All 3 lights are in parallel.

They will give \( R_{eq} = \left( \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4} \right)^{-1} \)

Then \( R_1 \) is in series with \( R_{234} \) so \( R_{eq} = R_1 + R_{234} \)

A) Find current in each bulb.

First find \( R_{eq} \), then use \( V = IR \) to get \( I \). Then divide current between resistors.

\[
R_{eq} = \left( \frac{1}{4.5\Omega} + \frac{1}{4.5\Omega} + \frac{1}{4.5\Omega} \right)^{-1} + 4.5\Omega = \left( \frac{\frac{3}{4.5\Omega}}{4.5\Omega} \right) + 4.5\Omega
\]

\[
= \left( \frac{0.667\Omega}{4.5\Omega} \right)^{-1} + 4.5\Omega = 1.5\Omega + 4.5\Omega
\]

\[
\text{Total} \quad V_{total} = 9.00V \quad I_{total} = 1.5\Omega
\]

\[
I_1 = \frac{V_{total}}{R_1} = \frac{9.00V}{4.5\Omega} = 2.00A
\]

The current divides equally \((1/3) \text{ for } R_2, R_3, R_4)\) as can be seen from \( \frac{1}{3} \text{ total} \) \((R_1, R_2)\).

Thus

\[
I_2 = I_3 = I_4 = \frac{1}{3} I_1 \quad (\text{or } \text{total}) = 0.50A
\]

You could also calculate voltage across \( R_1 \) and \( R_{234} \) and then break down to calc. \( I_4 \).
\[ P_2 = I_2^2 R_2 = (0.50 \text{A})^2 (4.50 \Omega) = 1.125 \text{W} \]

and \[ \frac{P_2}{P_3} = \frac{P_2}{P_3} = 1.125 \text{W} \text{ same as all } R \text{ 's are same} \]

and \[ \text{[LOW V] } \Rightarrow R \text{, brighter} \]

If bulb \( R_4 \) removed then circuit becomes \( E^2 \frac{R}{R_2} \)

and \[ R_{eq} = R_1 + \left(\frac{1}{R_2 + R_4}\right) = R_1 + \frac{R}{R_2 + R_4} \]

\[ V_{th} = \frac{I \times R_{eq}}{R} = 9.50 \text{V} \]

\[ I_t = \frac{V_{th}}{R_{eq}} = \frac{9.50}{6.75} \approx 1.33 \text{ A} \]

\[ I_t = I_1 + \left(\frac{1}{R_{eq}}\right) \text{ (series)} = \frac{1}{R_{eq}} \]

Current divide between \( I_1 + I_2 \) \( \frac{I_1}{I_2} = \frac{1}{2} \approx 0.667 \)

\[ R_4 \text{ same as } R_2, R_3, R_5 \text{ now?} \]

\[ P_2 = (1.25 \text{A})^2 (4.50 \Omega) = 7.96 \text{ W} \]

\[ P_2 + P_3 = 0.50 \text{V}^2 (4.50 \Omega) = 1.99 \text{ W} \]

\[ \frac{V_{th}}{V} = \frac{1}{2} \text{ (new)} \]

Note: \( V_1 = V_2 = 2.5 \text{V} \) or \( \frac{1}{2} V \)

Since \( P = \frac{V^2}{R} \text{ (area) } \) in each case \( R = 4.50 \Omega \) but \( V_1 = V_2 = \frac{1}{2} V \),

Then \[ P_2 = P_3 \left(\frac{V}{R}\right)^2 = \frac{1}{4} P_3 \]

\( P_1 = 10.13 \text{W} + P_2 + P_3 = 11.25 \text{W} \) (new \#)

\( P_1 = 7.96 \text{W} + P_2 + P_3 = 1.99 \text{W} \) (new \#)

Bulb one dimmer, but bulbs 2 

3 brighter

\[ \boxed{6 \text{pts}} \]