PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

HEATING EFFECT OF CURRENT

Illustration

1. Two wires of same mass , having ratio of lengths $1:2$, $density 1:3$, and resistivity $2:1$, are connected one by one to the same voltage supply. The rate of heat dissipation in the wire is found to be $10W$. Find the rate of heat dissipation in the second wire.

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2. A $100W$ bulb is designed to operate on a potential difference of $230V$.

(i) Find the resistance of the bulb.

(ii) Find the current drawn by the bulb if it is operated at a potential difference for which it is designed.

(iii) Find the current drawn and power consumed by the bulb if it is connected to a $200V$ supply.

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3. A $500W$ heating unit is designed to operate from a $200V$ line . By what percentage will its heat output drop if the line voltage drops to $160V$? Find the heat produced by it in $10\ \min$.

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4. Two bulbs are marked $220V - 100W$ and $220V - 50W$.

(i) Which bulb will produce more illumination if they are connected in parallel to a $220V$ supply?

(iii) Also find the total power consumed by both the bulbs in each of the two parts above.

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5. Two bulbs are rated $30W - 200V$ and $60W - 200V$. They are connected with a $400V$ power supply. Find which bulb will get fused if they are connected in (i) series and (ii) parallel.

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6. An electric tea kettle has two heating coils. When one of the coils is switched on , boiling begins in $6\ \min$. When the other coil is switched on , boiling begins in $8\ \min$. In what time will the boiling begin if both coils are switched on simultaneously (i) in series and (ii) in parallel.

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7. How will you connect (series and parallel) 24cells each of internal resistance 1Ω to get maximum power output across a load of 10Ω?

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8. A dry cell of emf $1.5V$ and internal resistance 0.10Ω is connected across a resistor in series with a very low resistance ammeter. When the circuit is switched on , the ammeter reading settles to a steady value of $2.0A$.

(i) What is the steady rate of chemical energy consumption of the cell ?

(ii) What is the steady rate of energy dissipation inside the cell ?

(ii) What is the steady rate of energy dissipation inside the resistor ?

(iv) What is the steady power out put of the source?

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9. Two wires made of tinned copper having identical cross section $\left(=10^{-6}m^2\right)$ and lengths 10 and $15cm$ are to be used as fuses. Show

that the fuses will melt at the same value of current in each case.

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10. An electric kettle taking $3A \text{at} 210V$ brings $1L$ of water from $20^\circ C \rightarrow 80^\circ C \text{in} 10 \text{ min}$. Find its efficiency.

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11. A line having a total resistance of 0.2ω delivers $10KWat220V$ to a small factory . Calculate the efficiency of transmission .

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Solved Examples

1. A series battery of six cells each of $emf2V$ and internal resistance 0.5Ω is charged by a $100Vdc$ supply. What resistance should be used in the

charging circuit in order to limit the charging current to $8A$. Using this relation , obtain (a) the powwer supplied by the dc source, (b) the power dissipated as heat , and (c) the chemical energy stored in the battery in $15\ \min$.

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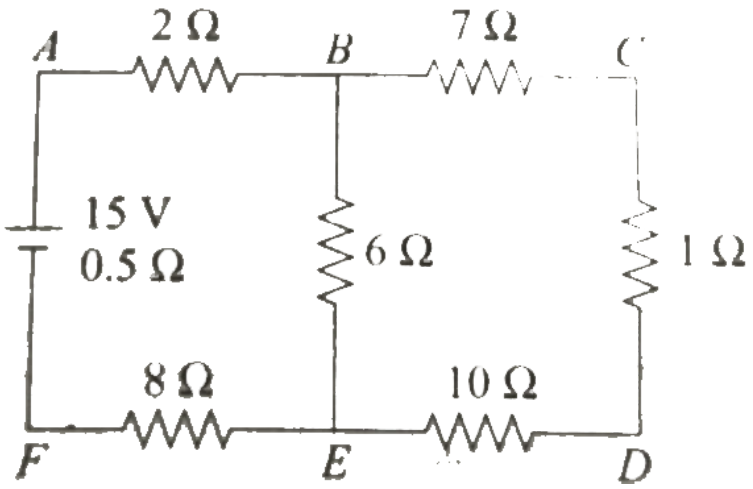
2. Dertermine the current through the battery of internal resistance 0.5Ω for the circuit shown in fig. 7.14. How much power is dissipated in 6ω resistance ?



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3. Two uniform wires of same material , each weighing $1g$ but one having double the length of the other, are connected in series , carrying a current of $10A$. The length of the longer wire is $20cm$. Calculate the rate of consumption of energy in each of the two wires. which wire gets hotter ? The density of the material of the wire is $20 \times 10^{-5} \Omega cm$.

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4. In a house having $220V$ line , the following appliances are operating :

(i) a $60W$ bulb, (ii) a $1000W$ heater , and (iii) a$40W$ radio.

Calculate (a) the current drawn by the heater and (b) the current passing through the fuse in the main line.

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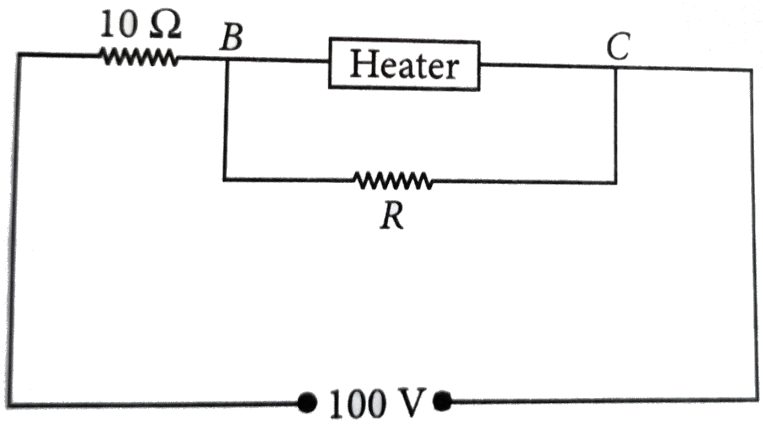
5. A heater is designed to operate with a power of 1000 W in a 100 V line. It is connected in combination with a resistance of 10Ω and a resistance R, to a 100 V mains as shown in the figure. What will be the value of R so

that the heater operates with a power of 62.5 W?



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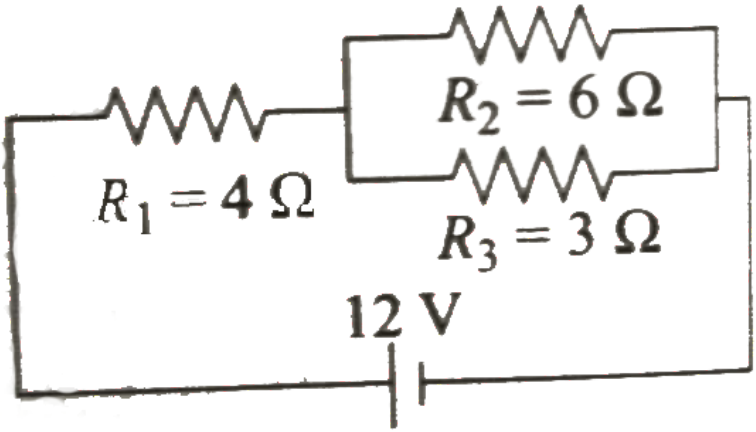
6. (i). Find the time taken by a filament of $200W$ to heat $500ml$ of water from $25^\circ C \rightarrow 75^\circ C$. Specific heat of water is $1calg^{-1\circ}C^{-1}$. Take $1cal = 4.2J$.

(ii) Find the power produced by each resistor shown in Fig. 7.17. If R_1 is dipped in $1000ml$ of water at $30^\circ C$, find the time taken by it to boil the

water.



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7. A heating coil of $2000W$ is immersed in water . How much time will it take in raising the temperature of $1L$ of water from $4^\circ C \text{to} 100^\circ C$? Only $80\ \%$ of the thermal energy produced is used in raising the temperature of water.

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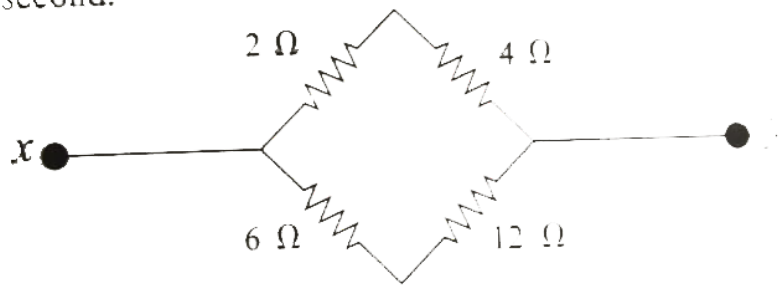
8. Consider the following circuit $(Fig.\ 7.18)$ where some resistances have been arranged in a definite order . With the given condition that heat produced by 6Ω resistance is $60cals^{-1}$ due to the current flowing throught it , find out the heat produced across 2Ω resistance in calorie per second.

second.



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9. Consider a wheatstone bridge $PQRS$ as shown in Fig. 7.19 $wherecurrentIis \in the \circ uitoffourresis\tan ces10,\ 20,\ 30,\ \text{and}\ 40\Omega.\ F \in$ PQ,QR, PS, and SR`.

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10. A person with body resistance between his hands of $10K\Omega$ accidentally grasps the terminals of a $18kV$ power supply.

(i) If the internal resistance of the power supply is 2000Ω, what is the power dissipated in his body?

(ii) What is the power dissipated in his body?

(iii) If the power supply is to be made safe by increasing its internal resistance, what should the internal resistance be for the maximum current in the above situation to be $1.00mA$ or less?

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11. An electric kettle has two coils of same power . When one coil is switched on , it takes $15\ \min$ to boil water , and when the second coil is switched on , it takes $30\ \min$. How long will it take to boil water when both the coils are used in i. Series and ii. parallel?

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12. What amount of heat will be generated in a coil of resistance R due to a charge q passing through it if the current in the coil

a. decreases down to zero uniformly during a time interval t_0?

b. decrases down to zero having its value every t_0 seconds?

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13. A variable capacitor is adjusted to its lowest capacitance C_0 and is connected with a source of constant voltage V for a long time. The resistance of connecting wires is R. At $t = 0$, its capacitance starts to increase so that a constant current I starts to flow through the circuit. Calculate at time t,

(i) Power supplied by the source

(ii) thermal power generated in the connecting wire

(iii) rate of increase of electrostatic energy stored in capacitor

(iv) What do you infer from the above three results?

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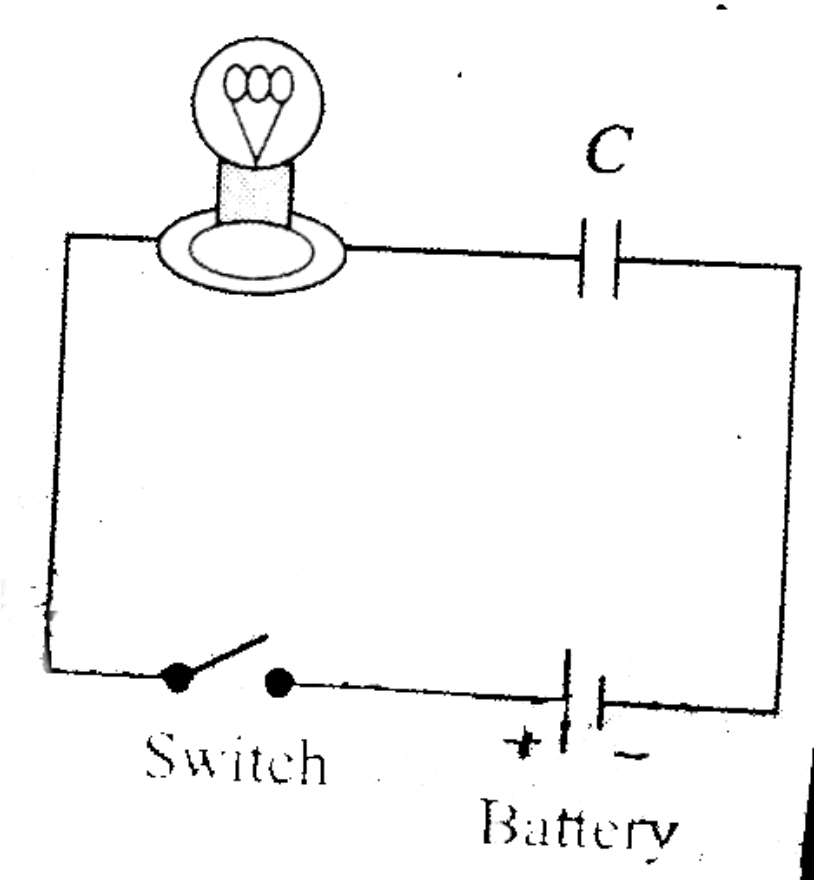
Exercise 7 1

1. When is the higher rate of energy being delivered to a light bulb higher : just after it is turned on, the glow of the filament is increasing, or after it has been on for a few seconds and the glow is steady ?



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2. A heater joined in series with a $50W$ bulb is connected to the mains . If the $50W$ bulb is replaced by a $100W$ bulb , then will the heater now give more heat , less heat, or same heat ? Why ?

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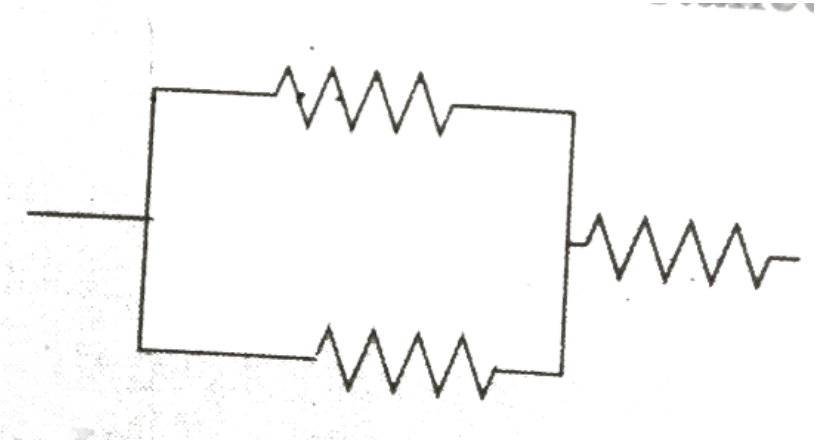
3. Each of three resistors in fig. 7.12 has a resistance of 2Ω and can dissipate a maximum of $18W$ without becoming excessively heated. Find the maximum power the circuit can dissipate.



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4. An electric bulb rated $220V$ and $60W$ is connected in series with another electric bulb rated $220V$ and $40W$. The combination is connected across a source of $emf 220V$. Which bulb will glow more?

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5. We have a $30W, 6V$ bulb , which we want to glow by a supply of $120V$. What can be done for this ?

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6. Two heater coils made of the same material are connected in parallel across the mains : the length and the diameter of one coil is double that of the other . Which of them will produce more heat?

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7. A series circuit consists of three identical lamps connected to a battery as shown in Fig. 7.13.

when the switch S is closed, what happens

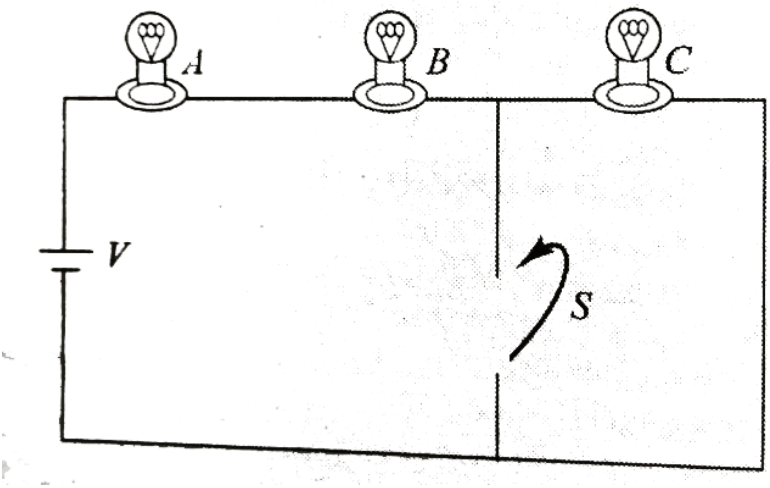
(a) to the intensities of lamps A and B,

(b) to the intensity of lamp C,

(c) to the current in the circuit , and

(d) to the voltage drop across the three lamps ?

Does the power dissipated in the circuit increase, decrease, or remain the same ?



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8. Two wires of the same material and having the same uniform area of cross section are connected in an electric circuit. The masses of the wires are m and $2m$, respectively. When a current I flows through both of them connected in series, then find the ratio of heat produced in them in a given time .

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9. Water boils in an electric kettle in $15\ \min$ after being switched on . Using the same main supply , should the length of the heating element be increased or decreased if the water is to be boiled in $10\ \min$? Why ?

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10. An electric motor operating on a $50Vdc$ supply draws a current of $12A$. If the efficiency of the motor is $30\ \%$,estimate the resistance of the windings of the motor.

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11. A fuse with a circular cross - sectional radius of $0.15mm$ blows at $15A$. What should be the radius of the cross section of a fuse made of the same material that blows at $30A$?

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12. A motor operating on $120V$ draws a current of $2A$. If the heat is developed in the motor at the rate of $9cals^{-1}$, what is the efficiency?

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13. The walls of a closed cubical box of edge$40cm$ are made of a material of thickness $1mm$ and thermal conductivity $4 \times 10^{-4} cals^{-1} {}^{\circ} C^{-1}$. The interior of the box is maintained at $100^{\circ} C$ above the outside temperature by a heater placed inside the box and connected across $400Vdc$. Calculate the resistance of the heater.

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14. Two tungsten lamps with resistances R_1 and R_2, respectively , are connected first in parallel and then in series in a lighting circuit of negligible internal resistance. Given $R_1 > R_2$.

(a) Which lamp will glow more brightly when they are connected in parallel ?

(b) If the lamps of resistance R_1 now burns out, how will the net illumination produced change ?

(c) Which lamp will glow more brightly when they are connected in series ?

(d) If the lamp of resistance R_2 now burns out and lamp R_1 alone is plugged in , will the net illumination increase or decrease ?

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15. n identical bulbs are connected in series and illuminated by a power supply . One of the bulbs gets fused. The fused bulb is removed , and the

remaining bulbs are again illuminated by the same power supply. Find the fractional change in the illuminated of (a) all the bulbs and (b) one bulb.

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16. An electric motor is designed to work at $100V$ and draws a current of $6A$. The output power supplied by the motor is $150W$, find the power remaining in the motor and its percentage efficiency?

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17. A house is fitted with certain numbers of $100W, 230V$ incandescent lamps. The power to the house is fed by a generator producing the power at $240V$. The resistance of the wires from the generator to the house is 2Ω. Find the maximum number of lamps that can be illuminated so that the voltage across none of the lampsdrops below $230V$.

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18. A house is fitted with seven tubelights of rating $220V, 40W$ each , two bulbs of rating $220V, 60W$ each, five fans each drawing a current of $0.4Aat220V$, and a heater of resistance 48.4Ω. The main line power supplied to the house is at $220V$. Calculate the bill for the month of january if tubelights and bulbs are used for $6h$ daily, fans for $1h$ daily , and heater for $10h$ daily. The electricity is to cost $Rs.\ 2per$ unit.

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19. Two bulbs are marked $200V, 300W$ and $200V, 600W$, respectively. The bulbs are connected in series and the combination is connected to a $200V$ supply .

(a) Which bulb will produce more illumination ?

(b) Find the total power consumed by both the bulbs.

(c) Find the total power consumed if both the bulbs were connected in parallel.

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20. A servo voltage stabiliser restricts the voltage output to $220V \pm 1\,\%$. If an electric bulb rated at $220V, 100W$ is connected to it, what will be the minimum and maximum power consumed by it?

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21. The efficiency of a cell when connected to a resistance R is $60\,\%$. What will be its efficiency if the external resistance is increased by six times?

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22. A $25W, 220V$ bulb and a $100W, 220V$ bulb are connected in series across a $220V$ line , which electric bulb will glow brightly?

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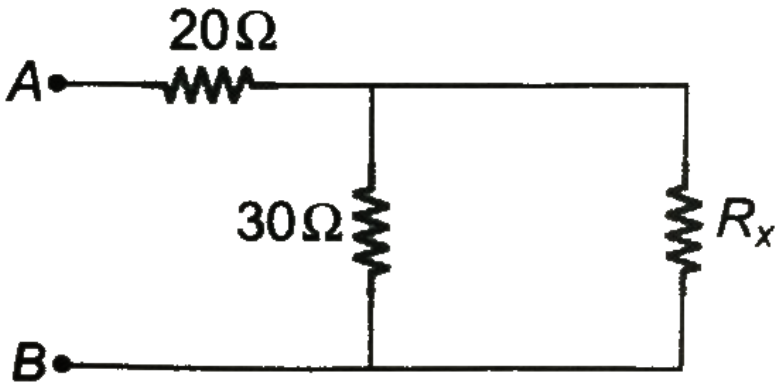
Subjective

1. A circuit shown in the figure has resistances 20Ω and 30Ω. At what value of resistance R_x will the thermal power generated in it be practically independent of small variations of that resistance? The voltage between points A and B is supposed to be constant in this case.



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2. A $1kW$ heater is meant to operate at $200V$.

(a) What is the resistance?

(b) How much power will it consume if the line voltage drops to $100V$?

(c) How many units of electrical energy will it consume in a month $(of 30 days)$ if it operates $10h$daily at the specified voltage $(200V)$?

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3. A resistor R_1 consumes electrical power P_1 when connected to an $emf \varepsilon$. When resistor R_2 is connected to the same emf , it consumes electrical power P_2 . In terms of P_1 and P_2, what is the total electrical power consumed when they are both connected to this emf source

(a) in parallel

(b) in series

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4. In a experiment , N identical electrical bulbs, each having resistance R , are connecteed in parallel to a dc source of emf E and internalresistance r . What is the power consumed by each bulb . Also find the percentage change in power by each bulb if one bulb turns out.

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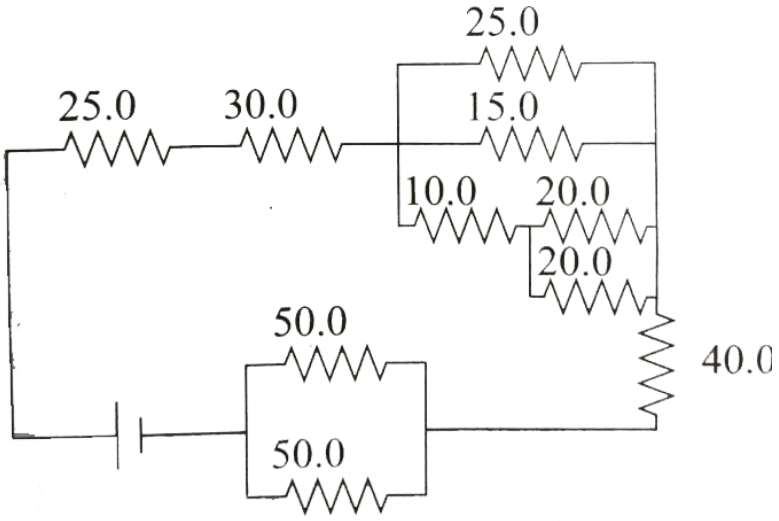
5. In the circuit shown in fig. 7.24 , all the resistors are rated at a maximum power of $1.00W$. What is the maximum $emf\varepsilon$ that the battery can have without burning up any of the resistors?



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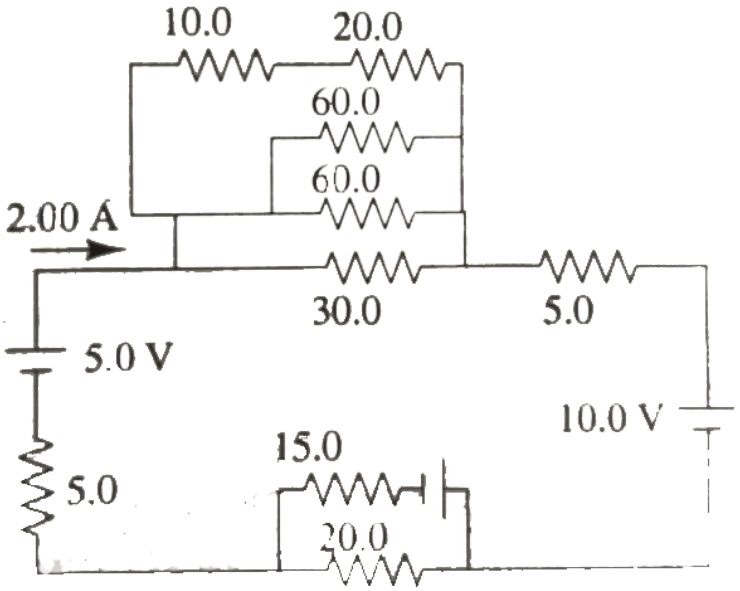
6. In the circuit shown in Fig 7.25,

(a) what must the $emf\varepsilon$ of the battery be in order for a current of $2.00A$ to flow through the $5.00V$ battery , as shown ? Is the polarity of the battery shown is correct?

b. How long does it take for $60.0J$ of thermal energy to be produced in

the 10.0Ωresistor?



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7. If two bulbs of $25W$ and $100W$ rated at $220V$ are connected in series across a $440V$ supply, will both the bulbs fuse ? If not which one ?

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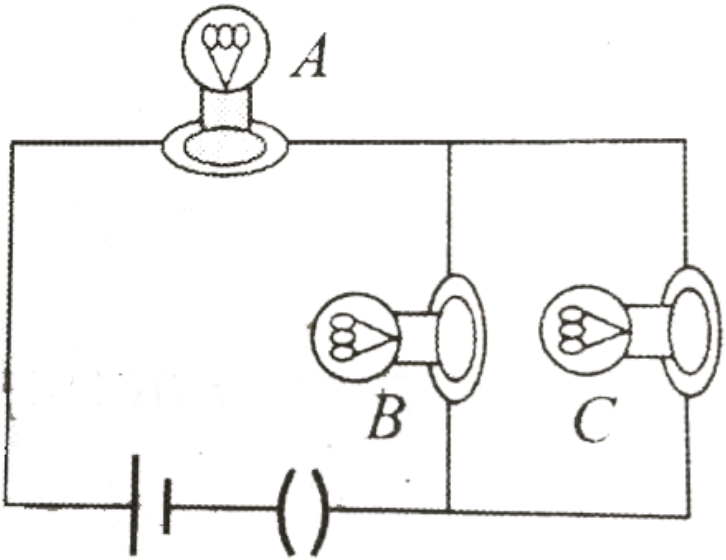
8. Three $60W$, $120V$ light bulbs are connected across a $120V$ power lines as shown in Fig. 7.26. Find (a) the voltage across each bulb and (b) the total power dissipated in the three bulbs.



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Single Correct

1. The operating temperature of the filament of lamp is $2000^{\circ}C$. The temperature coefficient of the material of the filament is $0.005^{\circ}C^{-1}$. If

the atmospheric temperature is $0^{\circ}C$, then the current in the $100W - 200V$ lamp when it is switched on is nearest to

A. $2.5A$

B. $3.5A$

C. $4.5A$

D. $5.5A$

Answer: D

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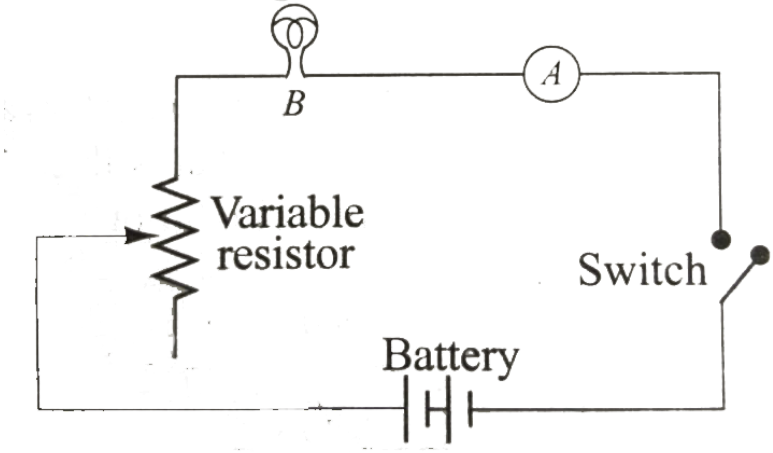
2. In the circuit in Fig. 7.27, bulb B does not glow although ammeter A indicates that the current is flowing . Why does the bulb not glow?



A. The bulb is fused .

B. tThere is a break in the circuit between bulb and ammeter.

C. The variable resistor has too large resistance.

D. There is a break in the circuit between the bulb and the variable resistance.

Answer: C

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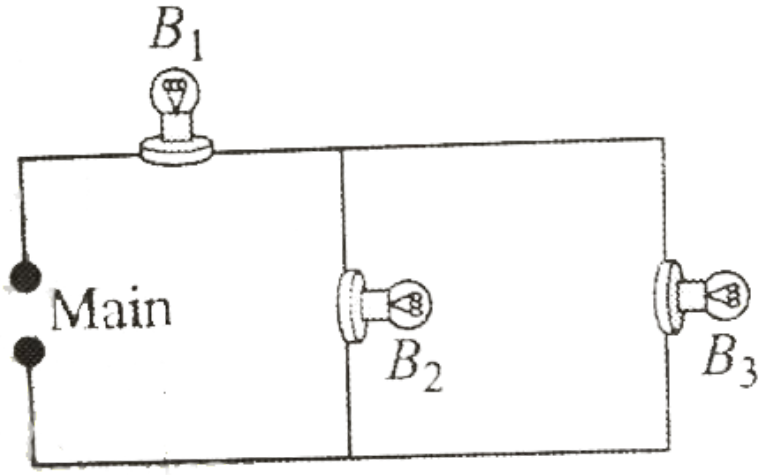
3. Three bulbs B_1, B_2 and B_3 are connected to the mains as shown in Fig. 7.28. How will the brightness of bulb B_1 be affected B_2 or B_3 are disconnected from the circuit?



A. Bulb B_1 becomes brighter

B. Bulb B_1 becomes dimmer.

C. No change occurs in the brightness.

D. Bulb B_1 becomes brighter if bulb B_2 is disconnected and dimmer if bulb B_3 is disconnected.

Answer: A

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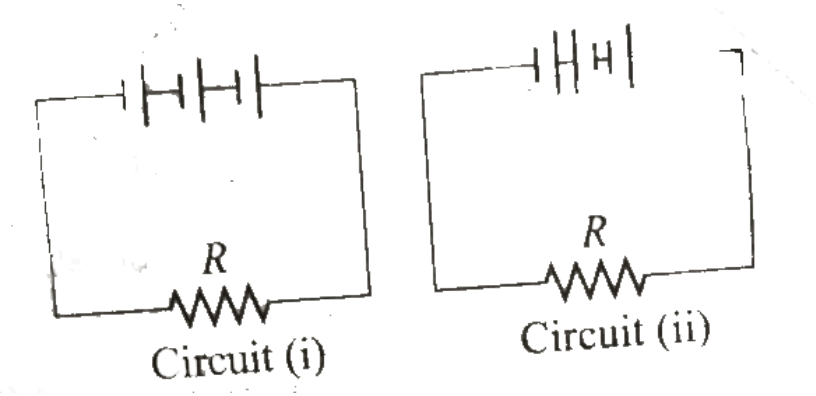
4. Three identical cells , each having an $emf 1.5V$ and a constant internal resistance $2.0ohm$, are connected in series with a $4.0ohm$ resistor R, first as in circuit (i) , and second as in circuit (ii) . Then

(power in R in circuit (i))/(Power in R in circuit (ii)) =



A. 9.0

B. 7.2

C. 1.8

D. 3.0

Answer: A

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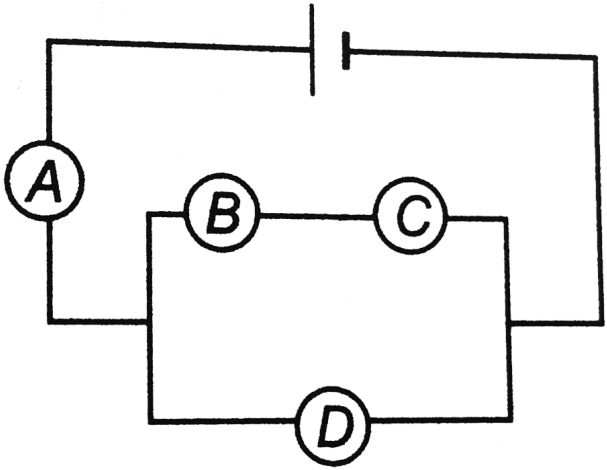
5. All bulbs in the circuit shown in figure are identical. Which bulb glows most brightly?



A. 1

B. 2

C. 3

D. 4

Answer: A

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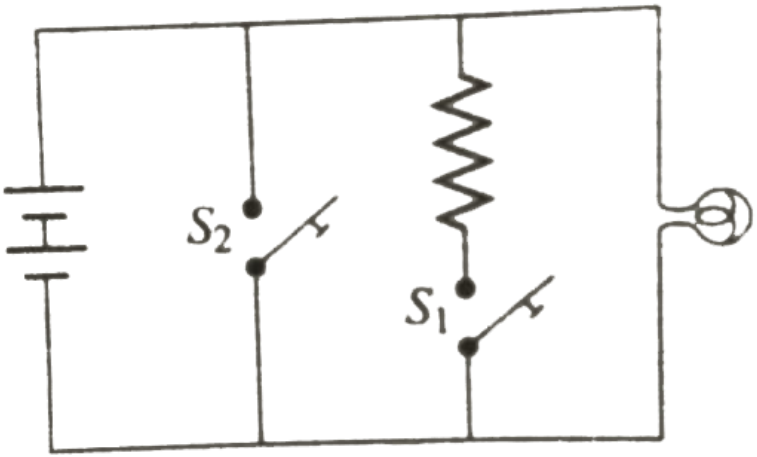
6. Which of two switches S_1 and S_2 shown in Fig. 7.31 will produce short - circuiting?



A. S_1

B. S_2

C. Both S_1 and S_2

D. Neither $S_1 n$ or S_2

Answer: B

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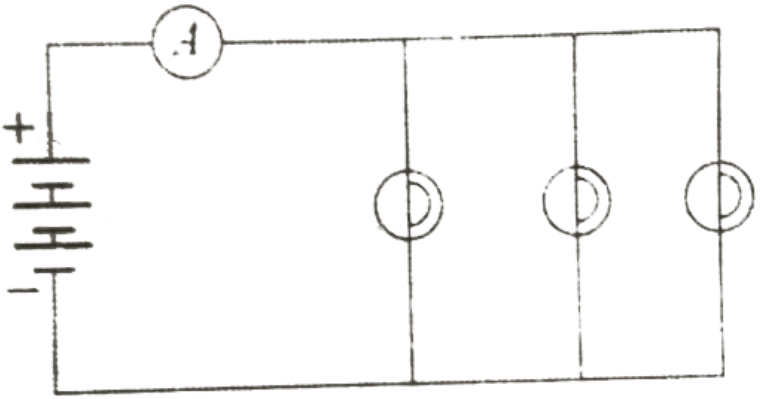
7. Three similar light bulbs are connected to a constant to a constant voltage dc supply as shown in $Fig.\ 7.32$. Each bulb operates at normal brightness and the ammeter (of negligible resistance) registers a steady current. The filament of one of the bulbs breaks. What happens to the ammeter reading and to the brightness of the remaining bulbs?



A. Ammeter reading - increases, Bulb brightness - increases

B. Ammeter reading - increases, Bulb brightness - unchanged

C. Ammeter reading - unchanged , Bulb brightness - unchanged

D. Ammeter reading - decreases, Bulb brightness - unchanged

Answer: D

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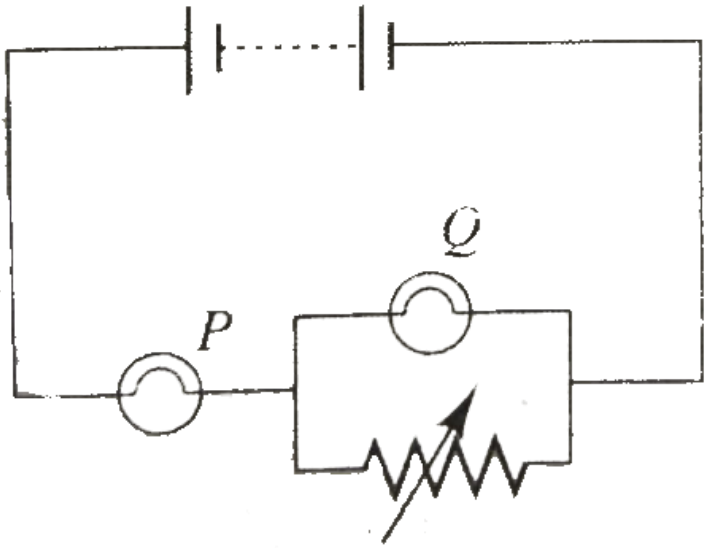
8. The circuit shownin Fig. 7.33 contains a battery , a rheostat , and two identical lamps. What will happen to the brightness of the lamps if the resistance of the rheostat is increased?



A. Lamp P - Less bright , Lamp Q - Brighter

B. Lamp P - Less brighter , Lamp Q - Less brighter

C. Lamp P - Brighter , Lamp Q - Less brighter

D. Lamp P - No change , Lamp Q - Brighter

Answer: A

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9. A cell of internal resistances r is connected to a load of resistance R . Energy is dissipated in the load, but some thermal energy is also wasted in the cell. The efficiency of such an arrangement is found from the expression

(Energy dissipated in the load)/(Energy dissipated in the complete circuit)

Which of the following gives the efficiency in this case?

A. $\frac{r}{R}$

B. $\frac{R}{r}$

C. $\frac{r}{R+r}$

D. $\frac{R}{R+r}$

Answer: D

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10. Two identical batteries each of emf $E = 2$ volt and internal resistance $r = 1$ ohm are available t. produce heat in an external resistance by passing a current through it. What is the maximum power that can be developed across an external resistance R using these batteries?

A. $1W$

B. $2W$

C. $4W$

D. $8W$

Answer: B

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11. Two similar headlight lamps are connected in parallel to each other. Together , they consume $48W$ from a $6V$ battery . What is the resistance

of each filament ?

A. 6Ω

B. 4Ω

C. 3.0Ω

D. 1.5Ω

Answer: D

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12. Two electric bulbs , rated for the same voltage , have powers of $200W$ and $100W$, respectively. If their resistances are r_1 and r_2 , respectively , then

A. $r_1 = 2r_2$

B. $r_2 = 2r_1$

C. $r_2 = 4r_1$

D. $r_1 = 4r_2$

Answer: B

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13. If the current in an electric bulb decreases by $0.5\,\%$, the power in the bulb decreases by approximately

A. $1\,\%$

B. $2\,\%$

C. $0.5\,\%$

D. $0.25\,\%$

Answer: A

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14. An electric bulb rated for $500W$ at $100V$ is used in a circuit having a $200V$ supply. The reistance R that must be put in series with bulb, so that the bulb delivers 500W is .....Ω.

A. 18Ω

B. 20Ω

C. 40Ω

D. 700Ω

Answer: B

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15. A $1^{\circ}C$ rise in temperature is observed in a conductor by passing a certain current . If the current is doubled , then the rise in temperature is approximately

A. $2.5^{\circ}C$

B. $4^\circ C$

C. $2^\circ C$

D. $1^\circ C$

Answer: B

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16. The electric bulb have tungsten filaments of same length. If one of them gives 60 W and other 100 W, then

A. $100W$ bulb has thicker filament

B. $60W$ bulb has thicker filament

C. both filaments are of same thickness

D. it is not possible to get different wattages unless the lengths are different

Answer: A

Watch Video Solution

17. n identical light bulbs, each designed to draw P power from a certain voltage supply , are joined in series across that supply. The total power which they will draw is

A. nP

B. P

C. P/n

D. P/n^2

Answer: C

Watch Video Solution

18. How many calories of heat will be produced approximately in 210 watt electric bulb in 5 min.

A. $15,000$

B. 1050

C. $63,000$

D. $80,000$

Answer: A

Watch Video Solution

19. A constant voltage is applied between two ends of a metallic wire if the length is halved and the radius of the wire is doubled the rate of heat developed in the wire will be :

A. be halved

B. be doubled

C. remain the same

D. be quadrupled

Answer: B

Watch Video Solution

20. The power rating of an electric motor that draws a current of $3.75A$, when operated at $200V$, is nearly

A. $54W$

B. $1hp$

C. $500W$

D. $750hp$

Answer: B

Watch Video Solution

21. A cable of resistance 10Ω carries electric power from a generator producing $250kWat10,000V$. The current in the cable is

A. $1000A$

B. $250A$

C. $100A$

D. $25A$

Answer: D

Watch Video Solution

22. a cable of resistance 10 ohm carries electric power from a generator producing 250kw at 10000v , the power lost in the cable during transmission is

A. $3.15kW$

B. $12.5kW$

C. $6.25kW$

D. $25kW$

Answer: C

Watch Video Solution

23. The heat generated through $4\Omega \text{ and } 9\Omega$ resistances separately , when a capacitor pf $100myF$ capacity charged to $200V$ is discharged one by one , will be

A. `2 J and 8 J, respectively

B. `8 J and 2 J, respectively

C. `2 J and 4 J, respectively

D. `2 J and 2 J, respectively

Answer: D

Watch Video Solution

24. If the length of the filament of a heater is reduced by $10\ \%$, the power of the heater will

A. increases by about $9\ \%$

B. increases by about $11\ \%$

C. increases by about $19\ \%$

D. decreases by about $10\ \%$

Answer: B

Watch Video Solution

25. A $2kW$ heater used for $1h$ every day consumes the following electrical energy in $30days$

A. $60units$

B. $120units$

C. $15units$

D. none of the above

Answer: A

Watch Video Solution

26. Two cells, each of emf E and internal resistance r are connected in parallel between the resistance R. The maximum energy given to the resistor will be, only when

A. $r/2$

B. r

C. $2r$

D. 0

Answer: A

Watch Video Solution

27. A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if

A. both the lengths and radius of the wire are halved

B. both the length and radius of the wire are doubled

C. the radius of the wire is doubled

D. the length of the wire is doubled

Answer: B

Watch Video Solution

28. A given resistor cannot carry currents exceeding $20A$, without exceeding its maximum power dissipaation ratings . By forced air cooling suppose that we increase the rate at which heat can be carried by a factor of 2. Now the maximum current that the resistor can carry is

A. $10A$

B. $20\sqrt{2}A$

C. $30\sqrt{2}A$

D. $40A$

Answer: B

Watch Video Solution

29. A wire when connected to 220 V mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is

A. 1

B. 4

C. 2

D. 3

Answer: B

Watch Video Solution

30. A 220 volt, 1000 watt bulb is connected across a 110 volt mains supply. The power consumed will be

A. $1000W$

B. $750W$

C. $500W$

D. $250W$

Answer: D

Watch Video Solution

31. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be

A. halved

B. one - fourth

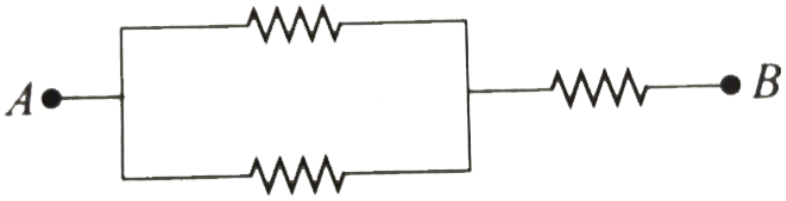
C. four times

D. doubled

Answer: D

Watch Video Solution

32. Three $10\Omega, 2W$ resistors are connected as in Fig. 7.34. The maximum possible voltage between points A and B without exceeding the power dissipation limits of any of the resistors is



A. $5\sqrt{3}V$

B. $3\sqrt{5}V$

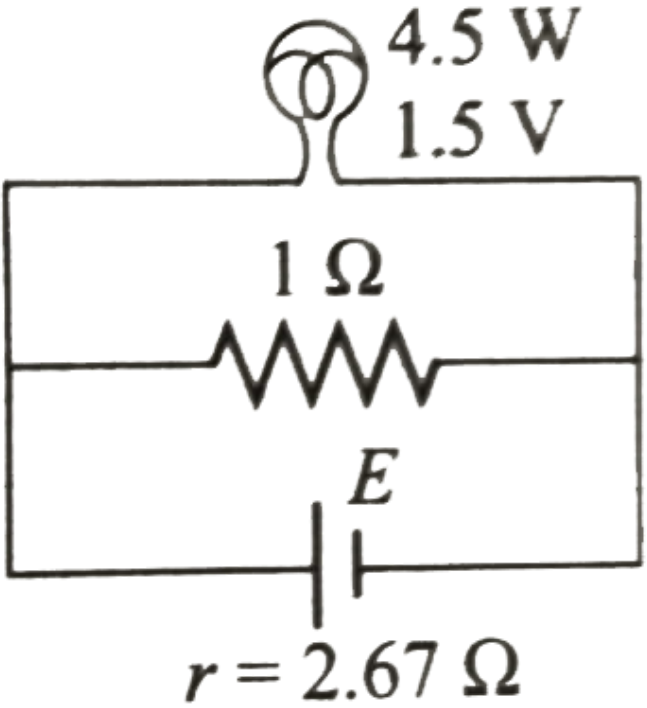
C. $15V$

D. $\frac{5}{3}V$

Answer: B

Watch Video Solution

33. A torch bulb rated $4.5W, 1.5V$ is connected as shown in Fig. 7.35. The emf of the cell needed to make the bulb glow at full intensity is



A. $4.5V$

B. $1.5V$

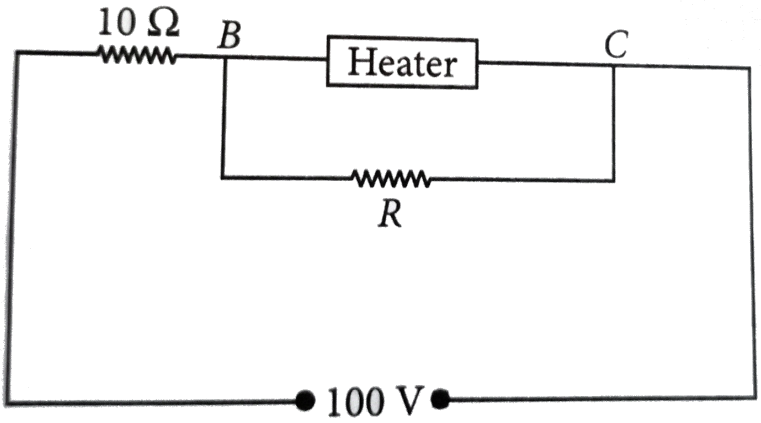
C. $2.67V$

D. $13.5V$

Answer: D

Watch Video Solution

34. A heater is designed to operate with a power of 1000 W in a 100 V line. It is connected in combination with a resistance of 10Ω and a resistance R, to a 100 V mains as shown in the figure. What will be the value of R so that the heater operates with a power of 62.5 W?



A. 5Ω

B. 10Ω

C. 15Ω

D. 20Ω

Answer: C

Watch Video Solution

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

A. no change

B. $10V$

C. $20V$

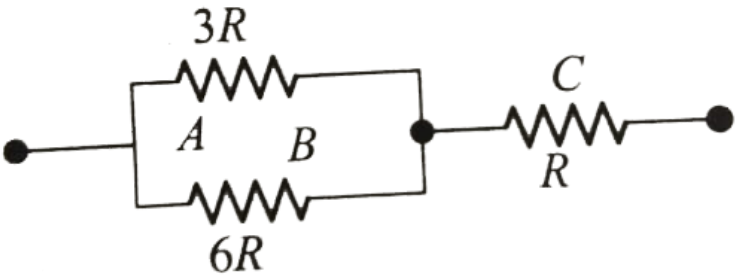
D. more than $10V$

Answer: D

Watch Video Solution

36. Figure 7.37 shows a network of three resistances. When some potential difference is applied across the network , thermal powers

dissipated by A, B and C are in the ratio



A. $2:3:4$

B. $2:4:3$

C. $4:2:3$

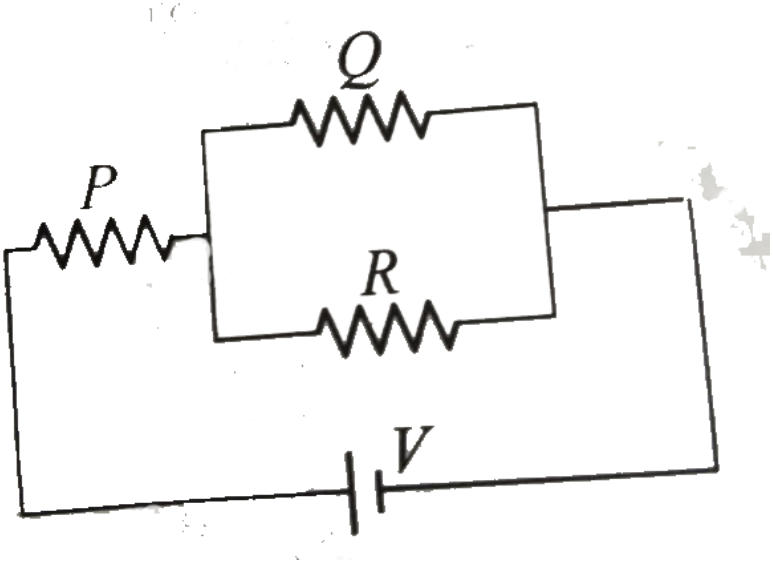
D. $3:2:4$

Answer: C

Watch Video Solution

37. Resistors $P, Q,$ and R in the circuit have equal resistances. If the battery is supplying a total power of $12W$, what is the power dissipated

as heat in resistors R?



A. $2W$

B. $6W$

C. $3W$

D. $8W$

Answer: A

Watch Video Solution

38. Three bulbs of $40W, 60W \text{ and } 100W$ are connected in series with a $240V$ source.

A. The potential difference will be maximum across the $40W$ bulb .

B. The current difference will be maximum in $100W$ bulb.

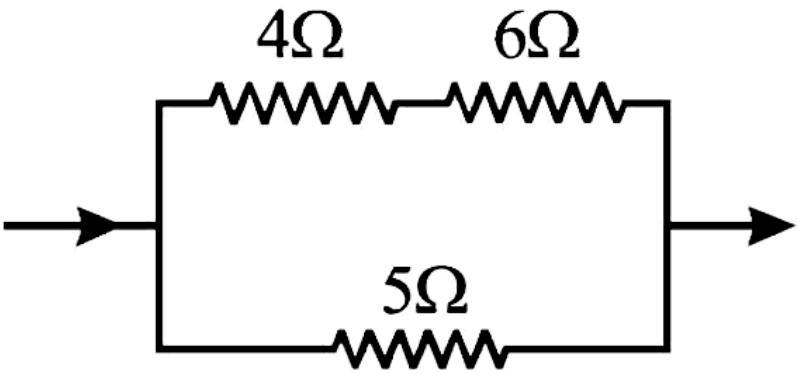
C. The resistance of the $40W$ bulb is minimum.

D. The current through the $60W$ bulb will be $0.1A$.

Answer: A

Watch Video Solution

39. In the circuit shown in fig the heat produced in the 5 ohm resistor due to the current flowing through it is 10 calories per second.



The heat generated in the 4 ohms resistor is

A. $1Cals^{-1}$

B. $2Cals^{-1}$

C. $3Cals^{-1}$

D. $4Cals^{-1}$

Answer: B

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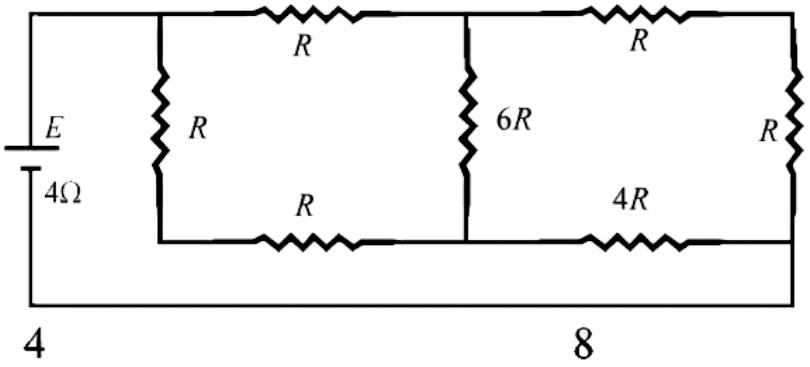
40. A battery of internal resistance 4Ω is connected to the network of resistance as shown . In order that the maximum power can be delivered to the network, the value of R in Ω should be



A. $\frac{4}{9}$

B. 2

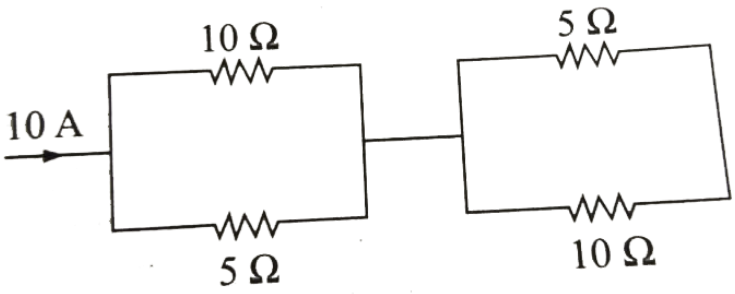
C. $\frac{8}{3}$

D. 18

Answer: B

Watch Video Solution

41. Four resistances carrying a current shown in Fig. 7.41 are immersed in a box containing ice at $0^\circ C$. How much ice must be put in the box every $10\ \min$ to keep the average quantity of ice in the box constant? Latent heat of ice is $80 calg^{-1}$.



A. $1.190kg$

B. $3.20kg$

C. $4.2kg$

D. $0.25kg$

Answer: A

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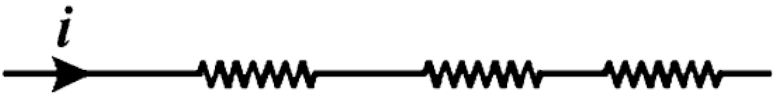
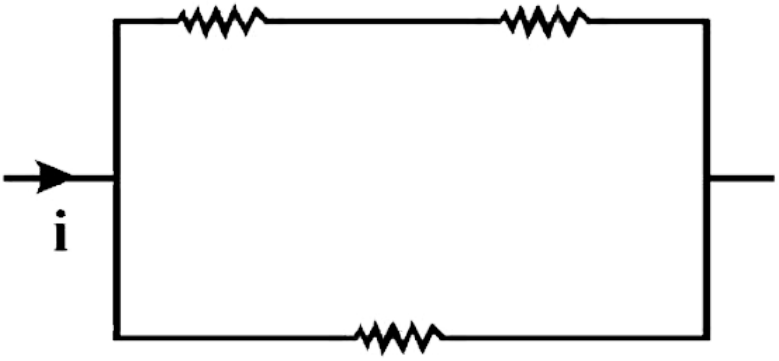
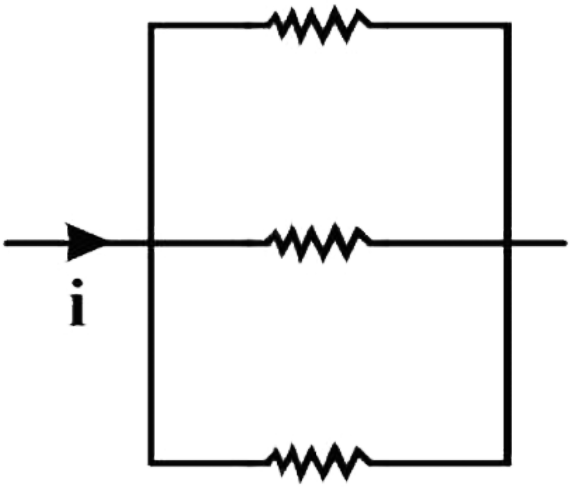
42. The three resistance of equal value are arranged in the different combination shown below. Arrange them in increasing order of power dissipation.



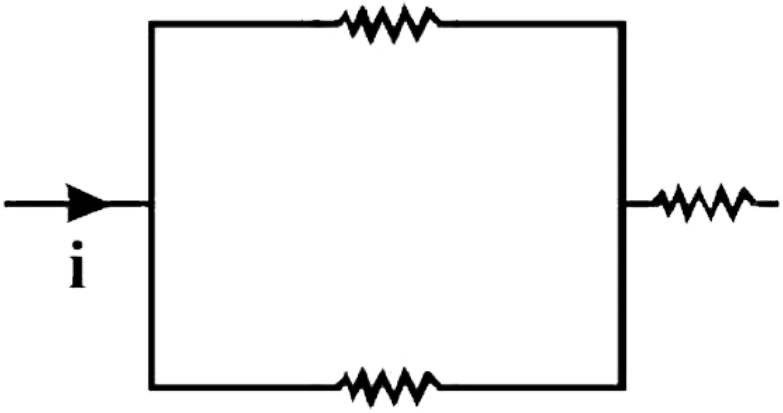
(I)



(II)



(IV)



A. $III < II < IV < I$

B. $II < III < IV < I$

C. $I < IV < III < II$

D. $I < III < II < IV$

Answer: A

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43. An ideal gas is filled in a closed rigid and thermally insulated container. A coil of 100Ω resistor carrying current 1 A for 5 minutes supplies heat to the gas. The change in internal energy of the gas is

A. $10kJ$

B. $30kJ$

C. $20kJ$

D. $0kJ$

Answer: B

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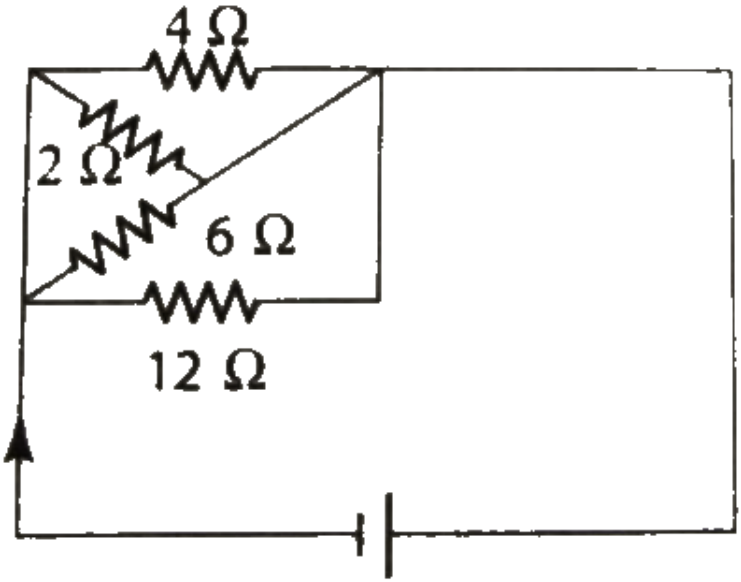
44. The resistance in which the maximum heat is produced is given by $(Fig.\ 7.43)$



A. 2ω

B. 6Ω

C. 4Ω

D. 12Ω

Answer: A

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45. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp when not in use?

A. $14,000\Omega$

B. 400Ω

C. 40Ω

D. 4Ω

Answer: C

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46. The resistance of the filament of a lamp increases with the increase in temperature. A lamp rated $100W$ and $220V$ is connected across $220V$ power supply. If the voltage drops by $10\,\%$, then the power of the lamp will be

A. $90W$

B. $81W$

C. between $90W$ and $100W$

D. between $81W$ and $90W$

Answer: D

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47. A wire of length L and three identical cell of negligible internal resistance are connected in series. Due to the current, the temperature of wire is raised by ΔT in a time t. A number N of similar cells is now connected in series with a wire of the same material and cross section but of length 2L. The temperature of wire is raised by the same amount ΔT in the same time t. The value of N is

A. 4

B. 6

C. 8

D. 9

Answer: B

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48. An electric immersion heator of 1.08 k W is immersed in water. After the water has reached a temperature of $100^{\circ}C$, how much time will be required to produce 100 g of steam?

A. $50s$

B. $420s$

C. $105s$

D. $210s$

Answer: D

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49. Two electric bulbs A and B are rated 60 and $100W$, respectively. If they are connected in parallel to the same source , then

A. both the bulbs draw the same current

B. bulb A draws more current than bulb B

C. bulb B draws more current than bulb A

D. currents drawn in the bulbs are in the ratio of their resistances

Answer: C

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50. A $25W$ and $a100W$ bulb are joined in series and connected to the mains. Which bulb will glow brighter?

A. $25W$ bulb

B. $100W$ bulb

C. Both will have equal incandescence.

D. Neither will give light.

Answer: A

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51. Two identical electric heaters each marked 1000 W 220 V are connected in series . This conbination is connected to an AC supply of 220 V . What will be their combined rate of heating? (Assume resistance of each heater remians contant

A. $1000W$

B. $2000W$

C. $500W$

D. $4000W$

Answer: C

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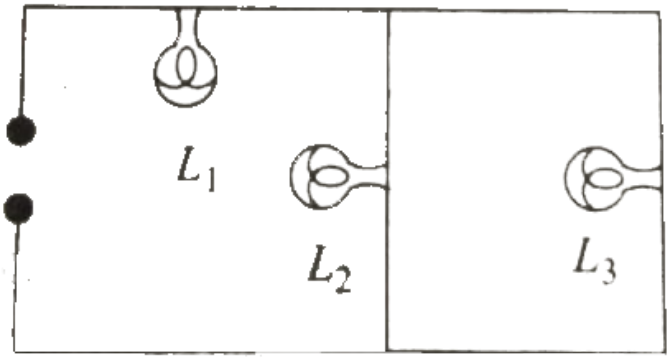
52. Figure 7.44 shows three similar lamps $L_1, L_2,$ and L_3 connectged across a power supply. If the lamp L_3 fuses, how will the light emitted by L_1 and L_2 change?



A. no change

B. brillance of L_1 decreases and that of L_2 increases

C. brilliance of both L_1 and L_2 increases

D. brillance of both L_1 and L_2 decreases

Answer: B

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53. If a wire of resistance 20Ω is covered with ice and a voltage of $210V$ is applied across the wire , then the rate of melting of ice is

A. $8.85gs^{-1}$

B. $1.92gs^{-1}$

C. $6.56gs^{-1}$

D. none of these

Answer: C

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54. How many $60W$ lamps may be safely run on a $230V$ circuit fitted with a $5A$ fuse?

A. `19

B. 22

C. 33

D. 66

Answer: B

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55. It takes 16 min to boil some water in an electric kettle. Due to some defect it becomes necessary to remove $10\,\%$ truns of heating coil of the kettle. After repairs, how much time will it take to boil the same mass of water?

A. $17.7\ \text{min}$

B. $14.4\ \text{min}$

C. $20.9\ \text{min}$

D. $13.7\ \text{min}$

Answer: B

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56. A electric kettle (rated accurately at $2.5kW$) is used to heat $3kg$ of water from $15^\circ C$ to boiling point . It takes $9.5\ \min$. Then the amount of heat that has been lost is

A. $3.5 \times 10^5 J$

B. $7 \times 10^8 J$

C. $3.5 \times 10^4 J$

D. $7 \times 10^8 J$

Answer: A

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57. a factory is served by a $220V$ supply line . In a circuit protected by a fise marjed $10A$, the maximum number of $100W$ lamps in parallel that can be turned on is

A. 2

B. 19

C. 20

D. 4

Answer: B

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58. If a given volume of water in a $220V$ heater is boiled in $5\ \text{min}$, then how much time will it take for the same volume of water in a $110V$ heater to be boiled?

A. $20\ \text{min}$

B. $30\ \text{min}$

C. $25\ \text{min}$

D. $40\ \text{min}$

Answer: A

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59. The charge flowing through a resistance R varies with time t as $Q = at - bt^2$. The total heat produced in R is

A. $\frac{a^3R}{6b}$

B. $\frac{a^3R}{3b}$

C. $\frac{a^3R}{2b}$

D. $\frac{a^3R}{b}$

Answer: A

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60. A $100W$ bulb designed to operate on $100V$ is to be connected across a $500V$ source . Find the resistance to be put in series so that bulb

consumes $100W$ only.

A. 100Ω

B. 500Ω

C. 400Ω

D. 300Ω

Answer: C

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Multiple Correct

1. Two electric bulbs , rated at (25W,220V) and (100W,220V), are connected in series across a 220 V voltage source , if the 25W and 100W bulbs draw powers P_1 and P_2 Respectively , then :

A. $P_1 = 16W$

B. $P_1 = 4W$

C. $P_2 = 16W$

D. $P_2 = 4W$

Answer: A::D

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2. A voltmeter and an ammeter are connected in series to an ideal cell of $emf E$. The voltmeter reading is V, and the ammeter readings is I. Then

(i) $V < E$ (ii) the voltmeter resistance is V / I

(iii) the potential difference across the ammeter is $E - V$

(iv) Voltmeter resistance + ammeter resistance = E//I`

Correct statements are

A. I and ii

B. ii and iii

C. iii and iv

D. all

Answer: A::B::C::D

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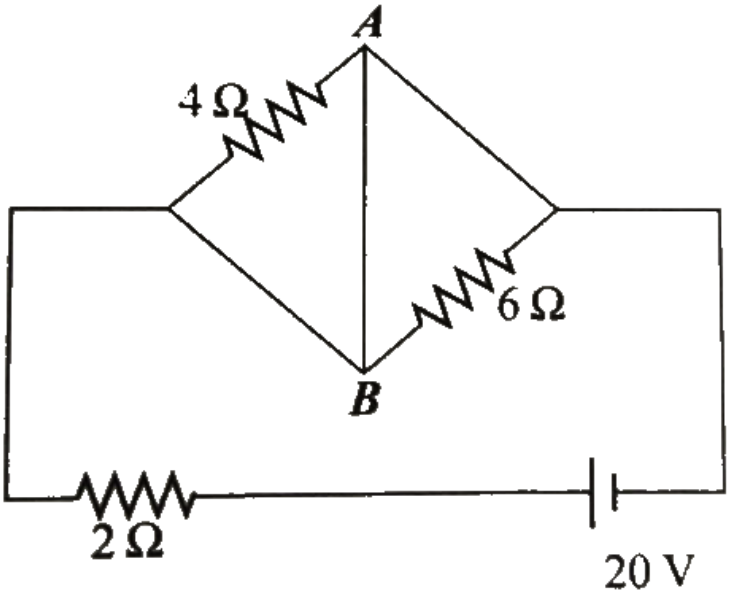
3. In the circuit shown in Fig. 7.45,



A. Power supplied by the battery is $200W$

B. current flowing in the circuit is $5A$

C. Potential difference across the 4Ω resistance is equal to the potential difference across the 6Ω resistance

D. current in wire AB is zero

Answer: A::C

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4. Two bulbs consume same power when operated at 200 V and 300 V, respectively. When these bulbs are connected in series across a DC source of 500 V, then

A. ratio of potential difference across them is $3/2$

B. ratio of potential difference across them is $4/9$

C. ratio of power produced in them is $2/3$

D. ratio of power produced in them is `4/9

Answer: B

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5. An element with $emf\varepsilon$ and interval resistance r is connected across an external resistance R. The maximum power in external circuit is $9W$. The current flowing through the circuit in these conditions is $3A$. Then which of the following is // are correct ?

A. $\varepsilon = 6V$

B. $r = R$

C. $r = 1\Omega$

D. $r = 3\Omega$

Answer: A::B::C

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Assertion Reasoning

1. Statement I : The wires supplying current to an electric heater are not heated appreciably.

Statement II: Resistance of connecting wires is very small and $H \propto R$.

A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: A

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2. Statement I : If the current of a lamp increases by $20\ \%$, the percentage increases in the illlumination of the lamp is $40\ \%$.

Statement II : Illumination of the lamp is directly proportional to the square of the current through the lamp.

A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: D

Watch Video Solution

3. Statement I: Heater wire must have high resistance than connecting wires and high netallic point.

Statement II : If resistance is high , the electrical conductivity will be less.

A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: B

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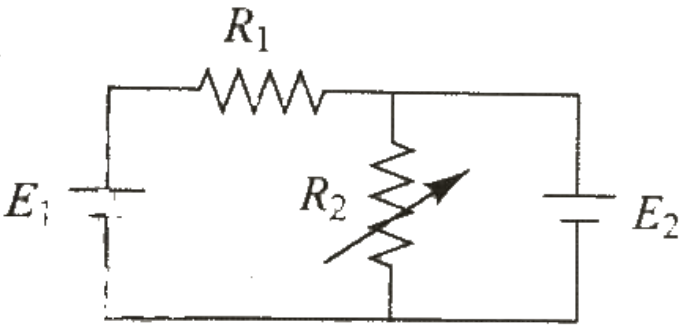
4. Statement I : In the circuit in $Fig.\ 7.46$, both cells are ideal and of fixed emf, the resistor R_1 has fixed resistance and the resistance of resistor R_2 can be varied (but R_2 is always non zero). Then the electric power delivered to the resistor of resistance R_1 is independent of the value of resistance R_2.

Statement II: If potential difference across a fixed resistance is unchanged

, the poweer delivered to the resistor remains constant.



A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: A

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5. Statement I: Since all the current coming to our house returns to powerhouse (as current travels in a closed loop), there is no need to pay the electricity bill.

Statement II: The electricity bill is paid for the power used , not for the current used.

A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: D

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6. Statement I: Internal resistance of a battery is drawn parallel to a battery in electical circuit.

Statement II: Heat generated in a battery is due to internal resistance.

A. Statement I is True , Statement II is True , Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True , Statement II is NOT a correct explanation for statement I.

C. Statement I is True , Statement is False.

D. Statement I is False, Statement II is True.

Answer: D

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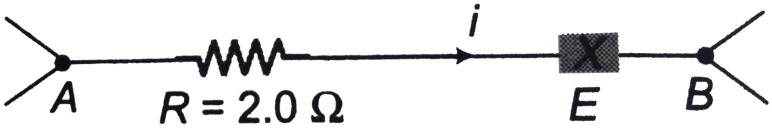
Comprehension

1. In figure circuit section AB absorbs energy at the rate of $5.0W$ when a current$i = 1.0A$ passes through it in the indicated direction.

(a) What is the potential difference between points A and B?

(b) Emf device X does not have internal resistance. What is its emf?

(c) What is its polarity (the orientation of its positive and negative terminals)?



A. $10V$

B. $50V$

C. $20V$

D. $30V$

Answer: B

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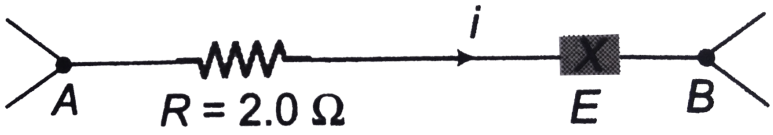
2. In figure circuit section AB absorbs energy at the rate of $5.0W$ when a current$i = 1.0A$ passes through it in the indicated direction.

(a) What is the potential difference between points A and B?

(b) Emf device X does not have internal resistance. What is its emf?

(c) What is its polarity (the orientation of its positive and negative terminals)?



A. $24V$

B. $32V$

C. 48 V`

D. $12V$

Answer: C

Watch Video Solution

3. A three - way light bulb has three brightness settings (low , medium , and high) but only two filaments . The two filaments are arranged in three settings, when connected across a $120V$ line and can dissipate $60, 120 \text{ and } 180W$. Answer the following questions:

(i) Higher resistance filament only works for $60W$

ii. Low resistance filament works for $120W$

iii.Low resistance filament works for $60W$

iv. High resistance filament works for $120W$

v. Low and high resistance filaments in parallel for $180W$

vi. Low and high resistance filament in series for $180W$

A. $I, ii, \text{ and } v$ are correct

B. $I, ii, \text{ and } vi$ are correct

C. $iii, iv, \text{ and } v$ are correct

D. $iii, iv, \text{ and } vi$ are correct

Answer: A

Watch Video Solution

4. A three - way light bulb has three brightness settings (low , medium , and high) but only two filaments . The two filaments are arranged in three settings, when connected across a $120V$ line and can dissipate $60, 120 \text{ and } 180W$. Answer the following questions:

A. all three settings is $120W$

B. all three settings is $60W$

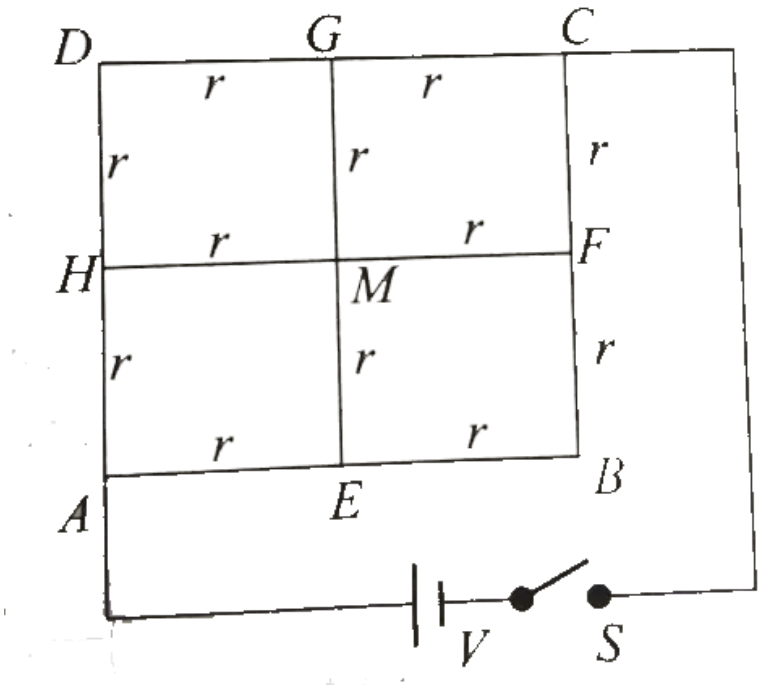
C. two settings is $60W$

D. two settings is $120W$

Answer: D

Watch Video Solution

5. In Fig. 7.48, each of the segments $(e.g., AE, GM, etc.)$ has resistance r. A battery of emf V is connected between $A \text{ and } C$. Internal resistance of the battery is negligible.



What is the equivalent resistance of the system about A and C?

A. r

B. $\frac{r}{2}$

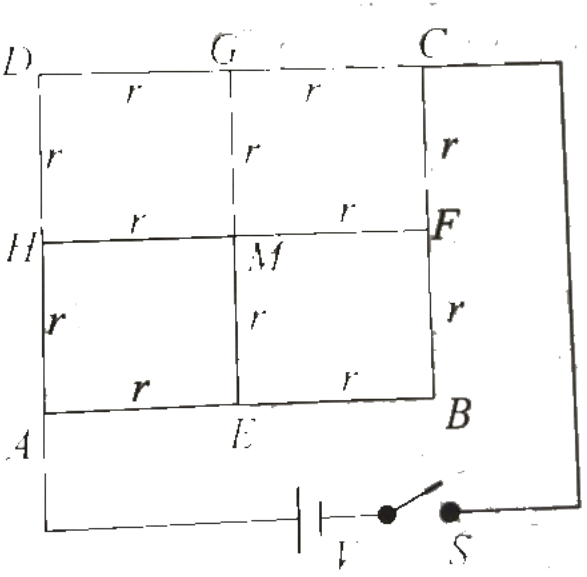
C. $\frac{3r}{2}$

D. $2r$

Answer: C

Watch Video Solution

6. In Fig. 7.48, each of the segments $(e.g., AE, GM, etc.)$ has resistance r. A battery of emf V is connected between A and C. Internal resistance of the battery is negligible.



Find the ratio of the power developed in segment AE to that in segment HM.

A. 1

B. 2

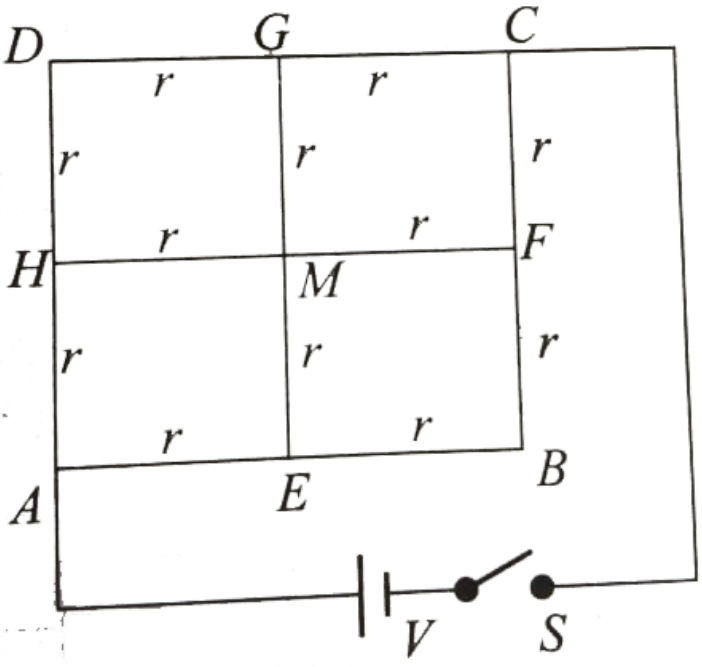
C. 3

D. 4

Answer: D

Watch Video Solution

7. In Fig. 7.48, each of the segments $(e.g., AE, GM, etc.)$ has resistance r. A battery of emf V is connected between A and C. Internal resistance of the battery is negligible.



If a potentiometer circuit having gradient k is connected across the points H and C, the balancing length shown by the potentiometer is

A. $\frac{v}{k}$

B. $\frac{2v}{3k}$

C. $\frac{3v}{2k}$

D. none of these

Answer: B

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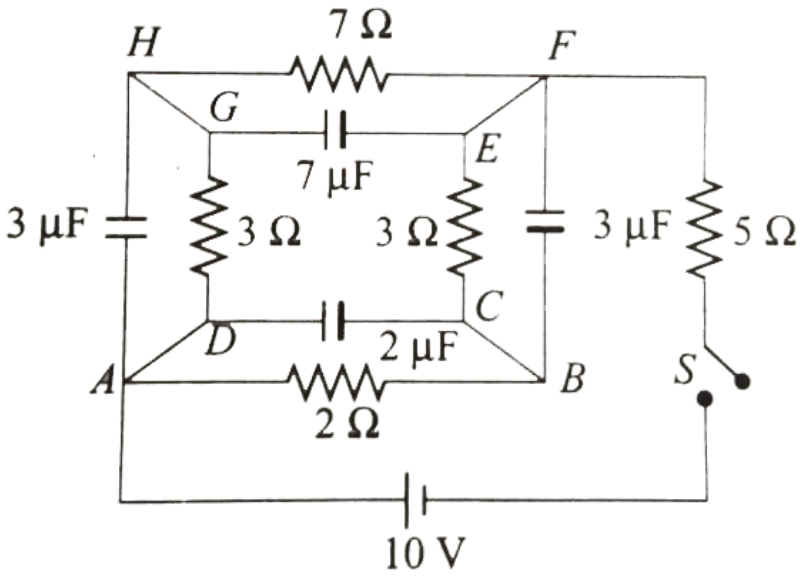
8. Refer to Fig. 7.49.



At $t = 0$, the switch is closed . Just after closing the switch, find the current through the 5Ω resistor.

A. $\frac{4}{5}A$

B. $\frac{2}{5}A$

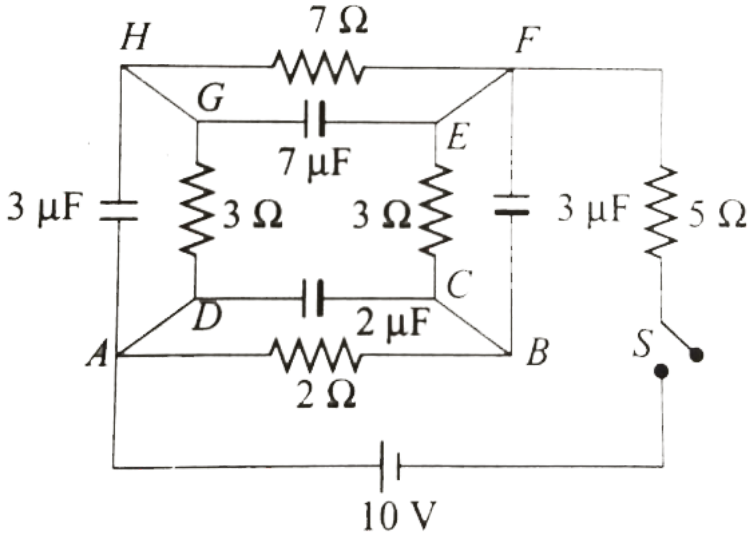
C. $\frac{6}{5}A$

D. $2A$

Answer: D

Watch Video Solution

9. Refer to Fig. 7.49.



Long time after closing the switch , find the current through the 5Ω resistor.

A. $\frac{4}{5}A$

B. $\frac{2}{5}A$

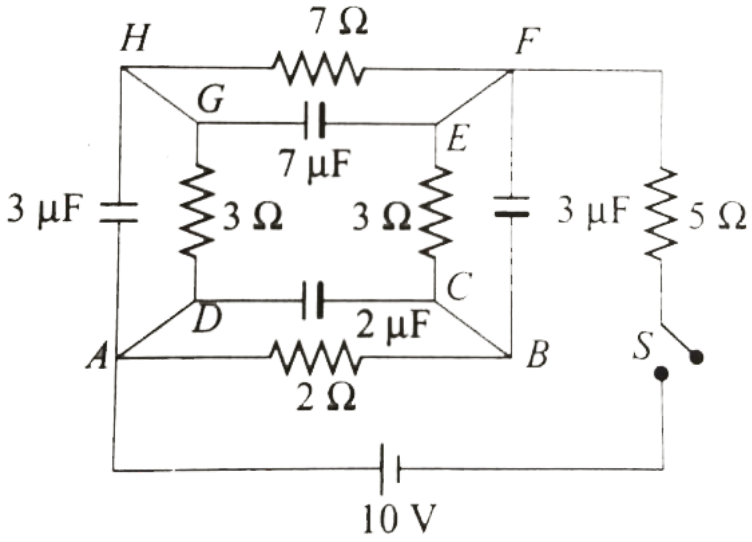
C. $\frac{6}{5}A$

D. $\frac{8}{5}A$

Answer: C

Watch Video Solution

10. Refer to Fig. 7.49.



Long time after closing the switch , find the current through the 5Ω resistor.

A. $40.8\mu J$

B. $50.8\mu J$

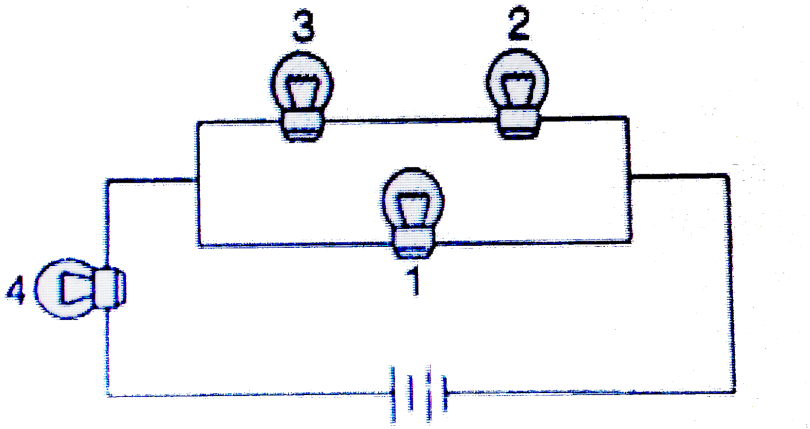
C. $40\mu J$

D. None of these

Answer: A

Watch Video Solution

11. All bulbs consume same power. The resistance of bulb 1 is 36Ω



What is the resistance of bulb 3?

A. 4Ω

B. 9Ω

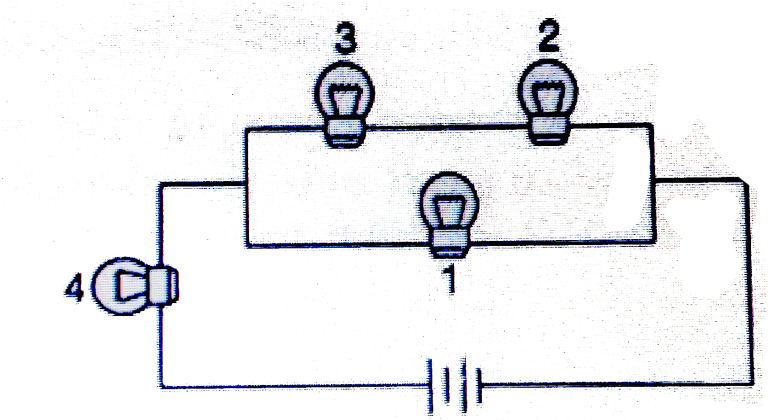
C. 12Ω

D. 18Ω

Answer: B

Watch Video Solution

12. All bulbs consume same power. The resistance of bulb 1 is 36Ω



What is the resistance of bulb 4?

A. 4Ω

B. 9Ω

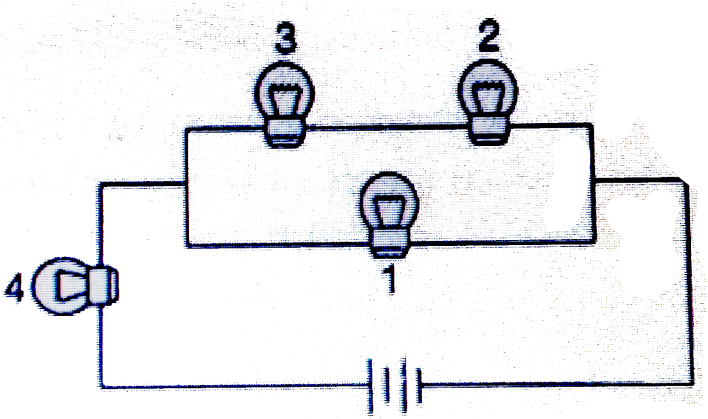
C. 12Ω

D. 18Ω

Answer: A

Watch Video Solution

13. All bulbs consume same power. The resistance of bulb 1 is 36Ω



What is the resistance of bulb 4?

A. $12V$

B. $16V$

C. $24V$

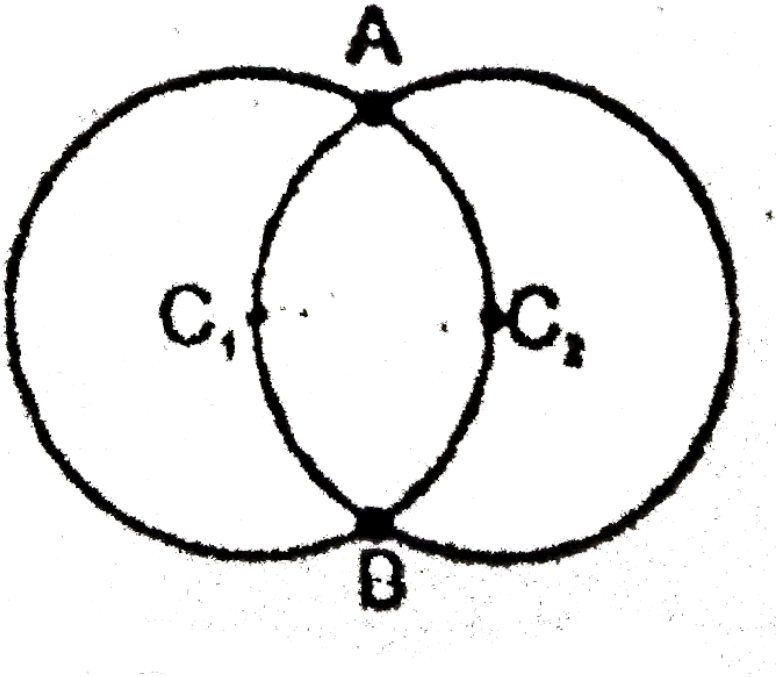
D. none of these

Answer: B

Watch Video Solution

Integer

1. Two circular rings of identical radii and resistance of 36Ω each are placed in such a way that they cross each others centre C_1 and C_2 as shown in figure. Conducting joints are made at intersection point A and B of the rings. An ideal cell of emf 20 volts is connected across AB. The power delivered by cell is:



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2. Three identical resistors are connected in series . When a certain potential difference is applied across the combination , the total power would be dissipated is $27W$. How many times the power would be dissipated if the three resistors were connected in parallel across the same potential difference ?

Watch Video Solution

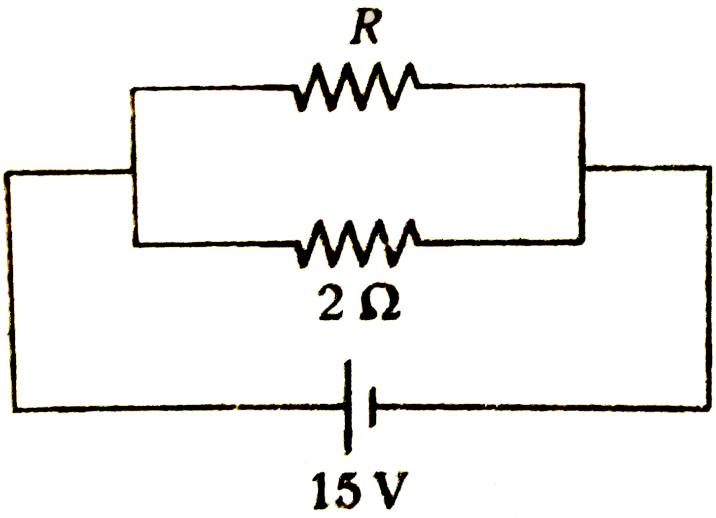
3. A heating coil is rated $100W, 200V$. The coil is cut in half and two pieces are joined in parallel to the same source . Now what is the energy $\left(\text{in} \times 10^2 J\right)$ liberated per second?

Watch Video Solution

4. A dynamo develops $0.5A$ at $6V$. Find the energy it generated in $1s$.

Watch Video Solution

5. If in the circuit, power dissipation is 150 W, then R is



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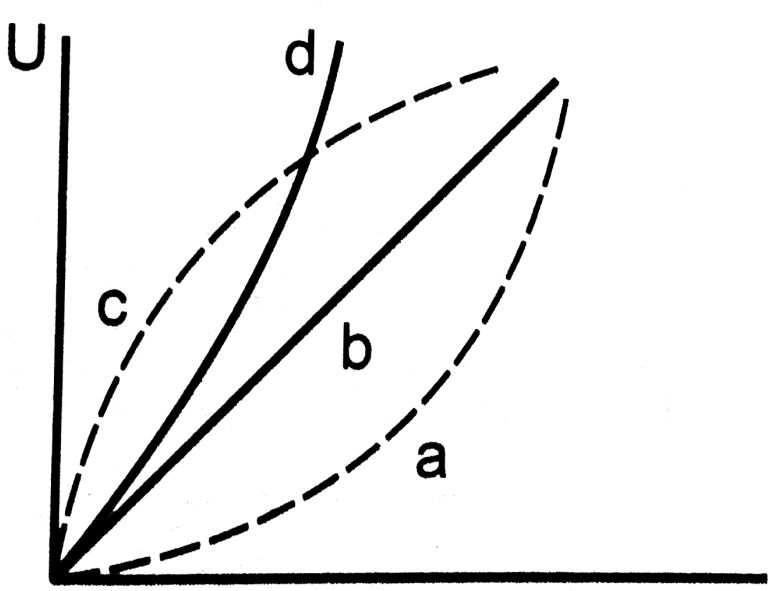
Calculating Thermal Power In Resistance

1. Which of the following plots may represent the thermal energy produced in a resistor in a given time as a function of the electric

current? Figure



A. a

B. b

C. c

D. d

Answer: D

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2. Two heating coils, one of fine wire and the other of thick wire of the same material and of the same length are connected in series and in parallel. Which of the following statement is correct ?

A. In series fine wire liberates more energy while in parallel thick wire will liberate more energy.

B. In series fine wire liberates less energy while in parallel thick wire will liberate more energy

C. Both will liberate quickly

D. In series the thick wire will liberate more while in parallel it will liberate less energy

Answer: A

Watch Video Solution

3. A resistor R_1 dissipates the power P when connected to a certain generator. If the resistor R_2 is put in series with R_1, the power dissipated

by R_1

A. decreases

B. increases

C. remains the same

D. any of the above depending upon the relative values of R_1 and R_2

Answer: A

Watch Video Solution

4. Two electric bulbs marked 25W - 220V and 100W - 220V are connected in series to a 440V supply. Which of the bulbs will fuse?

A. 100 W bulb

B. 25 W bulb

C. none of them

D. Both of them

Answer: B

Watch Video Solution

5. A 100 watt bulb working on 200 volt and a 200 watt bulb working on 100 volt have

A. resistance in the ratio of $4:1$

B. maximum current ratings in the ratio of $1:4$

C. resistance in the ratio of $2:1$

D. maximum current ratings in the ratio of $1:2$

Answer: B

Watch Video Solution

6. There are two electric bulbs of $40W$ and $100W$. Which one will be brighter when first connected in series and then in parallel ?

A. 40 W in series and 100 W in parallel.

B. 100 W in series and 40 W in parallel

C. 40 W both in series and parallel will be uniform

D. 100W both in series and parallel will be uniform

Answer: A

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7. Two bulbs of 500 watt and 200 watt are manufactured to operate on 220 volt line. The ratio of heat produced in $500W$ and $200W$, in two cases, when firstly they are joined in parallel and secondly in series, will be

A. $\frac{5}{2}, \frac{2}{5}$

B. $\frac{5}{2}, \frac{5}{2}$

C. $\frac{2}{5}, \frac{5}{2}$

D. $\frac{2}{5}, \frac{2}{5}$

Answer: A

Watch Video Solution

8. Two wires $'A'$ and $'B'$ of the same material have their lengths in the ratio $1:2$ and radii in the ratio $2:1$ The two wires are connected in parallel across a battery. The ratio of the heat produced in $'A'$ to the heat produced in $'B'$ for the same time is

A. $1:2$

B. $2:1$

C. $1:8$

D. $8:1$

Answer: D

Watch Video Solution

9. Two wires A and B of same material and mass have their lengths in the ratio $1:2$. On connecting them to the same source, the rate of heat dissipation in B is found to be 5 W . The rate of heat dissipation in A is

A. 10W

B. 5W

C. 20W

D. None of these

Answer: C

Watch Video Solution

10. An electric kettle has two heating coils. When one coil is used, water in the kettle boils in 5 minutes, while when second coil is used, same water boils in 10 minutes. If the two coils, connected in parallel are used simultaneously, the same water will boil in time

A. 3 min 20 sec

B. 5 min

C. 7 min 30sec

D. 2 min 30sec

Answer: A

Watch Video Solution

11. An electric kettle has two coils. When one of these is switched on, the water in the kettle boils in 6 minutes. When the other coil is switched on, the water boils in 3 minutes. If the two coils are connected in series, find the time taken to boil the water in the kettle.

A. 3 minutes

B. 6 minutes

C. 2 minutes

D. 9 minutes

Answer: D

Watch Video Solution

12. If resistance of the filament increases with temperature, what will be power dissipated in a $220V - 100W$ lamp when connected to $110V$ power supply

A. 25W

B. <25W

C. >25W

D. None of these

Answer: B

Watch Video Solution

13. Two bulbs consume same energy when operated at $200V$ and $300V$, respectively . When these bulbs are connected in series across a dc source of $500V$, then

A. ratio of potential difference across them is $\frac{3}{2}$

B. ratio of potential difference across them is $\frac{9}{4}$

C. ratio of power concumed across them is $\frac{4}{9}$

D. ratio of power consumed across them is $\frac{2}{3}$

Answer: C

Watch Video Solution

14. A steel wire has a resistance twice that of an aluminium wire. Both of them are connected with a constant voltage supply. More heat will be dissipated in

A. steel wire when both are connected in series

B. steel wire when both are connected in parallel

C. aluminium wire when both are connected in series

D. aluminium wire when both are connected in parallel.

Answer: A::D

Watch Video Solution

Thermal Power In Resistance Connected In Circuit

1. A room AC run for 5 hour at a voltage of $220V$ The wiring of the room constant of Cu of $1mm$ ratio and a length of $10m$ consumption per day is 10 commerclal unit What fraction of it goes in the joule heated in wire? What would happen if the wiring is made of aluminum of the same distances? $\left[\rho_{cu} = 1.7 \times 10^{-8}\Omega, \rho_{A1} = 2.7 \times 10^{-8}\Omega m\right]$

Watch Video Solution

2. Power P is to be delivered to a device via transmission cables having resistance R_C. If V is the voltage across R and I the current through it, find the power wasted and how can it be reduced.

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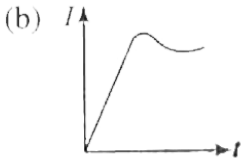
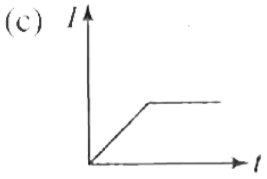
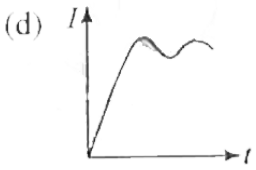
3. When an electric heater is switched on, the current flowing through it (i) is plotted against time (t). Taking into account the variation of resistance with temperature, which of the following best represents the resulting curve

A.

B.



C. 

D. 

Answer: B

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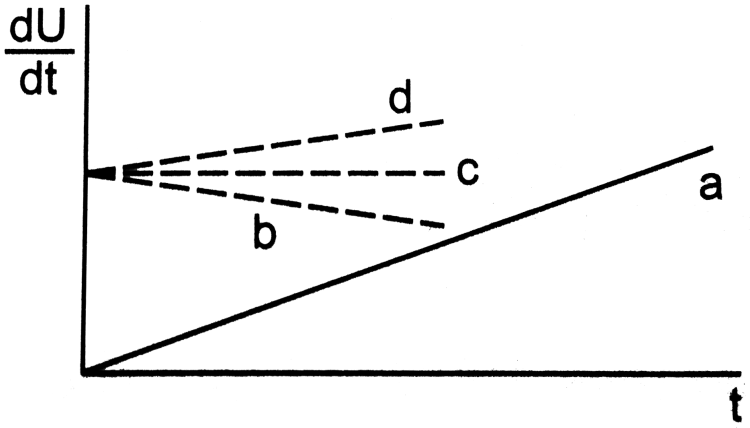
4. A constant current i is passed through a resistor. Taking the temperature coefficient of resistance into account, indicate which of the plots shown in Figure best represents the rate of production of thermal

energy in the resistor



A. a

B. b

C. c

D. d

Answer: D

Watch Video Solution

5. Electric bulb 50 W 100 V glowing at full power are to be used in parallel with battery 120 V, 10Ω. Maximum number of bulbs that can be connected so that glow in full power is

A. 2

B. 8

C. 4

D. 6

Answer: C

Watch Video Solution

6. What will happen when a 40 watt 220 volt lamp and 100 watt-220 volt lamp are connected in series across 40 volt supply?

A. 100 watt lamp will fuse

B. 40 watt lamp will fuse

C. Both lamps will fuse

D. Neither lamp will fuse

Answer: D

Watch Video Solution

7. Some electric bulbs are connected in series across a 220 V supply in a room. If one bulb is fused, then remaining bulbs are connected again in series (after removing the fused bulb) across the same supply. The illumination in the room will

A. increase

B. decrease

C. remains the same

D. not continous

Answer: A

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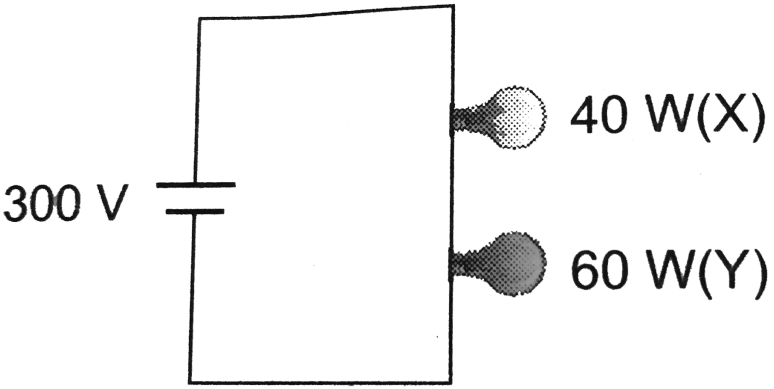
8. Two bulbs X and Y having same voltage rating and of power 40 watt and 60 watt respectively are connected in series across a potential difference of 300 volt, then



A. X will glow brighter

B. Resistance of Y is greater than X

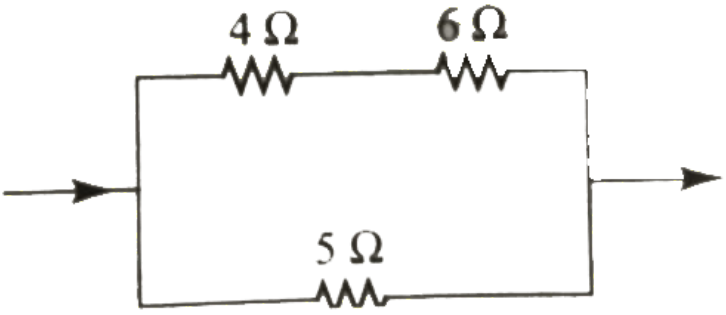
C. Heat produced in X will be greater than Y

D. Voltage drop in X will be greater than Y

Answer: A

Watch Video Solution

9. In the circuit shown in Fig. 7.39, the heat produced in the 5Ω resistor due to the current flowing through it is $10cals^{-1}$. The heat generated in the 4Ω resistor is



A. $1cal/\sec$

B. $2cal/\sec$

C. $3cal/\sec$

D. $4cal/\sec$

Answer: B

Watch Video Solution

10. Water boils in an electric kettle in 15 minutes after switching on. If the length of the heating wire is decreased to $2/3$ of its initial value, then the same amount of water will boil with the same supply voltage in

A. 15 minutes

B. 12 minutes

C. 10 minutes

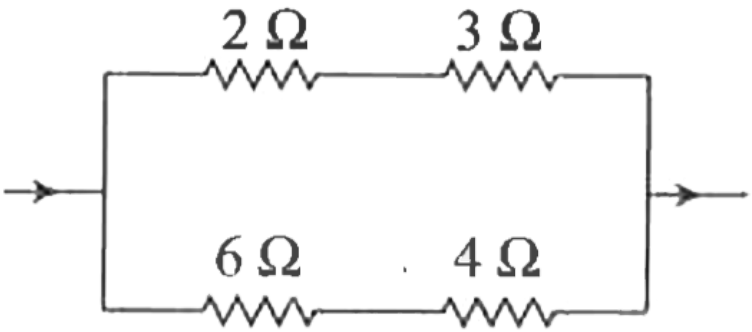
D. 8 minutes

Answer: C

Watch Video Solution

11. In the circuit as shown in the figure, the heat produced by 6 ohm resistance due to current flowing in it is 60 calorie per second. The heat

generated across 3 ohm resistance per second will be



A. 30 calorie/sec

B. 60 calorie/sec

C. 100 calorie/sec

D. 120 calorie/sec

Answer: D

Watch Video Solution

12. The resistance of a heater coil is 110Ω. A resistance R is connected in parallel with it and the combination is joined in series with a resistance of

11Ω to a $220V$ main line. The heater operates with a power of $110W$. The value of R in Ω is

A. 12.22

B. 24.42

C. negative

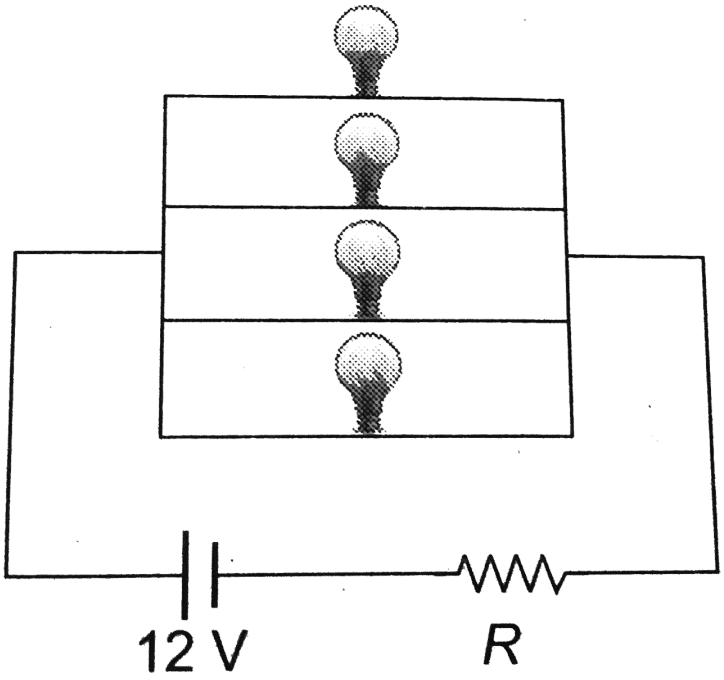
D. that the given values are not correct

Answer: A

Watch Video Solution

13. Four identical electrical lamps are labelled $1.5V$ $0.5A$ which describes the condition necessary for them to operate at normal brightness. A $12V$ battery of negligible internal resistance is connected to lamps as shon,

then



A. The value of R for normal brightness of each lamp is $\left(\frac{3}{4}\right)\Omega$

B. The value of R for normal brightness of each lamp is $\left(\frac{21}{4}\right)\Omega$

C. Total power dissipated in circuit when all lamps are normally bright is 24W.

D. Power dissipated in R is 21 W when all lamps are normally bright

Answer: B

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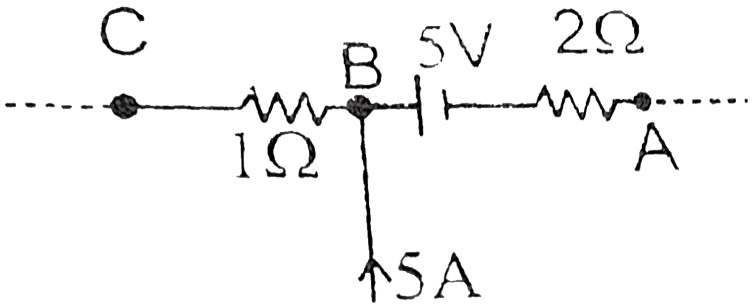
14. If the cell of emf 5 volt shown in the figure gives a power of 10W. Q, find the powers consumed by the resistors 2Ω and 1Ω



A. $2W, 18W$

B. $8W, 49W$

C. $8W, 18W$

D. $2W, 49W$

Answer: B

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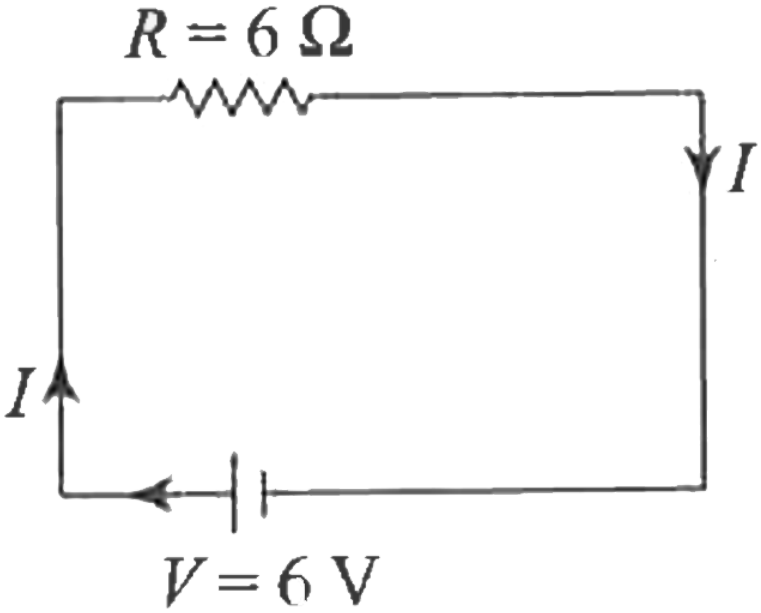
15. Consider the circuit in the figure.

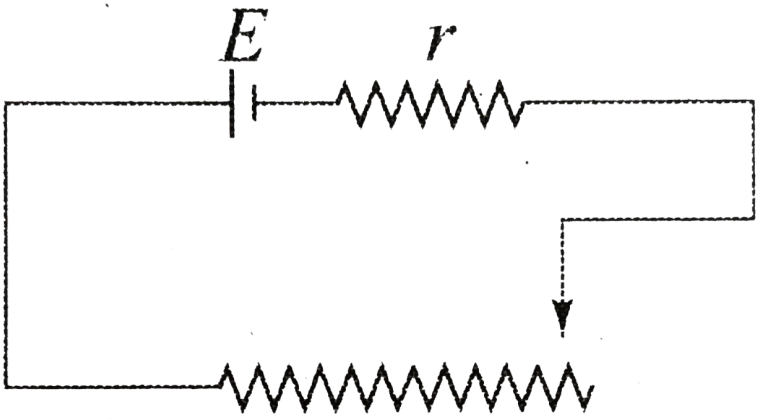


(a) how much energy is absorbed by electrons from the initial state of no current (ignore thermal motion) to the state of drift velocity?

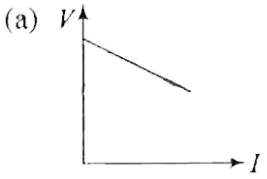
(b) Electrons give up energy at the rate of Rl^2 per second to the thermal energy. What time scale would the number associate with energy in problem (a)? n = number of electron/volume $= 10^{29}/m^3$. Length of circuit = 10cm cross-section = $A = (1mm)^2$.

Watch Video Solution

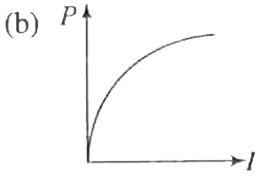
16. In figure , battery of emf E has internal reistance r and a variable resistor. At an instant, curent flowing through the circuit is i, potential difference between the terminals of cells is V, thermal power developed in external circuit is P, and thermal power developed in the cell is equal to fraction η of total electrical generated in it. Which of the following graphs is//are correct?

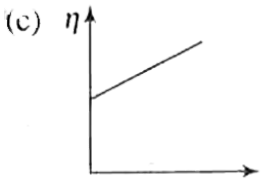


A.



B.



C. 

D. Both a and b are correct

Answer: D

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17. Two identical electric lamps marked $500W$, $220V$ are connected in series and then joined to a $110V$ line. The power consumed by each lamp is

A. $\left(\frac{125}{4}\right)W$

B. $\frac{25}{4}W$

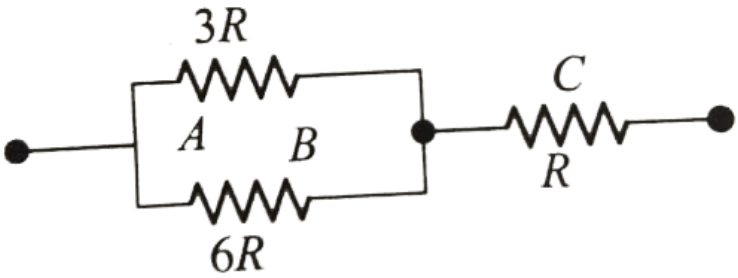
C. $\frac{225}{4}W$

D. $125W$

Answer: A

Watch Video Solution

18. Figure 7.37 shows a network of three resistances. When some potential difference is applied across the network , thermal powers dissipated by A, B and C are in the ratio



A. $2:3:4$

B. $2:4:3$

C. $4:2:3$

D. $3:2:4$

Answer: C

Watch Video Solution

19. If the length of the filament of a heater is reduced by $10\ \%$, the power of the heater will

A. increase by about 9%

B. increase by about 11%

C. increase by about 19%

D. decrease by about 10%

Answer: B

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20. The resistance of the filament of a lamp increases with the increase in temperature. A lamp rated $100W$ and $220V$ is connected across $220V$ power supply. If the voltage drops by $10\ \%$, then the power of the lamp will be

A. 90 W

B. 81 W

C. Between 90 W and 100 W

D. Between 81 W and 90 W

Answer: D

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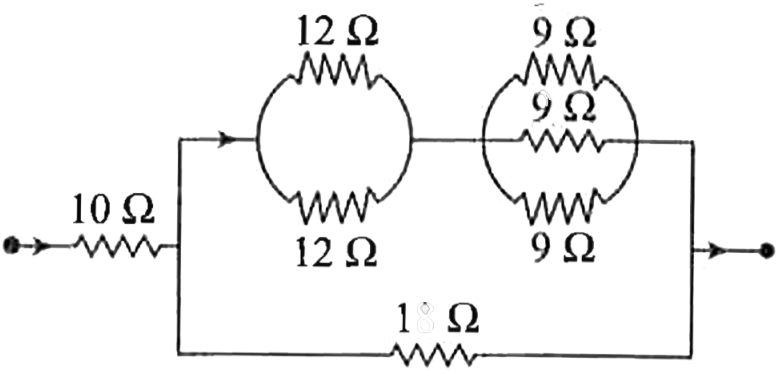
21. In the following circuit, 18Ω resistor develops 2J/sec due to current flowing through it. The power developed across 10Ω resistance is



A. 125 W

B. 10 W

C. 4/5 W

D. 25 W

Answer: B

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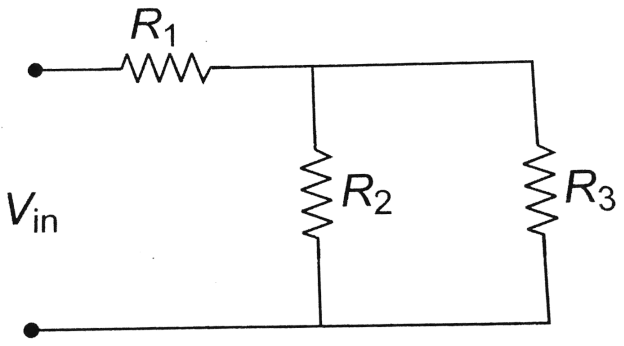
22. For ensuring dissipation of same energy in all three resistors (R_1, R_2, R_3) connected as shown in figure, their values must be related as



A. $R_1 = R_2 - R_3$

B. $R_2 = R_3$ and $R_1 = 4R_2$

C. $R_2 = R_3$ and $R_1 = \frac{1}{4}R_2$

D. $R_1 = R_2 + R_3$

Answer: C

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23. The resistance of the filament of an electric bulb changes with temperature. If an electric bulb rated 220 volt and 100 watt is connected (220×0.8) volt sources, then the actual power would be

A. 100×0.8W

B. $100 \times (0.8)^2$ W

C. Between 100×0.8 W and 100×0.8 W

D. Between $100 \times (0.8)^2$ W and 100×0.8W

Answer: B

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24. An electric bulb rated for $500W$ at $100V$ is used in a circuit having a $200V$ supply. The reistance R that must be put in series with bulb, so that the bulb delivers 500W is .....Ω.

A. 10Ω

B. 20Ω

C. 50Ω

D. 100Ω

Answer: B

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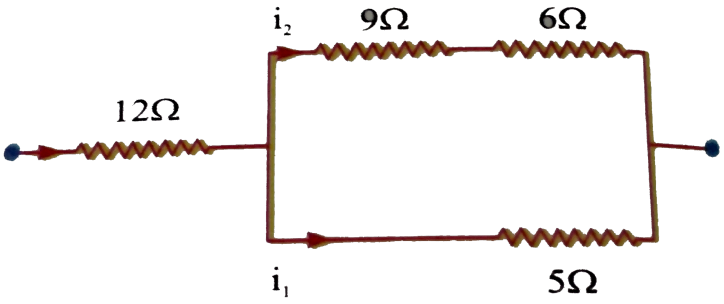

25.

In the following circuit, 5Ω resistor develops 45 J/s due to current flowing through it. The power developed across 12Ω resistor is

A. 16 W

B. 192 W

C. 36 W

D. 64 W

Answer: B

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26. Consider a resistor of uniform cross-sectional area connected to a battery of internal resistance zero. If the length of the resistor is doubled

by stretching it, then

A. Current will become four times.

B. the electric field in the wire will become half.

C. the thermal power produced by the resistor will become one-fourth.

D. the product of the current density and conductance will become half.

Answer: B::C

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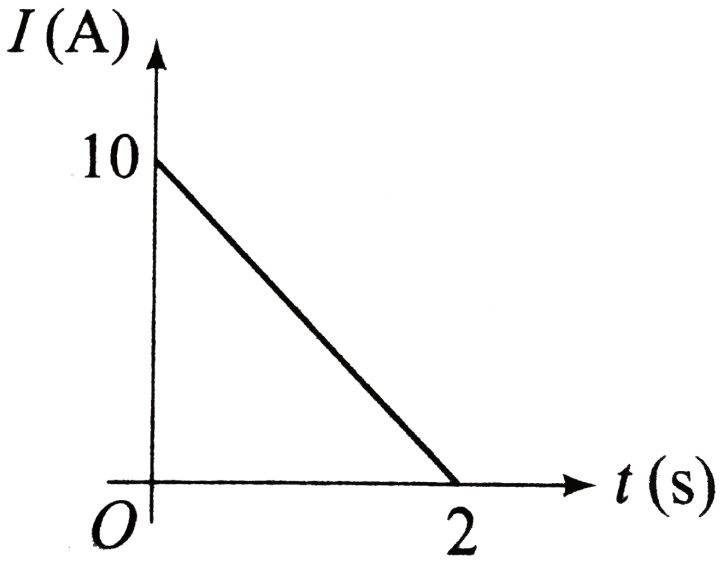
27. A variable current flows through a 1Ω resistor for 2 s. Time dependence of the current is shown in the graph.



A. Total charge flows through the resistor is 10° C.

B. Average current through the resistor is 5A.

C. Total heat produced in the resistor is 50 J.

D. Maximum power during the flow of current is 100 W.

Answer: A::B::D

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