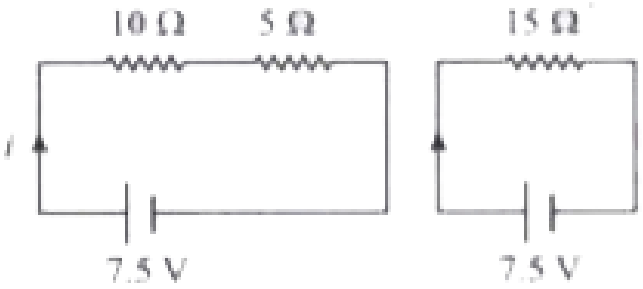
PHYSICS

BOOKS - CENGAGE PHYSICS

SOURCES OF ELECTRIC CURRENT

Worked Examples

1. Calculate the electric current in the circuit shown below.



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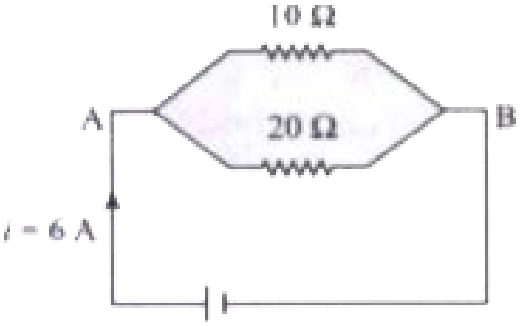
2. Two resistors of resistance 10Ω and 20Ω are connected in parallel. A battery supplies 6 A of current to the combination. Calculate the current in each

resistor.



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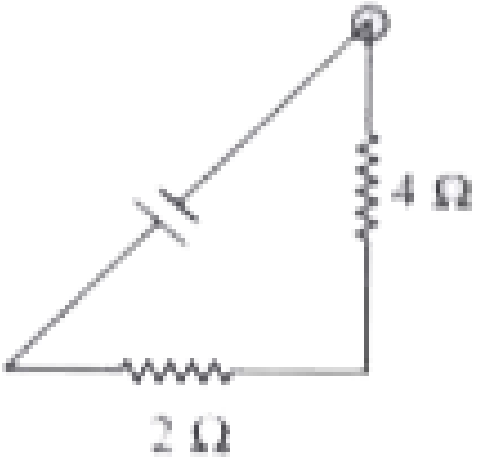
3. Find the effective resistance of the following circuit :



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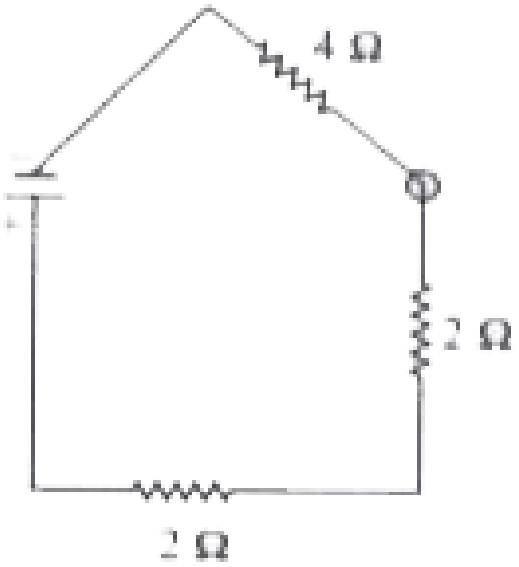
4. Find the equivalent resistance of the following circuit :



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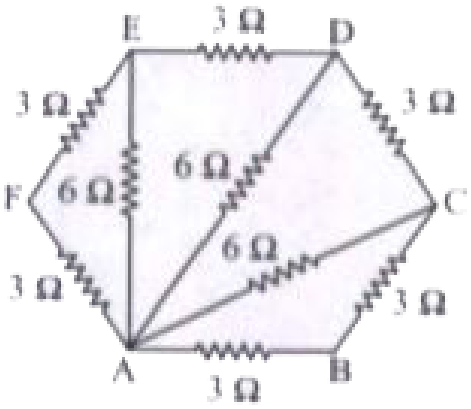
5. Find the effective resistance between the points A and B as shown in the figure.



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Mandatory Exercise Exercise Set I

1. What are the two ways in which cells can be grouped or arranged ?

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2. When are cells a said to be connected in series ? What is the advantage of such a connection ?

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3. When are cells said to be connected in parallel ? Why do you need such a circuit ?

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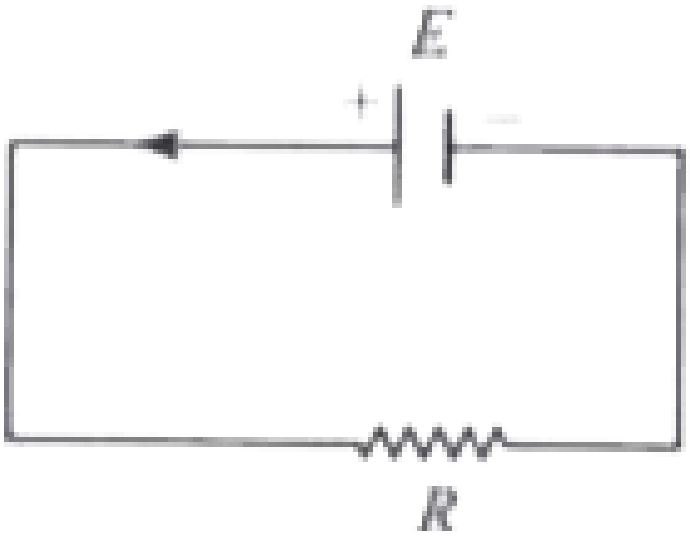
4. Deduce the simple relation $e = I(R + r)$ for the following circuit :



e = emf of the cell, R = external resistance and

r = internal resistance.

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Mandatory Exercise Exercise Set Ii

1. (i) In series connection of two elements, the same current flows through each element

(ii) In parallel connection of two elements, the same potential difference gets applied across each element.

A. Both (i) and (ii) are correct.

B. (i) is wrong but (ii) is correct

C. (i) is correct but (ii) is wrong

D. Both (i) and (ii) are wrong.

Answer: A

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2. In a voltaic cell, the positive terminal is known as

A. cathode

B. anode

C. cation

D. anion

Answer: B

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3. The commonly not used sources which give rise to direct current are

A. simple voltaic cell

B. bulb

C. lead storage batteries

D. dry cell

Answer: A::C::D

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4. In parallel combination, the effective resistance (of R_1 and R_2) is given by

A. $R = \frac{R_1 R_2}{R_1 + R_2}$

B. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

C. $R = R_1 + R_2$

D. $R = \frac{1}{R_1} + \frac{1}{R_2}$

Answer: A::B::D

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5. In order to obtain a maximum current from a combination of cells, we must join the cells in

A. parallel combination

B. series combination

C. mixed combination

D. in any of the above combinations depending upon the relative values of external and internal resistance

Answer: D

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6. If n identical cells, each of emf E, are joined in series, the net emf is

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

B. nE

C. n^2E

D. none of these

Answer: B

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7. Battery is a source of

A. current

B. emf

C. momentum

D. charge

Answer: B

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8. Which is the correct relation for emf of a cell ?

A. $E = Ir$

B. $E = V - Ir$

C. $E = V + Ir$

D. $E = V$

Answer: C

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9. What must be the current in a circuit if potential difference across a cell is equal to the emf of the cell.

A. 0

B. 10A

C. 0.5 A

D. 105 A

Answer: A

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10. The direction of current outside the battery is

A. (+)ve to (-)ve terminal

B. (-)ve to (+)ve terminal

C. independent of the polarity

D. none of these

Answer: A

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11. The direction of current inside a battery is

A. (+)ve to (-)ve terminal

B. (-)ve to (+)ve terminal

C. independent of the polarity

D. none of these

Answer: B

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12. The materials used as electrodes in simple voltaic cell are

A. copper and silver

B. silver and aluminum

C. aluminum and zinc

D. zinc and copper

Answer: D

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13. Which substance is liberated at the cathode of a simple voltaic cells ?

A. Zn

B. Cu

C. SO_4

D. $ZnSO_4$

Answer: D

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14. Which substance is liberated at the anode of a simple voltaic cell ?

A. Zn

B. Cu

C. SO_4

D. H_2

Answer: D

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15. In voltaic cells potential difference is produced due to

A. mechanical effects

B. thermal effect

C. chemical effects

D. all of these

Answer: C

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16. Polarization occurs in simple voltaic cells because

A. $ZnSO_4$ is bad conductor

B. Zn^{2+} is very heavy

C. ions are of limited numbers

D. hydrogen is bad conductor

Answer: D

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17. Which meterial is deposited at the zinc electrode in a carbon - zinc cell ?

A. $ZnCl_4$

B. MnO_2

C. NH_3

D. Mn_2O_3

Answer: A

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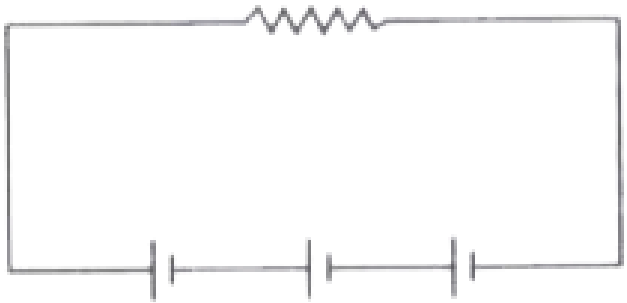
18. Three cells are connected to an external resistance as shown in the figure. Each of the cells has emf 10 V and internal resistance 2Ω.



If the external resistance is 6Ω. Find the current in the circuit.

A. 2A

B. 2.5 A

C. 3A

D. 3.5 A

Answer: B

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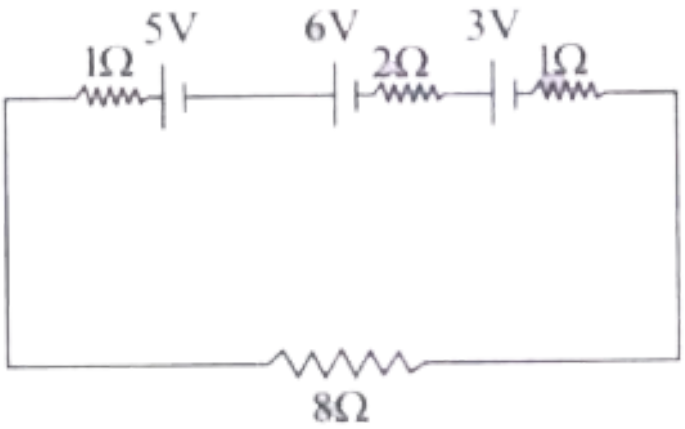
19. Consider a circuit as shown below.



What is the total emf in the circuit.

A. 2V

B. 4V

C. 2V

D. 14V

Answer: D

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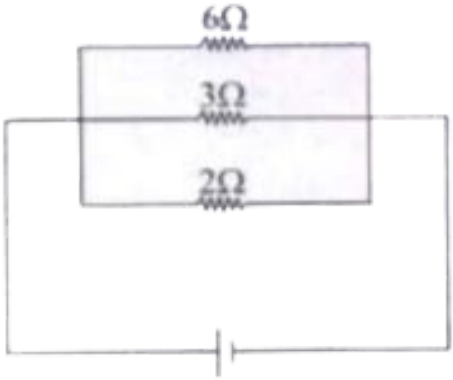
20. In the circuit shown below, what is the equivalent resistance ?



A. 11Ω

B. 4Ω

C. 1Ω

D. 3Ω

Answer: C

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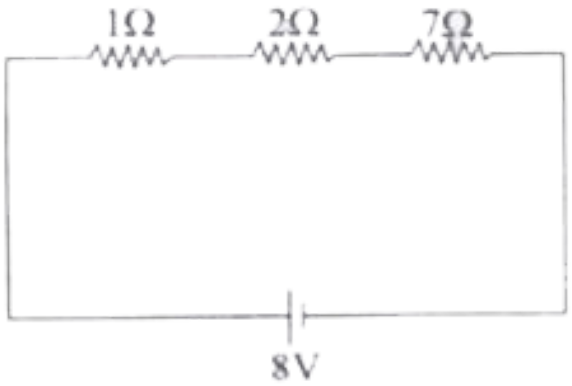
21. What is the potential difference across resistor in the given circuit ?



A. 80V

B. 0V

C. 32V

D. 16V

Answer: D

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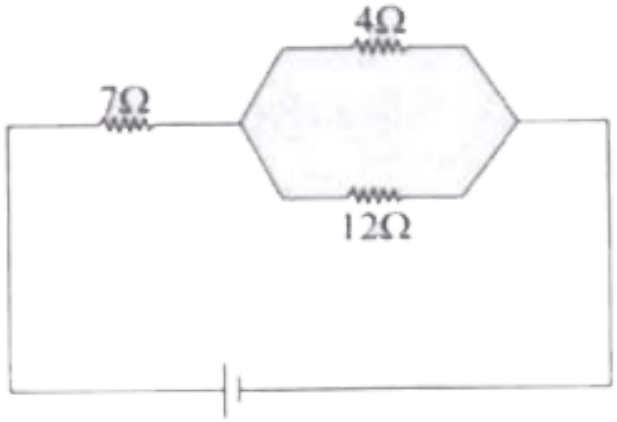
22. What is the equivalent resistance in the given circuit ?



A. 23Ω

B. 10Ω

C. 21Ω

D. 75Ω

Answer: B

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Mandatory Exercise Exercise Set Iii

1. Match the following

A	B
(1) Current through series grouping of m number of cells	(a) Constant voltage circuit
(2) Current through parallel grouping of n number of cells	(b) Constant current circuit
(3) Equivalent resistance in series combination of n resistances	(c) $I_p = \frac{nE}{nR+r}$
(4) Equivalent resistance in parallel combination of n resistances	(d) $R_{eq} = R_1 + R_2 + \cdots + R_n$
(5) Series combination of resistances	(e) $I_s = \frac{mE}{R+mr}$
(6) Parallel combination of resistances	(f) $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$

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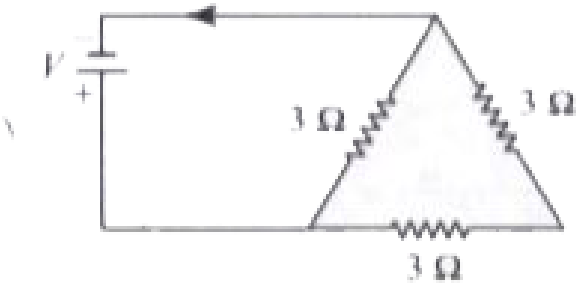
Mandatory Exercise Exercise Set Iv

1. Find equivalent resistance in each of the following circuits :



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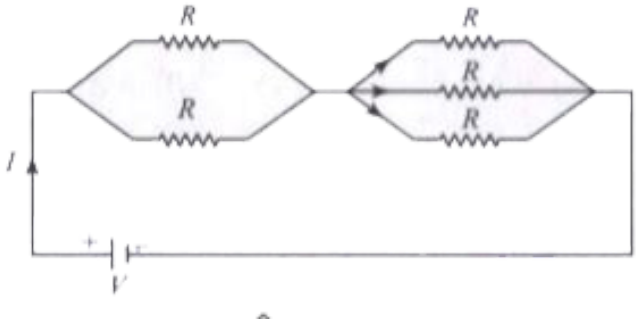
2. Find equivalent resistance in each of the following circuits :



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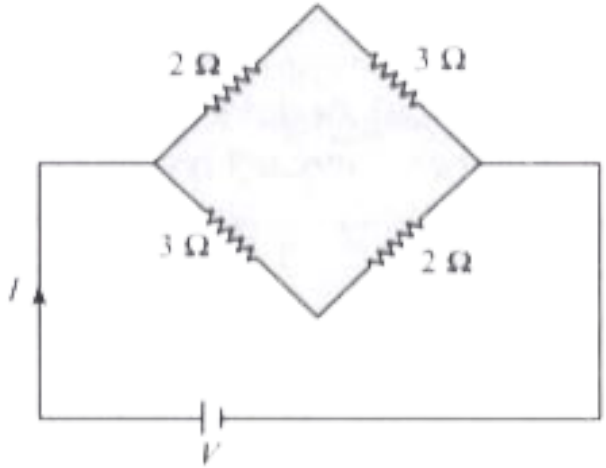
3. Find equivalent resistance in each of the following circuits :



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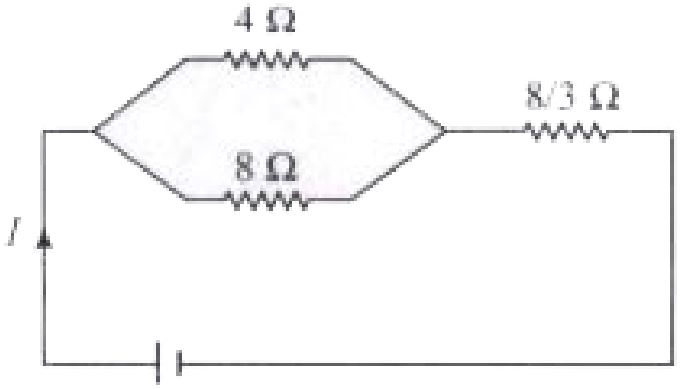
4. Find equivalent resistance in each of the following circuits :



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5. A cell supplies a current of 0.9 A through a 2Ω resistor and current of 0.3 A through a 7Ω resistor What is the internal resistance of the cell ?

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6. A wire of resistance 4Ω is connected to a battery having an internal resistance of 1Ω For a current of 6 A to flow through the circuit what should be the emf of the battery ?

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7. A bulb of resistance 5Ω is connected to a battery of emf 4.2 V and internal resistance 1Ω. Find the current through the bulb.

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8. Three identical cells of emf 4V with 1Ω internal resistance each are connected in series to an external resistance of 6Ω. Find the current flowing in the circuit.

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9. Four identical cells with 1.5Ω internal resistance each are connected in parallel to an external resistance of 5Ω. What should be the value of the emf of each cell to drive a current of 4 A in the circuit ?

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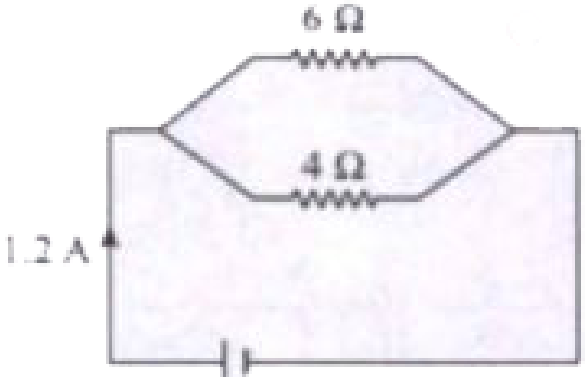
Challenging Exercise

1. What is the current passing through 6Ω resistor in the following circuits ?



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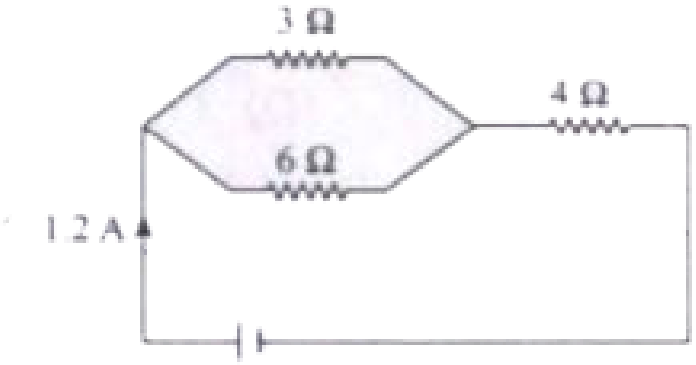
2. What is the current passing through 6Ω resistor in the following circuits ?



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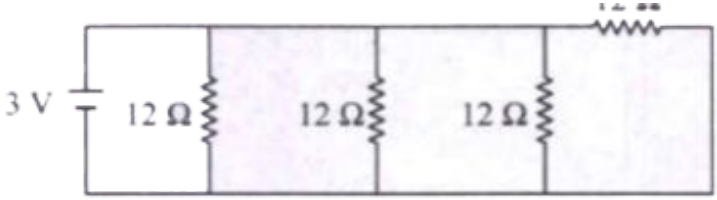
3. Find the current supplied by the battery in the following circuit.



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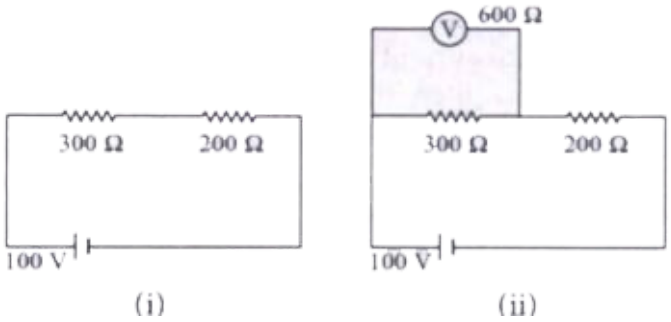
4. Find the potential drops across the two resistors shown in figure.



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5. A voltmeter of resistance 600Ω is used to measure the potential drop across the 300Ω resistor. What will be the measured potential drop ?

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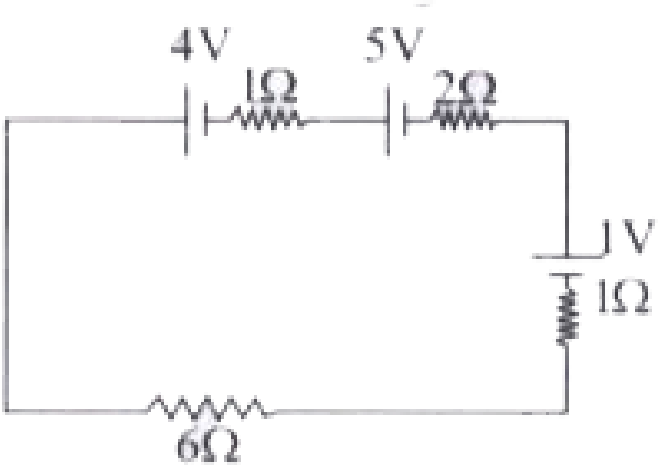
6. A circuit is shown in the figure.



What is the total resistance in the circuit ?

A. 5

B. 6

C. 11

D. 30

Answer: C

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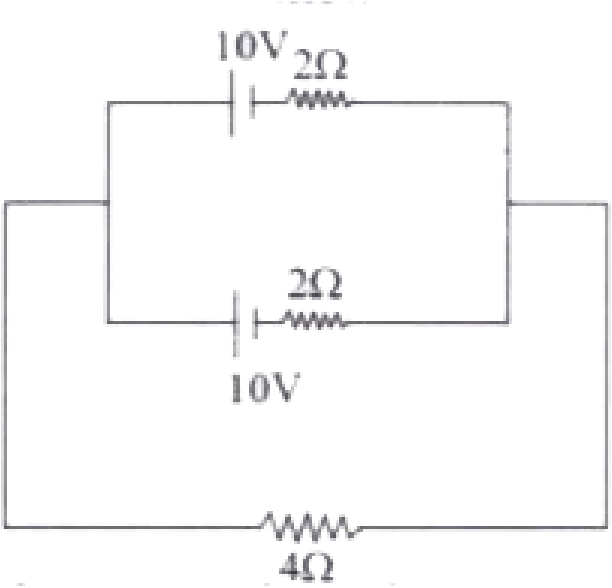
7. Consider a circuit as shown in the figure.



What is the current through 4 resistor ?

A. 3A

B. 1A

C. 4A

D. 2A

Answer: D

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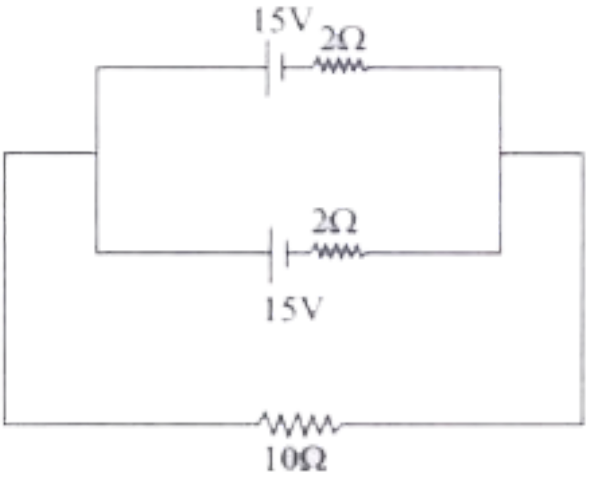
8. For the circuit shown in the figure what is the potential difference across the external resistance ?



A. 10V

B. 7.5 V

C. 15 V

D. 30V

Answer: C

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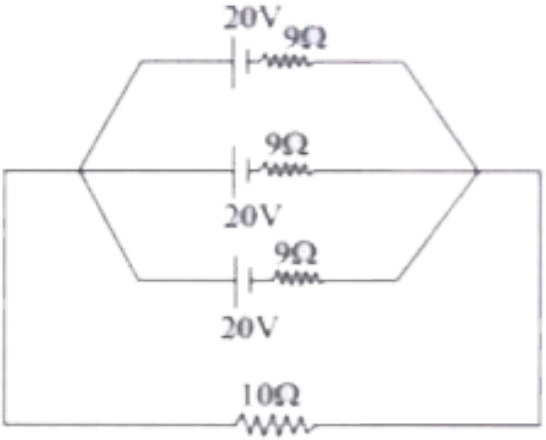
9. What is equivalent resistance on the circuit shown in the given circuit ?



A. 13Ω

B. 37Ω

C. $\frac{30}{13}\Omega$

D. 270Ω

Answer: A

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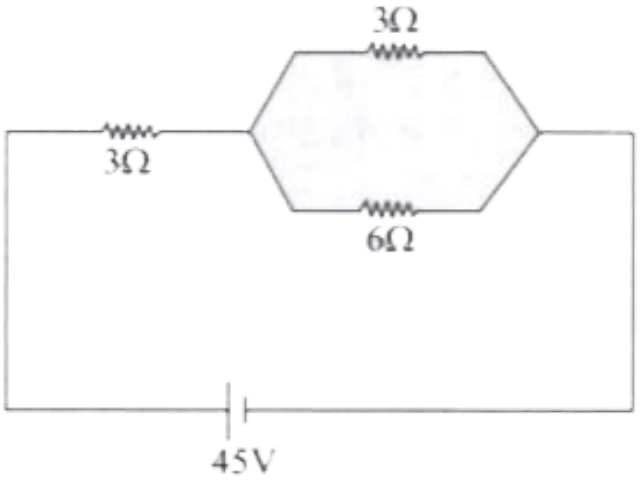

10.

Find the amount of current that flows through the 6Ω resistor.

A. 9A

B. 3A

C. 0A

D. 6A

Answer: B

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Olympiad And Ntse Level Exercises

1. Two resistors are connected (a) in series (b) in parallel. The equivalent resistance in the two cases are 9 ohm and respectively. Then the resistances of the component resistors are

A. 2 ohm and 7 ohm

B. 3 ohm and 6 ohm

C. 3 ohm and 9 ohm

D. 5 ohm and 4 ohm

Answer: B

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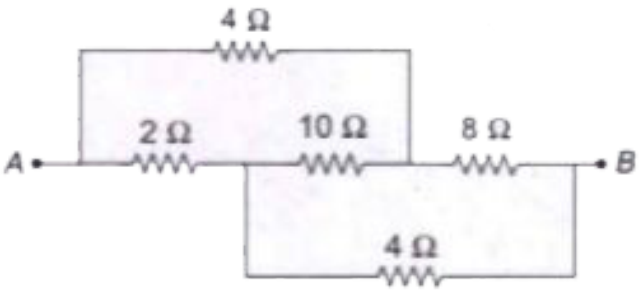
2. Find the equivalent resistance between the points a and b



A. 2Ω

B. 4Ω

C. 8Ω

D. 16Ω

Answer: B

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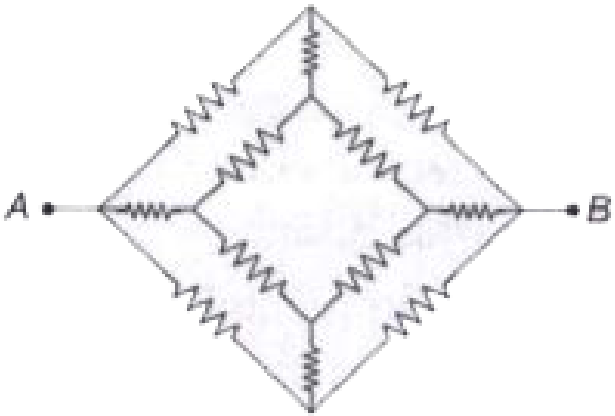
3. The figure shows a network of resistor each having value 12Ω. Find the equivalent resistance between points A and B.



A. 9Ω

B. $\frac{12}{5}\Omega$

C. 8Ω

D. $\frac{11}{3}\Omega$

Answer: A

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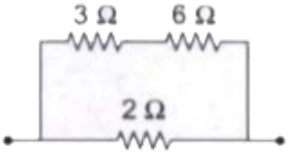
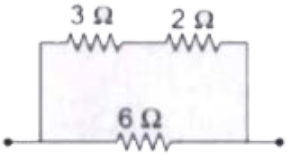
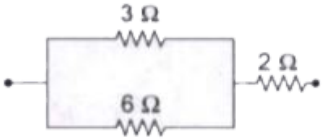
4. If you are provided three resistances 2Ω, 3Ω and 6Ω. How will you connect then so as to obtain the equivalent resistance of 4Ω ?

A. 

B. 

C. 

D. none of these

Answer: C

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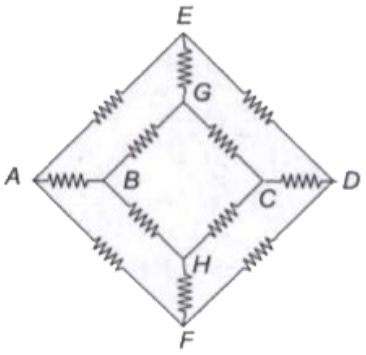
5. For the given network, the equivalent resistance between different point are represented by

$R_{AC}, R_{AD}, R_{BC}, R_{GH}, R_{EG}$ etc.



Column I	Column II
(i) R_{AB}	(p) Zero
(ii) R_{BC}	(q) $\frac{3R}{4}$
(iii) R_{AC}	(r) $\frac{5R}{6}$
(iv) R_{CH} when points C and H are shorted	(s) $\frac{7R}{12}$

Now match the given columns and select the correct option from the codes given below.

A. i-s, ii-r, iii-q, iv-p

B. i-q, ii-s, iiii-r, iv-p

C. i-p, ii-q, iii-r, iv-s

D. i-s, ii-q, iii-r, iv-p

Answer: D

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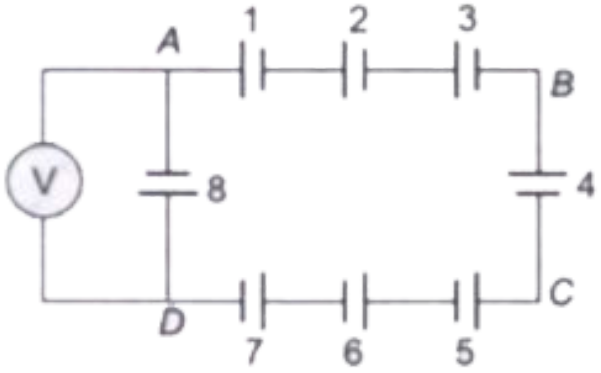
6. Eight cells marked 1 to 8, each of emf 5V and internal resistance 0.2Ω are connected as shown. What is the reading of ideal voltmeter ?



A. 40 V

B. 20 V

C. 5 V

D. zero

Answer: D

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7. N identical cells, each of emf E and internal resistance r are joined in series. Out of N cells, n cells are wrongly connected i.e., their terminals are connected in reverse of that required for series

connection. $\left(n < \frac{N}{2}\right)$. Let E_0 be the emf of resulting battery and r_0 be its internal resistance. then

A. $E_0 = (N-n)E, r_0 = (N-n)r$

B. $E_0 = (N-2n)E, r_0 = (N-2n)r$

C. $E_0 = (N-2n)E, r_0 = Nr$

D. $E_0 = (N-n)E, r_0 = Nr$

Answer: C

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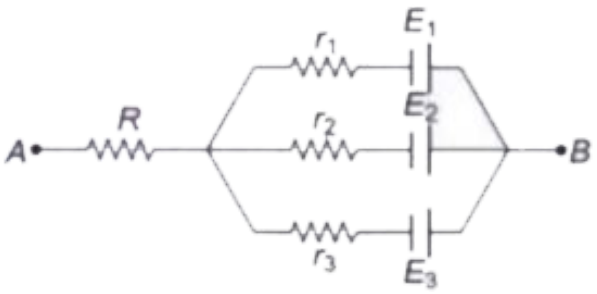
8. In the network shown the potential difference between A and B is

$(R = r_1 = r_2 = r_3 = 1\Omega, E_1 = 3V, E_2 = 2V, E_3 = 1V)$



A. 1 V

B. 2 V

C. 3 V

D. 4 V

Answer: B

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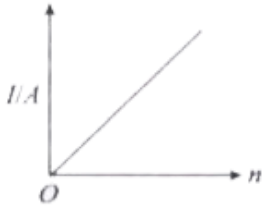
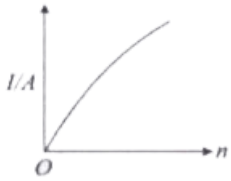
9. A battery consists of a variable number n of identical cells having internal resistance connected in series. The terminals of the battery are short circuited and the current I measured. Which one of the graph below shows the correct relationship between I and n ?

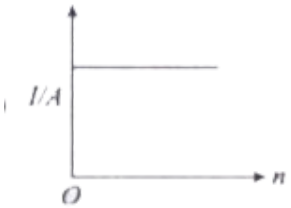
A.



B.



C.



D.

Answer: D

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10. Read the assertion and reason carefully to mark the correct option.

Assertion : When a cell is charged by connecting its positive electrode with positive terminal of the charger battery then potential difference across the electrodes of cell will be smaller to the EMF of cell.

Reason : Potential difference across electrodes in a cell

providing electric current is $E = Ir$ where E is EMF and r internal resistance.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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