

Chapter 7 Electrical Power

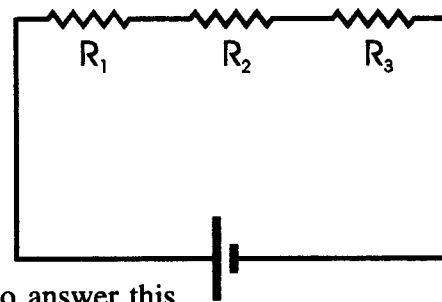
In-Class Questions

Prerequisite Concepts:

- Definition of power, $P = \Delta \text{Energy} / \Delta t$
- Equivalent resistance of series circuit: $R_{\text{equiv}} = R_1 + R_2 + \dots$
- Power supplied by battery given by $P = I \Delta V_{\text{bat}}$
- Power dissipated by resistor given by $P = I \Delta V_{\text{res}} (= I^2 R = [\Delta V_{\text{res}}]^2 / R)$

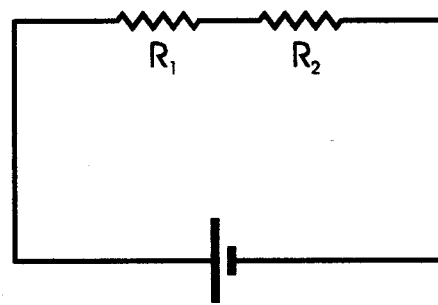
1. The battery in this circuit supplies 10 J of energy per second. Let P_1 represent the power dissipated in resistor R_1 , etc. Which of the following statements is correct?

- A. $[P_1 + P_2 + P_3] > 10 \text{ W}$
 B. $[P_1 + P_2 + P_3] = 10 \text{ W}$
 C. $[P_1 + P_2 + P_3] < 10 \text{ W}$
 D. Need to know magnitudes of R_1 , R_2 , and R_3 to answer this.
 E. Need to know battery voltage to answer this.
 F. Need to know battery voltage *and* magnitudes of each resistor to answer this.



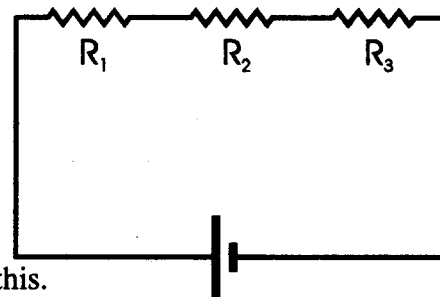
2. If $R_1 = R_2$, how do P_1 and P_2 compare:

- A. $P_2 > P_1$
 B. $P_2 = P_1$
 C. $P_2 < P_1$
 D. Need to know magnitudes of R_1 and R_2 to answer this.
 E. Need to know battery voltage to answer this.
 F. Need to know battery voltage *and* magnitudes of each resistor to answer this.



3. In this circuit, $R_2 = 2R_1$, and $R_3 = 3R_1$. Which resistor dissipates the most energy each second?

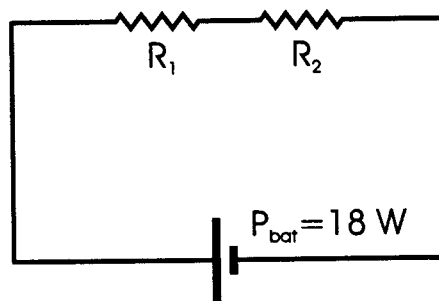
- A. R_1
 B. R_2
 C. R_3
 D. They all dissipate the same amount of energy each second.
 E. Need to know actual magnitudes of each resistor to answer this.



4. Resistors R_1 and R_2 are connected in series to a battery; $R_2 = 2R_1$. Then:
- A. $P_2 = 0.25 P_1$
 - B. $P_2 = 0.5 P_1$
 - C. $P_2 = P_1$
 - D. $P_2 = 2 P_1$
 - E. $P_2 = 4 P_1$
5. A battery is connected to a resistor with resistance R ; the power dissipated by the resistor is P . If this *same* battery is connected to a different resistor with resistance $2R$, what will be the power dissipated by this new resistor?
- A. $P/4$
 - B. $P/2$
 - C. P
 - D. $2P$
 - E. $4P$
 - F. not enough information to answer
6. If a 3 A current is flowing through a 12Ω resistor, how much energy is being dissipated each second in the resistor (mainly through heat)?
- A. 4 J
 - B. 24 J
 - C. 36 J
 - D. 48 J
 - E. 72 J
 - F. 108 J
 - G. 432 J
7. When a 3-ohm resistor is connected to a battery, 2 A of current flow through that resistor. If the same battery is connected to a 6-ohm resistor, how much power will be dissipated in the 6-ohm resistor?
- A. 4 W
 - B. 6 W
 - C. 9 W
 - D. 12 W
 - E. 24 W

In-Class Exercises

Questions #1–2 refer to this figure:



Let P_{R_1} and P_{R_2} represent the power dissipated by resistors R_1 and R_2 , respectively. The power supplied by the battery (P_{bat}) is 18 W.

1. If $R_2 = R_1$, find the following values:

$$P_{R_1} = \underline{\hspace{2cm}}$$

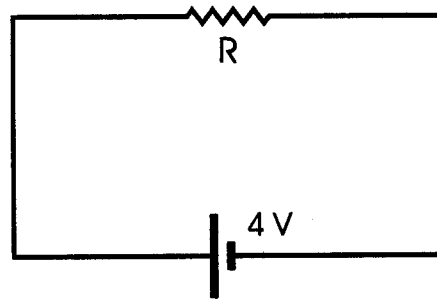
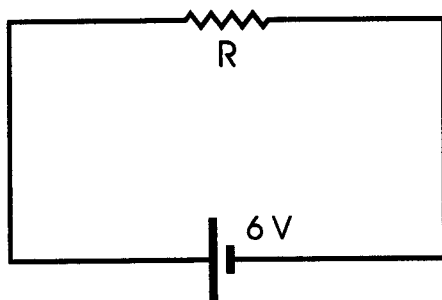
$$P_{R_2} = \underline{\hspace{2cm}}$$

2. If $R_2 = 2R_1$, find the following values:

$$P_{R_1} = \underline{\hspace{2cm}}$$

$$P_{R_2} = \underline{\hspace{2cm}}$$

3.



The two circuits shown have identical resistors, but different batteries. The current flowing in the circuit on the left is 3 A. What is the power dissipated by the resistor in the circuit on the *right*?

$$P = \underline{\hspace{2cm}}$$

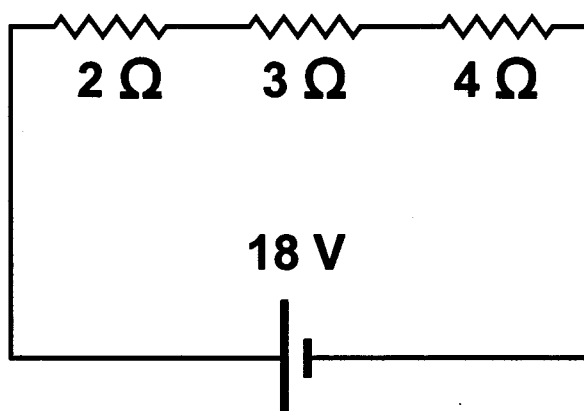
4. Write down the magnitude of the power dissipated in each resistor, and the amount of power supplied by the battery:

$$P_{2\Omega} = \underline{\hspace{2cm}}$$

$$P_{3\Omega} = \underline{\hspace{2cm}}$$

$$P_{4\Omega} = \underline{\hspace{2cm}}$$

$$P_{\text{bat}} = \underline{\hspace{2cm}}$$



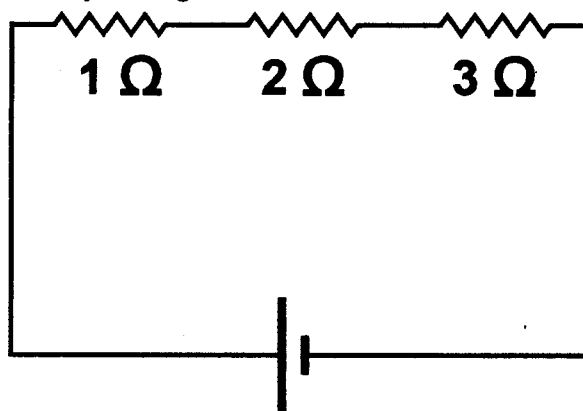
5. The battery in this circuit supplies 60 joules per second. Write down the magnitude of the power dissipated in each resistor, and the battery voltage:

$$P_{1\Omega} = \underline{\hspace{2cm}}$$

$$P_{2\Omega} = \underline{\hspace{2cm}}$$

$$P_{3\Omega} = \underline{\hspace{2cm}}$$

$$V_{\text{bat}} = \underline{\hspace{2cm}}$$



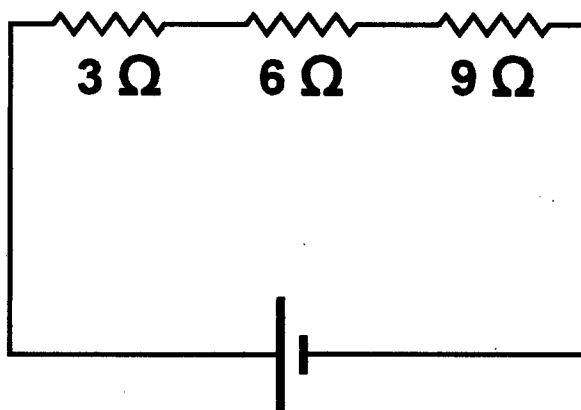
6. The power dissipated by the 3Ω resistor is 27 W. Find the power dissipated in each of the other resistors, and find the battery voltage and the amount of power supplied by the battery:

$$P_{6\Omega} = \underline{\hspace{2cm}}$$

$$P_{9\Omega} = \underline{\hspace{2cm}}$$

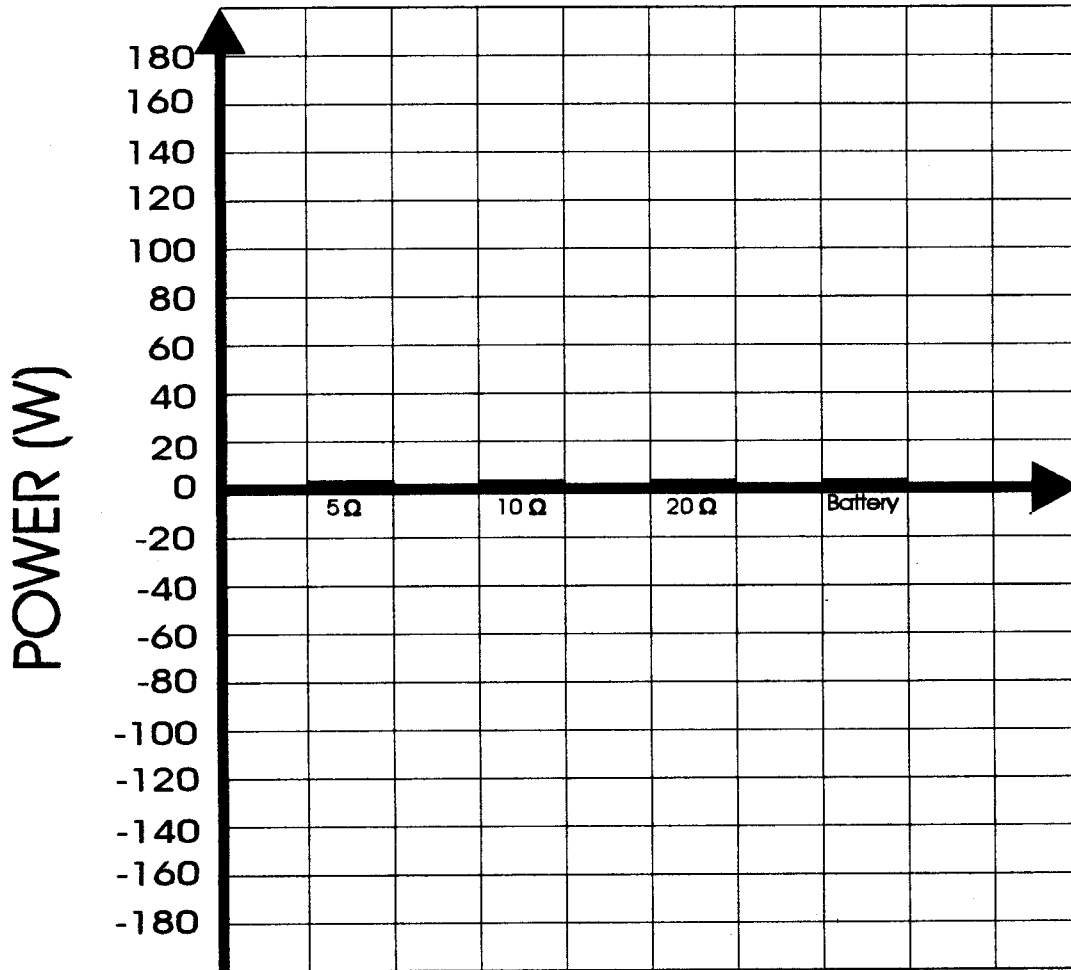
$$V_{\text{bat}} = \underline{\hspace{2cm}}$$

$$P_{\text{bat}} = \underline{\hspace{2cm}}$$



Homework Exercises

1. A 5-ohm resistor, a 10-ohm resistor and a 20-ohm resistor are connected in series with a 70-V battery. Draw a bar graph showing the amount of power supplied (positive) or dissipated (negative) by the 5-ohm resistor, the 10-ohm resistor, the 20-ohm resistor, and the battery.



For questions #2–5, explain your answers in detail.

2. How much energy is dissipated by a 100-W bulb burning for 5 minutes?

