Problem from Monday

What is the resistance ratio of a 50 W bulb and a 100 W bulb? R_{50}/R_{100} =

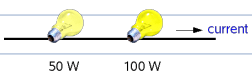
a) 1 / 1
b) 2 / 1
c) 1 / 2
d) 0 / ∞

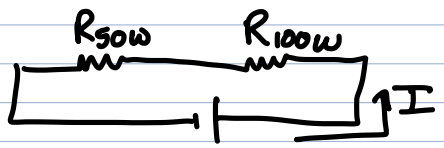
The power ratings correspond to what occurs after plugging them into 120 V source

1. $\frac{P_{50W}}{P_{100W}} = \frac{1}{2} = \frac{50W}{100W}$

2. $\frac{P_{50W}}{P_{100W}} = \frac{V^2/R_{50W}}{V^2/R_{100W}} = \frac{R_{100W}}{R_{50W}}$

① & ② $\Rightarrow \frac{R_{50W}}{R_{100W}} = \frac{2}{1}$





same current!

In series, which will burn brighter?
a) 50 W bulb
b) 100 W bulb
c) equally bright
d) not enough information

The convenient version for P here is I^2R

$\frac{P_{50W}}{P_{100W}} = \frac{I^2R_{50W}}{I^2R_{100W}} = \frac{R_{50W}}{R_{100W}} = 2 \Rightarrow$ 50 W bulb 2x as bright

A MODEL FOR CIRCUITS PART 1: CURRENT AND RESISTANCE

EM 97

In this tutorial, we construct a model for electric current that we can use to predict and explain the behavior of simple electric circuits.

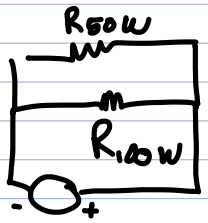
I. Complete circuits

A. Obtain a battery, a light bulb, and a single piece of wire. Connect these in a variety of ways. Sketch each arrangement below.

Arrangements that *do* light the bulb	Arrangements that *do not* light the bulb

You should have found at least four different arrangements that light the bulb. How are these arrangements similar? How do they differ from arrangements in which the bulb does not light?

bulbs in parallel

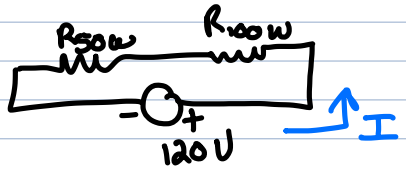


same voltage

$$\frac{P_{50W}}{P_{100W}} = \frac{V^2/R_{50W}}{V^2/R_{100W}} = \frac{1}{2}$$

Q: what is I for 2 bulbs in series?

A:



$$\Sigma \Delta V = 0 \rightarrow V_{outlet} - IR_{100} - IR_{50} = 0$$

$$\rightarrow V_{outlet} = I(R_{100} + R_{50})$$

Important finding: Resistances add when in series

$$R_{eq} = R_1 + R_2 + \dots + R_N$$

$$\Rightarrow I = \frac{V_{outlet}}{R_{100W} + R_{50W}}$$

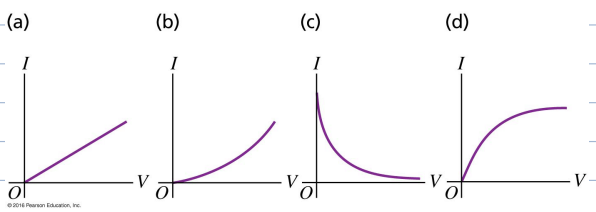
need to know R_{100W} & R_{50W} → but we know their power and the applied voltage

$R_{50W} = (120V)^2/50W = 288\,\Omega$

$R_{100W} = (120V)^2/100W = 144\,\Omega$

} $R_{eq} = R_{50} + R_{100} = 432\,\Omega$

$$\rightarrow I = \frac{V_{outlet}}{R_{eq}} = \frac{120V}{432\,\Omega} = 280\,mA$$



ch 9 concept Q #4

$I = \frac{1}{R}V$ and R increases for higher temps (and the resistor heats up for higher voltage)

Concept Q #5 ch 9

8 batteries in series. Each R is 0.2Ω (D cell)

Lame hunting story

$R_{eq} = 1.6\,\Omega \Rightarrow I = \frac{V}{R} = \frac{12V}{1.6\Omega} = 7.5\,A$

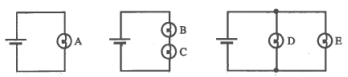
8 D cells in parallel: $\frac{1}{R_{eq}} = \frac{1}{R}+\frac{1}{R}+\frac{1}{R}+\frac{1}{R}+\frac{1}{R}+\frac{1}{R}+\frac{1}{R}+\frac{1}{R}$

$\frac{1}{R_{eq}} = 8\cdot\frac{1}{0.8} = 40 \rightarrow R_{eq} = 0.025\,\Omega$

$I = V/R = 1.5V/0.025\Omega = 60\,A$ almost enough current! Would theoretically 27 D cells in parallel to achieve 200A

Pretest: A model for circuits part 1: current and resistance Name _____ Pretests 139

1. The three circuits below contain identical bulbs and identical batteries. Assume the batteries are ideal (*i.e.*, the batteries have no internal resistance).



Rank the brightnesses of the five bulbs above. Explain how you determined your answer.

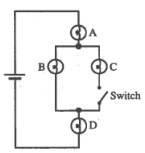
from ch 10 tutorials

current in bulb A is $\frac{V}{R}$

$P_A = P_D = P_E$ same voltage and resistance

$P_A = 4P_B = 4P_C$ since $I_B = \frac{1}{2}A$ since $R_{BC} = 2R_A$ and $P = I^2R$

2. The circuit at right contains an ideal battery, three identical light bulbs, and a switch.



With the switch open:

Rank the brightnesses of the bulbs. Explain.

$P_C = 0$ $P_A = P_B = P_D$

After the switch closes:

Does the brightness of bulb A *increase*, *decrease*, or *remain the same?* Explain.

$R_{eq} = 2.5\,R$ (versus $3R$ above) $\Rightarrow I_A$ is larger when switch is closed