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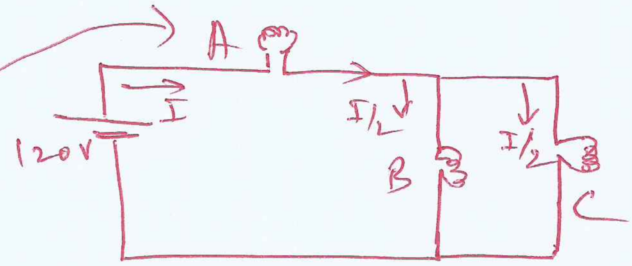
Q: Three 60 W, 120 V light bulbs are connected to 120 V supply as shown. Find (a) the voltage across each bulb
(2) total power developed in the circuit

(a)

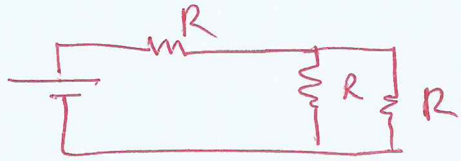
→ 60 W bulbs have ~~s~~ same resistances.



Total $R_{eff} = R + R/2$

$R_{total} = R + R/2 = \frac{3}{2}R$

$I = \frac{\cancel{120}^{40}}{\cancel{3/2}R} = \frac{80}{R}$



$\therefore V_A = IR = \cancel{\frac{80}{R} \cdot R} = 80V$

$I_B = I/2 \quad \therefore V_B = I/2 \times R = I \times \frac{R}{2} = \cancel{\frac{80}{R} \times \frac{R}{2}} = 40V$

$I_C = I/2 \quad \therefore V_c = \frac{I}{2} \times R = I \times \frac{R}{2} = \cancel{\frac{80}{R} \times \frac{R}{2}} = 40V$

→ (b) Total power.

B & C are in parallel, so ~~total power~~ $= P_B + P_C$
$= 60 + 60$
$= 120 W$.

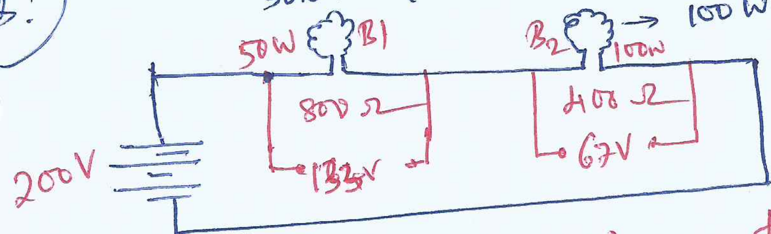
A is in series with B||C (60 W || 120 W)

$\therefore \frac{60 \times 120}{60 + 120} = \frac{\cancel{60} \times \cancel{120}\,40}{\cancel{180}\,3} = 40 W$

Q:

50W bulb (Max rating 200V)

100 W bulb (max. vol rating = 200V)



~~which bulb glows more~~
which bulb is brighter?
B_1 or B_2?

– Calculate R of each bulb $R = \frac{V^2}{P}$
→ ~~Total~~ bulb 1 → $\frac{200 \times \cancel{200}^{4}}{\cancel{50}} = 800\ \Omega$
→ bulb 2 → $\frac{200 \times 200}{100} = 400\ \Omega$

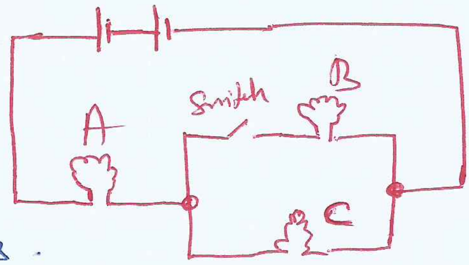
→ Current in circuit $I = \frac{200}{800 + 400} = \frac{2\cancel{00}}{12\cancel{00}} = 1/6\ A$

→ voltage across each bulb
→ bulb 1 → $V_{bulb1} = IR = \frac{1}{6 \cancel{3}} \times \cancel{800}\,400$ 133V ~~134 V~~
→ bulb 2 → $V_{bulb2} = IR = \frac{1}{6} \times 400 = 67V$

→ 50 W bulb glows brighter since $P \propto V$ → 50 W will consume more power ~~than~~ than 100 W bulb.

Q:: 3 Bulbs A, B and C are connected as shown. What changes occur in brightness of the bulbs when switch is closed?

(a) Brightness of A increases, but that of C decreases
(b) — " — A remains same but of C — " —
(c) — " — of both A and C decreases
(d) — " — of A increases, but that of C remains same.



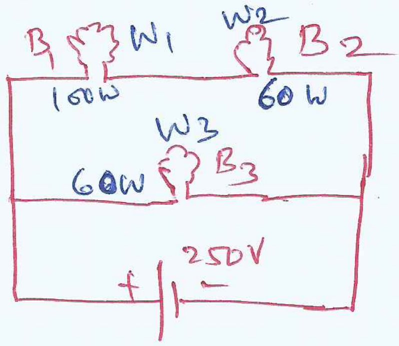
→ When switch is open, A and C are glowing depending on their power ratings.

→ when switch is closed, effective resistance in B & C loop decreases ⇒ overall resistance decreases ⇒ this will increase the current ⇒ A gets more current ⇒ and since brightness of bulb $\propto I^2$, brightness of A increases.

→ Now the current is shared betⁿ B and C, therefore, the brightness of the bulb C decreases.

Q: A 100W bulb B_1 and two 60W bulbs B_2 and B_3 are connected to a 250V source as shown. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3 respectively, then

(a) $W_1 > W_2 = W_3$ (b) $W_1 > W_2 > W_3$
(c) $W_1 < W_2 = W_3$ (d) $W_1 < W_2 < W_3$

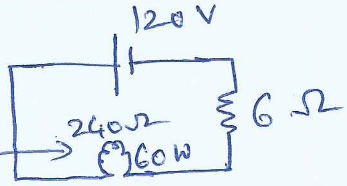


→ voltage across B_3 is greatest, hence B_3 will show maximum brightness.

→ B_1 and B_2 are in series ⇒ hence the bulb of lesser voltage will glow more ~~than~~ bright (than B_1)
Hence $W_2 > W_1$ and also from above $W_3 > W_2$ and $W_3 > W_1$

∴ $W_3 > W_2 > W_1$ or $W_1 < W_2 < W_3$.

Q: The supply voltage to room is 120 V. The resistance of the connecting wires is 6 Ω. A 60 W bulb is already switched on. What is the decrease of the voltage across the bulb when a 240 W heater is switched on in parallel to bulb.



fig①

Given $V = 120V$, $P = 60W$

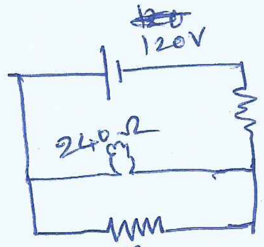
Connecting wire resistance $= 6\ \Omega$

$$R_{bulb} = \frac{V^2}{P} = \frac{120 \times \cancel{120}^{2}}{\cancel{60}} = 240\ \Omega$$

(Since $P = V^2/R$) ∴ ~~V_{bulb} = Voltage across bulb~~

~~V_{bulb}~~ =

$$\therefore R_{eq} = 240 + 6 = 246\ \Omega$$



fig②

$R_{heater} = 60\ \Omega$

Vol. across bulb $= V_B = \frac{120}{246} \times 240$

$$V_B = 117.07\ V$$

Now heater is connected (as shown in fig ②)

$$R_{heater} = \frac{V^2}{P} = \frac{\cancel{120}^{60} \times \cancel{120}}{\cancel{240}_{2}} = 60\ \Omega$$

∴ Equivalent resistance of circuit

$$R'_{eq} = 6 + \frac{240 \times 60}{240 + 60} = 6 + \frac{\cancel{240 \times 60}^{48}}{\cancel{300}_{5}} = 54\ \Omega$$

∴ Voltage across bulb $= V'_B = \frac{120}{54} \times 48 = 106.66\ V$

Change in voltage $= 117.07 - 106.66 = 10.41\ V$

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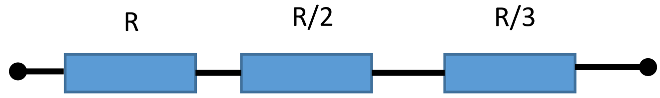
In the given problem (see right), all resistors are equal, say R ohms.

The equivalent circuit is



The equivalent resistance = R + R/2 + R/3

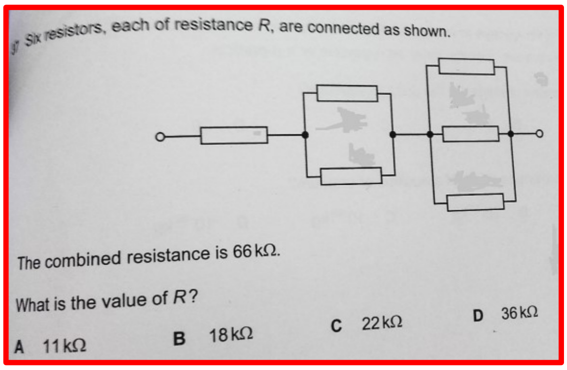
= R (1 + ½ + 1/3) = R (3/2 + 1/3)

= R {(9+2) /6} = R (11/6)

Given equivalent resistance = 66K ohms

Therefore, R (11/2) = 66 kΩ

So, R = (66 x 6)/11 = 6 x 6 = 36 kΩ ; Answer is [D]

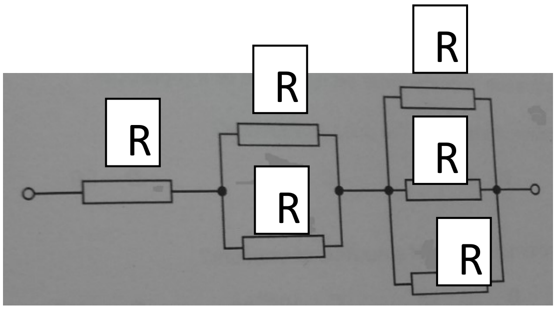


Six resistors, each of resistance *R*, are connected as shown.

The combined resistance is 66 kΩ.

What is the value of *R*?

A 11 kΩ **B** 18 kΩ **C** 22 kΩ **D** 36 kΩ



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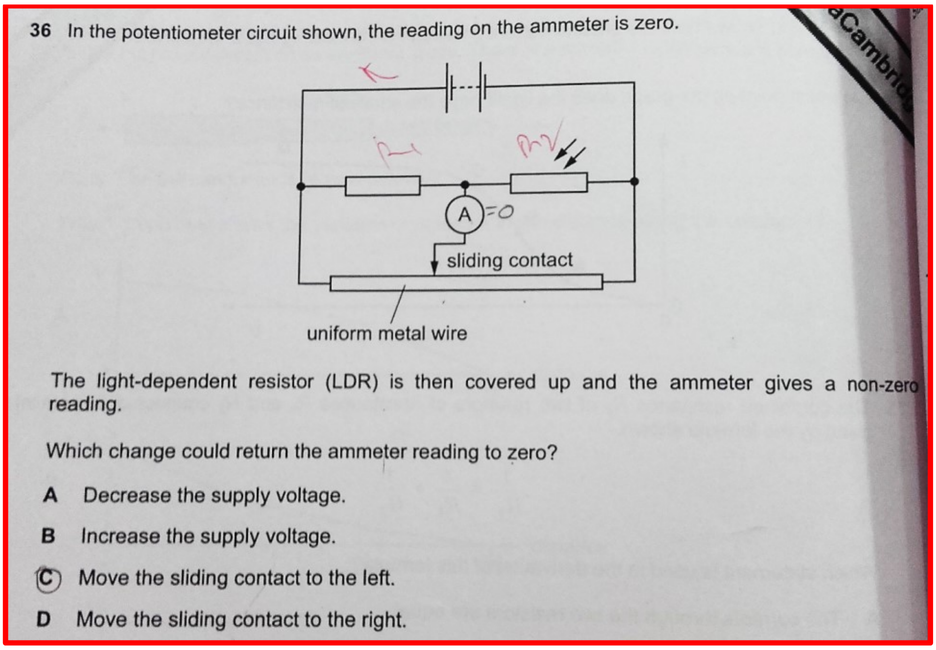


36 In the potentiometer circuit shown, the reading on the ammeter is zero.

The light-dependent resistor (LDR) is then covered up and the ammeter gives a non-zero reading.

Which change could return the ammeter reading to zero?

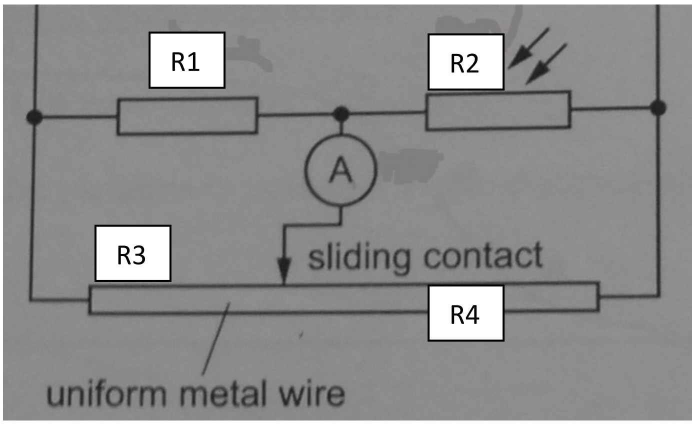
A Decrease the supply voltage.

B Increase the supply voltage.

C Move the sliding contact to the left.

D Move the sliding contact to the right.

- We know that the resistance of a photoresistor decreases with increasing incident light intensity.
- The equivalent circuit portion is a Wheatstone bridge
- R1/R2 = R3/R4
- When LDR is covered, R2 value increases, hence R1/R2 decreases
- ∴ R3/R4 should also decrease to get null reading
- ∴ R3 to be made lower value or R4 to be made a bigger value
- For R3 to become smaller value and R4 to increase, the sliding contact has to be moved towards left so that R3 decreases and R4 increases and rationR3/R4 remains constant and we get null point (no current in the ammeter)



- **Answer is [C]**