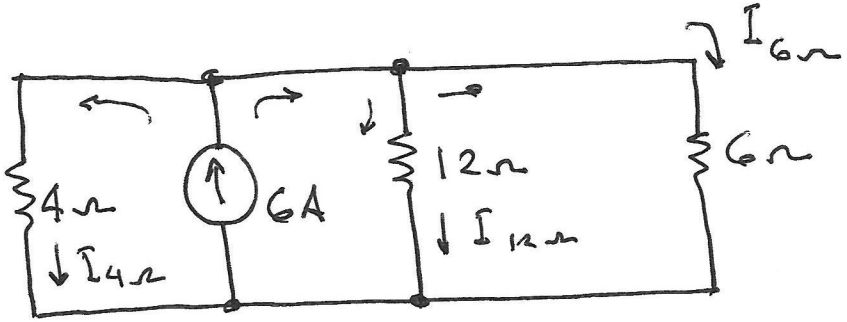
$$\frac{I_k}{I} = \frac{\frac{1}{R_k}}{\frac{1}{R_1} + \cdots + \frac{1}{R_k} + \cdots + \frac{1}{R_N}} = \frac{G_k}{G_{eq}}$$

Special case, 2 resistors



$$\frac{I_2}{I} = \frac{R_1}{R_1 + R_2}$$

Do not try to extend this to 3 or more resistors.



$$\frac{I_{6\Omega}}{6A} = \frac{\frac{1}{6}}{\frac{1}{4}+\frac{1}{12}+\frac{1}{6}}$$

$$= \frac{2}{6} = \frac{1}{3}$$

$$I_{6\Omega} = 2\,A$$

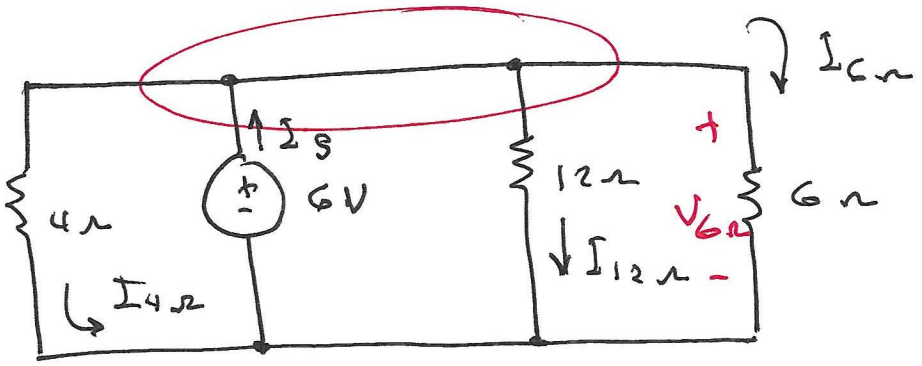
$$\frac{I_{12\Omega}}{6A} = \frac{\frac{1}{12}}{\frac{1}{4}+\frac{1}{12}+\frac{1}{6}} = \frac{1}{6}$$

$$I_{12A} = 1\,A$$

$$\frac{I_{4\Omega}}{6A} = \frac{\frac{1}{4}}{\frac{1}{4}+\frac{1}{12}+\frac{1}{6}} = \frac{3}{6} = \frac{1}{2} \Rightarrow I_{4\Omega} = 3\,A \quad (CD)$$

$$I_{4\Omega} + I_{12\Omega} + I_{6} = 6A \Rightarrow I_{4\Omega} = 3\,A \quad (KCL)$$

1 2



$$I_{6\Omega} = \frac{6V}{6\Omega} = 1A$$

$$I_{12\Omega} = \frac{6V}{12\Omega} = \frac{1}{2}A$$

$$I_{4\Omega} = 1\frac{1}{2}A$$

$$I_s = 3A \quad (KCL)$$

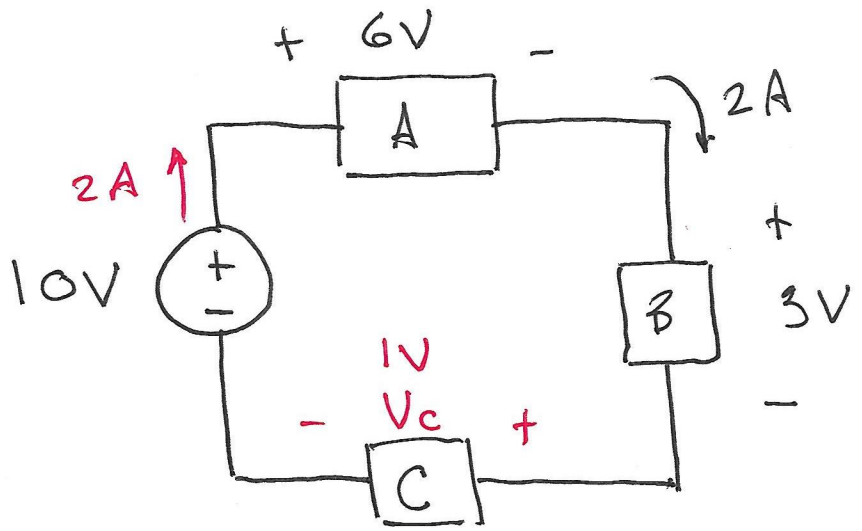
$P_{6\Omega} = V_{6\Omega} \cdot I_{6\Omega} = 6V \cdot 1A = 6\,W$

$P_{12\Omega} = V_{6\Omega} \cdot I_{12\Omega} = 6V \cdot \frac{1}{2}A = 3\,W$

$P_{4\Omega} = V_{6\Omega} \cdot I_{4\Omega} = 6V \cdot \frac{3}{2}A = 9\,W$

$P_S = P_{6\Omega} + P_{12\Omega} + P_{4\Omega} = 6 + 3 + 9 = 18\,W$

or $6V \cdot I_S = 6V \cdot 3A = 18\,W$

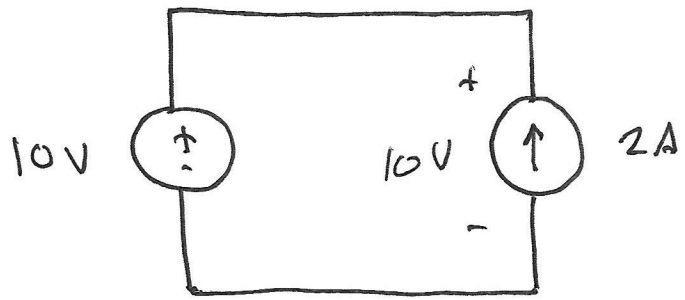


1. Does C "absorb" or "deliver" power?
2. How much?
3. Does the source "absorb" or "deliver" power?
4. How much?

1. $-10 + 6 + 3 + V_c = 0 \Rightarrow V_c = 1\,V$
2. C absorbs power because V_c and the current satisfy the PSC.

$$P_c = 1V \cdot 2A = 2W$$

3. delivers because it does not satisfy the PSC.
4. $P = 10V \cdot 2A = 20W$



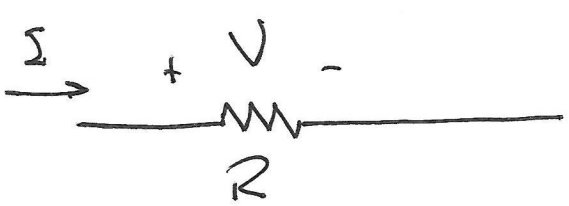
Does the voltage source deliver power?

No because it satisfies the PSC.

It absorbs $P = 10V \cdot 2A = 20W$

The current source does not satisfy the PSC

$\therefore$ it delivers power $= 10V \cdot 2A = 20W$



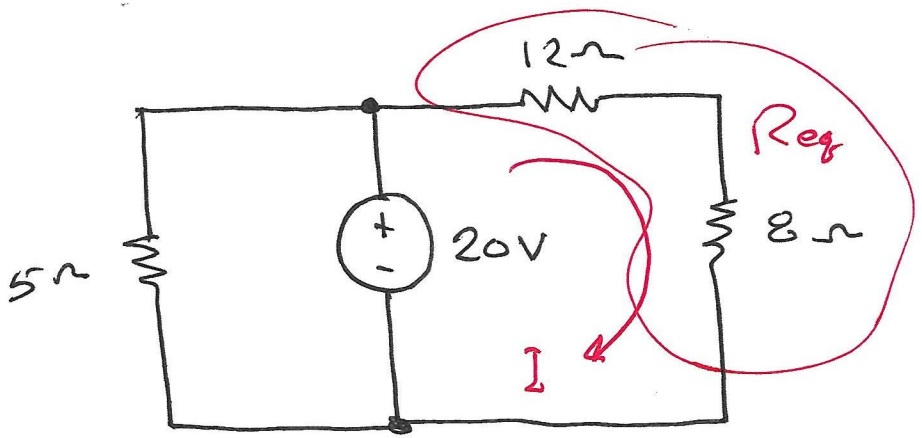
$V = RI$

or $I = \frac{1}{R}V$

$$P = VI = RI \cdot I = RI^2$$

$$= V \cdot \frac{1}{R}V = \frac{V^2}{R}$$

$P = RI^2$ or $\frac{1}{R}V^2$ for a resistor



How much power does each component deliver or absorb?

$$P_{abs,\,5\Omega} = \frac{(20V)^2}{5\Omega} = 80\ W$$

$$R_{eq} = 12 + 8 = 20\Omega$$

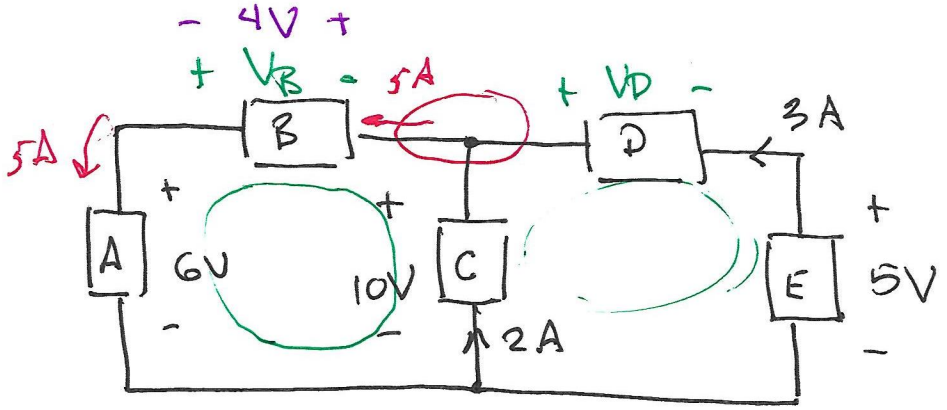
$$I = \frac{20V}{R_{eq}} = \frac{20V}{20\Omega} = 1A$$

$$P_{abs,\,12\Omega} = I^2 \cdot 12\Omega = 1^2 \cdot 12 = 12\ W$$

$$P_{abs,\,8\Omega} = I^2 \cdot 8\Omega = 1^2 \cdot 8 = 8\ W$$

$$P_{del,\,20V} = P_{abs,\,5\Omega} + P_{abs,\,12\Omega} + P_{abs,\,8\Omega} = 80 + 12 + 8$$

$$= 100\ W$$



For each component, is power "delivered" or "absorbed"?

A absorbs power

$-6 + V_B + 10 = 0 \Rightarrow V_B = -4V$

B absorbs power

C delivers power

D delivers power

E delivers power

$-10 + V_D + 5 = 0$

$\Rightarrow V_D = 5V$

How much?

$P_A = 6V \cdot 5A = 30W$ absorbed
$P_B = 4V \cdot 5A = 20W$ absorbed
} 50W absorbed

$P_C = 10V \cdot 2A = 20W$ delivered
$P_D = 5V \cdot 3A = 15W$ delivered
$P_E = 5V \cdot 3A = 15W$ delivered
} 50W delivered

Conservation of power is satisfied.