PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

THERMAL AND ELECTRIC EFFECT oF CURRENT

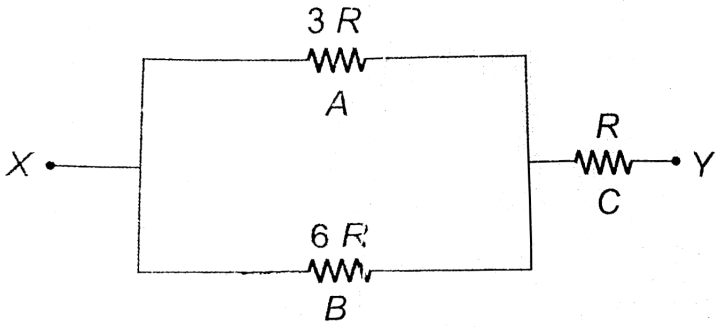
Examples

1. (a) Two heater coils made of the same material are connected in paralled across the mains. The length of diameter of one the coil is triple that of other. Which of these will produce more heat?

(b) Three equal resistors connected in series across a source of emf together dissipated $10Wa$ of power. What would be the power disspated if the same resistors are connected in parallel across the same source of emf?

Two resistor R_1 and R_2 may be connect either in series or in parellel across a battery of zero internal resistance. it is required that joule heating for the parallel combination be four times than for series combination. if $R_1 = 100\Omega$ find R_2

(d) The three resistance A, B and C have values $3R, 6R$ and R respectively. Now some potential difference is applied across the network . Find the ratio of thermal powers dissipated between X and Y . find ratio of power consumed by $A, B,$ and C.



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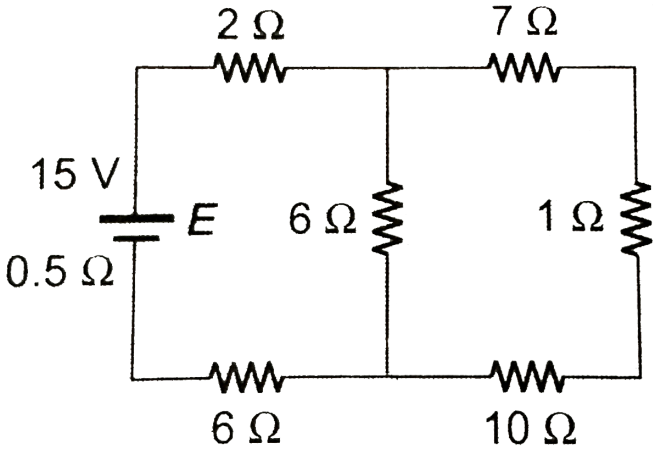
2. (a) When a cell sends current through a resistance R_1 for time t, the heat produced in the resistor is Q. When the same cell sends

current through another resistance R_2 for time t the heat porduced is again Q. Find internal resistance of the cell.

(b) An electric kettle has coil A is swithched on, the water boils in 10min. and when coil b is switched on the water boils in $20\ \text{min}$. Calculate the time taken by the water to boil if the coils connected in (i) series and (ii) parallel are swithched on.

(c) The emf of battery E in the circuit shown in the figure is 15V and internal resistance $0.5ohm$ (i) What is the current drown from the battery? (ii) How much power is consumed in $6ohm$ resistance?



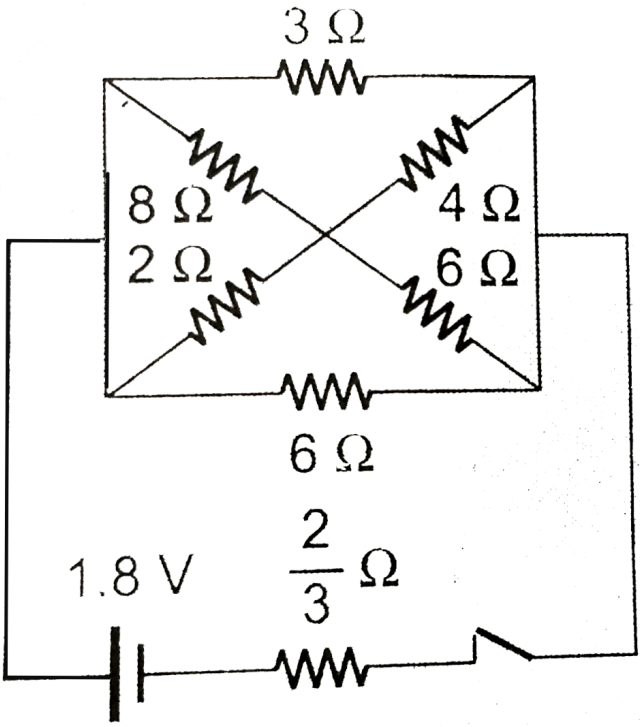
(d) A $500W$ heating unit is designed to opreate from a $115V$ line.

(i) By what percentage will its heat output drop if the line voltage

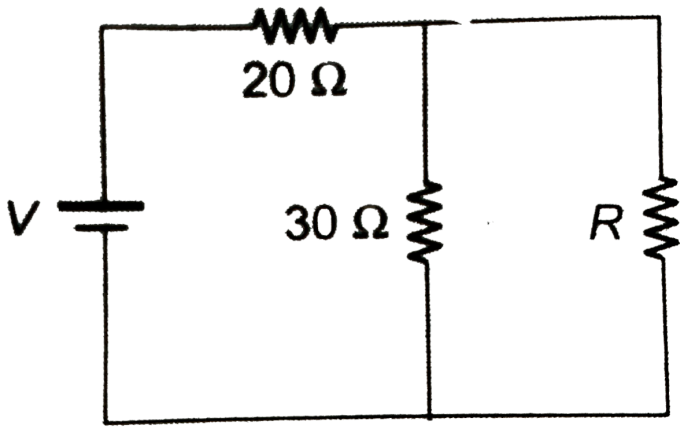
drops to $110V$. Assuming no change in resistance?

(ii) Taking variation of resistance with temperature into account. would the actual heat output drop be larger or smaller than case(i)

(e) If emf of the cell is $1.8V$ and its internal resistance $2/3\Omega$ for the circuit shown in the figure what is the (i) current in $3ohm$ resistance? (ii) Power consumed by the circuit from the battery?



(i) for what value of R , power in R is maximum?



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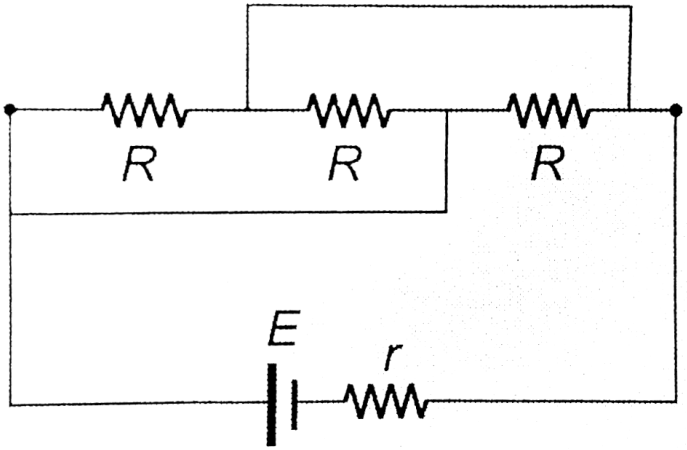
3. (a) A cell of emf E and internal resistance r is connected to a resistance R.

(i) Relate r and R, so that power in R is maximum.

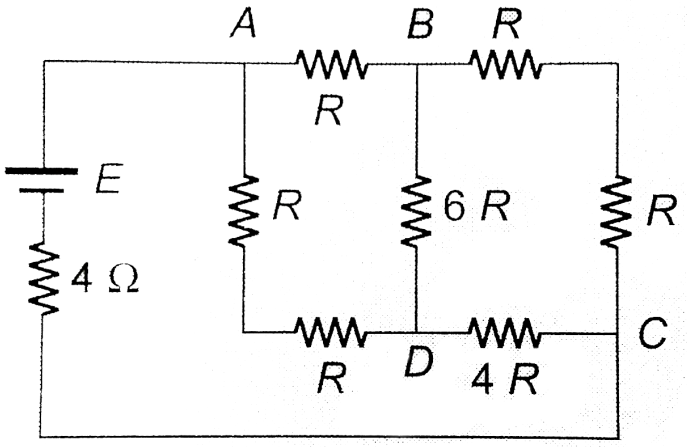
(ii) Maximum power consumed by R.

(iii) Efficiency.

(b) Find value r in terms of R so that power in external circuit is maximum.



(c) A battery of internal resistance 4Ω is connected to the network of resistance as shown in the figure. what must be the value of R so that maximum power is delivered to the network? what is tha maximum power?



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4. (a) A $220V - 100W$ bulb is connected to $110V$ source. Calculate the power consumed by the blub.

(b) Calculate the following for a $100W - 200V$ bulb

(i) Resistance of the filament of bulb

(ii) Current through bulb when it is connected to $200V$ line

(iii) Power consumed when bulb is connected to $100V$ line

(c) An electric bulb rated $100W - 200V$ is used in a circuit having $400V$ supply. what resistance R must be put in series with bulb so that bulb delivers $100W$?

(d) Repeat the previous problem, if bulb delivers $25W$.

(e) Two bulbs, $50W - 220V, 100W - 200V$ are connected in series across a $220V$ supply. find the power consumed by each bulb.

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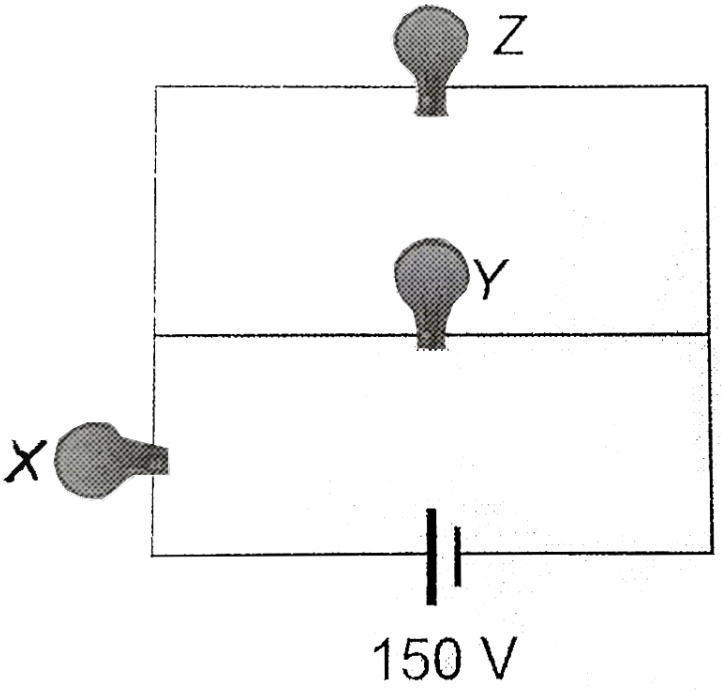
5. Three $100W, 150V$ lamps are connected across a `150V power line as shown. Find (a) Voltage across each lamp and (b) total power dissipated in three bulbs.



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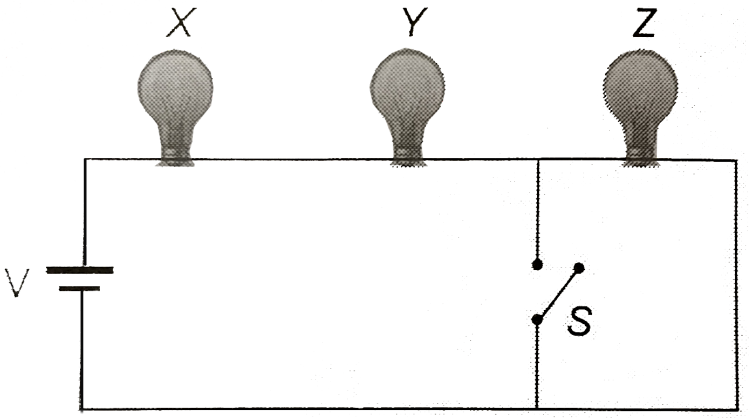
6. A series circuit consists of three bulbs connected to a battery as shown. When switch S is closed, what happens to (a) Power consumed in bulb X and Y (b) Power consumed in bulb Z (c) the current in the circuit (d) the voltage drop across three bulbs and (e) the power consumed in circuit?



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7. (a) A $220V - 100W$ bulb is connected to $110V$ source. Calculate the power consumed by the blub.

(b) Calculate the following for a $100W - 200V$ bulb

(i) Resistance of the filament of bulb

(ii) Current through bulb when it is connected to $200V$ line

(iii) Power consumed when bulb is connected to $100V$ line

(c) An electric bulb rated $100W - 200V$ is used in a circuit having $400V$ supply. what resistance R must be put in series with bulb so that bulb delivers $100W$?

(d) Repeat the previous problem, if bulb delivers $25W$.

(e) Two bulbs, $50W - 220V, 100W - 200V$ are connected in series across a $220V$ supply. find the power consumed by each bulb.

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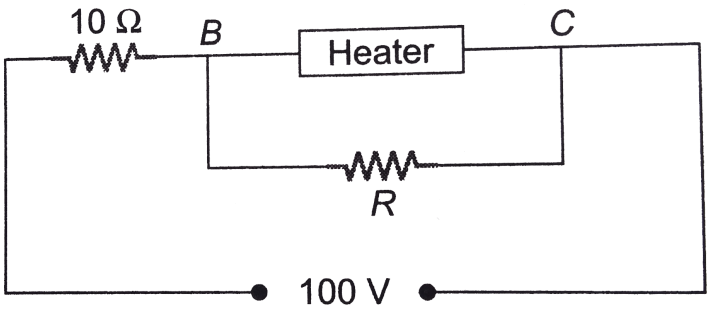
8. A heater is designed to operate with a power of $1000W$ in a $100V$ line. It is connected in combination with a resistance of 10Ω and a resistance R, to a $100V$ mains as shown in figure. What will be the value of R so that the heater operates with a power of

$62.5W$?



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9. Two fuse wires are made of the same material . The radius of first and second wires are $r_1 = 2mm$ and $r_2 = 4mm$. The first wire blows when a current of $15A$ passes through it. Find the current required to blow the second wire.

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10. An electrically heating coil was placed in a calorimeter containing $360g$ of water at $10^\circ C$. The coil consumes energy at the rate of $70W$. The water equivalent of calorimeter and coil is $40g$. Find temperature of the water after $10\ \min$. Given specific heat of water = $1cal/g.^\circ C, 1cal = 4.2J.$

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11. A copper wire having area of cross section $0.4mm^2$ and a length of 10 cm is initially at $75^\circ C$ and is thermally insulated from the surroundings. If a current of $10A$ is set up in this wire. ltbr. (a) Find the time in which the wire will strat melting. ignore variation of resistance with temperature.

(b) If length of wire is doubled, find time.

Given for copper : density $=10^4kg/m^3$, specific heat =

$9 \times 10^{-2} kcalkg^{-1}(.^{\circ} C)^{-1}$, melting point $=1075^{\circ} C$,

resispectively $= 1.6 \times 10^{-8} \Omega \cdot m$.

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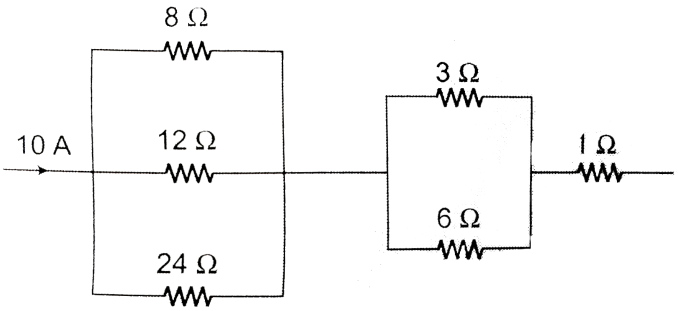
12. Consider the following arrangement of resistors .



This arrangement is immersed in a box containting ice at $0^{\circ})C$.

How much ice must be put in the box constant? (Latent heat of ice

$L = 80cal / g)$.

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13. The walls of a closed cubical box of edge $50cm$ are made of a material of thickness $1mm$ and thermal conductivity $4 \times 10^{-4} cm^{-1}(.^{\circ} C)^{-1}$. The interior of the box is maintained $100^{\circ} C$ above the outside temperature by a heater placed inside the box and connected across $420V$ d.c. calculate the resistance of copper.

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14. The cold junction of a thermocouple is maintained at $15^{\circ} C$. No thermo-emf is developed when the hot junction is mainted at $525^{\circ} C$. Find neutral temperature.

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15. The junction of a $Ni - Cu$ thermocouple is maintained to $0^\circ C$ and $100^\circ C$. Find the thermo-emf produced. Also, find nautral temperature and inversion temperature. Given $a_{Ni,Cu} = 16.3 \times 10^{-6} V/.^\circ C, b_{Ni,Cu} = -0.042 \times 10^{-6} V/(\circ C)^2$.

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16. (a) Electroplating unit plates $3.0g$ of silver on a brass plate in 3.0min. Find the current used by the unit. The electrochemical equivalent of silver is $1.12 \times 10^{-6} kg/C$.

(b) Find the amount of silver liberated at cathode if $0.05A$ of current is passed through $AgNO_3$ electrolyte for $1hr$. Atomic weight of silver is $108g/\text{mole}$.

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17. How long a current of 3amp has to be passed through a solution of $AgNO_3$ to coat a metal surface of $80cm^2$ with $0.005mm$ thick layer. Density of silver is $10g/cm^3$ and atomic weight = $108g/\text{mole}$.

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18. The potential difference across the terminals of a battery of $emf 12V$ and internal resistance 2Ω drops to $10V$ when it is connected to a silver voltameter. Find the silver deposited at the cathode in half an hour. Atomic weight of silver is $107.9gmol^{-1}$.

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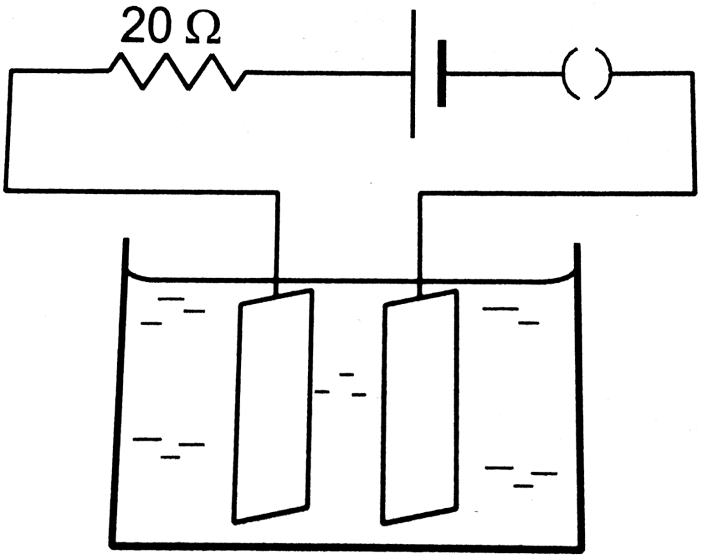
19. Figure, shows an electrolyte of $AgCI$ through which a current is passed. It is observed that $2.68g$ of silver is deposited in 10

minutes on the cathode. Find the heat developed in the 20Ω resistor during this period. Atomic weight of silver is $107.9 gmol^{-1}$. (Figure)



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20. A plate of area $10 cm^2$ is to be electroplated with copper $(density 9000 kgm^{-3})$ to a thickness of 10 micrometres on both sides, using a cell of $12V$. Calculate the energy spend by the cell in the process of deposition. If this energy is used to heat $100g$ of

water, calculate the rise in the temperature of the water. ECE of copper $= 3 \times 10^{-7} kgC^{-1}$ and specific heat capacity of water $= 4200 Jkg^{-1}K^{-1}$.

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21. Find the time requried to liberate 1.0 litre of hydrogen at STP in an electrolytic cell by a current of $5.0A$.

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22. Two voltameters, one having a solution of silver salt and the other of a trivalent-metal salt, are connected in series and a current of $2A$ is maintained for $1.50 hours$. It is found that $1.00g$ of the trivalent metal is deposited. (a) What is the atomic weight of the trivalent metal? (b) How much silver is deposited during

this period?

Atomic weight of silver is $109.9 g mol^{-1}$

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23. A current of $1A$ is passed through a dilute solution of sulphuric acid for some time to liberate $1g$ of oxygen. How much hydrogen is liberated during this period? How long was the current passed? Faraday constant $= 96500 C mol^{-1}$.

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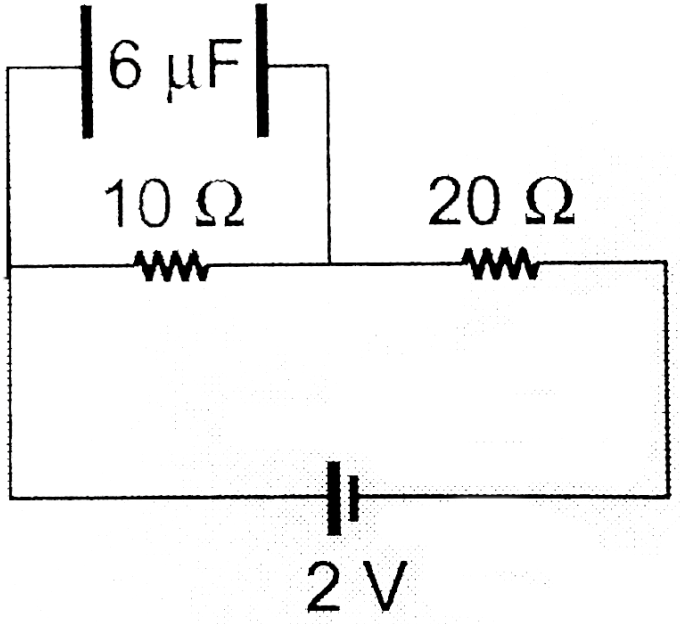
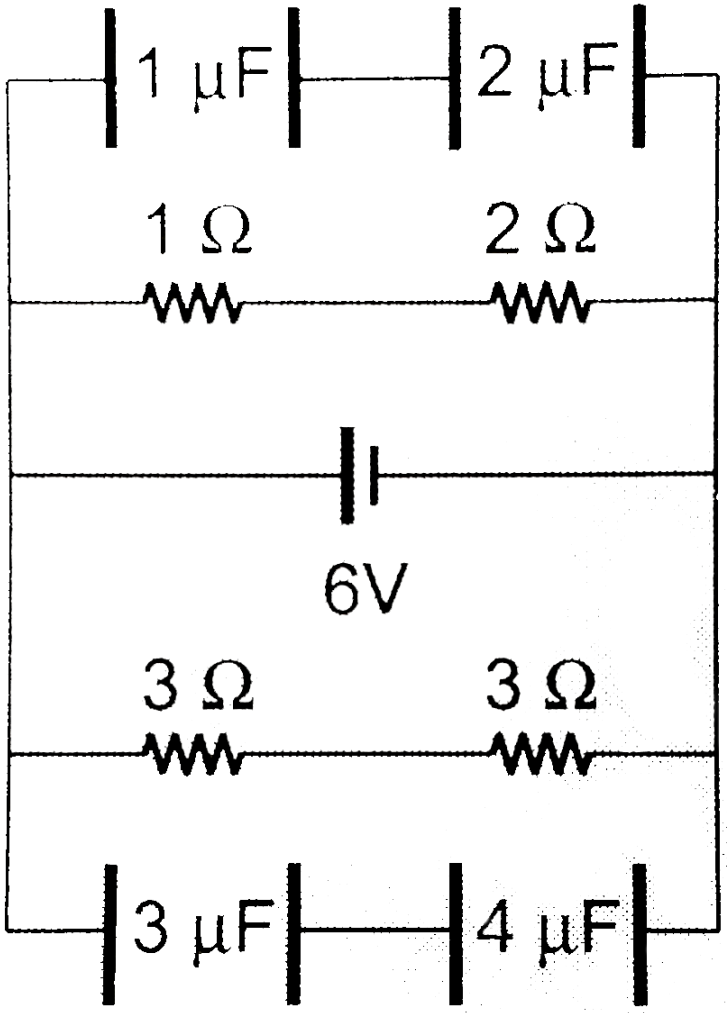
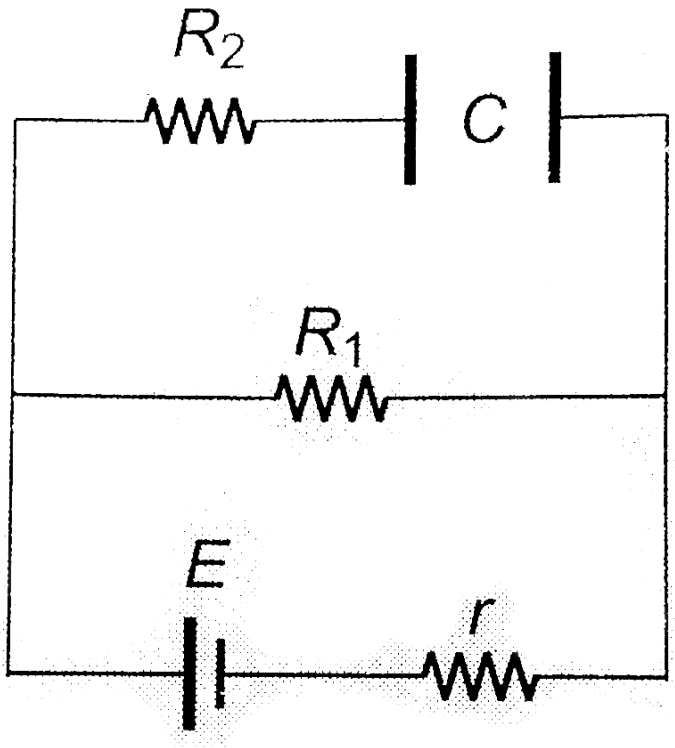
24. Find charge on capacitors in the following cases.



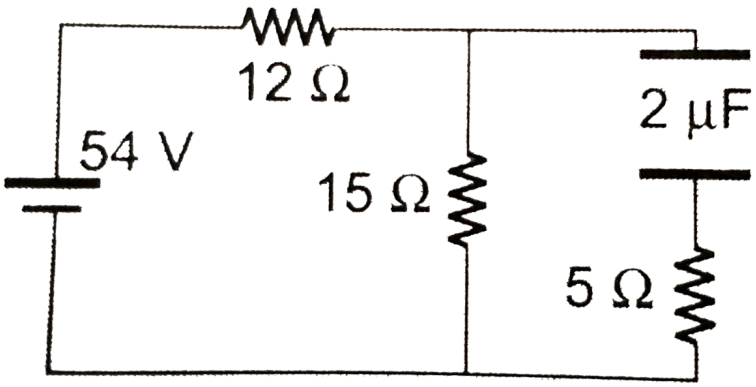
(a)



(b)



(c)



(d)

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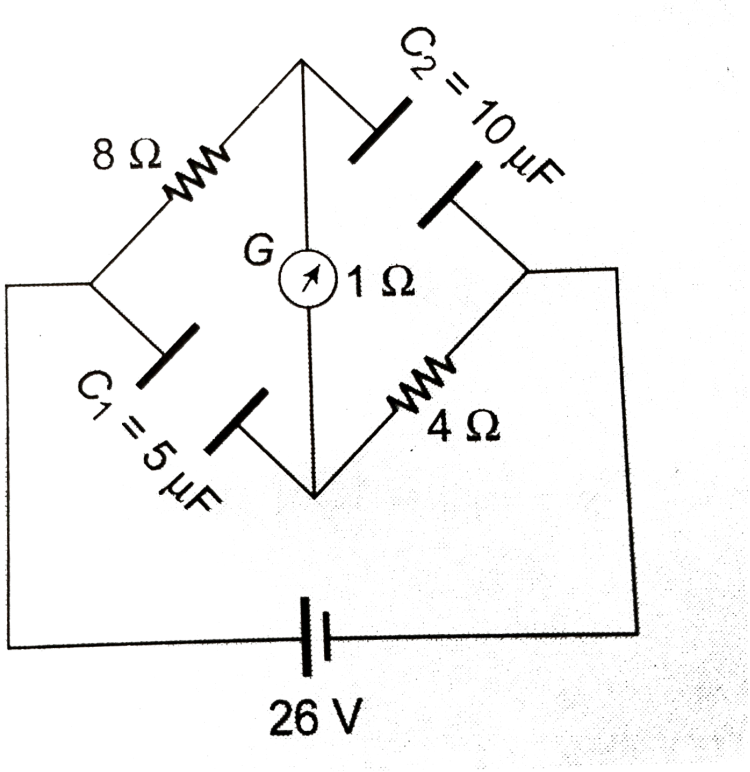
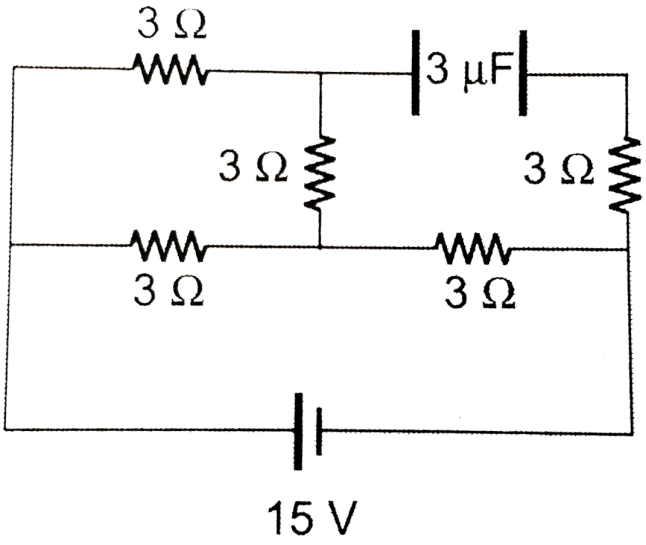
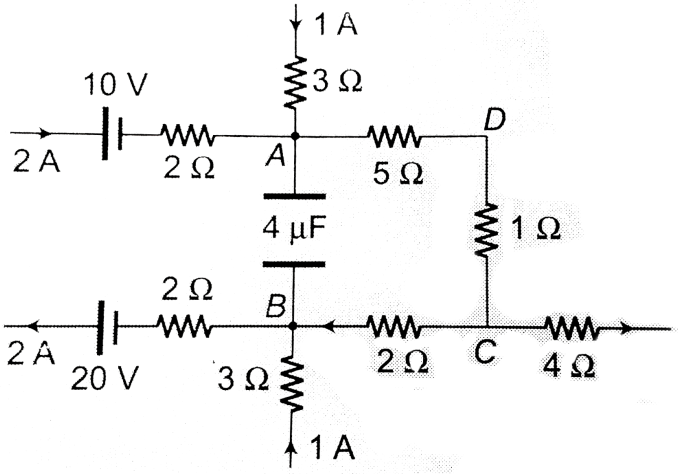
25. (a) Find charge on capacitors



(b) Find charge on capacitor



(c) Find energy stored in capacitor.



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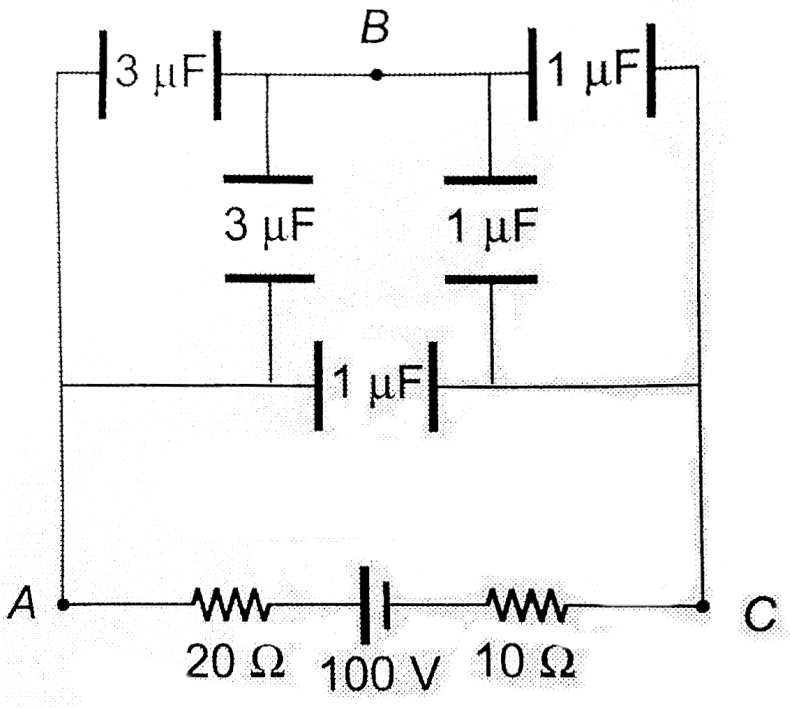
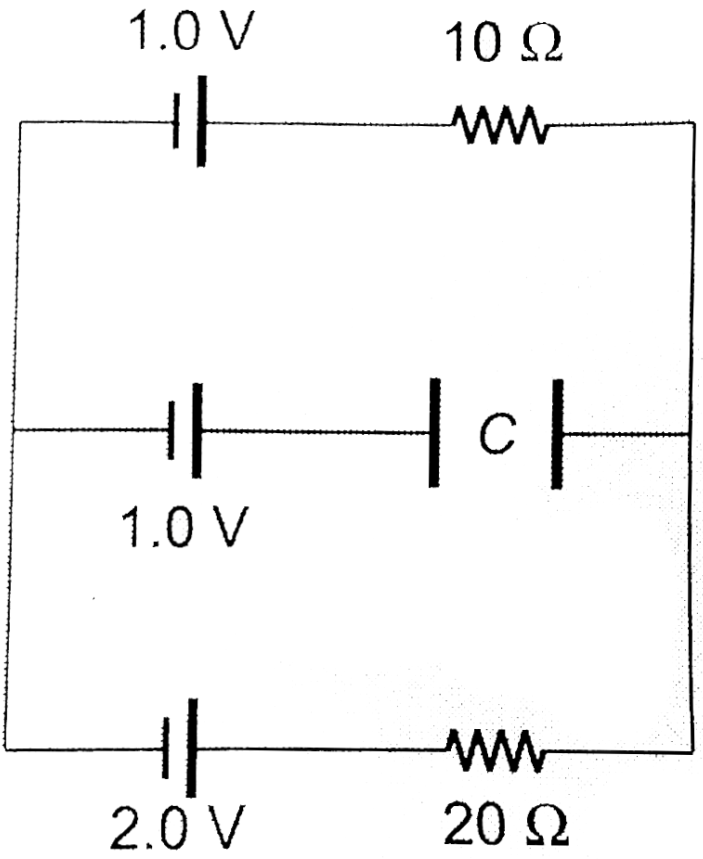
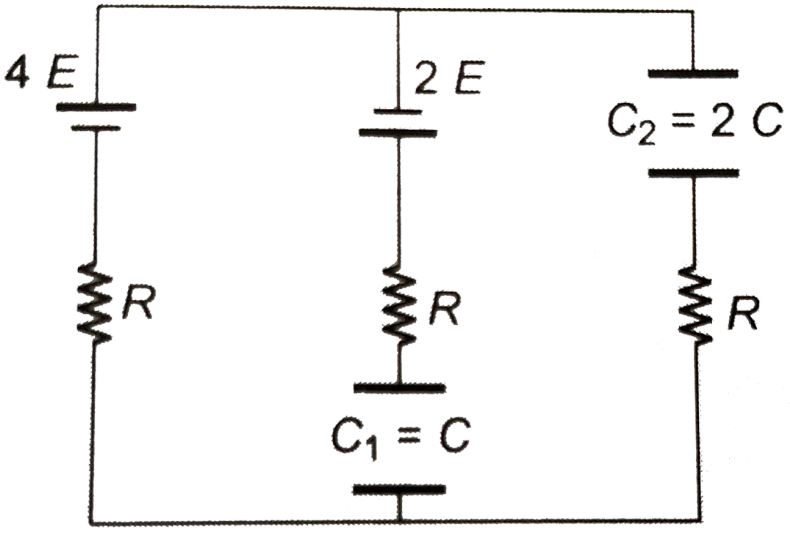
26. (a) Find potential difference between A and B and C.



(b) Find potential difference across capacitor C.


1.0 V
10 Ω
C
1.0 V
2.0 V
20 Ω


4 E
2 E
C2 = 2 C
R
R
R
C1 = C

(i) Find ratio of energy stored in capacitors, C_1 and (C_2)

(ii) If battery of emf of $2E$ is short -circuited, find charge flown in battery of emf $4E$.

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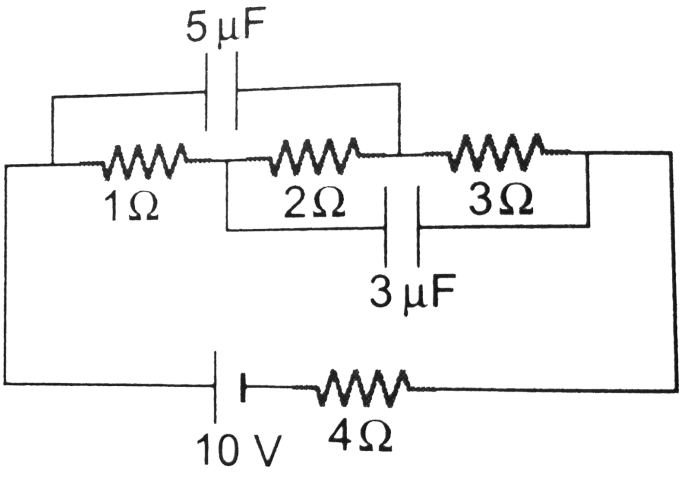
27. In the shown network, find the charges on capacitors of capacitances $5\mu F$ and $3\mu F$, in steady state.



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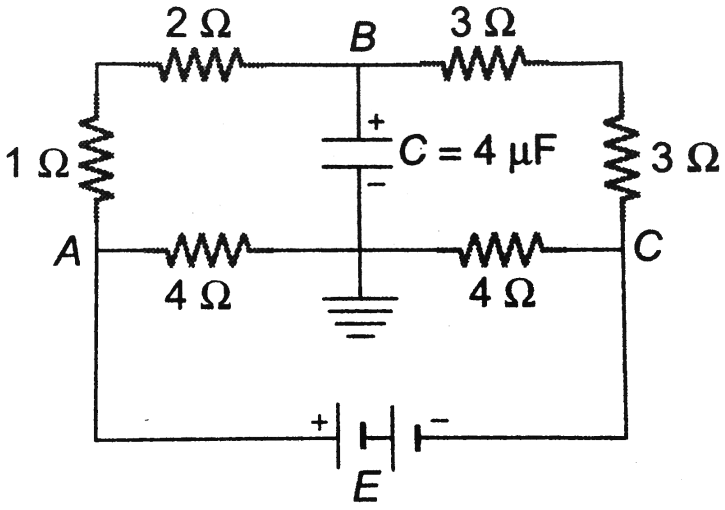
28. Analyze the given circuit in the steady state condition. Charge on the capacitor is $q_0 = 16\mu C$



(a) Find the current in each branch

(b) Find the emf of the battery.

(c) If now the battery is removed and the points A and C are shorted. Find the time during which charge on the capacitor becomes

$8\mu C$

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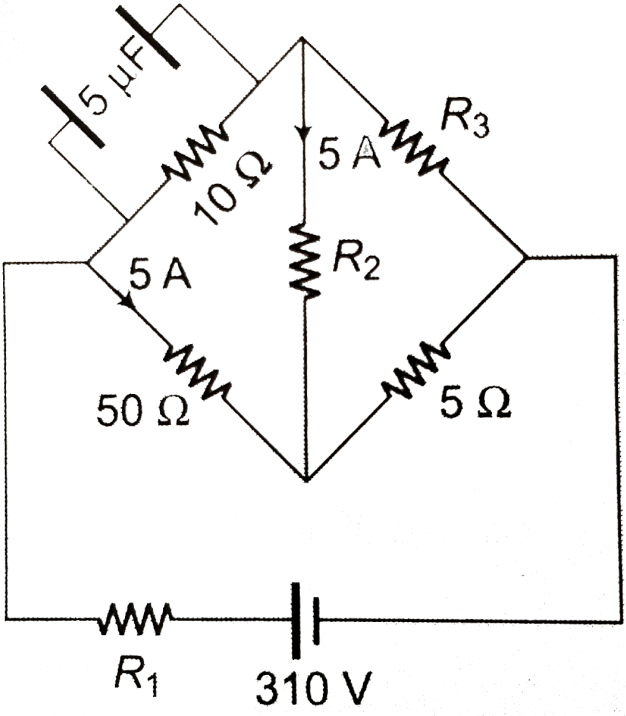
29. As shown circuit in steady state. If charge on capacitor is $1000\mu C$, find (a) battery current, (b) R_1, R_2, R_3. The current in 50Ω resistor and $R_2 is 5A$`.



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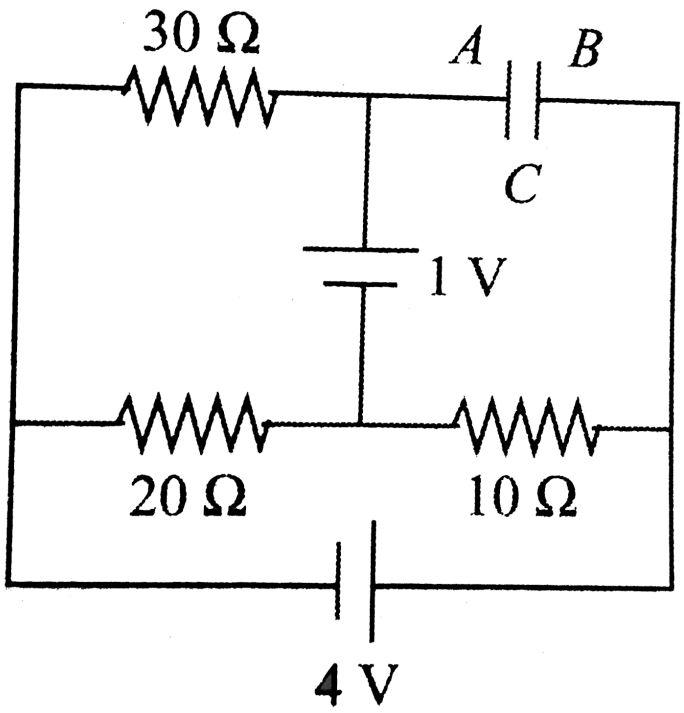
30. Find the potential difference between the plates of the capactior C in the circuit shown in fig.5.236



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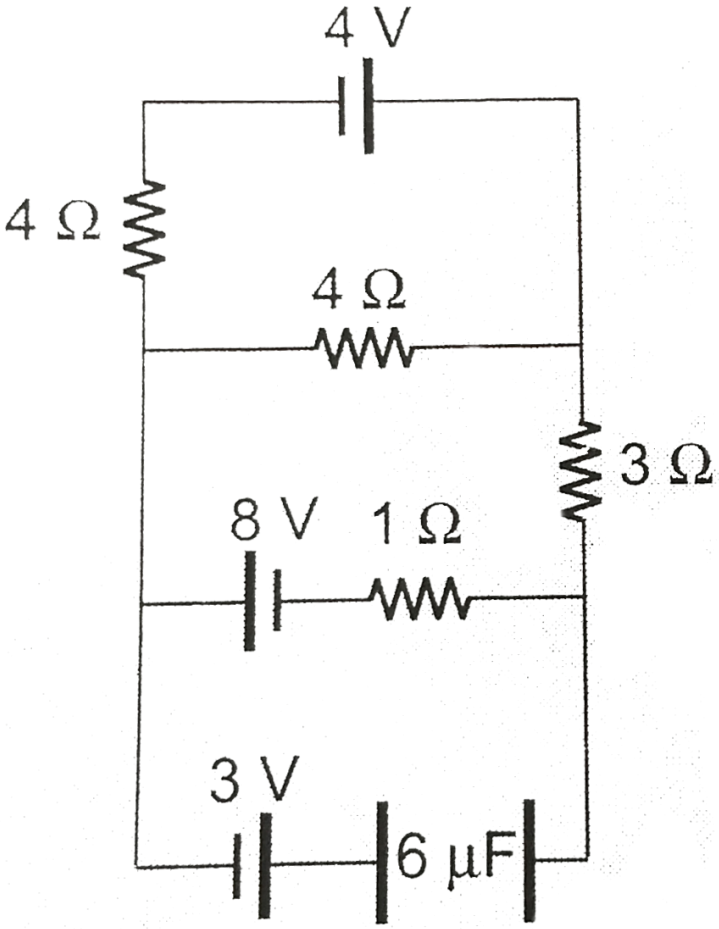
31. find

(a) the current in 3Ω resistance

(b) the change on the capacitor



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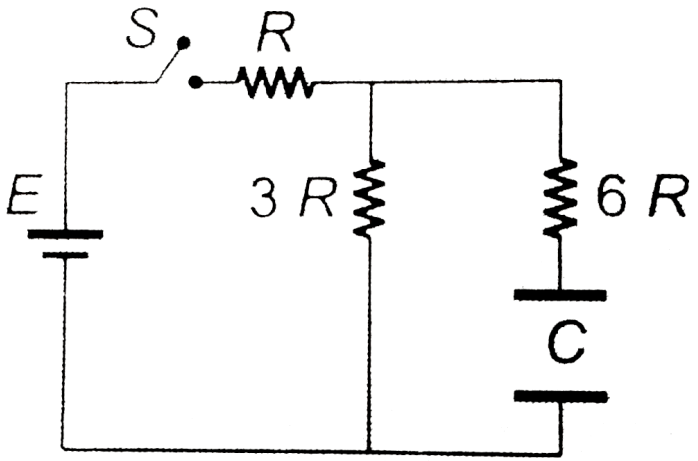

32.

Find currents through resistors

(i) immediately after closing the switch

(ii) after a long time.

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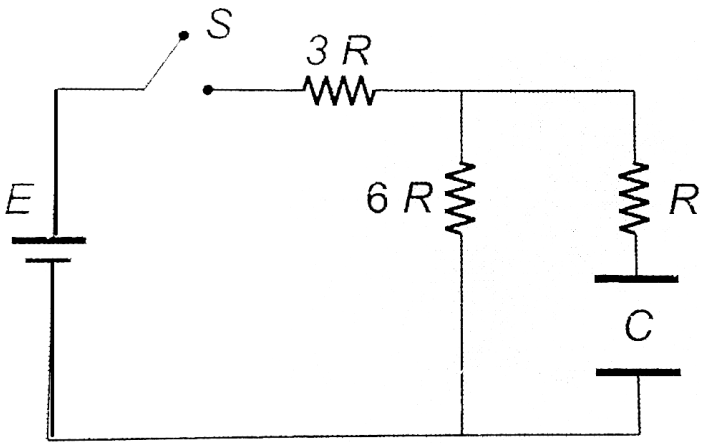

33.

Find (a) equivalent time constant, (b) charge on capacitor in terms of time t.

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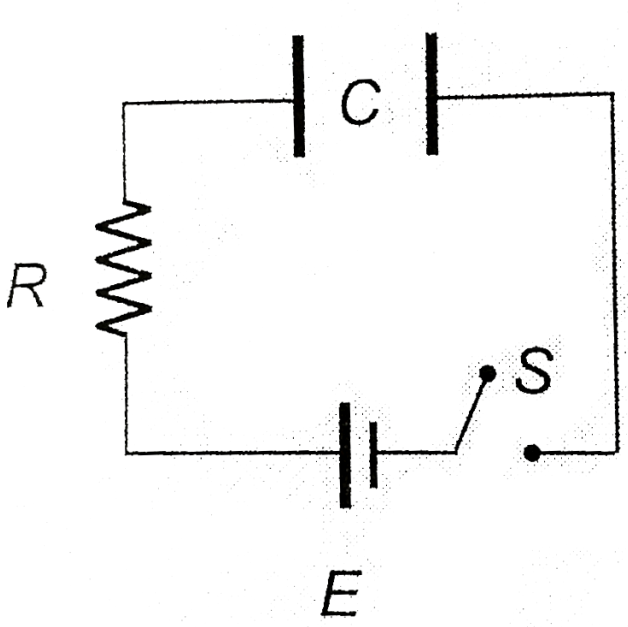

34.

At $t = 0$ switch S is closed . Find

`(a) charge on capacitor after one time constant

(b) the time when p.d. across resistance equals p.d. across capacitance

(c) maximum energy stored in capacitor.

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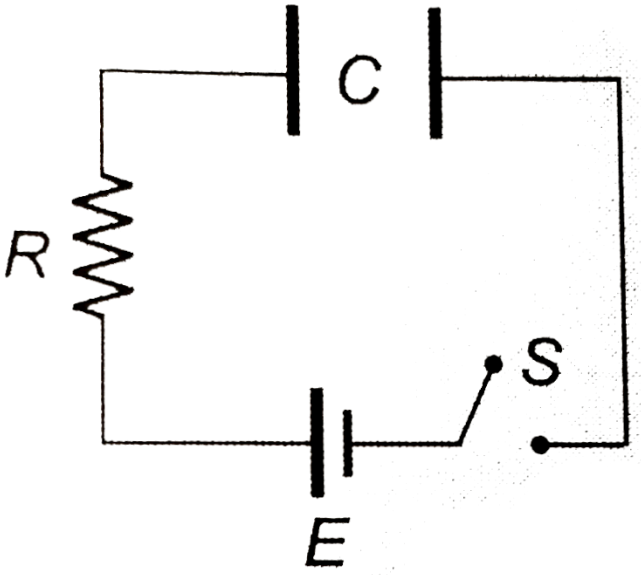

35.

At $t = 0$ switch S is closed .

(a) After how much time , charge on capacitor is 50% of maximum charge stored on capacitor.

(b) After how much time, energy stored in capacitor is halt of maximum energy stored in capacitor.

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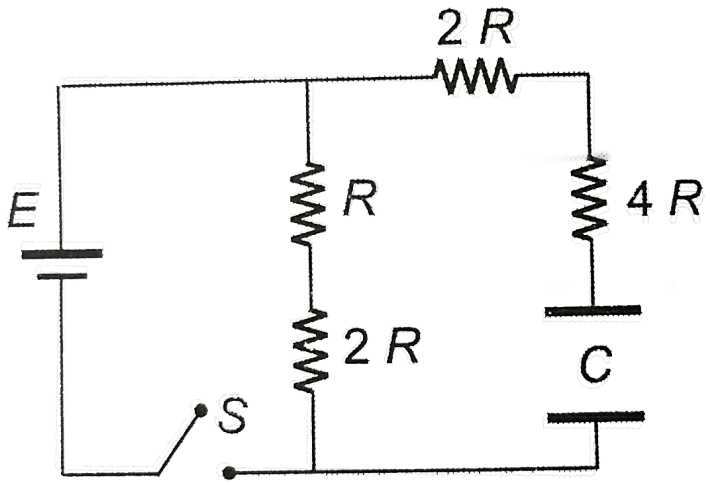
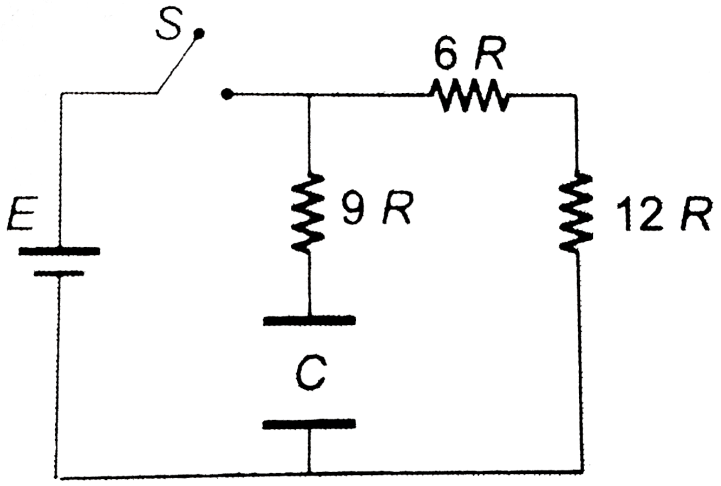
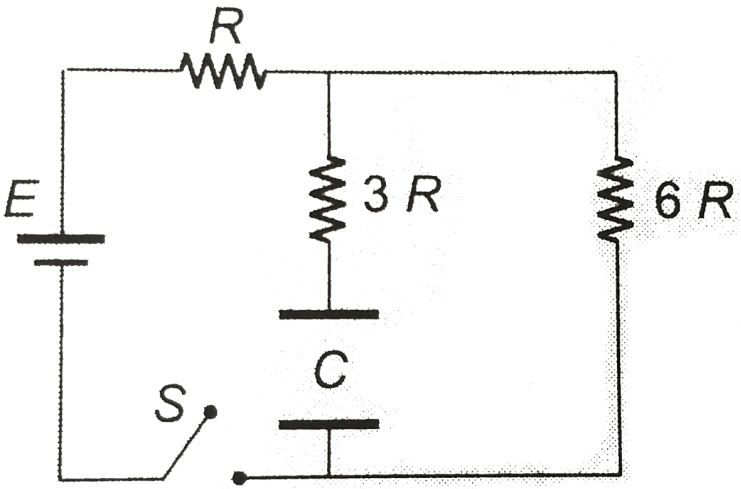
36. Consider the circuits shown in figure. Find



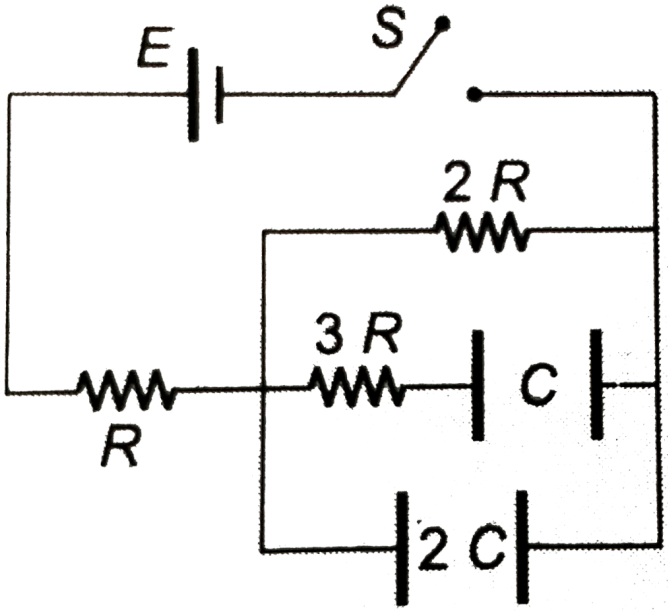
(a)



(b)



(c)



(d)

(i) currents through resistances immediately after closing the switch

(ii) Currents through resistaces after a long time ie., steady state.

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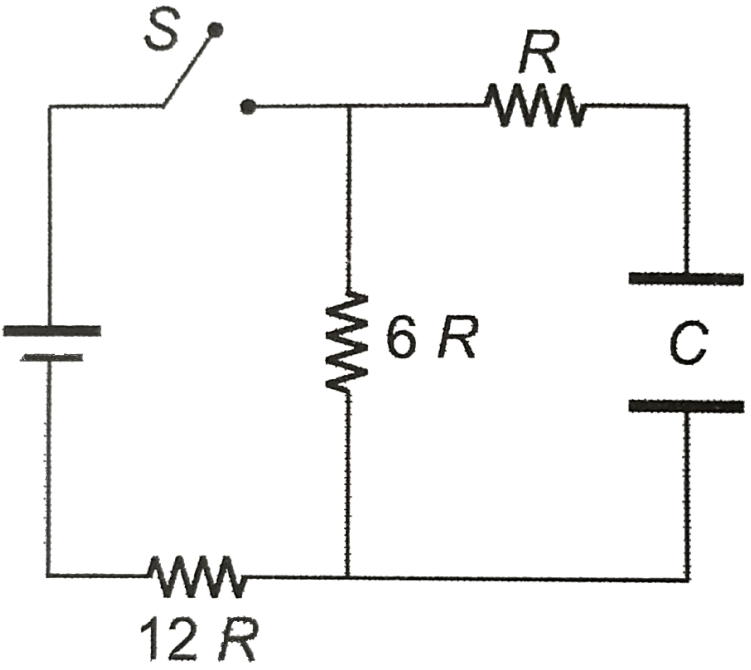
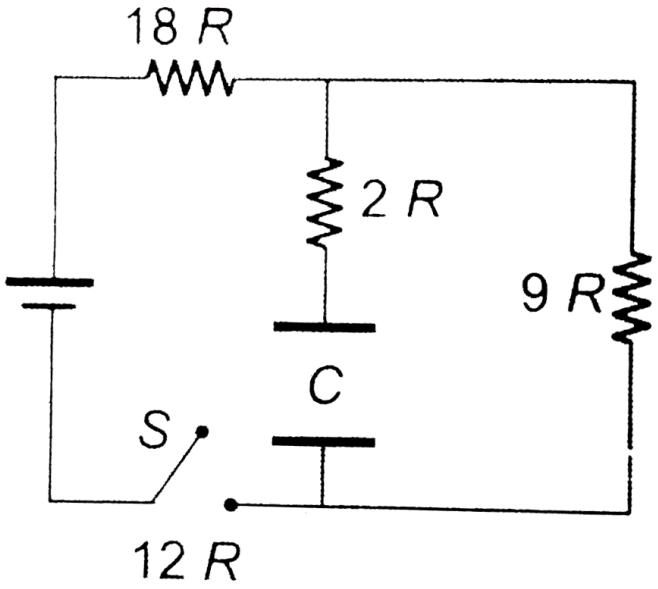
37. Find time constant of the following circuits.



(a)



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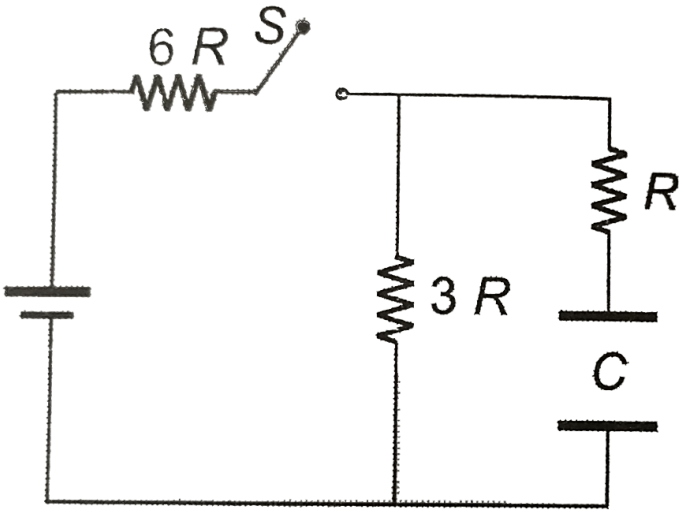
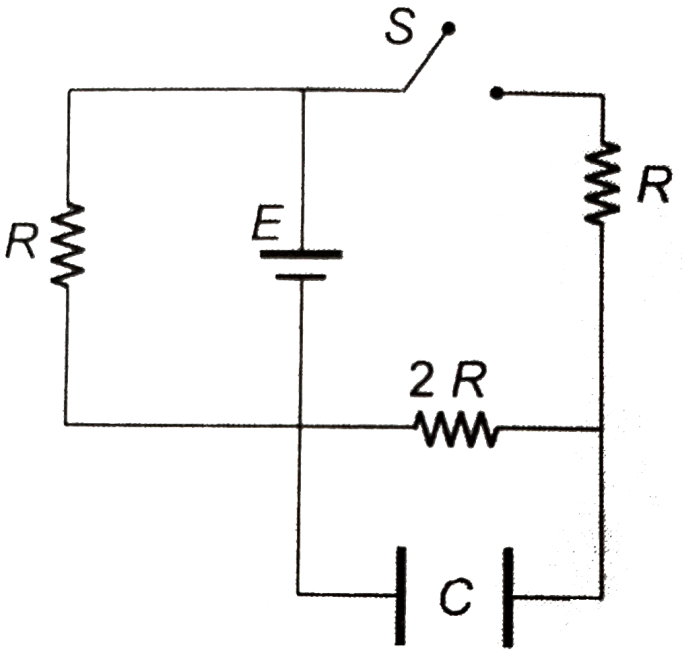


(c)



(d)

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38. A capacitance C, a resistance R and an emf E are connected in series at $t = 0$ what is the maximum value of (a) the potential differnece across the resistor, (b) the current in the circuit , (c) the power delivered by the battery. (d) the power converted into heat, (e) the potential differnece across the capicitor and (f) the energy stored in the capacitor.

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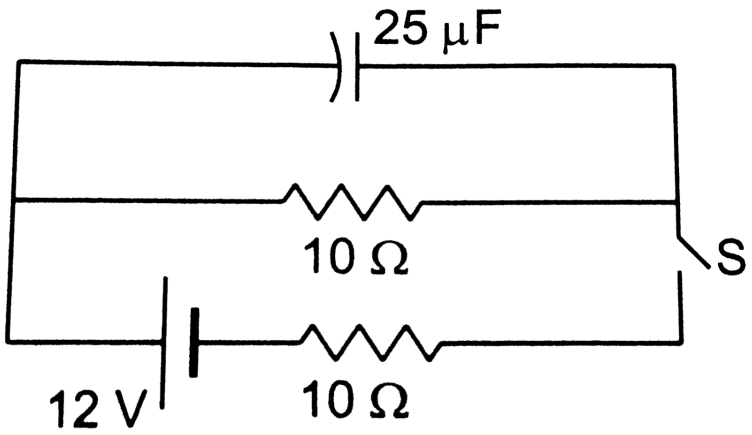
39. How many time constants will elapse before the charge on a capacitor falls to $0.1\,\%$ of its maximum value in a discharging RC circuit.

Watch Video Solution

40. A capacitor charged to $100V$ is discharged by connecting the two ptates at $t = 0$. If the potential difference across the plates drops to $1.0V$ at $10ms$, what will be the potential difference at $t = 20ms$.

Watch Video Solution

41. The switch S shown in figure is kept closed for a long time and is then opened at $t = 0$.Find the current in the middle $10(\Omega)$ resistor at $t = 1.0ms$.



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Exercises

1. According to Joule's law, if the potential difference across a conductor having a material of specific resistance remains

constant, then the heat produced in the conductor is directly proportinal to

A. ρ

B. ρ^2

C. $\frac{1}{\sqrt{\rho}}$

D. $\frac{1}{\rho}$

Answer: D

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2. If the current in an electric bulb drops by 1% the power decreases by

A. 0.01

B. 0.02

C. 0.04

D. $0.5\ \%$

Answer: B

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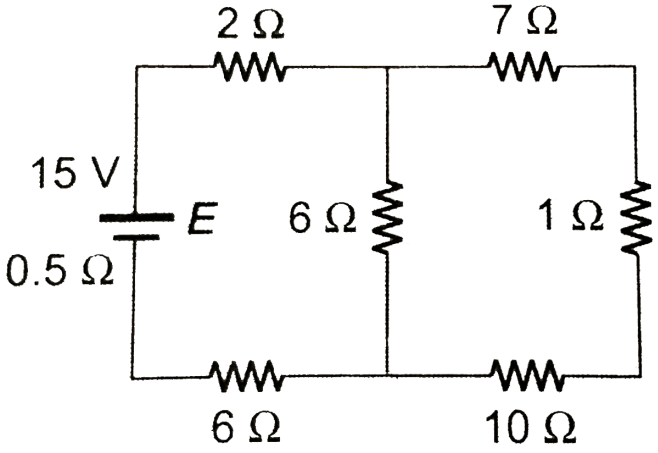
3. (a) When a cell sends current through a resistance R_1 for time t, the heat produced in the resistor is Q. When the same cell sends current through another resistance R_2 for time t the heat porduced is again Q . Find internal resistance of the cell.

(b) An electric kettle has coil A is swithched on, the water boils in 10min. and when coil b is switched on the water boils in $20\ \min$. Calculate the time taken by the water to boil if the coils connected in (i) series and (ii) parallel are swithched on.

(c) The emf of battery E in the circuit shown in the figure is 15V and internal resistance $0.5 ohm$ (i) What is the current drown from

the battery? (ii) How much power is consumed in $6ohm$ resistance?

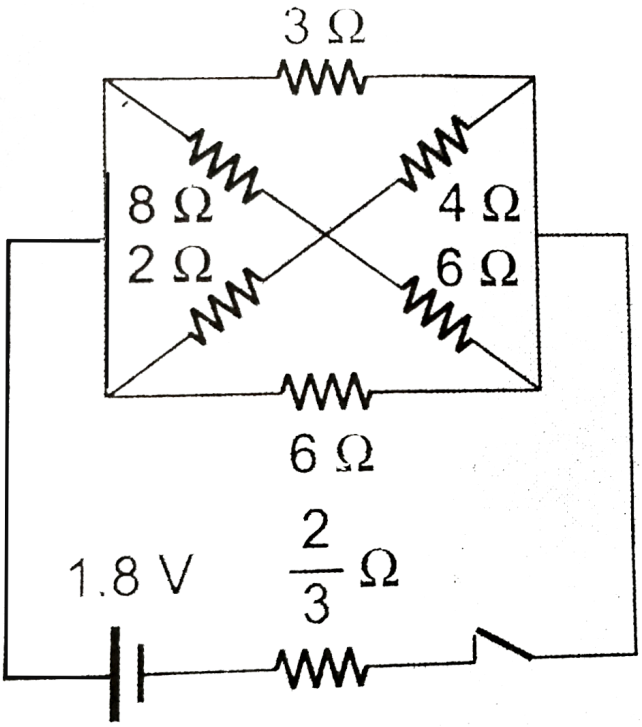


(d) A $500W$ heating unit is designed to opreate from a $115V$ line.

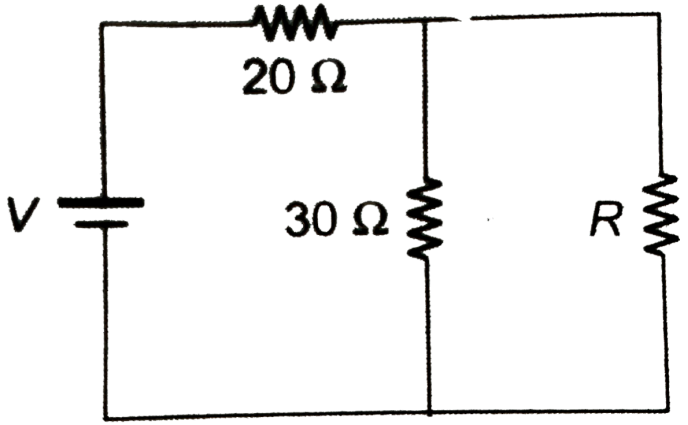
(i) By what percentage will its heat output drop if the line voltage drops to $110V$. Assuming no change in resistance?

(ii) Taking variation of resistance with temperature into account. would the actual heat output drop be larger or smaller than case(i)

(e) If emf of the cell is $1.8V$ and its internal resistance $2/3\Omega$ for the circuit shown in the figure what is the (i) current in $3ohm$ resistance? (ii) Power consumed by the circuit from the battery?



(i) for what value of R , power in R is maximum?



A. $\frac{R_1 + R_2}{2}$

B. $\frac{R_1 - R_2}{2}$

C. $\sqrt{R_1 R_2}$

D. $\sqrt{\frac{R_1 + R_2}{2}}$

Answer: C

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4. Two resistances , connected in parallel across a source of negligible interna resistance, consumes four times the power that they would consume when connected in series across the same source. If one of the resistances is 10Ω the other is

A. 5Ω

B. 10Ω

C. 20Ω

D. 40Ω

Answer: B

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5. A heating coil transforms $100J$ of electrical energy into heat energy per second. The coil is cut into two halves and both the halves are joined togeter in parallel to the same source. Now the energy transformed per second will be

A. 50J

B. 100J

C. 200J

D. 400J

Answer: D

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6. 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 length 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: A

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7. You are given a resistance coil and a battery. In which of the following cases is largest amount of heat generated?

A. When the coil is connected to the battery directly

B. when the coil is divided into two equal parts and both the parts are connected to the battery in parallel

C. when the coil is divided into four equal parts and all the four parts are connected to the battery in parallel

D. When only half the coil is connected to the battery .

Answer: C

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8. Two indential heated produce heat H_1 in time t when connected in parallel across the main supply. They produce heat H_2 in time t

when connected in series. Then H_1 / H_2 is

A. $\frac{1}{4}$

B. 4

C. $\frac{1}{2}$

D. 2

Answer: B

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9. A $500W$ heating unit is designed to operate from a 115volt line. If the line voltage drop to 110Volt , the percentage drop in heat output will be

A. $10.20\ \%$

B. $8.1\ \%$

C. 8.6%

D. 7.6%

Answer: C

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10. Three equal resistor connected in series across a source of enf together dissipate $10Wa$. If the same resistors aer connected in parallel across the same emf, then the power dissipated will be

A. 10 Watt

B. 30Watt

C. $10/3Wa$

D. $90Wa$

Answer: D

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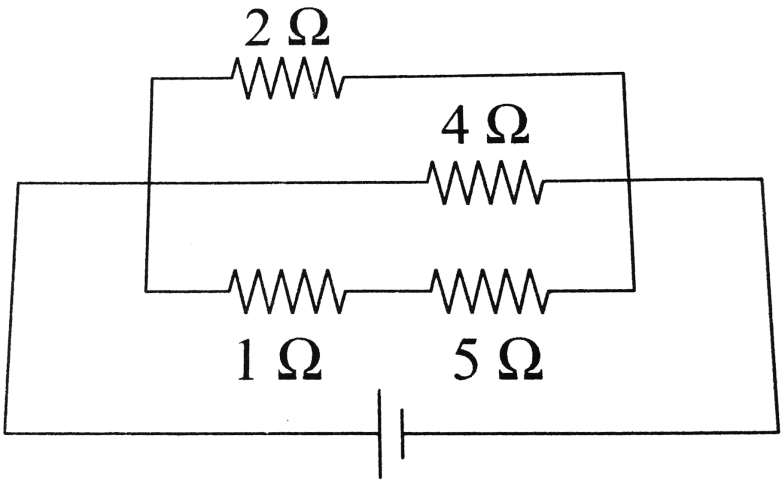
11. A current of $3A$ flows through the 2Ω resistor as shown in the circuit. The power dissipated in the 5Ω resistor is



A. 1 Watt

B. 5Watt

C. 4 Watt

D. 2Watt

Answer: B

Watch Video Solution

12. A heater coil is cut into two parts of equal length and one of them is used in the leader. The ratio of the heat procued by this half coil to that by the original coil is

A. $2:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer: A

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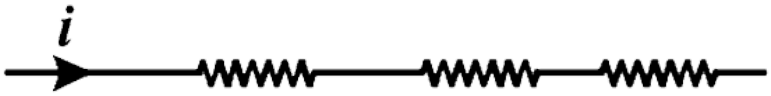
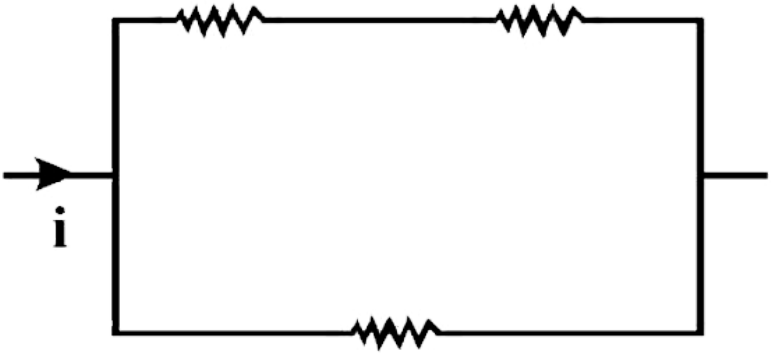
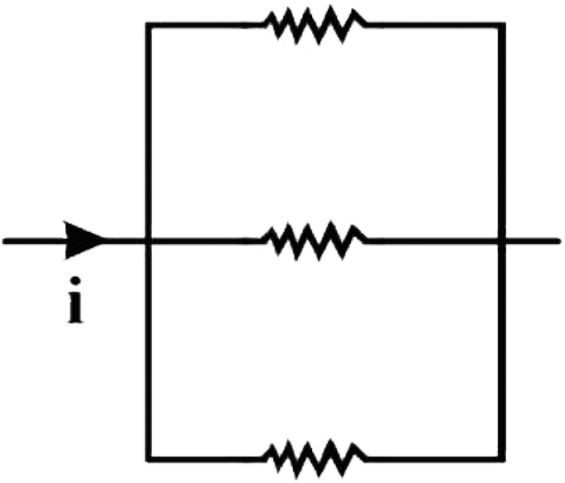
13. The three resistance of equal value are arranged in the different combination shown below. Arrange them in increasing order of power dissipation.

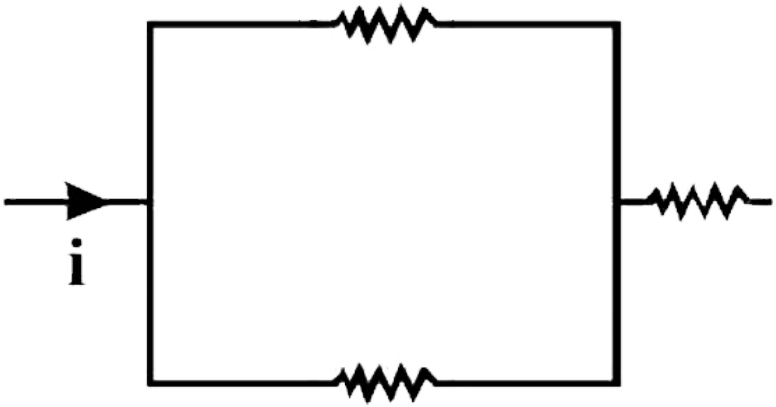


(I) (II)





(IV)



A. III lt II ltIV lt I

B. II lt III lt IV lt I

C. I lt IV lt III lt II

D. I lt III lt II ltIV

Answer: C

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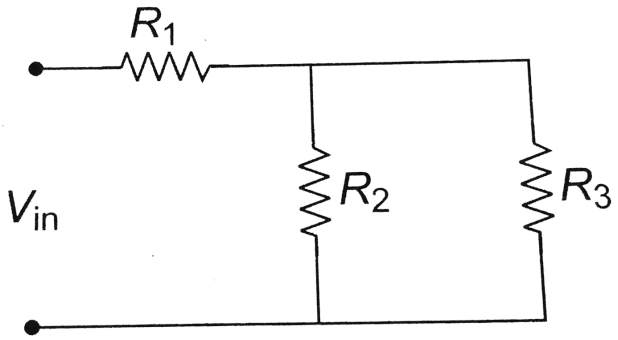
14. For ensuring dissipation of same energy in all three resistors (R_1, R_2, R_3) connected as shown in figure, their values must be related s



A. $R_1 = R_2 = R_3$

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

C. $R_2 = R_3$ and $R_1 = R_2/4$

D. $R_1 = R_2 + R_3$

Answer: C

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15. A wire of length L and 3 identical cells of negligible internal resistance are connected in series. Due to the current, the temperature of the 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 the 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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16. An electric kettle has two coils. When one coil is switched an it takes 5 minutes to boil water and when second coil is switched on it takes 10 minutes .How long will it take to boil water, when both the coil are used in series ?

A. 15 min

B. 7.5 min

C. $\frac{10}{3}$ min

D. `2.5 min

Answer: A

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17. 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. $\frac{20}{3}$ min

B. 7.5 min

C. $\frac{10}{3}$ min

D. `2.5 min

Answer: C

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18. An electric kettle of $1200W$has 1 kg water at $20^\circ C$. The water equivalent of the kettle is $500g$. The time required to heat water

from $20^\circ \rightarrow 100^\circ C$ will be (specific heat of water = $4200 J/kg^\circ C$)

.

A. 5min

B. 6 min

C. 7 min

D. 8min

Answer: C

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19. Water of volume 2 litre in a container is heated with a coil of $1kW at 27^\circ C$. The lid of the container is open and energy dissipates at rate of $160 J/s$. In how much time temperature will rise from $27^\circ C \rightarrow 77^\circ C$ Given specific heat of water is $[4.2 kJ/kg]$

A. $8\ \text{min}\ 20\,\text{sec}$

B. $6\ \text{min}\ 2\,\text{sec}$

C. 7 min

D. 8min

Answer: A

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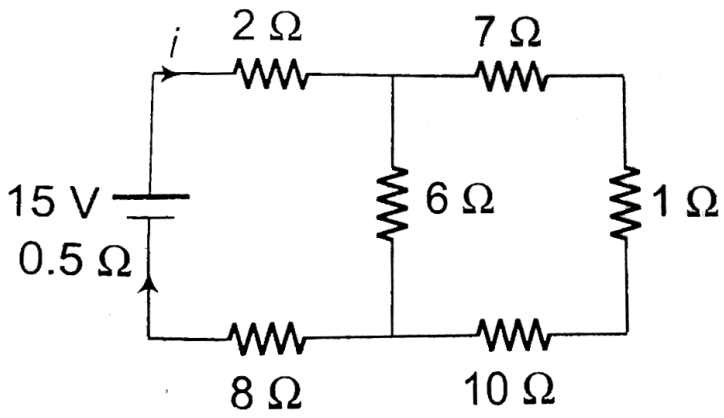
20. The power dissipated 6Ω resistor is



A. $\frac{27}{8}W$

B. $\frac{9}{16}W$

C. $\frac{6}{16}W$

D. $\frac{3}{16}W$

Answer: A

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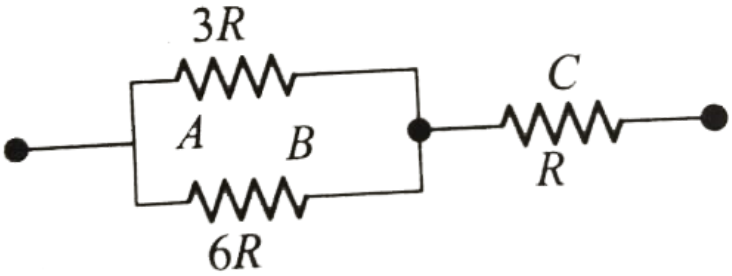
21. Figure 7.37 shows a network of three resistances. When some potential difference is applied across the network , thermal powers dissipated by A, B and C are in the ratio



A. $2:3:4$

B. $2:4:3$

C. $4:2:3$

D. $3:2:4$

Answer: C

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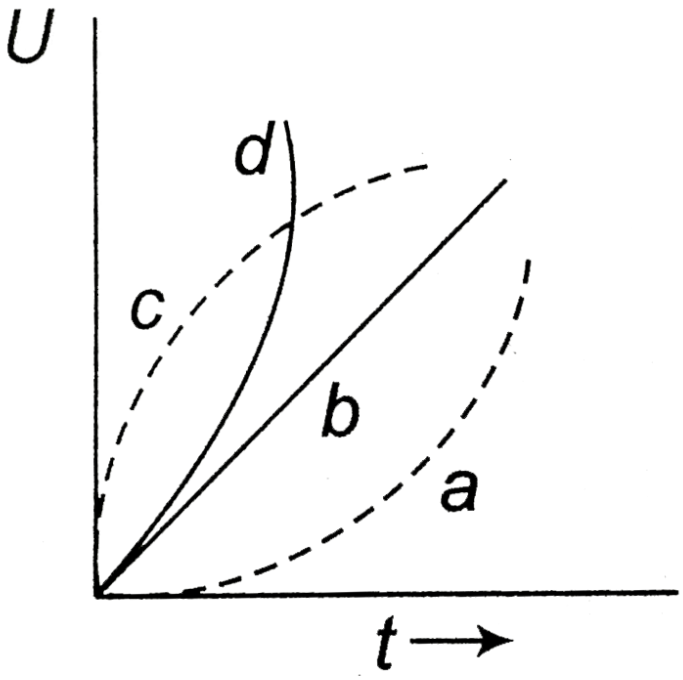
22. Which of the following plots may represent the thermal energy produced in a resistor for a given current as a function of time?



A. a

B. b

C. c

D. d

Answer: B

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23. The charge flowing in a conductor varies with times as $Q = at - bt^2$. Then, the current

A. (i) , (ii)

B. (ii), (iii)

C. (i),(iii),(iv)

D. all

Answer: C

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24. The charge flowing through a resistance R varies with time $tasQ = at - bt^2$. The total heat produced in R is

A. $\frac{a^2R}{6b}$

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

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

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

Answer: A

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25. Two resistors having equal resistances are joined in series and a current is passed through the combination. Neglect any variation in resistance as the temperature changes. In a given time interval,

A. (i) , (ii)

B. (i) , (iii)

C. (ii), (iv)

D. (i) , (iv)

Answer: D

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26. A cell of emf ε and internal resistance r drives a current i through an extermal resistance R

(i) The cell supplied εi power

(ii) Heat is produced in R at the rate εi

(iii) Heat is produced in R at the rate $\varepsilon I\left(\frac{R}{R+r}\right)$

(iv) Heat is produced in the cell at the rate $\varepsilon i\left(\left(r\frac{?}{R+r}\right)\right.$

A. (i) , (ii)

B. (ii), (iii)

C. (i),(iii),(iv)

D. all

Answer: C

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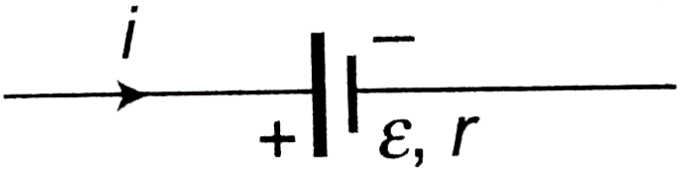
27. Current i is being driven through a cell of emf ε and internal resistance3 r, as shown



(i) the cell absorbs energy at rate of εi

(ii) The cell stores chemical energy at the rate of $\left(\varepsilon i - i^2 r\right)$

(iii) The potential differnece across the cell is $\varepsilon + ir$

(iv) some heat is produced in the cell

A. (i) , (ii)

B. (ii), (iii)

C. (i),(iii),(iv)

D. all

Answer: D

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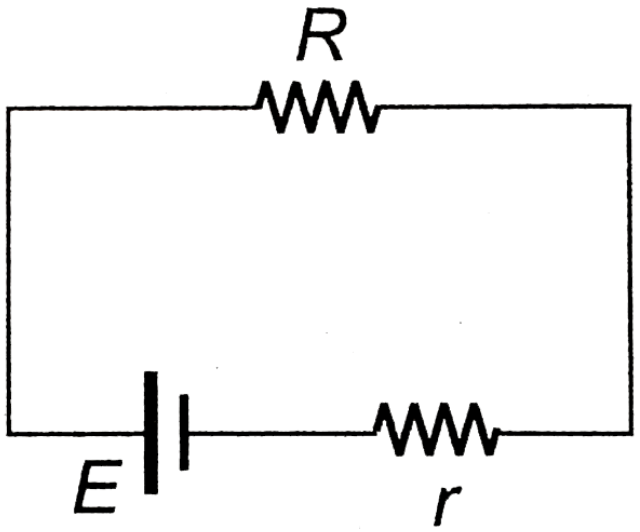
28. If power in external resistance R is maximum, then



(i) $R = r$

(ii) Power in R is $\frac{E^2}{4R}$

(iii) Input power is $\frac{E^2}{2R}$

(iv) Efficiency is $50\ \%$

A. (i) , (ii)

B. (ii), (iii)

C. (i),(iii),(iv)

D. all

Answer: D

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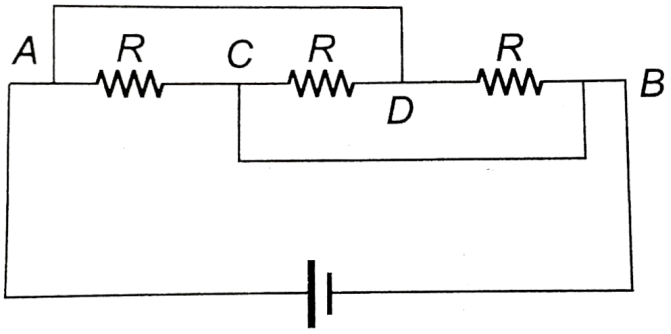
29. Three equal resistace, each of R ohm, are connectedd as shown in the figure. A battery of $2V$ and of internal resistance 0.1 ohm is connected across the circuit. The value of R for which the

heat generated in the circuit maximum will be



A. 0.1Ω

B. 0.2Ω

C. 0.3Ω

D. 0.4Ω

Answer: C

Watch Video Solution

30. 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. 1.28Watt

B. 0.2 watt

C. $\frac{8}{9}wa$

D. $3.2wa$

Answer: B

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31. A $100W, 200V$ bulb is operated on a $110V$ line. The power consumed is

A. 25W

B. 50W

C. 75W

D. 90W

Answer: A

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32. Ten $50W$ bulbs are operated for 10 hours per day. The energy consumed in kWh in a 30 day month is

A. 15

B. 150

C. 1500

D. 15000

Answer: B

Watch Video Solution

33. 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. 30Ω

D. 40Ω

Answer: B

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34. An electric bulb is designed to draw P_0 power at V_0 voltage. If the voltage is V, it drawas power. Then

A. $P = \left(\frac{V_0}{V}\right) P_0$

B. $P = \left(\frac{V}{V_0}\right) P_0$

C. $P = \left(\frac{V}{V_0}\right)^2 P_0$

D. $P = \left(\frac{V_0}{V}\right)^2 P_0$

Answer: C

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35. Two electric bulbs rated $25W, 220V$ and $100W, 220V$ are connected in series across a $220V$ voltage source . The $25W$ and $100W$ bulbs now draw P_1 and P_2 powers , respectively.

A. (i),(iv)

B. (ii), (iii)

C. (i), (iii)

D. all

Answer: A

Watch Video Solution

36. A $100W$ bulb and a 25W bulb are desigened for the same voltage. They have filaments of the same length and material. The ratio of the diameter of $100W$ bulb to that of the $25W$ bulb is

A. $4:1$

B. $2:1$

C. $\sqrt{2}:1$

D. $1:2$

Answer: B

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37. Two electric bulbs, one of $200V, 40W$, and the othere $220V$, $100W$ are connected in a house wiring circuit

A. they have equal currents through them

B. the resistance of the filaments in both the bulbs is same

C. The resistance of the filament in $40wa$ bulb is more than the resistance in $100wa$ bulb

D. The resistance of the filament in $100wa$ bulb is more than the resistance in $400wa$ bulb

Answer: C

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38. A $200W$ and a $100W$, both meant for operation a t $220V$ are connected to a $220V$ supply. The total power consumed by them will be

(i) 300W, if connected in series

(ii) 300W, if connected in parallel

(iii) $\frac{200}{3}W$, if connected in series

(iv) $\frac{200}{3}W$, if connected in parallel

A. (i) only

B. (ii), (iii)

C. (i),(iv)

D. (ii) only

Answer: B

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39. Two bulbs one of $60W$ and the other of $100W$, are connected in series across a supply

(i) The current through each is same

(ii)The potential drop across $60W$ bulb is more

(iii) The potential drop acorss each is the same

(iv) The current through $100W$ bulb is more

A. (i) only

B. (ii), (iii)

C. (i),(ii)

D. (ii) only

Answer: C

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40. Two bulb one of 60W and the other of 100W , are connected in a house wiring circuit

(i) The current through each is same

(ii)The potential drop across each is the same

(iii) The current through $100W$ bulb is more

The potential drop acorss $100W$ bulb is more

A. (i) only

B. (ii), (iii)

C. (i),(iv)

D. (ii) only

Answer: B

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41. A $25W - 120V$ bulb and a $100W - 120V$ bulb are connected in series across $120V$ line. Which bulb will be brighter?

A. 25W-120V

B. 100W-120V

C. both will have the same incandescence

D. neither will give any light

Answer: A

Watch Video Solution

42. 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 ?

A. 100W bulb will fuse

B. 25W bulb will fuse

C. none will free

D. both will fuse

Answer: B

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43. 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. $\frac{P}{n}$

D. $\frac{P}{n^2}$

Answer: C

Watch Video Solution

44. Two tungsten lamps A and B of resistances R_1 and R_2 respectively are connected in a circuit of negligible internal resistance, if $R_1 > R_2$

(i) The lamp A will glow brightly if lamps are connected in series

(ii) the lamb A will glow brightly if lamps are connected in parallel

(iii) the lamp B will glow brightly if lamps are connected in series.

(iv) the lamb B will glow brightly if lamps are connected in parallel

A. (i),(ii)

B. (i),(iv)

C. (i), (iii)

D. (ii),(iii)

Answer: B

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45. These are two electric bulbs A and B rated $50W - 100V$, $100W - 100V$ respectively. The bulbs are connected with a $200V$ dc supply.

The bulb A will fuse, if in series

(ii) The bulbs B will fuse , if in series

The bulb A will fuse, if in parallel

(iv) The bulb B will fuse if in parallel

A. (i),(ii)

B. (i),(iii),(iv)

C. (ii),(iii)

D. all

Answer: B

Watch Video Solution

46. A standard 50W electirc bulb in series with a room heater is connected across the mains. If the 50W bulb is replaced by $100W$ bulb the heater output will

A. increase

B. decrease

C. remains same

D. no conclusion

Answer: A

Watch Video Solution

47. Two electric bulbs A and B are designed for the same voltage. Their power ratings are P_A and P_B respectively with $P_A > P_B$. If they are joined in series across V voltage supply

A. A will draw more power than B

B. B will draw more power than A

C. the ratio of powers drawn by then will depend on V

D. A and B will draw the same power

Answer: B

Watch Video Solution

48. 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

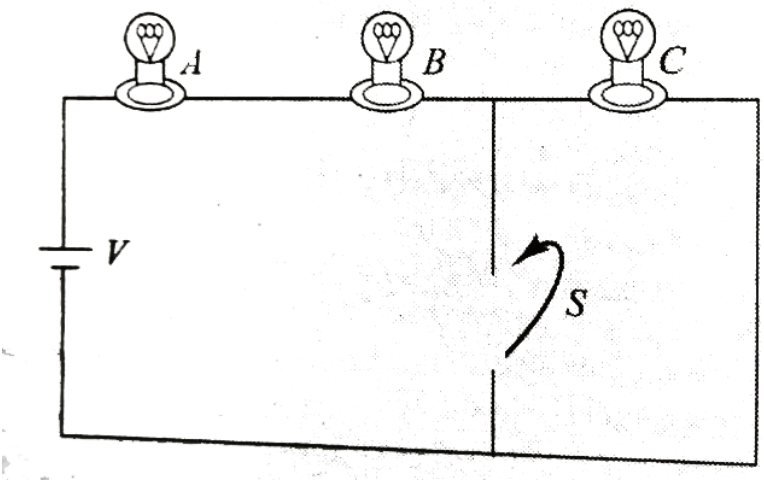
(a) to the intensities of lamps A and B,

(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 ?



A. (i) , (ii)

B. (i),(ii),(iii)

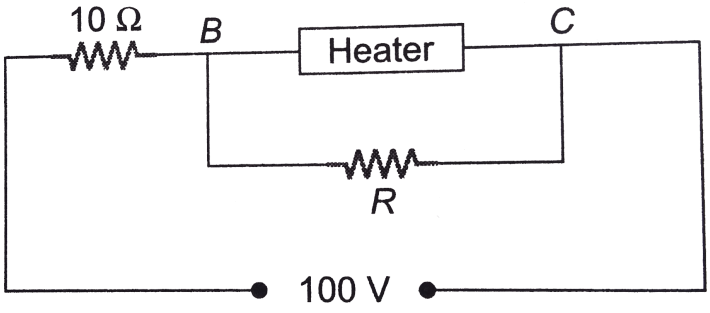
C. (ii) ,(iii) ,(iv)

D. all

Answer: D

Watch Video Solution

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



A. 5Ω

B. 10Ω

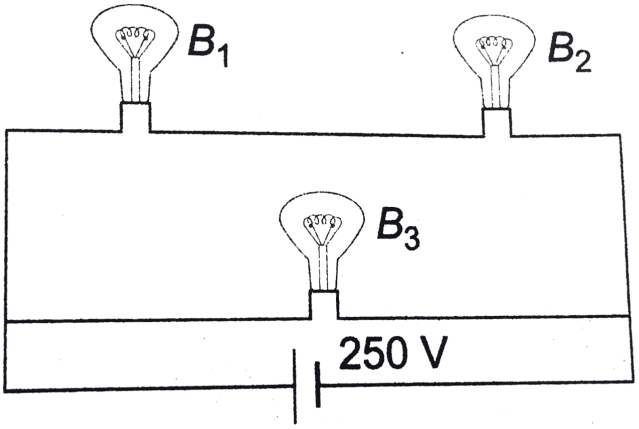
C. 15Ω

D. 20Ω

Answer: A

Watch Video Solution

50. A $100W$ bulb B_1, and two$60W$ bulbs $B_2$and B_3 are connected to a $250V$ source as shown in the figure. 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. $W_1 > W_2 > W_3$

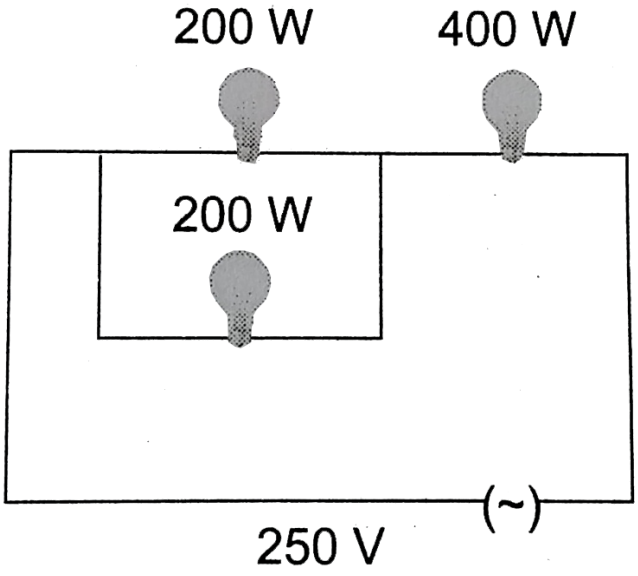
C. $W_1 < W_2 = W_3$

D. $W_1 < W_2 < W_3$

Answer: D

Watch Video Solution

51. Three electric bubls of 200W, 200 W and 400W are shown in figure. The resultant power of the combination is



A. 800W

B. 400W

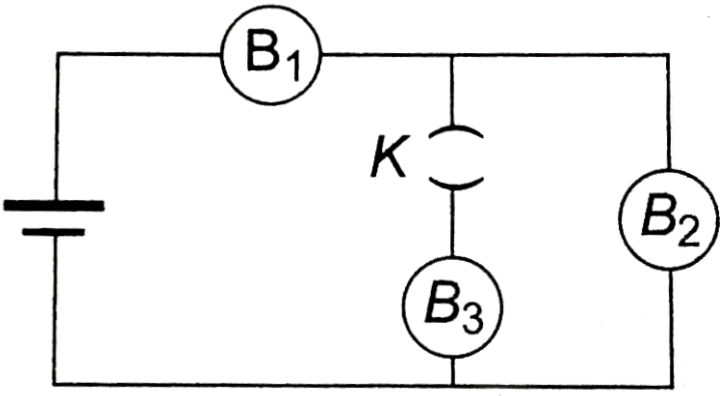
C. 200W

D. 600W

Answer: C

Watch Video Solution

52. B_1, B_2 and B_3 are the three identical bulbs connected to a battery of steady emf with key K closed. What happens to the brightness of the bulbs B_1 and B_2 when the key is opened?



A. Brightness of the bulb B_1 increases and that of B_2 decreases

B. Brightness of the bulb B_1 and B_2 increase

C. Brightness of the bulb B_1 decrease and that of B_2 increase

D. Brightness of the bulbs B_1 and B_2

Answer: C

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53. Incandescent bulbs are designed by keeping in mind that the resistance of their filament increases with the increase in temperature. If at room temperature, $100W, 60W$ and $40W$ bulbs have filament resistances R_{100}, R_{60} and R_{40}, respectively, the relation between these resistances is

A. $\frac{1}{R_{100}} = \frac{1}{R_{40}} + \frac{1}{E_{60}}$

B. $R_{100} = R_{40} + R_{60}$

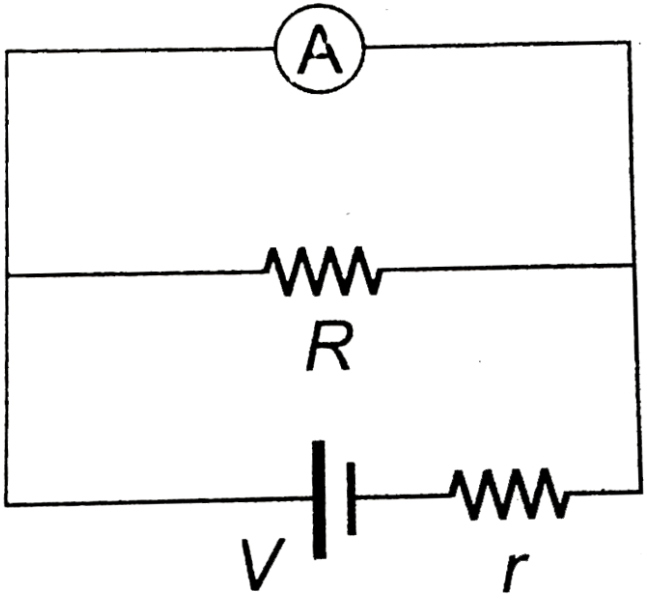
C. $R_{100} > R_{60} > R_{40}$

D. $\frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{40}}$

Answer: D

Watch Video Solution

54. The resistance of ammeter is R_0



A. If $r = 0$, if the value of resistance R increase, the current in ammeter will remain same

B. If $r = 0$, if the value of resistance R decrease, the current in ammeter will remain same

C. If $r \neq 0$, if R increase, the current in ammeter will remian same

D. If $r \neq 0$, if R increases, the current in ammeter will increase

Answer: A

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55. The material of fuse wire should should have

A. a high specific resistance and high melting point

B. a low specific resistance and low melting point

C. a high specific resistance and low melting point

D. a low specific resistance and a high melting point

Answer: C

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56. What is immeterial for an electric fuse wire ?

A. its specific resistance

B. its radius

C. its length

D. current flowing through it

Answer: C

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57. The maximum current that flows through a fuse wire before it blows out varies with its radius as

A. $r^{3/2}$

B. r

C. $r^{2/3}$

D. $r^{1/2}$

Answer: A

Watch Video Solution

58. The production of emf by maintaining a difference of tempreture between the two junctions of two different metals is known as

A. Joule effect

B. Seebeck effect

C. Peltirer effect

D. Thomson effect

Answer: B

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59. In a thermocouple, which of the following statements is not true?

A. Neutral temperature depends upon the nature of materials in the thermocouple

B. Temperature of inversion depends upon the tenperature of cold junction

C. When the temperature of the hot junction is equal to the temperature of inversion, the thermo emf becomes zero.

D. when the temperature of cold junction increases, the temperature of inversion also increases.

Answer: D

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60. If the cold junction of thermocouple is kept at $0^\circ C$ and the hot junction is kept at $T^\circ C$, then the relation between neutral temperature (T_n) and temperature of inversion (T_i) is

A. $t_n = \frac{T_i}{2}$

B. $t_n = 2T_i$

C. $T_n = T_i - T$

D. $T_n = T_i + T$

Answer: A

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61. If for a thermocouple $T_n)$ is the neutral temperature, T_c is the tempreture of the cold junction and $T_i)$ is the temperature of inversion, then

A. $T_i = 2T_n - T_c$

B. $T_i = T_n - 2T_c$

C. $T_i = T_n - T_c$

D. None of these

Answer: A

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62. Neutral temperature of a thermocouple is define as the temperature at which

A. The thermo emf change sign

B. the thermo emf is maximum

C. the thermo emf is minimum

D. the thermo emf is zero

Answer: B

Watch Video Solution

63. The expression for thermo emf in a thermocouple given by the relation $E = 40\theta - \frac{\theta^2}{20}$, where θ is the temperatue difference of two junctons. For this, the neutral temperature will be

A. $100^\circ C$

B. $200^\circ C$

C. $300^\circ C$

D. $400^\circ C$

Answer: D

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64. Thermoelectric constant of a thermocouple are α and β. Thermoelectric power at inversion tempreture is

A. α

B. $-\alpha$

C. $\frac{\alpha}{\beta}$

D. $-\frac{\alpha}{\beta}$

Answer: B

Watch Video Solution

65. If $E = at + bt^2$, what is the neutral temperature

A. $-\frac{a}{2b}$

B. $+\frac{a}{2b}$

C. $-\frac{a}{b}$

D. $+\frac{a}{b}$

Answer: A

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66. Faraday's laws of electrolysis are related to

A. the atomic number of positive ion

B. the equivalent weight of electrolyte

C. the atomic number of negative ion

D. the velocity of positive ion

Answer: B

Watch Video Solution

67. The relation between faraday constant (F), chemical equicalent (E) and electrochemical equivalent (Z) is

A. $F = EZ$

B. $F = \frac{Z}{E}$

C. $F = \frac{E}{Z}$

D. $F = \frac{E}{Z^2}$

Answer: C

Watch Video Solution

68. To deposit one gm equivalent of an element at an electrode. The quantity of electricity needed is

A. one ampere

B. 96000ampere

C. 96500 farad

D. 96500 coulomb

Answer: D

Watch Video Solution

69. In producing chlorine through electrolysis $100W$ power at $125V$ is being consumed. How much chlorine per min is liberated ? ECE of chlorine is $0.367 \times 10^6 kg/C$

A. 24.3 mg

B. 16.6 mg

C. 17.6 mg

D. 21.3 mg

Answer: C

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70. If nearly 10^5 coulomb liberate $1g$ equivalent of aluminium, then the amount of aluminium (equivalent weight 9) deposited through electrolysis in 20 minutes by a current of 50 amp will be

A. 0.06g

B. 0.09g

C. 5.4g

D. 10.8g

Answer: C

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71. when a copper votameter is connected with a battery of emf $12V$, $2g$ of copper is deposite in 30 min. if the same voltmeter is connected across a $6V$ battery then the mass of copper deposite in 45 min would be

A. 1g

B. 1.5g

C. 2g

D. 2.5g

Answer: B

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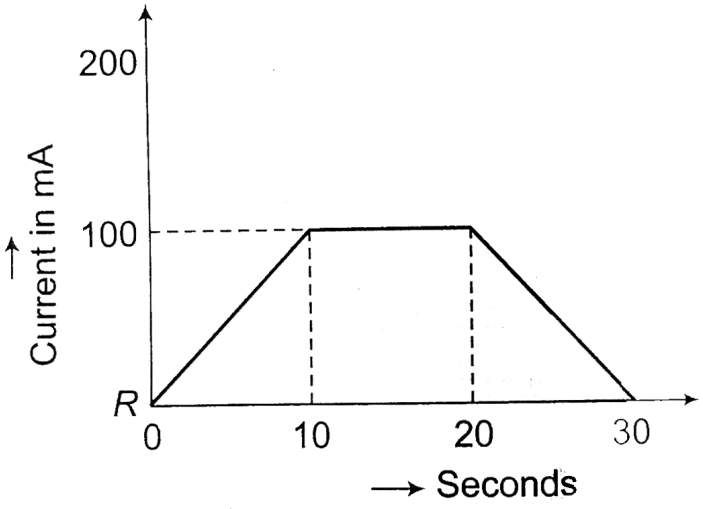
72. In a copper voltmeter, mass deposite in 30 seconds is $'m'$ gram. If the time-current graph is as shown in figure. ECE of copper is



A. m

B. $m/2$

C. $0.1m$

D. $0.6m$

Answer: B

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73. In an electroplating experiment, m gram of silver is deposited when 4 ampere of current flows for 2 minute. The amount (in$g$) of silver deposite by 6 ampere of current for 40 second will be

A. $4m$

B. $m/2$

C. $m/4$

D. $2m$

Answer: B

Watch Video Solution

74. Silver and copper voltmeters are connected in parallel with a battery of emf $12V$. In 30 minutes, $1g$ of silver and $1.8g$ of copper are liberated. The power supplied by the battery is

$(Z_{Cu} = 6.6 \times 10^{-4} g/C \text{ and } Z_{Ag} = 11.2 \times 10^{-4} g/C)$

A. $24.13J/\sec$

B. $2.413J/\sec$

C. $0.2416J/\sec$

D. $2413J/\sec$

Answer: A

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75. Two voltameters, one of copper and another of silver, are joined in parallel. When a total charge q flows through the voltameters, equal amount of metals are deposited. If the electrochemical equivalents of copper and silver are Z_1 and Z_2 respectively the charge which flows through the silver voltameter is

A. $q\frac{Z_1}{Z_2}$

B. $q\frac{Z_2}{Z_1}$

C. $\frac{q}{1+\frac{Z_1}{Z_2}}$

D. $\frac{q}{1+\frac{Z_2}{Z_1}}$

Answer: D

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76. The current flowing in a copper voltmeter is $1.6A$. The number of Cu^{++} ions deposite at the cathode per minute are

A. 1.5×10^{20}

B. 3×10^{20}

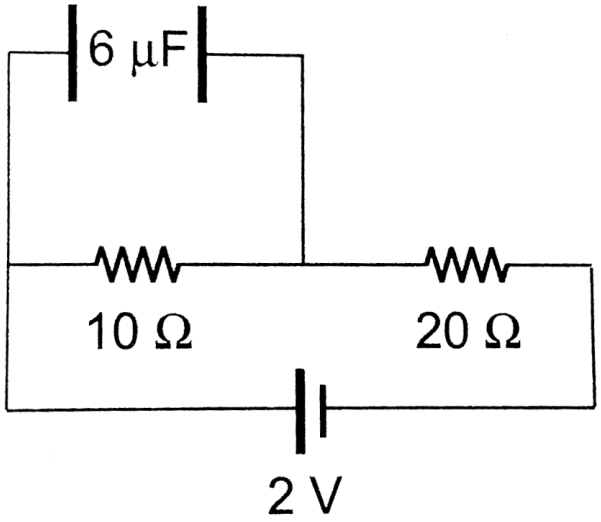
C. 6×10^{20}

D. 1×10^{19}

Answer: B

Watch Video Solution

77. The charge on the capacitor is



A. $2\mu C$

B. $4\mu C$

C. $6\mu C$

D. $8\mu C$

Answer: B

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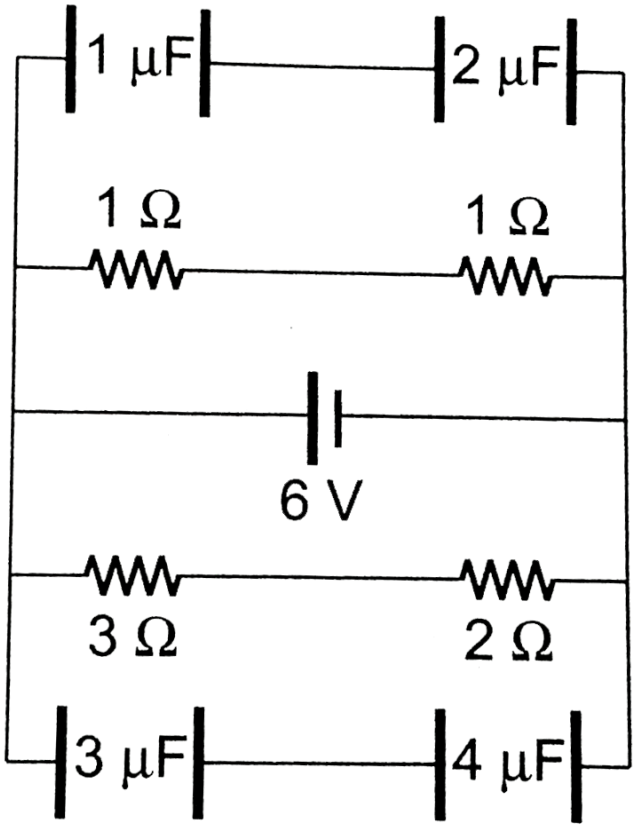
78. The charge on capacitor $4\mu F$ is



A. $2\mu C$

B. $6\mu C$

C. $10\mu C$

D. $12\mu C$

Answer: D

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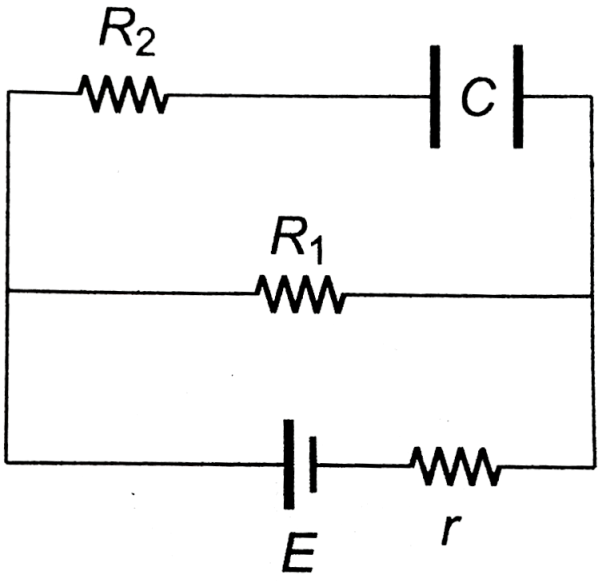
79. The charge on capacitor is



A. $\frac{CER_1}{R_1 + r}$

B. $\frac{CEr}{R_1 + r}$

C. $\frac{CER_1}{r}$

D. $\frac{CEr}{R_1}$

Answer: A

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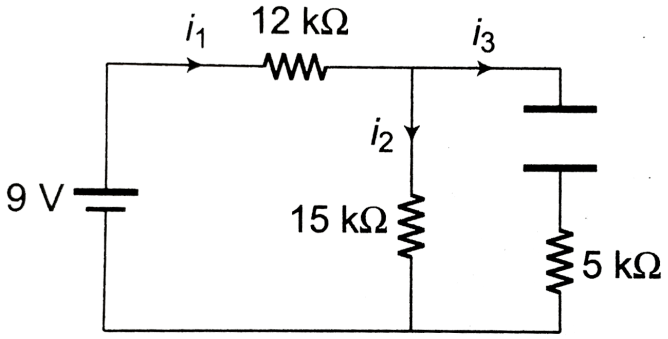
80. In the following diagram



A. $i_1 = \frac{1}{3}mA$

B. $i_2 = \frac{1}{3}mA$

C. $i_3 = 0$

D. all

Answer: D

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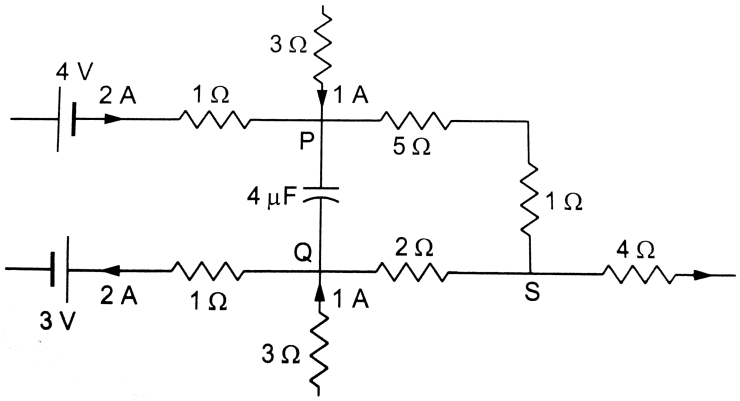
81. A part of a circuit in steady state along with the currents flowing in the branches,the values of resistances,etc, is shown in figure.Calculate the energy stored in the capacitor.



A. $200\mu J$

B. $400\mu J$

C. $600\mu J$

D. $800\mu J$

Answer: D

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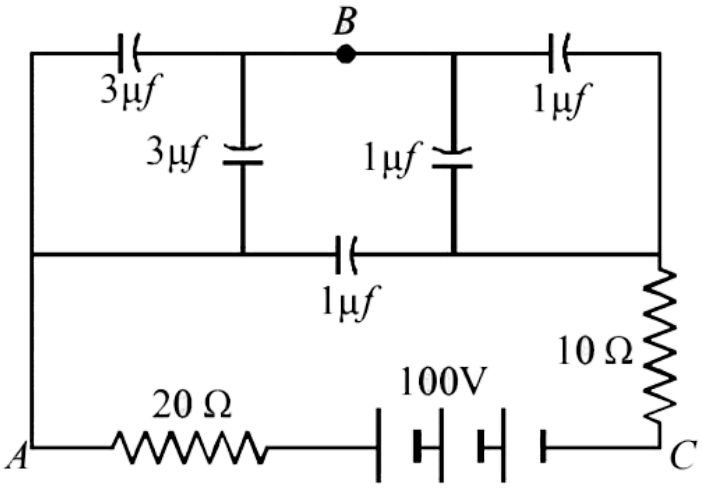
82. In the diagram shown find the potential difference between the points A and B and between the points B and C in the steady state.



A. $25V$

B. $50V$

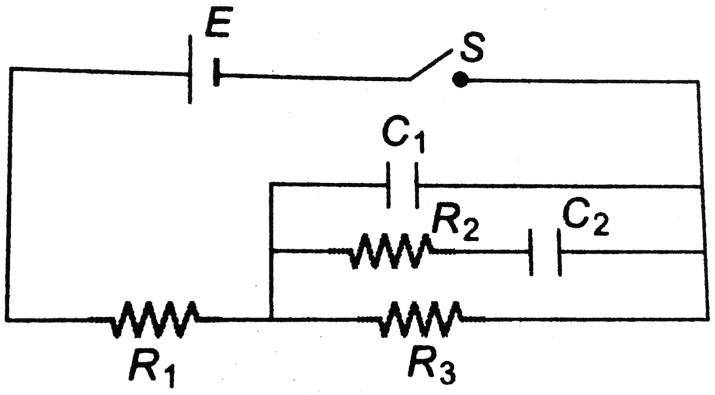
C. $75V$

D. $100V$

Answer: A

Watch Video Solution

83. Determine the current through the battery in the circuit shown in figure.



(a) immediately after the switch S is closed

(b) after a long time.

A. $\frac{E}{R_1}$

B. $\frac{E}{R_3}$

C. $\frac{E}{R_1 + R_3}$

D. None of these

Answer: C

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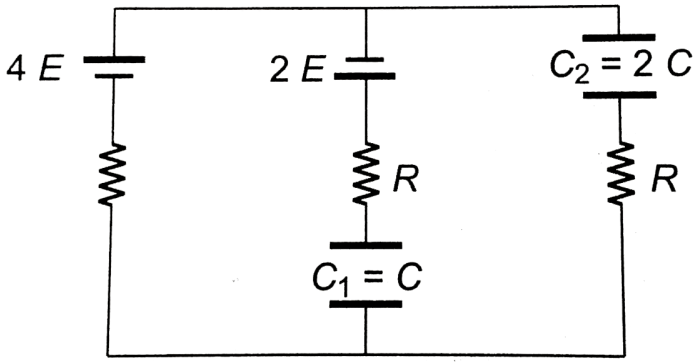
84. The ratio of energy stored in capacitors C_1 and C_2



A. $\frac{9}{8}$

B. $\frac{8}{9}$

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

D. $\frac{6}{5}$

Answer: A

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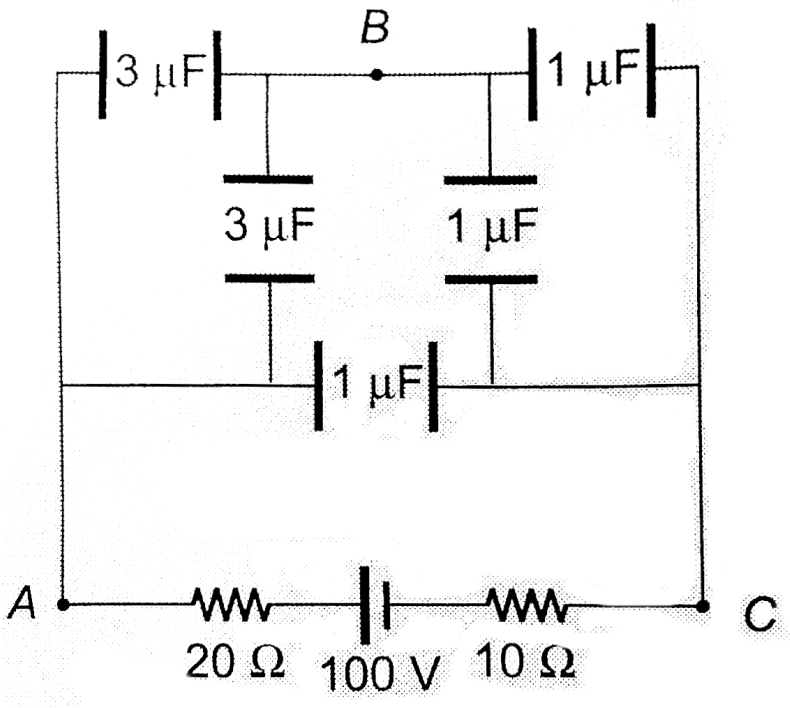
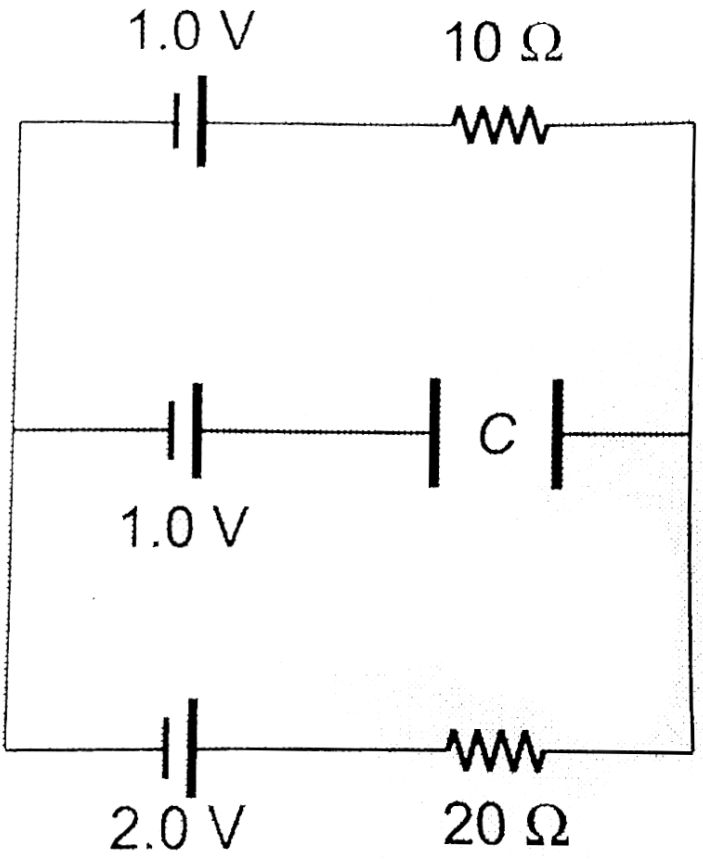
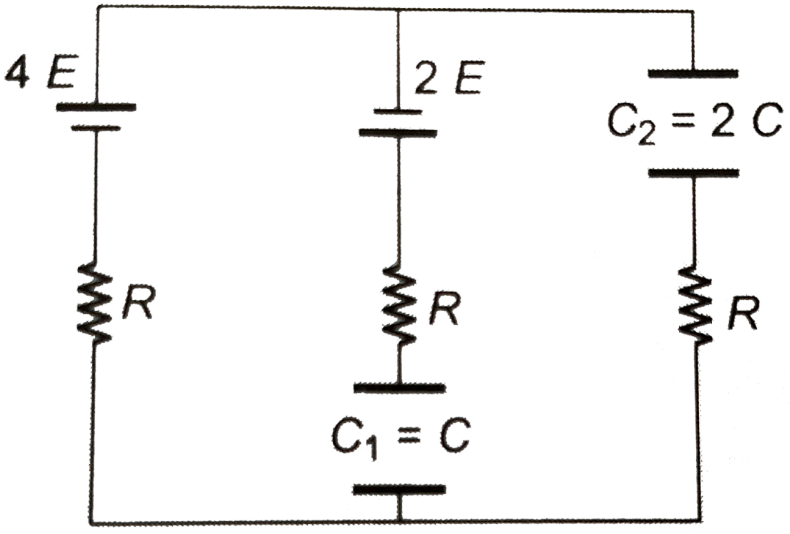
85. (a) Find potential difference between A and B and C.



(b) Find potential difference across capacitor C.


1.0 V
10 Ω
C
1.0 V
2.0 V
20 Ω


4 E
2 E
C2 = 2 C
R
R
R
C1 = C

(i) Find ratio of energy stored in capacitors, C_1 and (C_2)

(ii) If battery of emf of $2E$ is short -circuited, find charge flown in battery of emf $4E$.

A. CE

B. $2CE$

C. $3CE$

D. $4CE$

Answer: B

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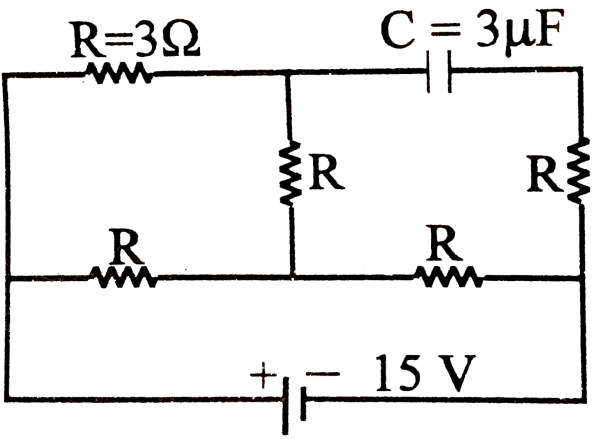
86. In the circuit shown, the cell is ideal , with $emf = 15V$. Ecah resistance is of 3Ω. the potential difference across the capacitor

is



A. zero

B. $9V$

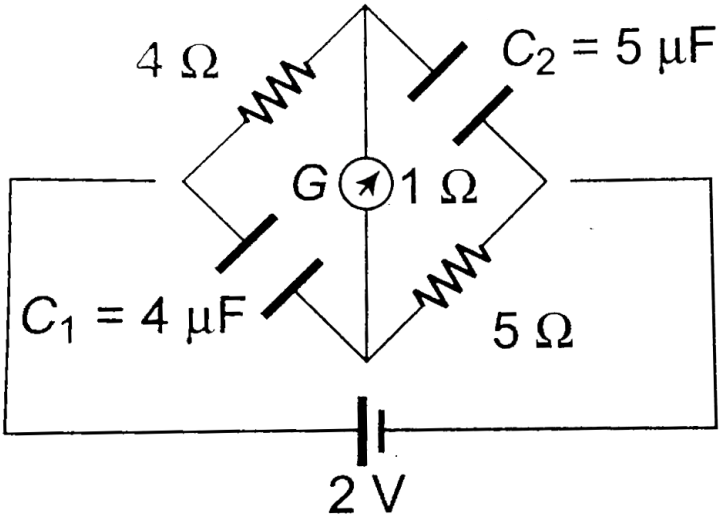
C. $12V$

D. $15V$

Answer: C

Watch Video Solution

87. In the circuit shown, the cell is ideal with emf = $2V$. The resistance of the coil of the galvanometer G is 1Ω.



(i) No current flows in G

(ii) $0.2A$ current flows in G

(iii) potential difference across $C_1 is 1V$

(iv) Potential difference across C_2 is $1.2V$

A. (i),(iii)

B. (i),(ii),(iv)

C. (ii),(iii),(iv)

D. (i),(ii),(iv)

Answer: C

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88. A capacitor charges from a cell through a resistance. The time constant is τ. In what time will the capacitor collect $10\,\%$ of the final charge?

A. $\tau 1n(0.1)$

B. $\tau 1n(0.9)$

C. $\tau 1n\frac{10}{9}$

D. $\tau 1n\frac{11}{10}$

Answer: C

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89. A capacitor is charged and then made to discharged through a resistance. The time constant is τ. In what time will the potential difference across the capacitor decreases by $10\,\%$?

A. $\tau 1n(0.1)$

B. $\tau 1n(0.9)$

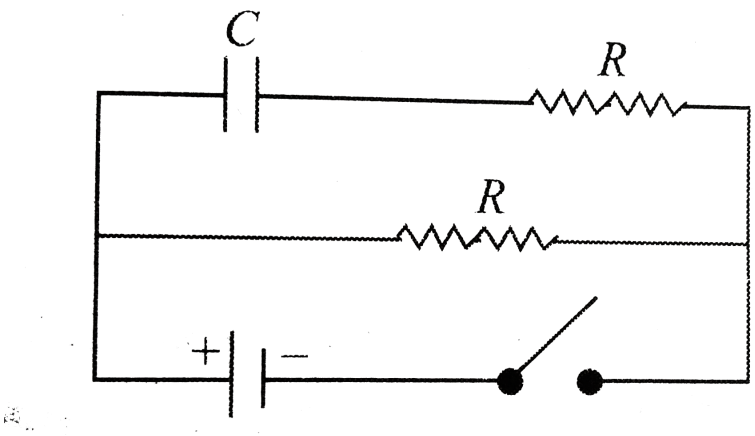
C. $\tau 1n\frac{10}{9}$

D. $\tau 1n\frac{11}{10}$

Answer: C

Watch Video Solution

90. In the circuit shown in fig. when the switch is closed, the capacitor charges with a time constant



A. RC

B. $\frac{R}{C}2$

C. $2RC$

D. $3RC$

Answer: A

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91. In the previous question, if the switch is opened after the capacitor has been charged, it will discharge with a time constant

A. RC

B. $2RC$

C. $\frac{1}{2}RC$

D. $RC1n2$

Answer: B

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92. A capacitor of capacitance C has charge Q. it is connected to an identical capacitor through a resistance. The heat produced in the resistance is

A. $\frac{Q^2}{2C}$

B. $\frac{Q^2}{4C}$

C. $\frac{Q^2}{8C}$

D. depending on the value of the resistance

Answer: B

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93. The charge on a capacitor decrease η time in time t, when it discharging through a circuit with a time constantτ

A. $t = \eta\tau$

B. $t = \tau 1n\eta$

C. $t = \tau(1n\eta - 1)$

D. $t = \tau 1n\left(1 - \frac{1}{\eta}\right)$

Answer: B

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94. Two identical capcitors A and B are charged to the same potential and then made to discharge through resistance R_A and R_B respectively with $R_A > R_B$

A. A wil require greater time then B to discharge completely

B. More heat will be produced in A than in B

C. More heat will be produced in B than in A

D. All the above options are incorrect

Answer: D

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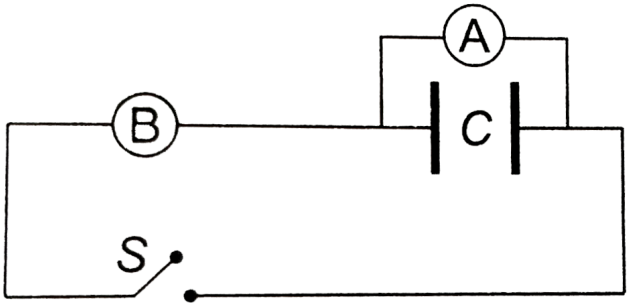
95. a capacitor of capacitance C is connected to two voltmeter A and B. A is ideal , having infinite resistance, while B has resistance R. The capcitor is charged and then switch S is closed.

The reading of A and B will be equal



A. at all times

B. after time RC

C. after time $RC1n2$

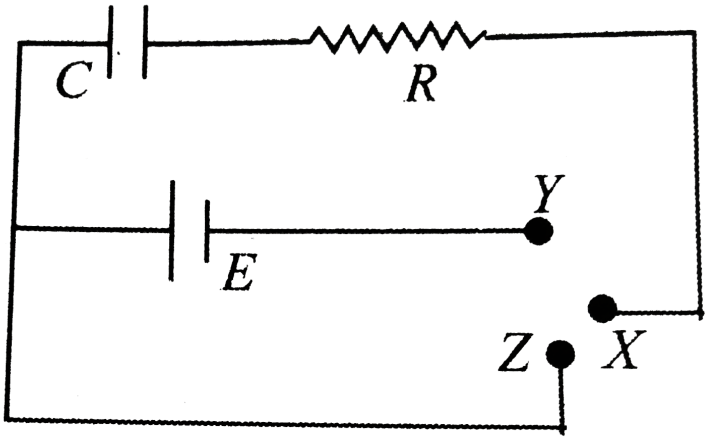
D. only after a very long time

Answer: A

Watch Video Solution

96. The capacitor C is initially without charge. X is now joined to Y for a long time, during which H_1 heat is produced in the

resistance R. X is now joined to Z for a long time, during which H_2 heat is produced in R



A. $H_1 = H_2$

B. $H_1 = H_2/2$

C. $H_1 = 2H_2$

D. the maximum energy stored in C at any time is H_2

Answer: A

Watch Video Solution

97. The energy supplied by the cell during charging is equal to

A. H_1

B. H_2

C. $3H_2$

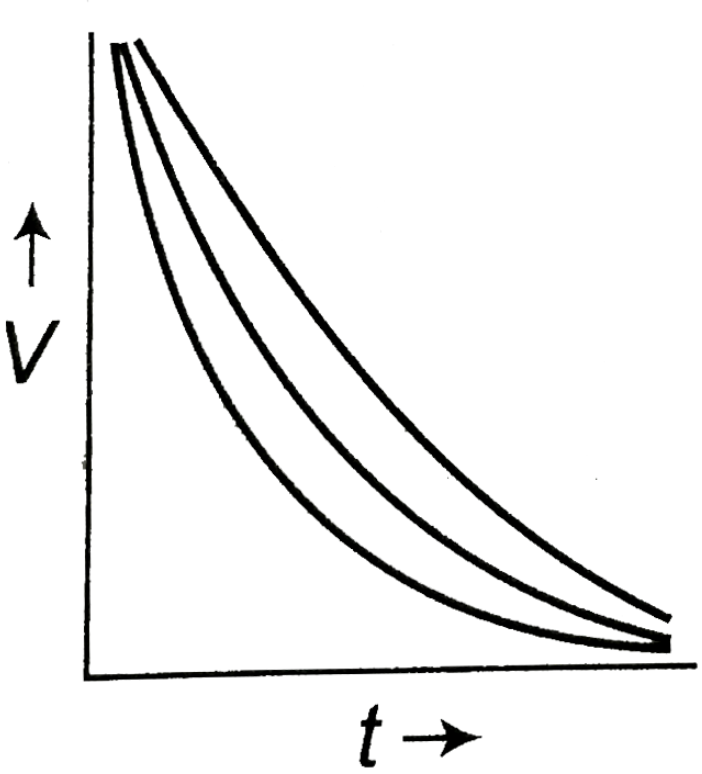
D. $2H_1$

Answer: D

Watch Video Solution

98. three identical capacitor, A, B and C are charged to the same potential and then made to discharge through three resistance $R_A > R_B > R_C$. Their potential differnece (V) are plotted against time t, giving the curves $1, 2,$ and 3. Choose the incorrect

option.



A. $1 \rightarrow A$

B. $2 \rightarrow B$

C. $1 \rightarrow C$

D. $3 \rightarrow A$

Answer: A

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99. Capacitor C_1 of capacitance 1 micro-farad and capacitor C_2 of capacitance 2 microfarad are separately charged fully by a common battery. The two capacitors are then separately allowed to discharged through equal resistors at time t = 0.

A. (i),(iv)

B. (ii),(iv)

C. (iii),(iv)

D. (i),(ii)

Answer: A

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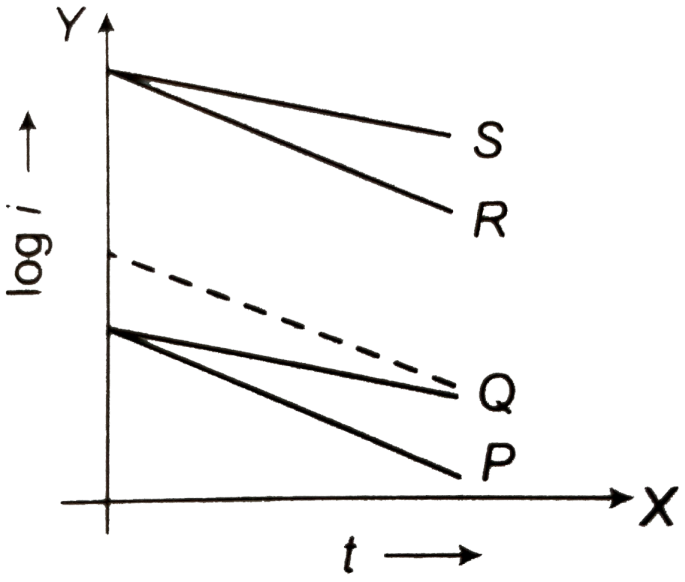
100. In an RC circuit while charging, the graph of $1ni$ versis time is as shown by the dotted line in the diagram figure. Where i is the current. When the value of the resistance is doubled, which of the solid curve best represents the variation of $1ni$ versus time



A. P

B. Q

C. R

D. S

Answer: B

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101. Two cities are $150km$ apart. Electric power is sent from one city to another city through copper wire. The fall of km is 0.5Ω. The power less in the wire is

A. $19.2kW$

B. $19.2J$

C. $12.2kW$

D. $19.2W$

Answer: A

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