410.

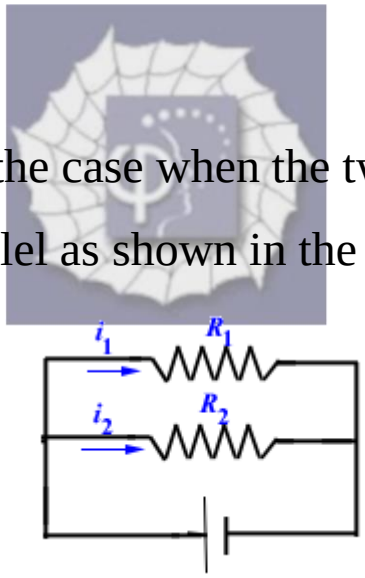
Problem 33.31 (RHK)

Two light bulbs, one of resistance R_1 *and the other of resistance* $R_2 (< R_1)$ *are connected* (a) *in parallel and* (b) *in series. We have to find which bulb is brighter in each case.*

Solution:

(a)

We first consider the case when the two light bulbs are connected in parallel as shown in the figure below.



As the two bulbs are connected in parallel, potential difference across them will be equal. That is

$i_1 R_1 = i_2 R_2.$

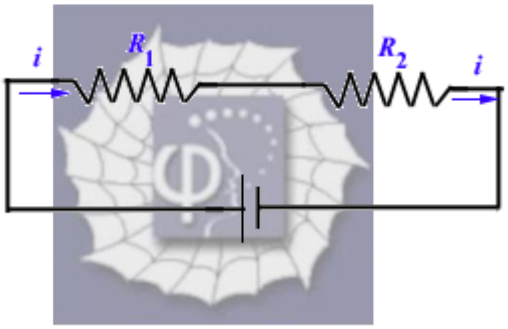
$\therefore \quad \dfrac{i_1^2 R_1}{i_2^2 R_2} = \dfrac{R_2}{R_1} < 1$

or

$i_1^2 R_1 < i_2^2 R_2.$

Therefore, the light bulb with resistance $R_2 \left(< R_1\right)$ will be brighter than the light bulb with resistance R_1, when the two are connected in parallel.

(b)



When the two light bulbs are connected in series as shown in the figure above, the same current *i* flows through their resistances R_1 and R_2. Therefore,

$i^2 R_1 > i^2 R_2,$ for $R_1 > R_2.$

Therefore, the light bulb with resistance R_1 will be brighter than the light bulb with resistance R_2.