

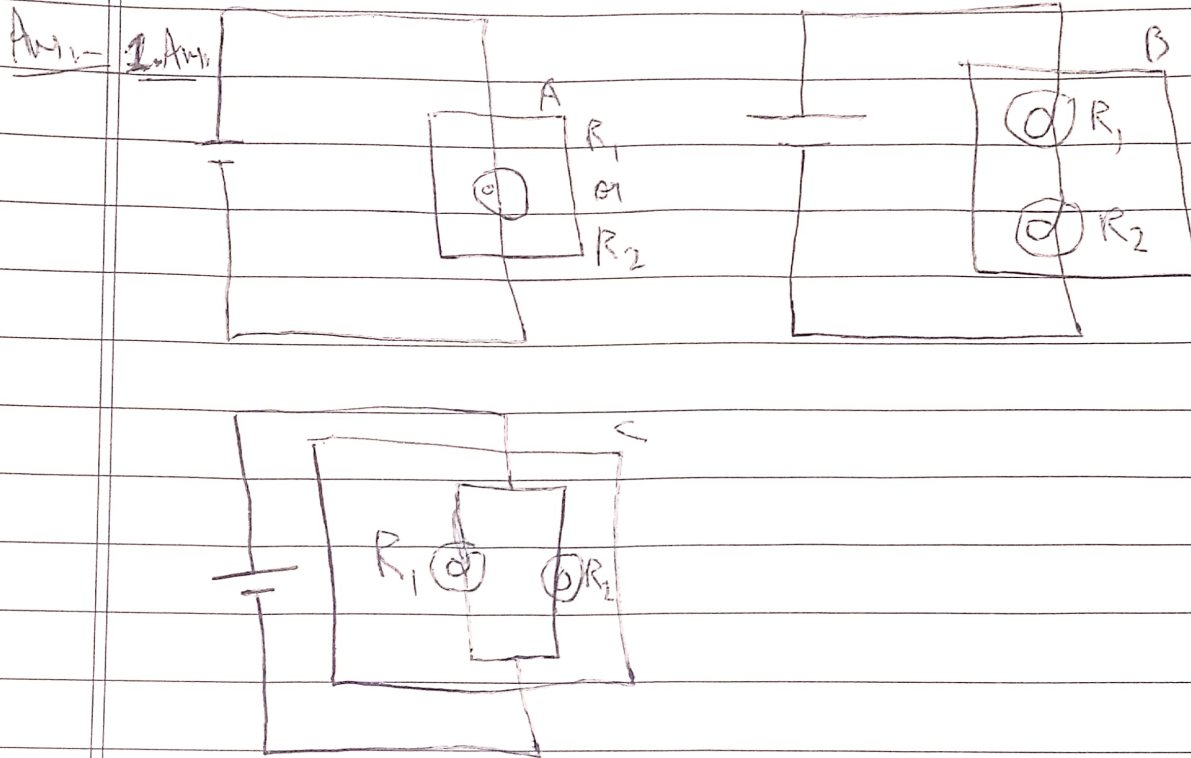
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PH-222-2A  
RECITATION #8

①

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Box A - Individual Resistor ( $R_1$  or  $R_2$ ).

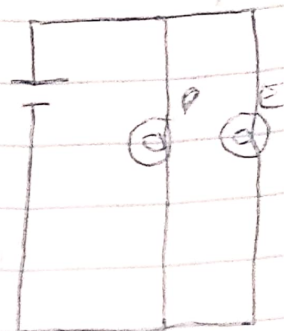
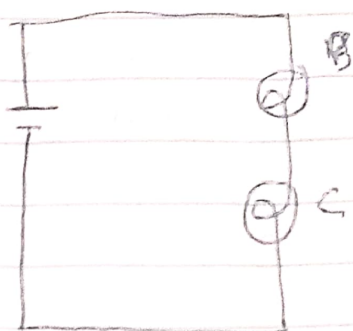
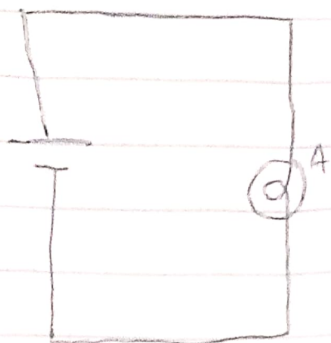
Box B - Resistors in series  $\Rightarrow R_s = R_1 + R_2$   
i.e.  $R_s > R_1$  &  $R_2$

Box C - Resistors in parallel  $\Rightarrow \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

i.e.  $R_p < R_1$  &  $R_2$

$\therefore B > A > C$

2. Ans



Let  $R$  be the resistance of each bulb and ' $V$ ' the battery voltage.

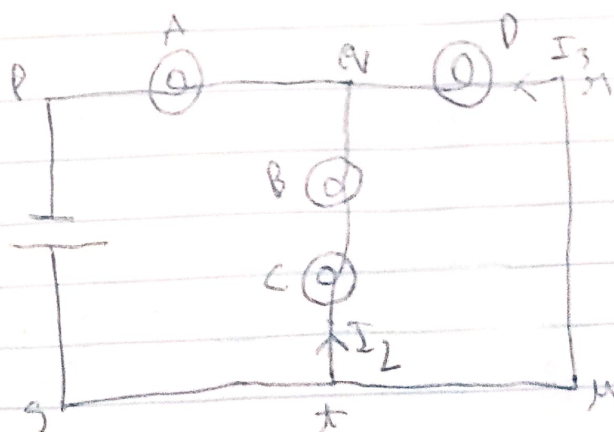
Bulb A  $\Rightarrow P = \frac{V^2}{R}$

Bulb B & C  $\Rightarrow P = \frac{\left(\frac{V}{2}\right)^2}{R} = \frac{V^2}{4R}$  (Voltage equally divided)

Bulb D & E  $\Rightarrow P = \frac{V^2}{R}$  (Voltage will remain the same).

For Brightness  $\Rightarrow A = D = E > (B = C)$

3. Ans (a)



(2)

Let  $R$  be the resistance and  $V$  the voltage of the battery.

Now  $B$  &  $C$  are in series.

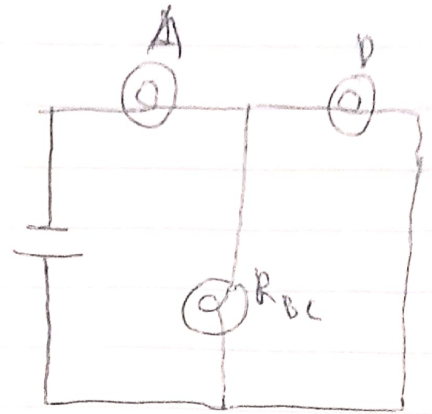
$$\therefore R_{BC} = R + R = 2R.$$

$R_{BC}$  &  $D$  are in parallel.

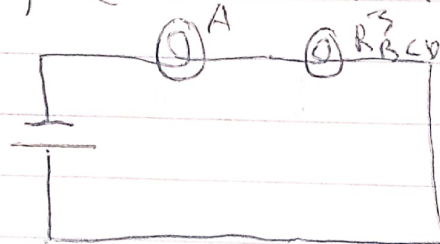
$$\frac{1}{R_{BCD}} = \frac{1}{2R} + \frac{1}{R}$$

$$= \frac{R + 2R}{2R^2} = \frac{3R}{2R^2} = \frac{3}{2R}$$

$$\therefore R_{BCD} = \frac{2}{3}R$$



Effective resistance,  $R_e = R + \frac{2}{3}R = \frac{5}{3}R$



Total current in the circuit,  $I_1 = \frac{V}{R_e} = \frac{V}{\frac{5}{3}R}$

$$= \frac{3V}{5R} \left[ \because I = 0.6 \frac{V}{R} \right]$$

(3)

(4)

From the figure,  $I_1 = I_2 + I_3$  (KCL)

Using KVL for the mesh path a-b-c:

$$I_1 R + I_2 \times 2R = V$$

$$2I_2 R = V - I_1 R$$

$$= V - \frac{3V}{5R} \times R$$

$$= V - \frac{3V}{5}$$

$$= \frac{2V}{5}$$

$$\therefore I_2 = \frac{V}{5R} = 0.2 \frac{V}{R}$$

$$I_3 = I_1 - I_2$$

$$= 0.6 \frac{V}{R} - 0.2 \frac{V}{R}$$

$$= 0.4 \frac{V}{R}$$

Bulb A  $\rightarrow P = I_1^2 R$

$$= \left(0.6 \frac{V}{R}\right)^2 \times R = 0.36 \frac{V^2}{R}$$



(4)

$$\text{Bulb B \& C} \rightarrow P = I_2^2 R$$

$$= \left(0.2 \frac{V}{R}\right)^2 \times R$$

$$= 0.04 \frac{V^2}{R}$$

$$\text{Bulb D} \Rightarrow P = I_3^2 R$$

$$= \left(0.4 \frac{V}{R}\right)^2 \times R$$

$$= 0.16 \frac{V^2}{R}$$

$\therefore$  For Brightness,

$$A > D > (B = C)$$

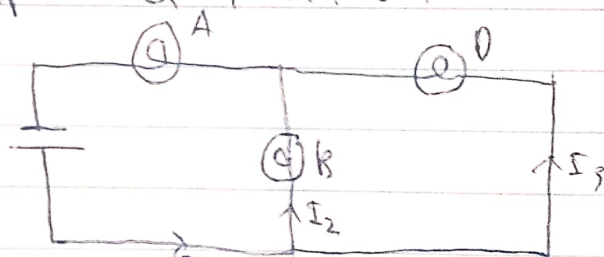
(5) In this case, bulb 'C' is bypassed,

so, B & D are in parallel and no current flows through C,

$$R_{BD} = \frac{R}{2}$$

$$R_{eq} = R + \frac{R}{2} = \frac{3}{2} R$$

$$\text{Current } I_1 = \frac{V}{\frac{3}{2} R} = \frac{2}{3} \frac{V}{R}$$



(6)

$$\text{Current } I_2 = I_3 = \frac{I_1}{2} = \frac{1}{3} \frac{V}{R} \quad (\text{Both are of equal resistance})$$

$$\text{Bulb A} \rightarrow P = I_1^2 R$$

$$= \left( \frac{2}{3} \frac{V}{R} \right)^2 \times R$$

$$= \frac{4}{9} \frac{V^2}{R}$$

$$= 0.44 \frac{V^2}{R}$$

$$\text{Bulb B \& D} \rightarrow P = I_2^2 R$$

$$= \left( \frac{1}{3} \frac{V}{R} \right)^2 \times R$$

$$= \frac{1}{9} \frac{V^2}{R}$$

$$= 0.11 \frac{V^2}{R}$$

$\therefore$  ~~409~~ Brightness :-

$$A > (B = D) > C$$