Power Plan Test

Model voltage and current at two loads

PS.3.d "Develop and use models to determine the relationships among voltage, current, and resistance at specific loads in series and parallel circuits."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the rule for current in a series circuit and circle the rule for voltage in a parallel circuit. Number the two steps used to find a load's current.

Wiring the Warming Pads

1 A portable exhibit uses two resistive warming pads powered by an 18 V supply. Pad A has a resistance of 6 Ω, and pad B has a resistance of 12 Ω. A designer tests two wiring plans before building anything. The table records an ideal circuit model, with wires and the power supply treated as having no resistance.

IDEAL MODEL FOR AN 18 V SUPPLY

Wiring plan	Load	Resistance	Voltage across load	Current through load
Series	Pad A	6 Ω	6 V	1 A
Series	Pad B	12 Ω	12 V	1 A
Parallel	Pad A	6 Ω	18 V	3 A
Parallel	Pad B	12 Ω	18 V	1.5 A

2 In a series circuit, charges have only one path, so the same current passes through both loads. The voltage drops across the loads add to the supply voltage. A load with greater resistance gets a greater share of that voltage. To check any load, first identify its voltage. Next divide that voltage by its resistance to find its current.

3 In a parallel circuit, each branch connects across the supply, so each load receives the full supply voltage. Branch currents add to give the current delivered by the supply. For either wiring plan, divide supply voltage by total current to find equivalent resistance. This lets the designer compare how much current each plan demands from the supply.

2 ANSWER WITH EVIDENCE

Use the passage

1. Using the series rows, what current passes through each pad, and what feature of the circuit explains this match?

2. In the series plan, how do the pads' resistances and voltage drops compare? Use the drops to check the supply voltage.

3. In the parallel plan, compare the voltage and current at the two pads. Why are their currents different?

4. What total current does the parallel plan draw, and what equivalent resistance does that give for the 18 V supply?

3 YOUR TURN

Your own words

Create a four-row model for a 24 V supply connected to an 8 Ω load and a 16 Ω load, showing each load in both series and parallel plans. Fill in each load's voltage and current, then write one sentence comparing the plans' total currents.

WIRING PLAN	LOAD	RESISTANCE	VOLTAGE ACROSS LOAD	CURRENT THROUGH LOAD

Power Plan Test

PART 1 · READ AND MARK

Underline the rule for current in a series circuit and circle the rule for voltage in a parallel circuit. Number the two steps used to find a load's current. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Using the series rows, what current passes through each pad, and what feature of the circuit explains this match?	**Each pad carries 1 A because a series circuit has only one path for current.**
2	In the series plan, how do the pads' resistances and voltage drops compare? Use the drops to check the supply voltage.	**Pad B has twice Pad A's resistance and twice its voltage drop. The drops add to 18 V: 6 V + 12 V.**
3	In the parallel plan, compare the voltage and current at the two pads. Why are their currents different?	**Both pads have 18 V across them. Pad A carries 3 A, twice Pad B's 1.5 A, because Pad A has half the resistance.**
4	What total current does the parallel plan draw, and what equivalent resistance does that give for the 18 V supply?	**The total current is 3 A + 1.5 A = 4.5 A. The equivalent resistance is 18 V ÷ 4.5 A = 4 Ω.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Series | 8 Ω load | 8 Ω | 8 V | 1 A
Series | 16 Ω load | 16 Ω | 16 V | 1 A
Parallel | 8 Ω load | 8 Ω | 24 V | 3 A
Parallel | 16 Ω load | 16 Ω | 24 V | 1.5 A
The series plan draws 1 A total, while the parallel plan draws 4.5 A total.

Accept equivalent wording for the circuit rules. In Part 3, the series currents must match, and the parallel branch currents must add to 4.5 A.