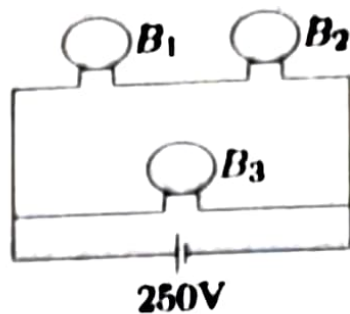


Q 22. A 100 W bulb B_1 and two 60 W bulbs B_2 and B_3 , are connected to a 250 V source, as shown in the figure. Now W_1 , W_2 and W_3 are the output powers of the bulb B_1 , B_2 and B_3 respectively. Then, (2002)



- (A) $W_1 > W_2 = W_3$ (B) $W_1 > W_2 > W_3$
 (C) $W_1 < W_2 = W_3$ (D) $W_1 < W_2 < W_3$

Sol. Let the given power ratings be defined at an operating voltage V . The resistances of the three bulbs are given by

$$R_1 = V^2/100, \quad R_2 = V^2/60, \quad R_3 = V^2/60.$$

In the given configuration, the current through B_1 and B_2 is

$$i = \frac{250}{R_1 + R_2} = \frac{250}{V^2} \left(\frac{100 \times 60}{100 + 60} \right) = \frac{250}{V^2} \left(\frac{75}{2} \right).$$

Substitute the values of i , R_1 , and R_2 to get the output powers

$$W_1 = i^2 R_1 \approx 14 (250/V)^2,$$

$$W_2 = i^2 R_2 \approx 23 (250/V)^2,$$

and

$$W_3 = (250)^2/R_3 = 60 (250/V)^2.$$

It is interesting to note that B_1 (100 W) is dimmer than B_2 (60 W) which in turn is dimmer than B_3 (60 W).

Ans. D \square