Bulbs rated at 120 V, A: 100 watt — 140 Ω

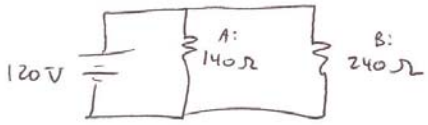
B: 60 watt — 240 Ω

find resistance of each bulb, since resistance is an unchanging property of each:

$$P = \frac{V^2}{R} \longrightarrow R = \frac{V^2}{P} = \frac{(120\text{V})^2}{100\text{ W}} =$$

$$= \frac{(120\text{V})^2}{60\text{ W}} =$$

(a) Both bulbs get their rated 120 V. Circuit looks like this:



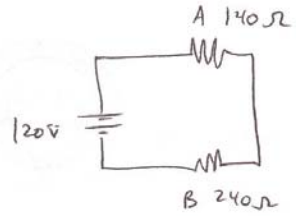
start with:

	V	I	R	P
A	120 V		140 Ω	
B	120 V		240 Ω	
total	120 V			

use ohm's law for A + B; $I = \frac{V}{R}$ and $P = \frac{V^2}{R}$ to get

	V	I	R	P
A	120 V	860 mA	140 Ω	100 W
B	120 V	500 mA	240 Ω	60 W
total	120 V	1360 mA	88 Ω	160 W

(b)



Resistance of each is unchanged; Power will NOT be as rated!

Series resistors have 380Ω equivalent resistance.

start with:

	V	I	R	P
A			140Ω	
B			240Ω	
total	120V		380Ω	

Solve for total current in the circuit, which is also the current through each bulb; then use ohm's law to fill in.

$$I_{tot} = \frac{V}{R} = .32\ A \quad (= 320mA)$$

$P = I^2R$

	V	I	R	P
A	45 V	320mA	140Ω	14 W
B	77 V	320mA	240Ω	25 W
total	120 V	320mA	380Ω	39 W

($V_A + V_B$ don't quite equal 120 V because of rounding.)

(c) The brightness of a bulb depends on the power dissipated by the bulb. In part (a), when the bulbs connect to their rated 120 V, the bulbs also dissipated their rated power, thus the 100 W bulb is brighter.

However, in (b), the bulbs are connected in series & thus are NOT connected to the 120 V they're rated for. The bulbs must split the 120 V provided. Since the "60 W" bulb has a bigger resistance, it gets the majority of the 120 V from the battery. Since both bulbs get the same current, the "60 W" bulb with more voltage dissipates more power!

Note that even though the "60 W" bulb is brighter than the "100 W" bulb when they're connected in series, both bulbs dissipate less power than they're rated for — thus both bulbs are less bright than when they connect directly to a wall outlet.