Physics · Electric Current and Electromagnetism · Electric Current, Ohm's Law and Kirchhoff's Laws

Connecting Resistors

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281	3	136
questions	sets	pages

Contents

Multiple choice questions (220 questions) — Questions · p. 2 — Answers · p. 113

Essay questions (29 questions) — Questions · p. 90 — Answers · p. 127

Past exam questions (32 questions) — Questions · p. 100 — Answers · p. 132

Click a question number to jump to its answer, and an answer number to go back to the question.

Multiple choice questions — 220 questions

1 Three resistors are connected in parallel. If the resistance of one of them is one ohm, the equivalent resistance of these resistors is .....

(A) less than one ohm
(B) greater than one ohm
(C) equal to one ohm
(D) cannot be found without knowing the two unknown resistances

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2 Three resistors of 120 Ω, 60 Ω and 40 Ω. Their total resistance when connected: in series is .....

(A) 520 Ω (B) 220 Ω (C) 110 Ω (D) 34 Ω

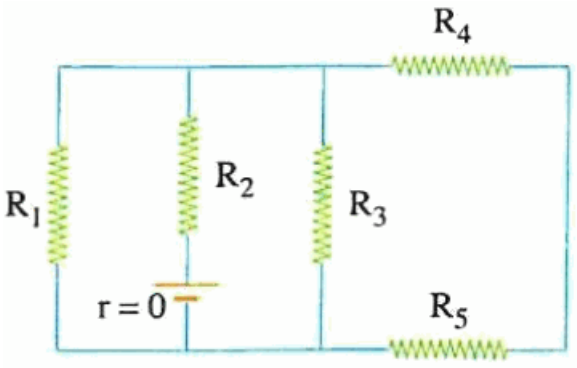
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3 Three resistors of 120 Ω, 60 Ω and 40 Ω. Their total resistance when connected: in parallel is .....

(A) 10 Ω (B) 20 Ω (C) 30 Ω (D) 40 Ω

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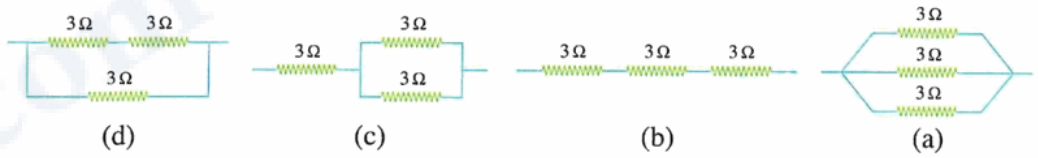
4 Which of the following statements is correct for the opposite electric circuit?



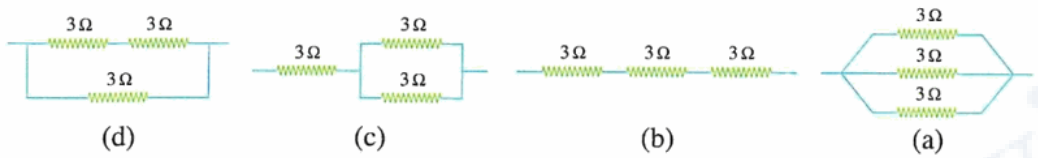
(A) R_2 and R_3 are connected in series
(B) R_1 and R_3 are connected in parallel
(C) R_4 and R_5 are connected in parallel
(D) R_1 and R_2 are connected in parallel

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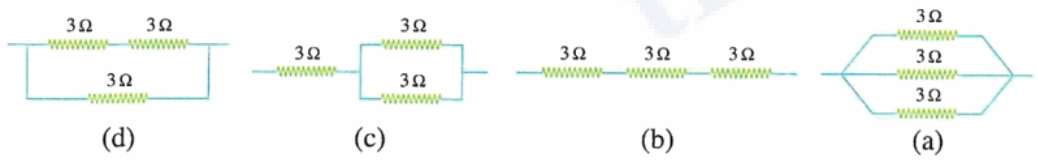
5 You have three resistors of 3 Ω each, connected in four different ways (a), (b), (c), (d) as in the following figures. The way of connection in which the equivalent resistance is:
4.5 Ω is .....



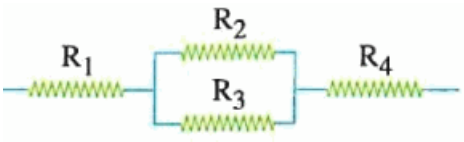
6 You have three resistors of 3 Ω each, connected in four different ways (a), (b), (c), (d) as in the following figures. The way of connection in which the equivalent resistance is:
2 Ω is .....



7 You have three resistors of 3 Ω each, connected in four different ways (a), (b), (c), (d) as in the following figures. The way of connection in which the equivalent resistance is:
1 Ω is .....

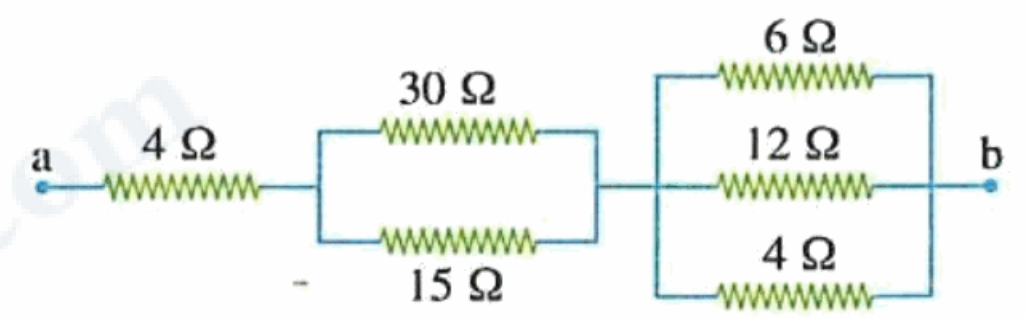


8 The opposite figure represents part of an electric circuit. Removing which resistor(s) from the circuit increases the equivalent resistance?



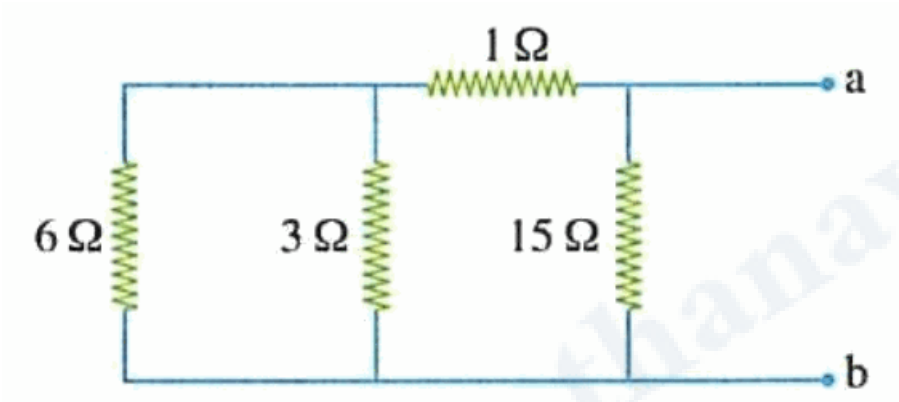
(A) R_1 (B) R_2 (C) R_4 (D) R_1, R_2, R_3

9 In the opposite figure, the equivalent resistance between points a and b is .....



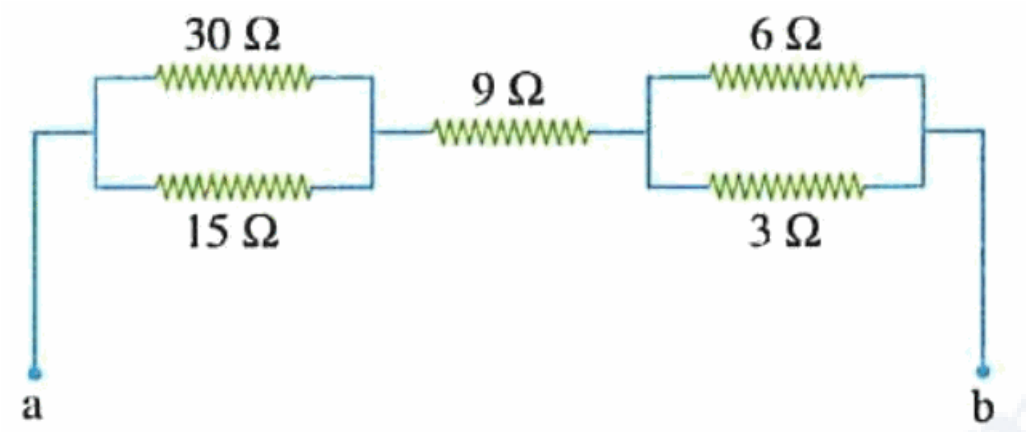
(A) 15 Ω (B) 16 Ω (C) 17 Ω (D) 18 Ω

10 In the opposite figure, the equivalent resistance between points a and b is .....



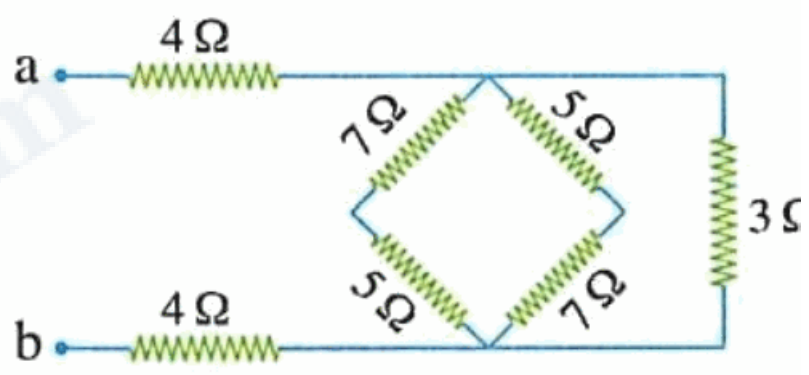
(A) 1 Ω (B) 1.5 Ω (C) 2 Ω (D) 2.5 Ω

11 In the opposite figure, the equivalent resistance between points a and b is .....



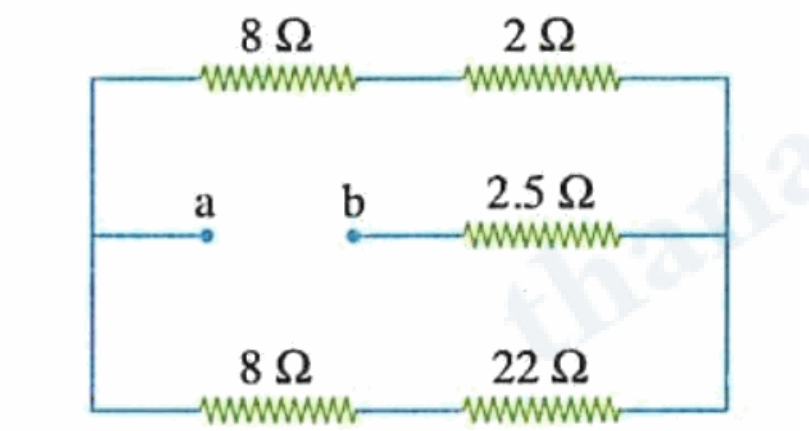
(A) 15 Ω (B) 21 Ω (C) 24 Ω (D) 30 Ω

12 In the opposite figure, the equivalent resistance between points a and b is .....



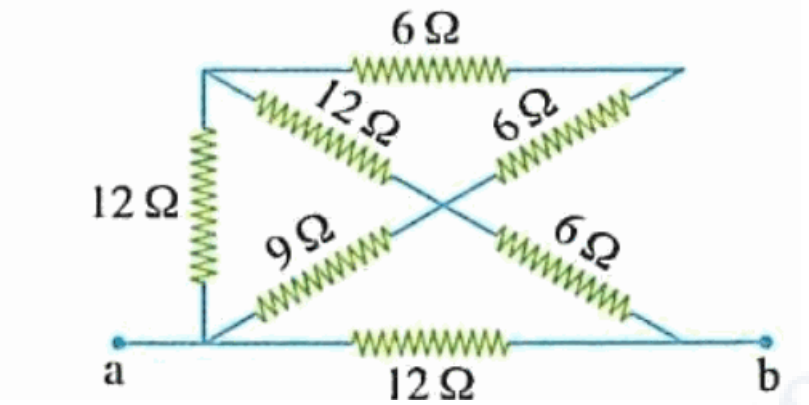
(A) 5 Ω (B) 10 Ω (C) 15 Ω (D) 20 Ω

13 In the opposite figure, the equivalent resistance between points a and b is .....



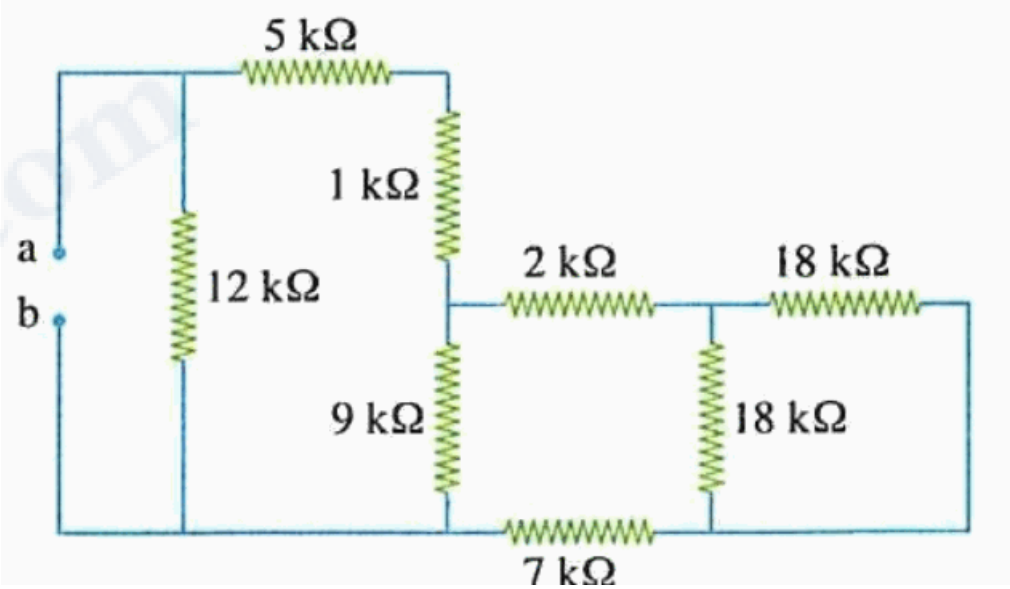
(A) 2.5 Ω (B) 5 Ω (C) 7.5 Ω (D) 10 Ω

14 In the opposite figure, the equivalent resistance between points a and b is .....



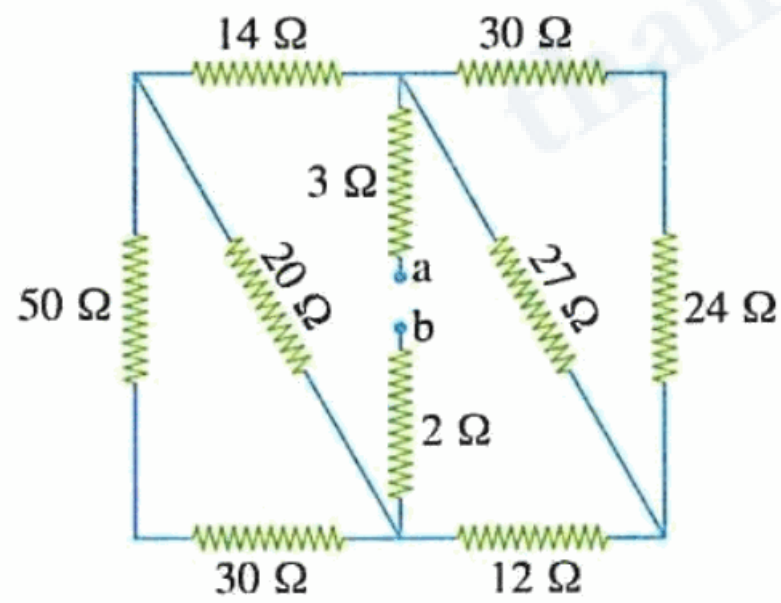
(A) 2 Ω (B) 4 Ω (C) 6 Ω (D) 8 Ω

15 In the opposite figure, the equivalent resistance between points a and b is .....



(A) 3 kΩ (B) 6 kΩ (C) 9 kΩ (D) 12 kΩ

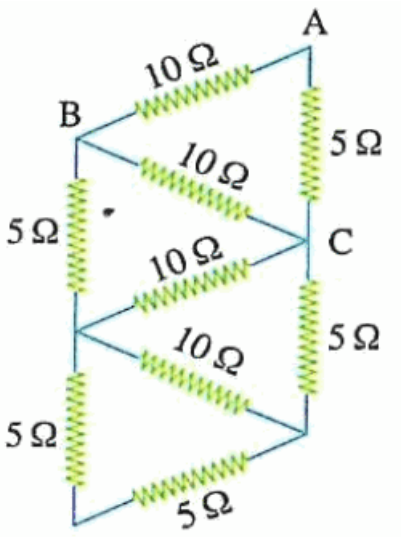
16 In the opposite figure, the equivalent resistance between points a and b is .....



(A) 13 Ω (B) 17 Ω (C) 20 Ω (D) 25 Ω

17 The equivalent resistance of the opposite circuit when an electric source is connected between points:

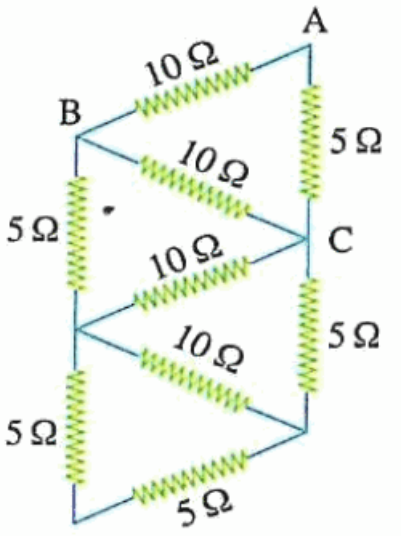
A and B equals .....



(A) 20 Ω (B) 17 Ω (C) 9 Ω (D) 5 Ω

18 The equivalent resistance of the opposite circuit when an electric source is connected between points:

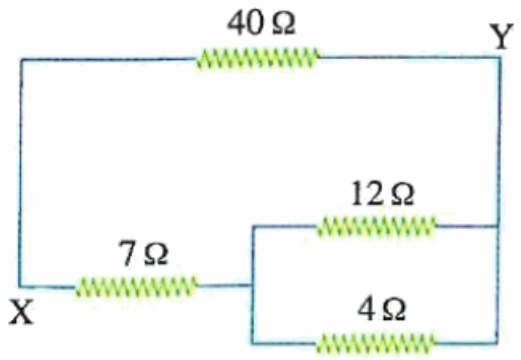
C and B equals .....



(A) 1.25 Ω (B) 2.5 Ω (C) 3.75 Ω (D) 6.3 Ω

19 In the opposite figure:

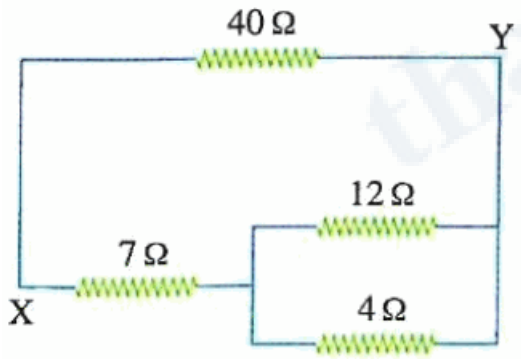
the equivalent resistance when a battery of negligible internal resistance is connected between points X and Y is .....



(A) 2 Ω (B) 4 Ω (C) 6 Ω (D) 8 Ω

20 In the opposite figure:

if the battery is connected in place of the 7 Ω resistor, the equivalent resistance of the circuit becomes .....



(A) 40 Ω (B) 41 Ω (C) 42 Ω (D) 43 Ω

21 Three resistors (x), (y), (z) are connected together and with a battery and a rheostat (S) as in figure (1). Figure (2) shows graphically the relation between the potential difference (V) across each of the three resistors and the current (I) through each of them.
The equivalent resistance between points (a) and (b) shown in figure (1) equals .....

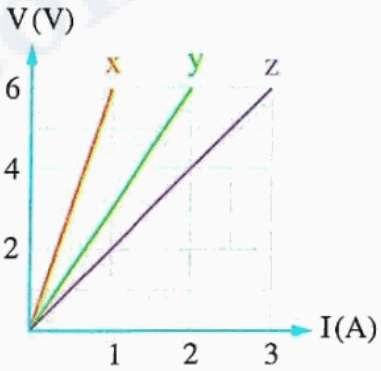


Figure (2)

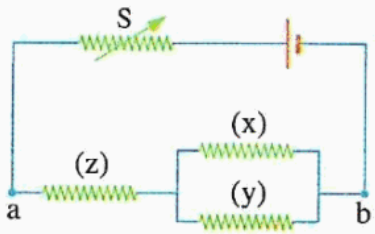
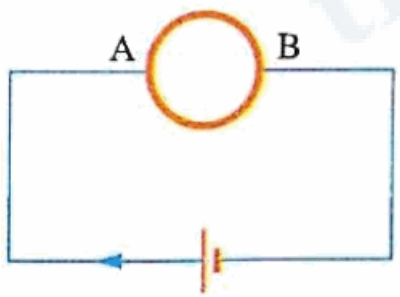


Figure (1)

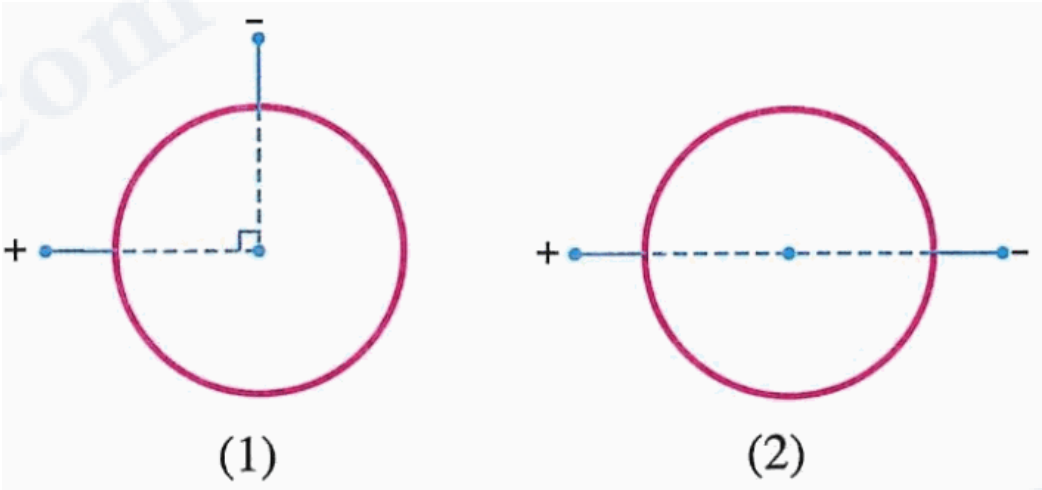
(A) 1 Ω (B) 3 Ω (C) 4 Ω (D) 11 Ω

22 A wire of resistance 48 Ω is bent into a closed ring, then a battery is connected across the two ends of one of its diameters as in the figure. The equivalent resistance between points A and B equals .....



(A) 96 Ω (B) 48 Ω (C) 24 Ω (D) 12 Ω

23 A straight wire of resistance R is bent into a circular ring and connected to an electric source in two different ways as shown in figures (1) and (2). The ratio between the equivalent resistances in the two figures (R_1/R_2) equals .....



(A) *3/4* (B) *4/3* (C) *2/1* (D) *1/2*

---

24 A wire of uniform cross-section carries a current of 0.1 A when the potential difference across its ends is 1.2 V. If it is bent into a closed square abcd, the equivalent resistance of the wire when a battery is connected:

to points a and c equals .....

(A) 2 Ω (B) 3 Ω (C) 4 Ω (D) 6 Ω

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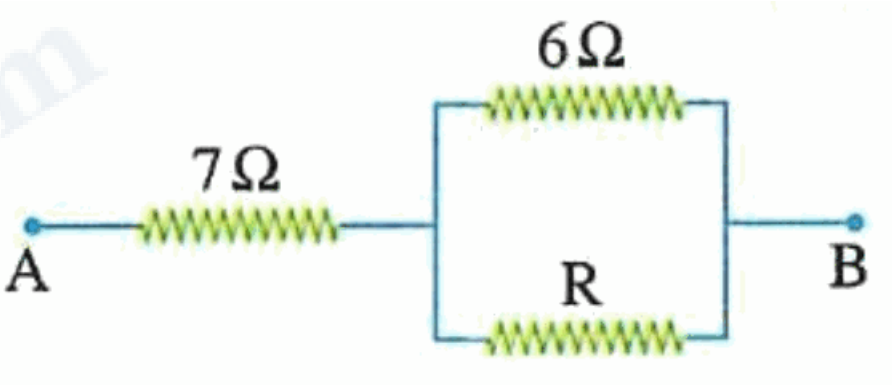
25 A wire of uniform cross-section carries a current of 0.1 A when the potential difference across its ends is 1.2 V. If it is bent into a closed square abcd, the equivalent resistance of the wire when a battery is connected:

to points a and d equals .....

(A) 6 Ω (B) 4.5 Ω (C) 2.25 Ω (D) 1.5 Ω

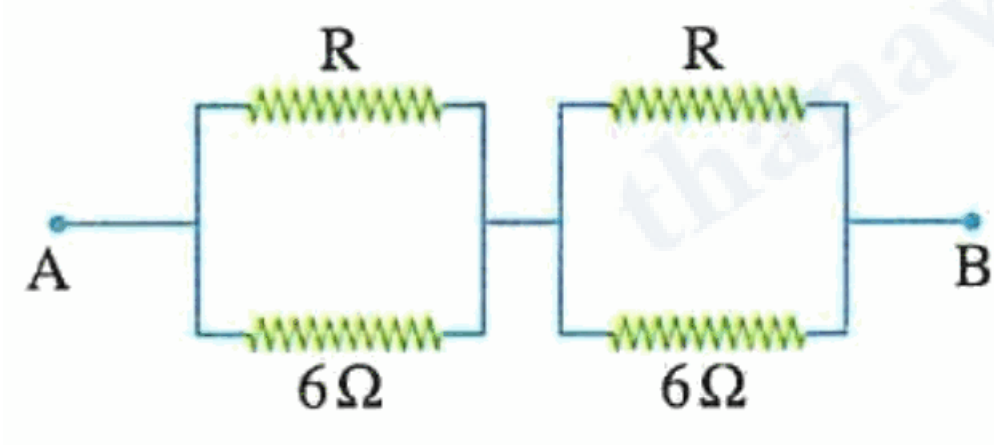
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26 In the opposite figure, if the equivalent resistance between points A and B is 9 Ω, the value of resistance R equals .....



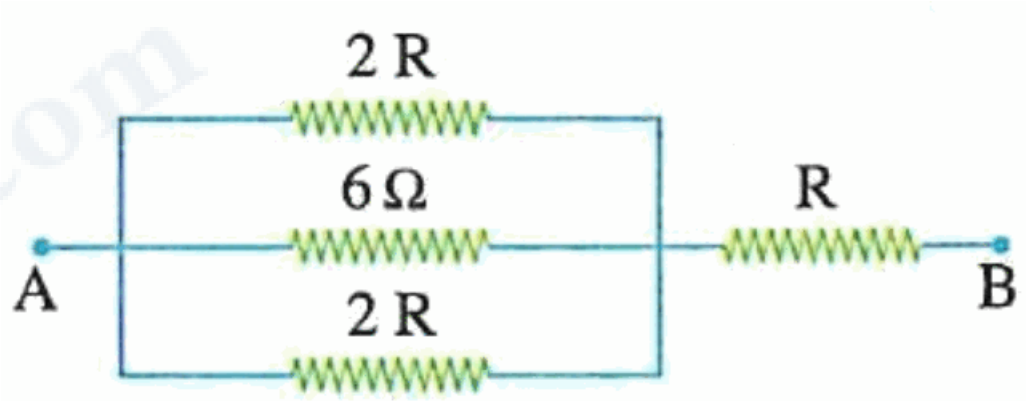
(A) 1 Ω (B) 2 Ω (C) 3 Ω (D) 6 Ω

27 In the opposite figure, if the equivalent resistance between points A and B is 9 Ω, the value of resistance R equals .....



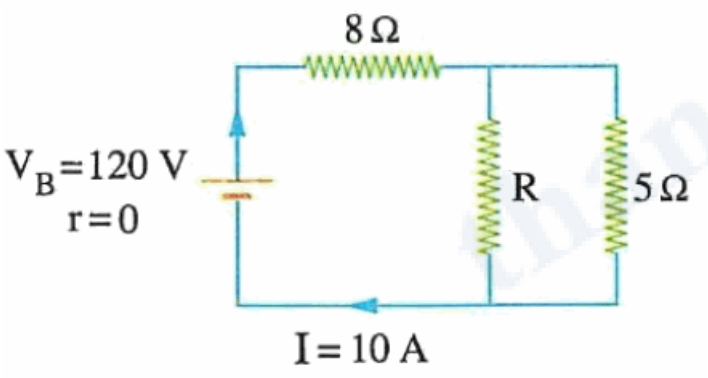
(A) 4 Ω (B) 6 Ω (C) 12 Ω (D) 18 Ω

28 In the opposite figure, if the equivalent resistance between points A and B is 9 Ω, the value of resistance R equals .....



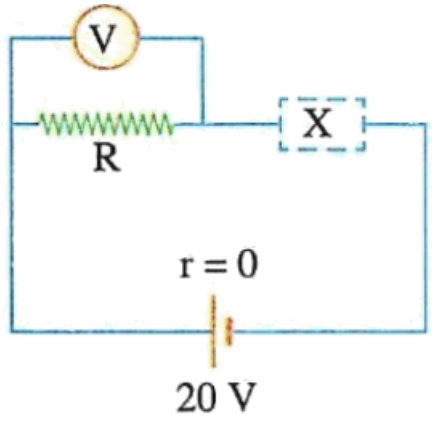
(A) 8 Ω (B) 6 Ω (C) 5 Ω (D) 3 Ω

29 In the circuit shown in the figure, the value of R equals .....



(A) 20 Ω (B) 40 Ω (C) 60 Ω (D) 80 Ω

30 The opposite figure represents a closed electric circuit containing an unknown element X. If the voltmeter reading is 5 V, element X is .....



(A) a resistance R (B) a resistance 2R (C) a resistance 3R (D) a resistance 4R

31 A number (N) of resistors, each of 40 ohm, are all connected either in series or in parallel, then the two ends of the group are connected to an electric source of potential difference 120 volt, so a current of 15 ampere flows in the circuit. The number of resistors (N) equals .....

(A) 3 (B) 4 (C) 5 (D) 6

32 An electric circuit in a house consists of an electric source of potential difference 110 V, a fuse whose wire withstands a maximum current of 5 A, and other parts connected in series with the source whose equivalent resistance is 2 Ω. What is the greatest number of identical lamps, each of resistance 620 Ω, that can be lit at the same time without damaging the fuse wire?

(A) 10 (B) 27 (C) 31 (D) 40

33 When a group of equal resistors is connected in series, its equivalent resistance is 100 Ω, and when connected in parallel, its equivalent resistance is 4 Ω. The value of one resistor equals .....

(A) 20 Ω (B) 25 Ω (C) 100 Ω (D) 104 Ω

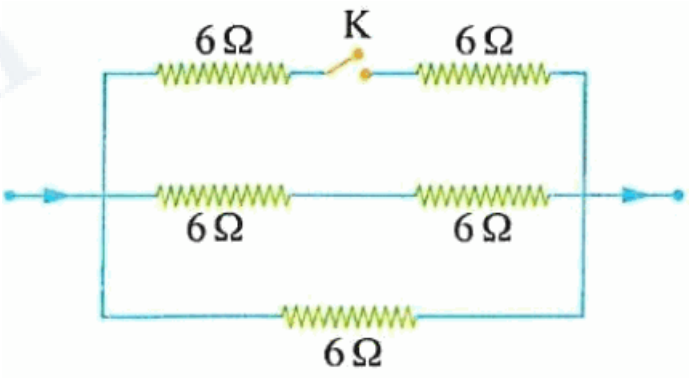
34 Two resistors R_1 and R_2: when connected in parallel, their equivalent resistance is 6 Ω, and when connected in series, their equivalent resistance is 27 Ω. The value of one of the two resistors is .....

(A) 8 Ω (B) 12 Ω (C) 15 Ω (D) 18 Ω

35 A group of n identical electric resistors is connected once in series, giving an equivalent resistance R_1, and once again in parallel, giving an equivalent resistance R_2. The number of resistors (n) equals .....

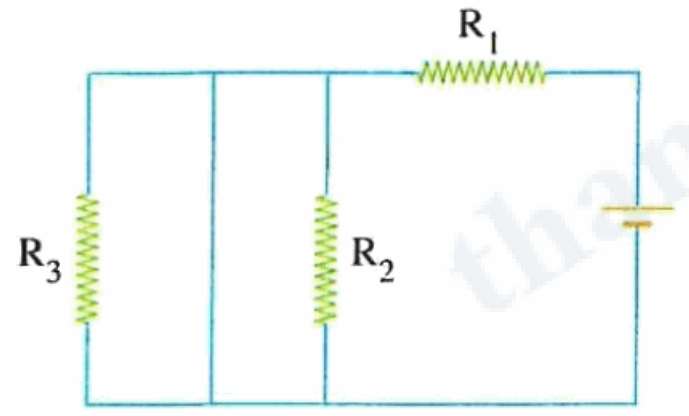
(A) R_1/R_2 (B) $(R_1/R_2)^2$ (C) $\sqrt{(R_1/R_2)}$ (D) $\sqrt{(R_2/R_1)}$

36 In the opposite figure, the difference between the two values of the equivalent resistance of the circuit when switch K is open and when it is closed equals .....



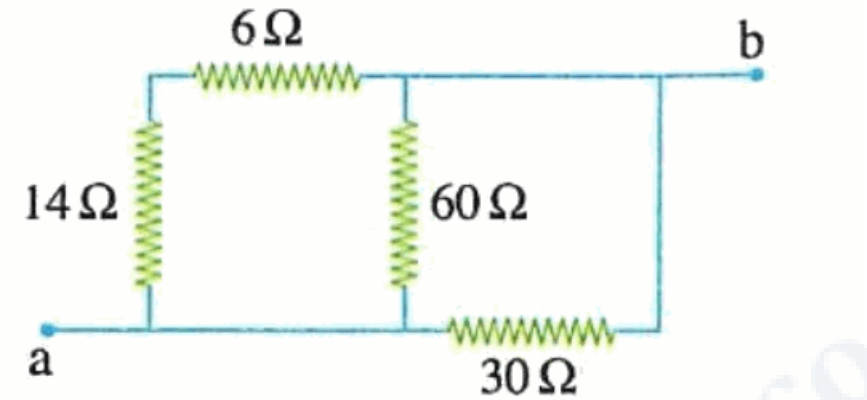
(A) 1 Ω (B) 2 Ω (C) 4 Ω (D) 6 Ω

37 In the opposite circuit, which resistors carry an electric current?



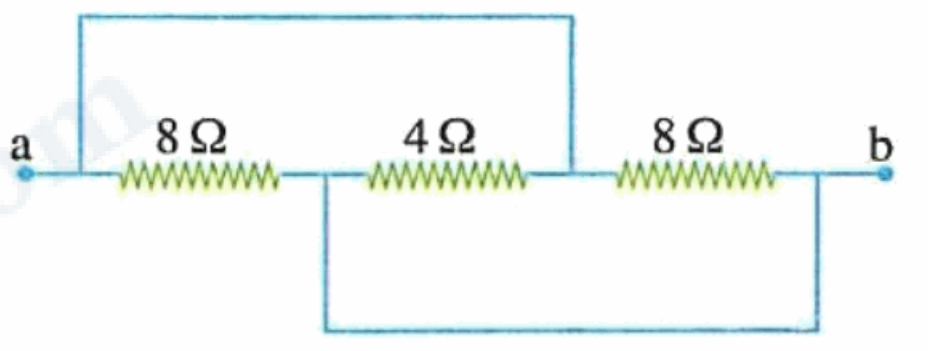
(A) R_1 only (B) R_1, R_2 (C) R_1, R_3 (D) R_1, R_2, R_3

38 In the opposite figure, the equivalent resistance between points a and b is .....



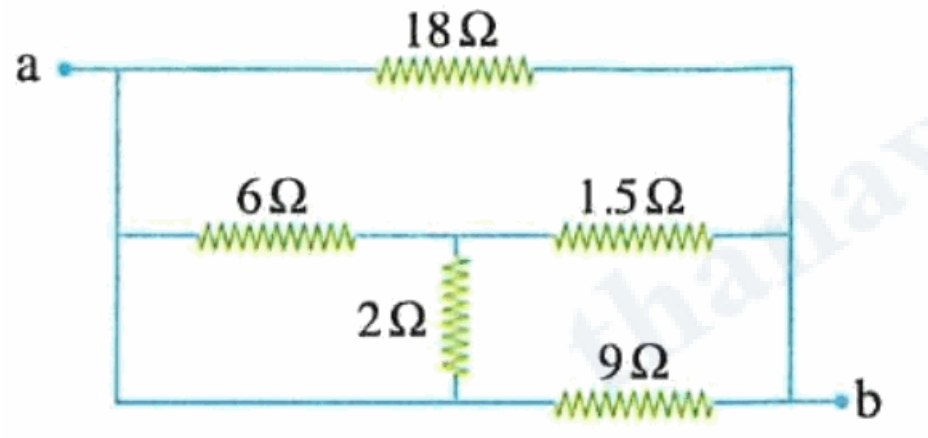
(A) 5 Ω (B) 10 Ω (C) 30 Ω (D) 60 Ω

39 In the opposite figure, the equivalent resistance between points a and b is .....



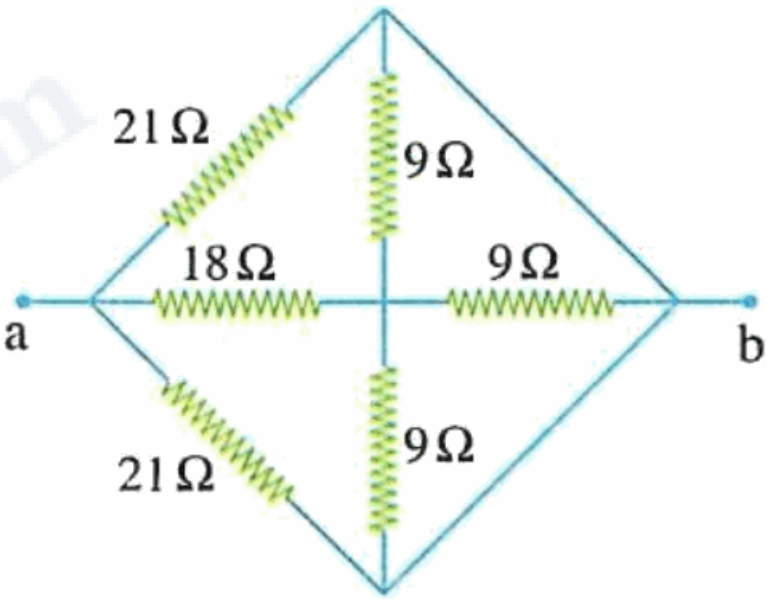
(A) 1 Ω (B) 2 Ω (C) 3 Ω (D) 4 Ω

40 In the opposite figure, the equivalent resistance between points a and b is .....



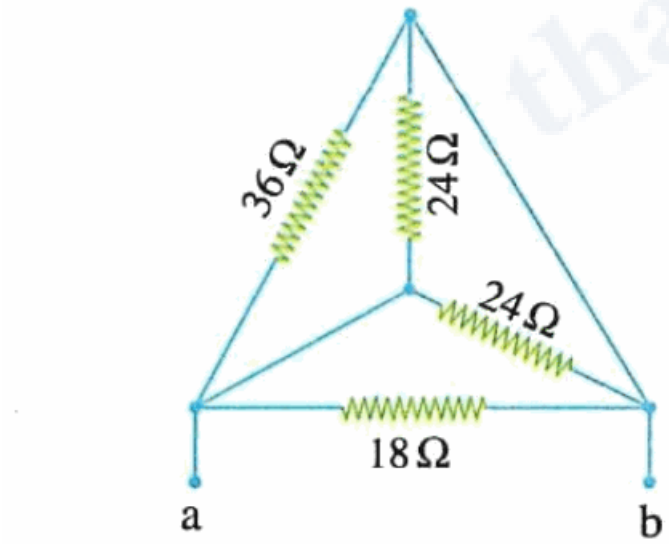
(A) 9 Ω (B) 6 Ω (C) 3 Ω (D) 2 Ω

41 In the opposite figure, the equivalent resistance between points a and b is .....



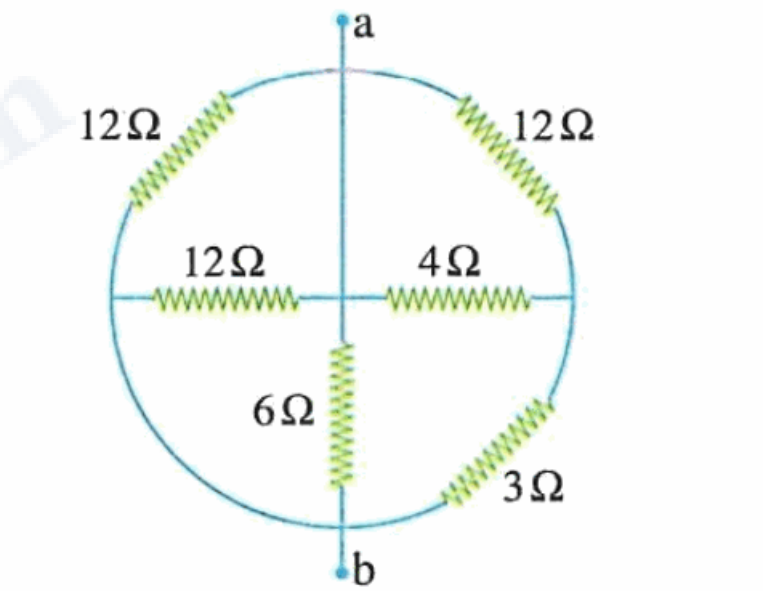
(A) 3 Ω (B) 7 Ω (C) 9 Ω (D) 11 Ω

42 In the opposite figure, the equivalent resistance between points a and b is .....



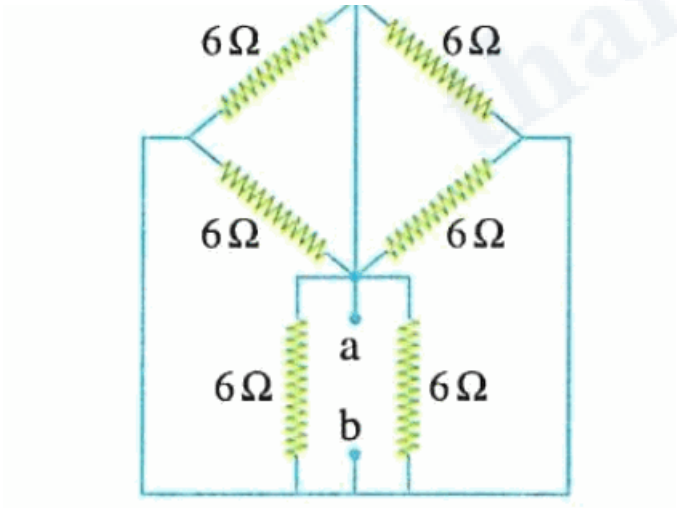
(A) 3 Ω (B) 5 Ω (C) 6 Ω (D) 8 Ω

43 In the opposite figure, the equivalent resistance between points a and b is .....



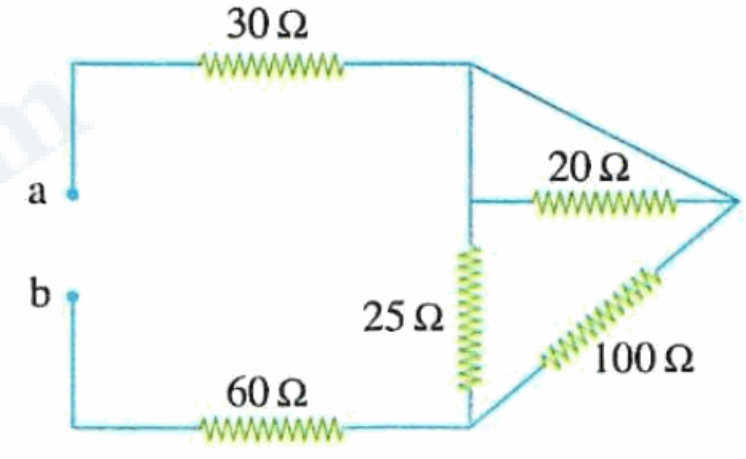
(A) 1 Ω (B) 1.5 Ω (C) 2 Ω (D) 2.5 Ω

44 In the opposite figure, the equivalent resistance between points a and b is .....



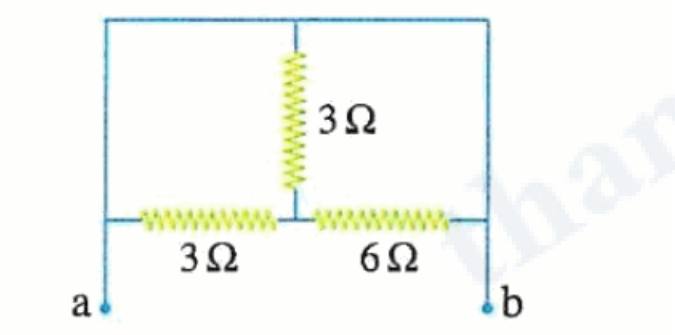
(A) 1 Ω (B) 3 Ω (C) 6 Ω (D) 12 Ω

45 In the opposite figure, the equivalent resistance between points a and b is .....



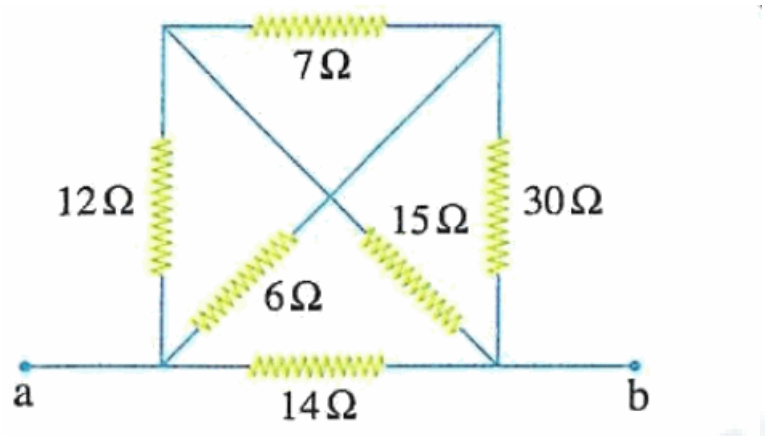
(A) 45 Ω (B) 72 Ω (C) 90 Ω (D) 110 Ω

46 In the opposite figure, the equivalent resistance between points a and b is .....



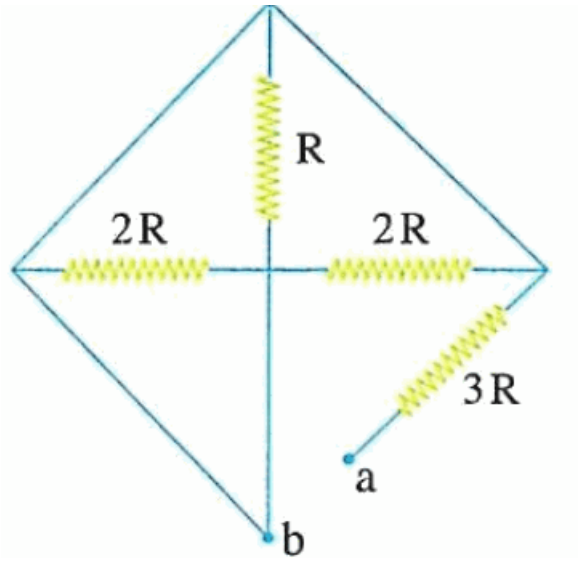
(A) 0 (B) 1 Ω (C) 2 Ω (D) 5 Ω

47 In the opposite figure, the equivalent resistance between points a and b is .....



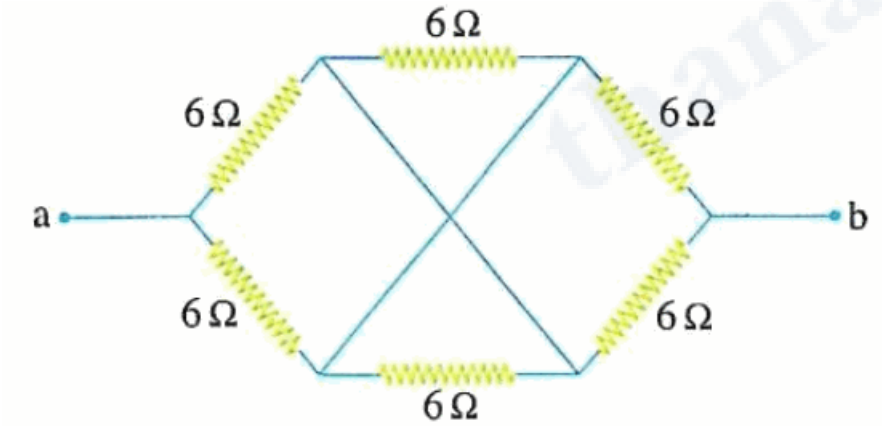
(A) 4 Ω (B) 7 Ω (C) 14 Ω (D) 15 Ω

48 In the opposite figure, the equivalent resistance between points a and b is .....



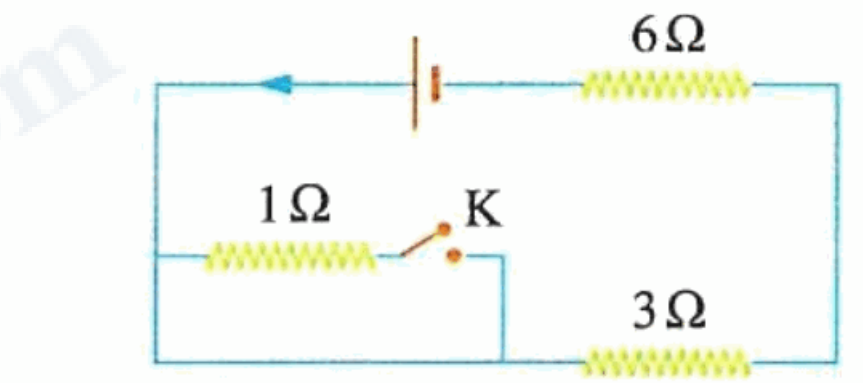
(A) R (B) 2R (C) 3R (D) 6R

49 In the opposite figure, the equivalent resistance between points a and b is .....



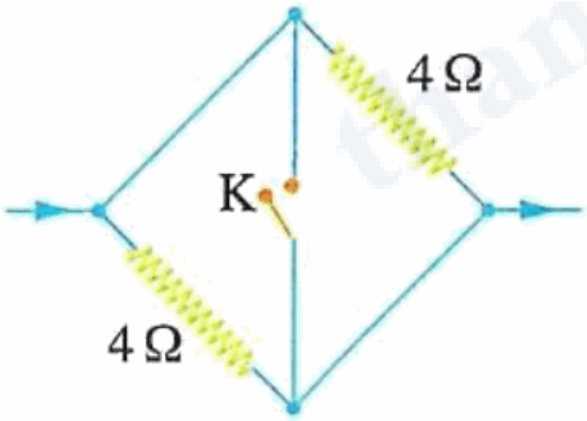
(A) 18 Ω (B) 12 Ω (C) 9 Ω (D) 6 Ω

50 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



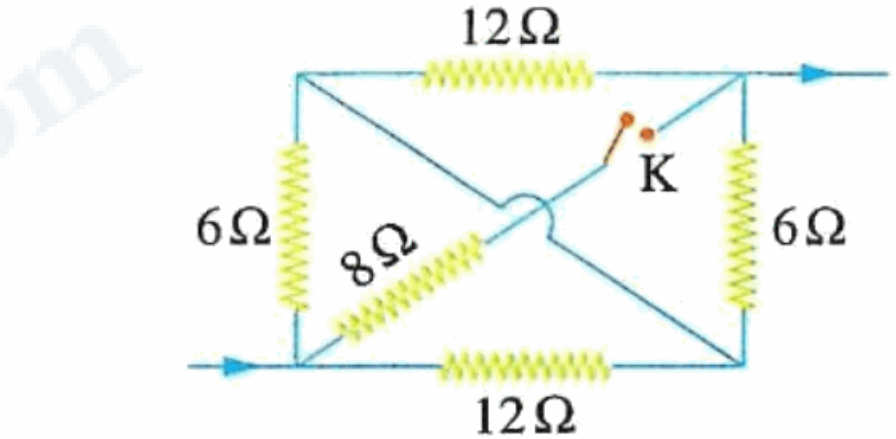
(A) K open: 9 Ω, K closed: 10 Ω
(B) K open: 9 Ω, K closed: 9 Ω
(C) K open: 6 Ω, K closed: 3 Ω
(D) K open: 6 Ω, K closed: 6 Ω

51 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



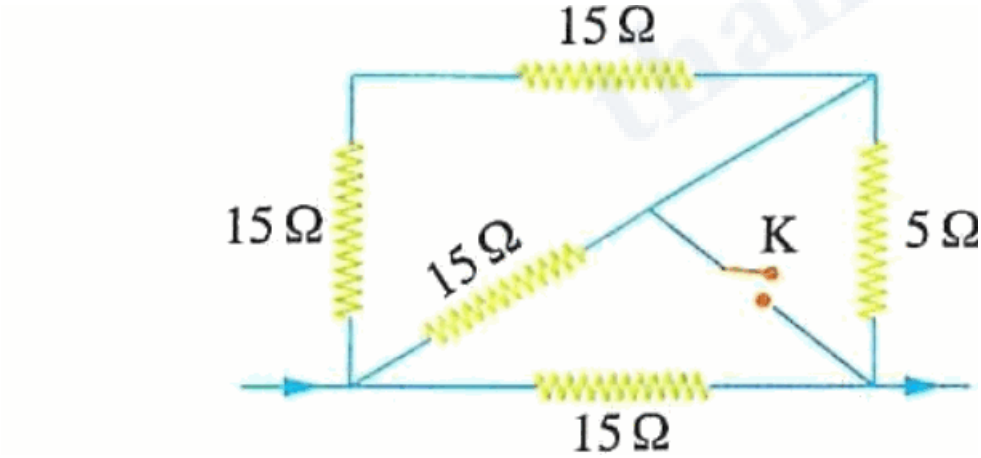
(A) K open: 0, K closed: 2 Ω
(B) K open: 2 Ω, K closed: 0
(C) K open: 8 Ω, K closed: 0
(D) K open: 4 Ω, K closed: 0

52 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



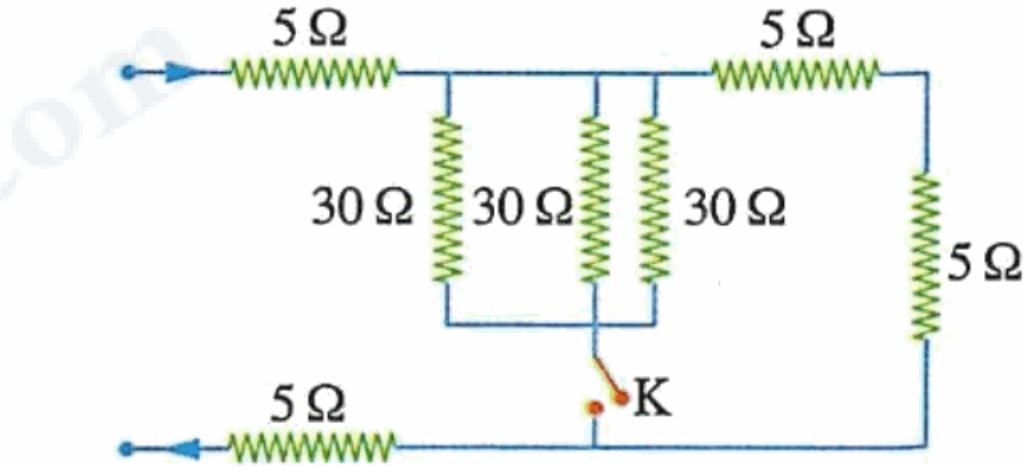
(A) K open: 8 Ω, K closed: 2 Ω
(B) K open: 9 Ω, K closed: 4 Ω
(C) K open: 8 Ω, K closed: 4 Ω
(D) K open: 36 Ω, K closed: 6 Ω

53 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



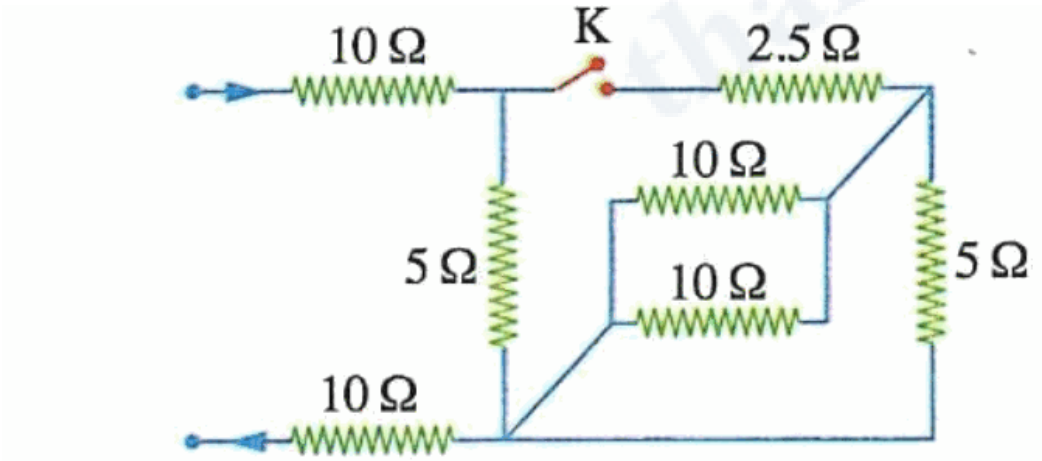
(A) K open: 7.5 Ω, K closed: 6 Ω
(B) K open: 3 Ω, K closed: 6 Ω
(C) K open: 15 Ω, K closed: 7.5 Ω
(D) K open: 7.5 Ω, K closed: 3.5 Ω

54 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



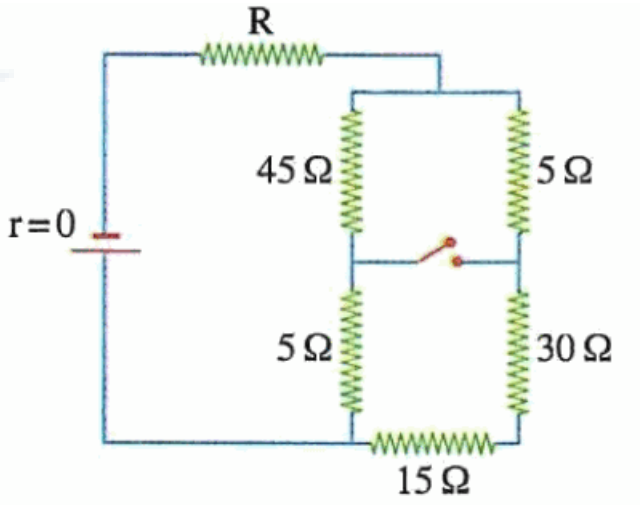
(A) K open: 20 Ω, K closed: 10 Ω
(B) K open: 20 Ω, K closed: 15 Ω
(C) K open: 15 Ω, K closed: 20 Ω
(D) K open: 10 Ω, K closed: 20 Ω

55 In the opposite circuit, the equivalent resistance when switch K is open and when it is closed, respectively, is .....



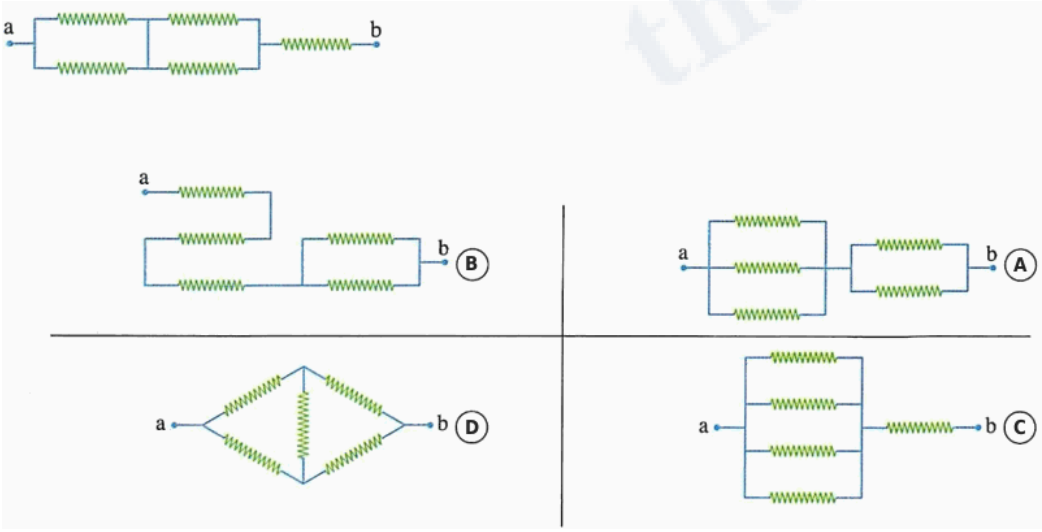
(A) K open: 10 Ω, K closed: 22.5 Ω
(B) K open: 25 Ω, K closed: 22.5 Ω
(C) K open: 25 Ω, K closed: 7.5 Ω
(D) K open: 30 Ω, K closed: 15 Ω

56 In the opposite circuit, when the switch is closed, the equivalent resistance of the circuit decreases to half its value. The value of resistance R equals .....

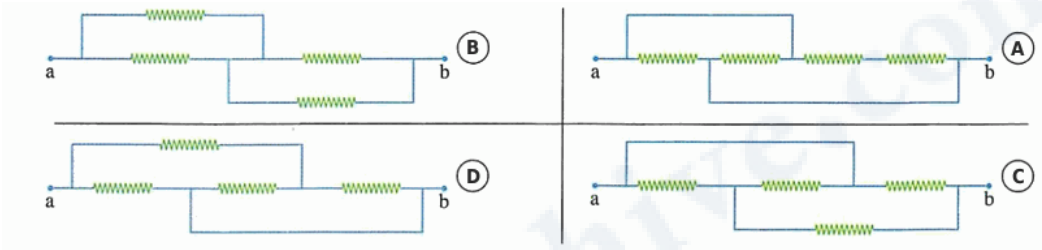


(A) 3 Ω (B) 5 Ω (C) 7 Ω (D) 11 Ω

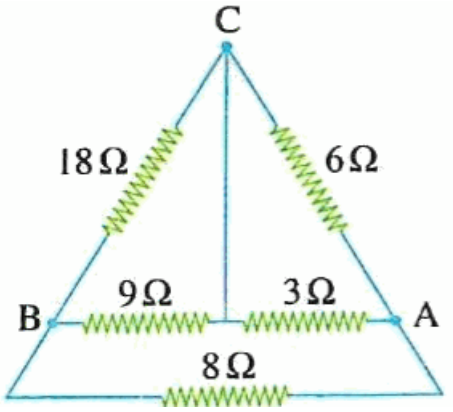
57 Five identical resistors are connected together as in the opposite figure, and their equivalent resistance is R_o. If the five resistors are reconnected in several ways, which of the ways of connection in the following figures makes the equivalent resistance of the group $1/2\ R_o$?



58 Four identical resistors are connected in different ways as in the following figures. In which of these figures is the equivalent resistance between points a and b the greatest?

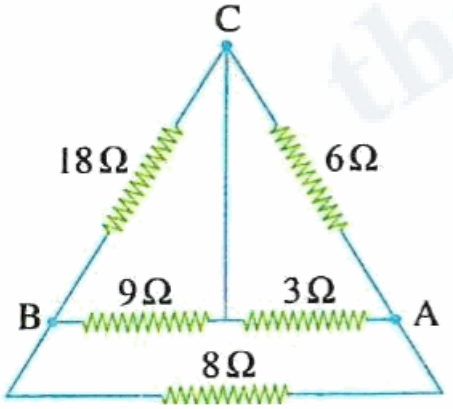


59 The equivalent resistance of the group of resistors shown in the opposite figure when an electric source is connected:
to points A and B equals .....



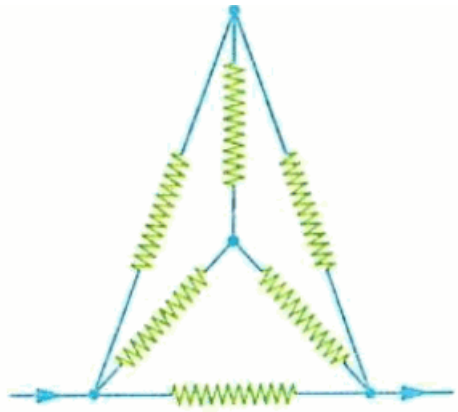
(A) 2 Ω (B) 4 Ω (C) 6 Ω (D) 8 Ω

60 The equivalent resistance of the group of resistors shown in the opposite figure when an electric source is connected:
to points B and C equals .....



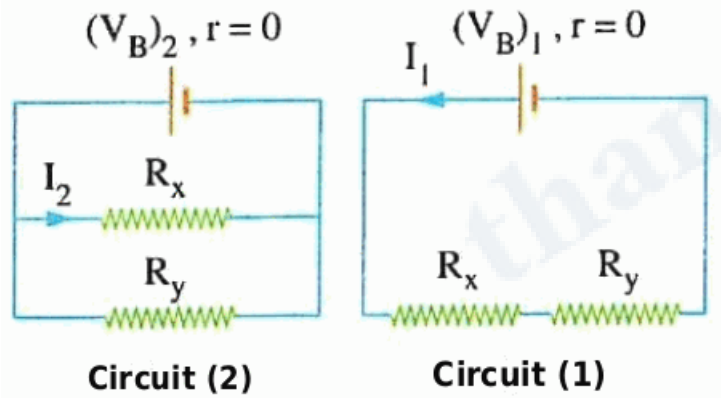
(A) 3.75 Ω (B) 6 Ω (C) 7.5 Ω (D) 10 Ω

61 In the opposite figure, if each resistance = R, the equivalent resistance of the group = ...



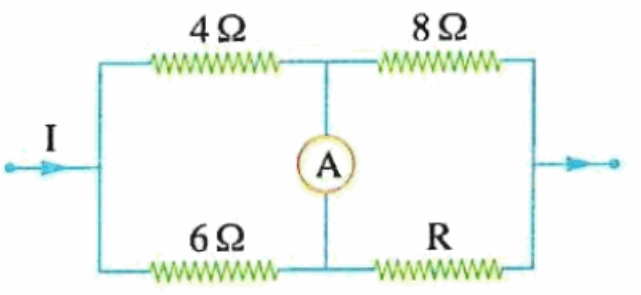
(A) 6R (B) 3R (C) $R/2$ (D) $R/6$

62 In the two opposite electric circuits, the currents I_1 and I_2 are equal. The ratio between the emfs of the two batteries $(((V_B)_1)/((V_B)_2))$ equals .....



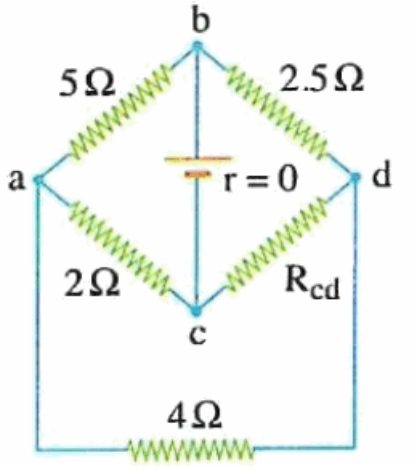
(A) R_y/R_x (B) R_x/R_y (C) $(R_x + R_y)/R_y$ (D) $(R_x + R_y)/R_x$

63 The opposite figure represents part of an electric circuit. If the ammeter reading is zero, the value of resistance R equals .....



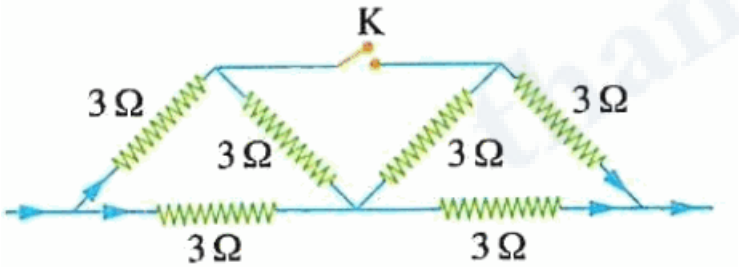
(A) 8 Ω (B) 9 Ω (C) 12 Ω (D) 24 Ω

64 In the opposite electric circuit, what is the value of resistance R_{cd} if the potential difference across the 4 Ω resistor is zero?



(A) 0.5 Ω (B) 1 Ω (C) 2 Ω (D) 4 Ω

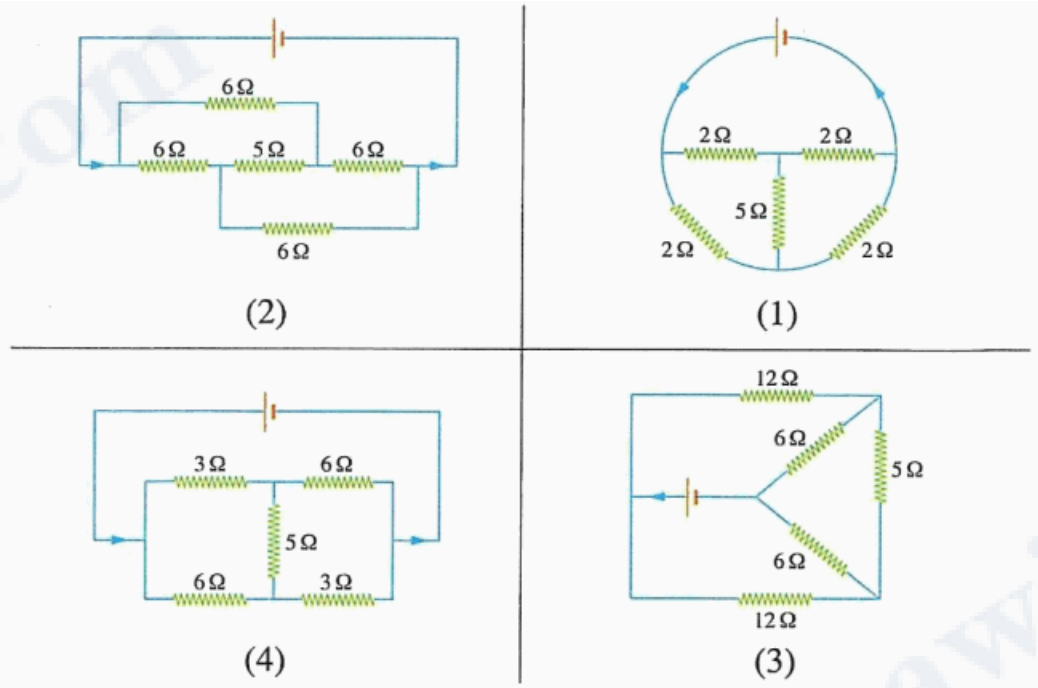
65 In the opposite figure, the ratio between the two values of the equivalent resistance when switch K is open and when it is closed, respectively, equals .....



(A) *1/3* (B) *1/2* (C) *4/3* (D) *5/2*

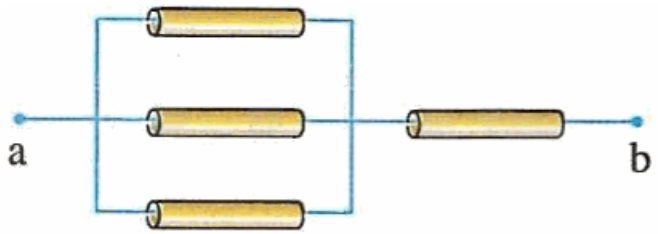
66 The following figures represent four electric circuits.

The circuits in which no electric current flows in the 5 Ω resistor are .....



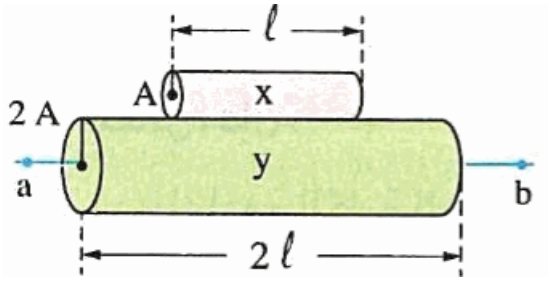
(A) (1), (2) only
(B) (3), (4) only
(C) (1), (2), (3) only
(D) (2), (3), (4) only

67 A metal wire of uniform cross-section and electric resistance (R) is divided into four identical parts, and these parts are connected together as in the opposite figure. The equivalent resistance of the group between points (a) and (b) equals .....



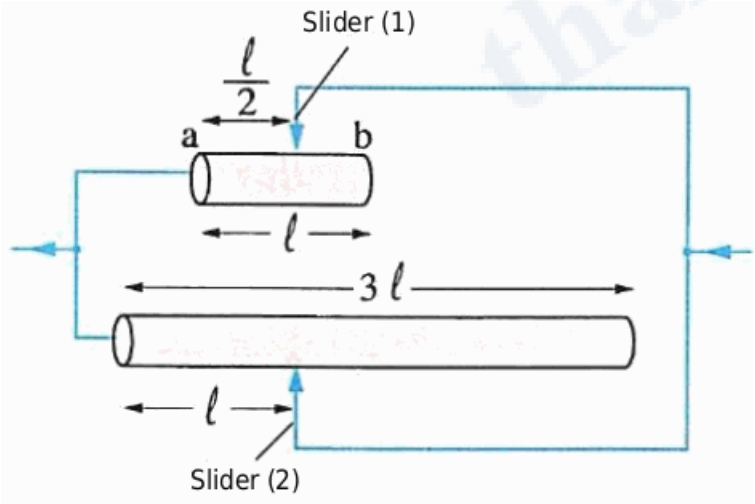
(A) *R/12*
(B) *R/6*
(C) *R/4*
(D) *R/3*

68 Two uninsulated conductors x and y of uniform cross-section have lengths ℓ and 2ℓ, cross-sectional areas A and 2A, and electric conductivities of their materials 8σ and σ, respectively. They are placed in full contact as in the opposite figure. If the electric resistance of conductor x is 5 Ω, their equivalent resistance when an electric source is connected between points a and b equals .....



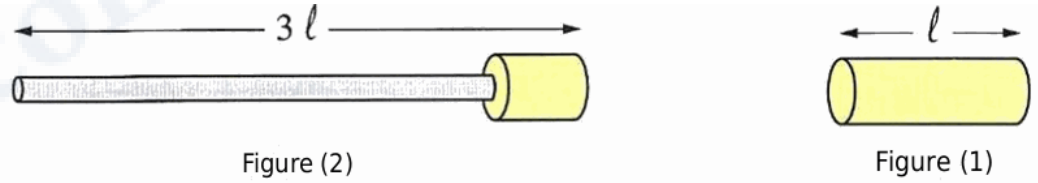
(A) 7.5 Ω (B) 14 Ω (C) 20 Ω (D) 24 Ω

69 Two conductors of uniform cross-section, made of the same material and having the same cross-sectional area, are connected together by two sliders (1) and (2) and included in an electric circuit as shown in the opposite figure; their equivalent resistance is R. When slider (1) is moved to position (b), their equivalent resistance becomes .....



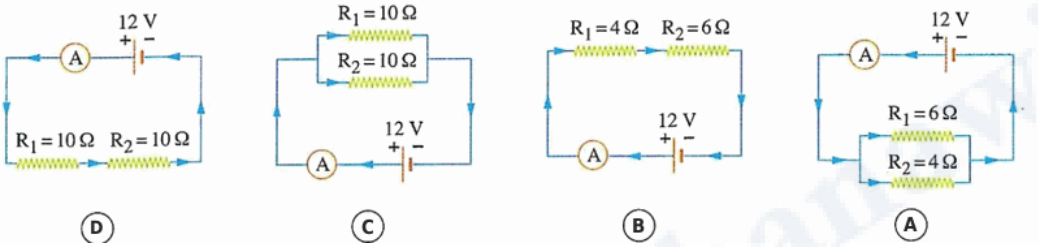
(A) *R/2* (B) *2/3* R (C) *3/2* R (D) 2R

70 In figure (1), a wire of uniform cross-section has length (ℓ) and resistance (R). It is cut into two halves, one of the halves is stretched, then the two are connected together again so that the length of the whole wire becomes (3ℓ) as in figure (2).
The total resistance of the wire in figure (2) equals .....

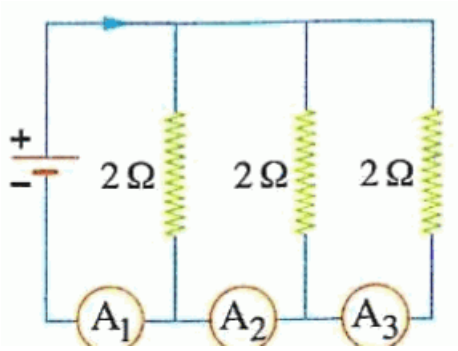


(A) 12.5 R (B) 13 R (C) 25 R (D) 25.5 R

71 In which of the following electric circuits is the current in one of the two resistors different from that in the other resistor?

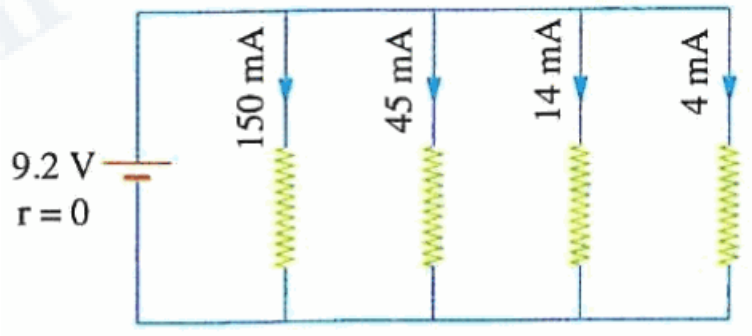


72 In the electric circuit shown, if the reading of ammeter A_1 is 1.2 A, the reading of ammeter A_2 equals .....



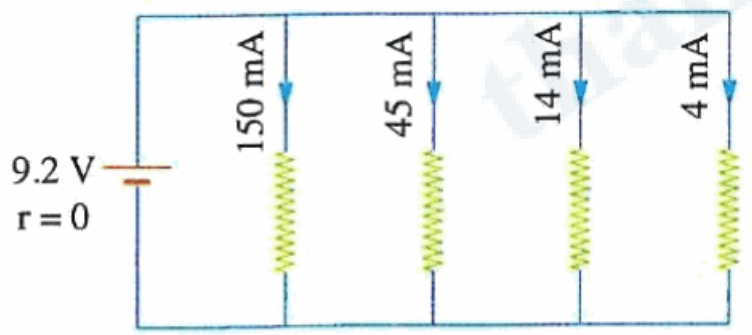
(A) 0.2 A (B) 0.4 A (C) 0.6 A (D) 0.8 A

73 Four resistors are connected in parallel to a battery of emf 9.2 V, and the currents through them are 4 mA, 14 mA, 45 mA and 150 mA as shown in the opposite figure. Then:
the total resistance of the circuit equals .....



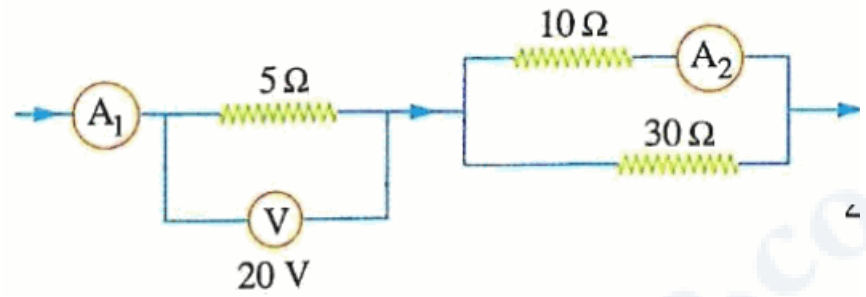
(A) 9.71 Ω (B) 13.35 Ω (C) 29.53 Ω (D) 43.19 Ω

74 Four resistors are connected in parallel to a battery of emf 9.2 V, and the currents through them are 4 mA, 14 mA, 45 mA and 150 mA as shown in the opposite figure. Then:
the total current through the battery if the largest resistor is replaced by another of double its value equals .....



(A) 105.5 mA (B) 211 mA (C) 422 mA (D) 633 mA

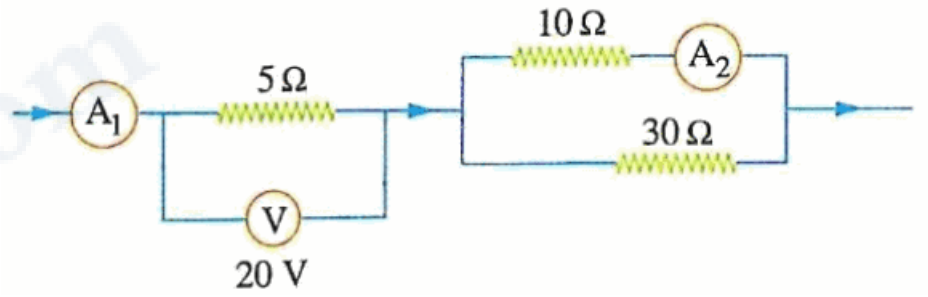
75 In the figure shown:
the reading of ammeter A_1 equals .....



(A) 2 A (B) 4 A (C) 6 A (D) 8 A

76 In the figure shown:

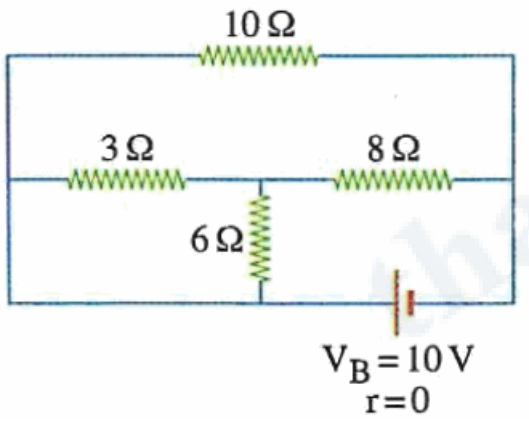
the reading of ammeter A_2 equals .....



(A) 1 A (B) 2 A (C) 3 A (D) 4 A

77 In the circuit shown:

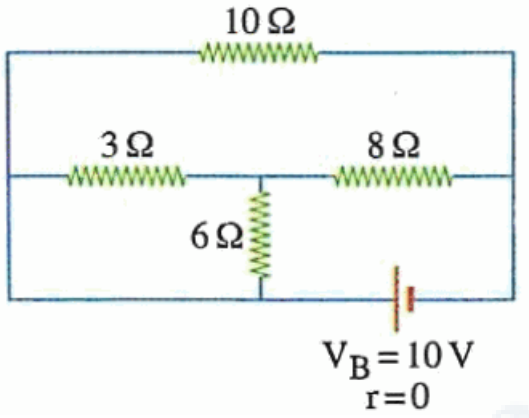
the equivalent resistance of the circuit equals .....



(A) 5 Ω (B) 9 Ω (C) 11 Ω (D) 13 Ω

78 In the circuit shown:

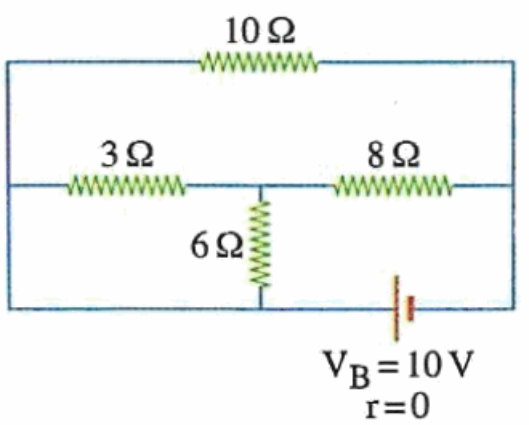
the total current in the circuit equals .....



(A) 0.5 A (B) 2 A (C) 3.5 A (D) 4 A

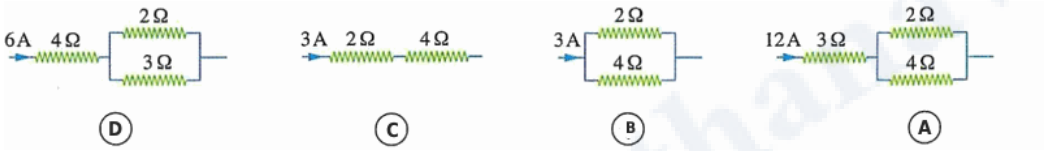
79 In the circuit shown:

the electric current through the 6 Ω resistor equals .....

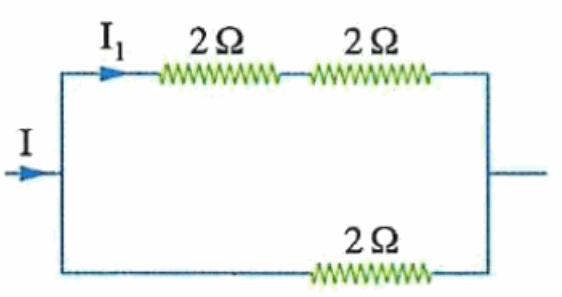


(A) 0.13 A (B) 0.91 A (C) 0.33 A (D) 0.45 A

80 In which of the following figures is the potential difference across the 4 Ω resistor equal to 4 V?

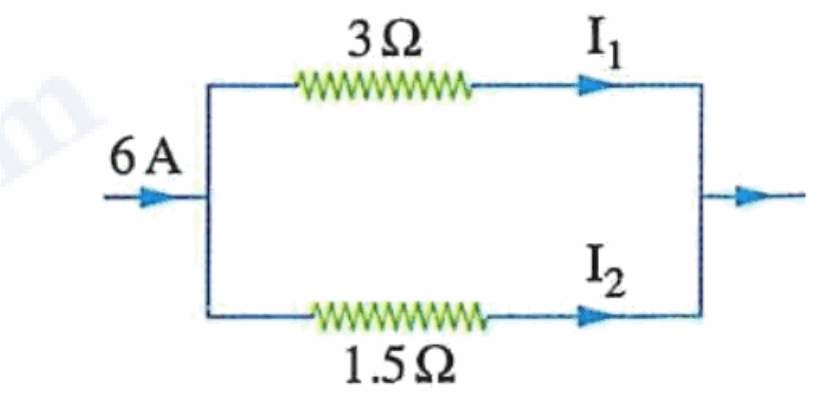


81 In the opposite figure, the ratio (I_1/I) is .....



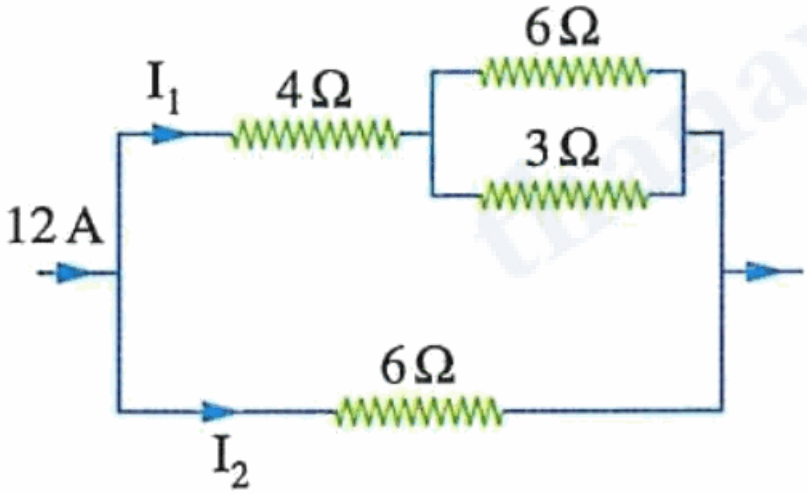
(A) *1/2* (B) *1/3* (C) *1/4* (D) *1/6*

82 In the opposite figure, the currents I_1 and I_2 are .....



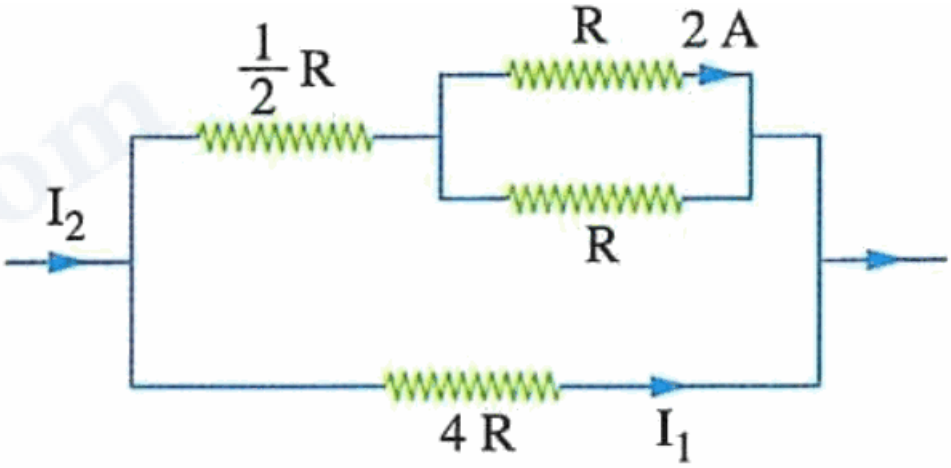
(A) $I_1 = 1$ A, $I_2 = 5$ A
(B) $I_1 = 2$ A, $I_2 = 4$ A
(C) $I_1 = 4$ A, $I_2 = 2$ A
(D) $I_1 = 5$ A, $I_2 = 1$ A

83 In the opposite figure, the currents I_1 and I_2 are .....



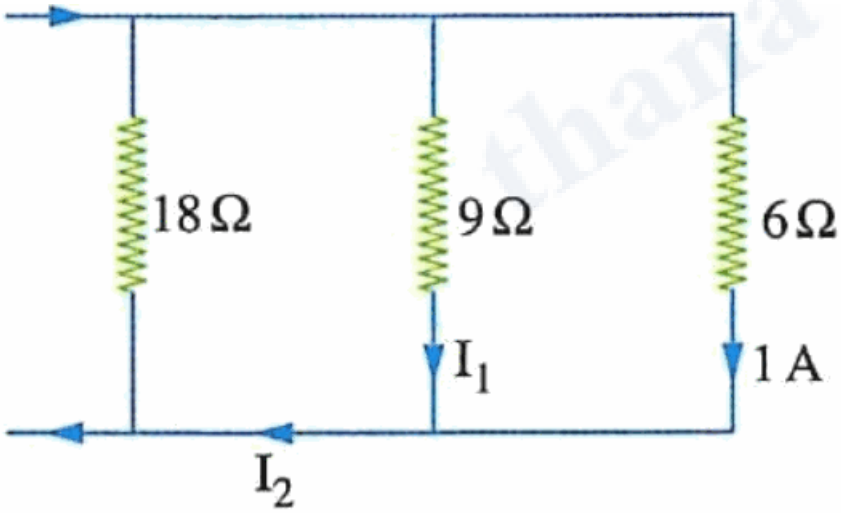
(A) $I_1 = 3$ A, $I_2 = 6$ A
(B) $I_1 = 3$ A, $I_2 = 9$ A
(C) $I_1 = 6$ A, $I_2 = 6$ A
(D) $I_1 = 6$ A, $I_2 = 9$ A

84 In the opposite figure, the currents I_1 and I_2 are .....



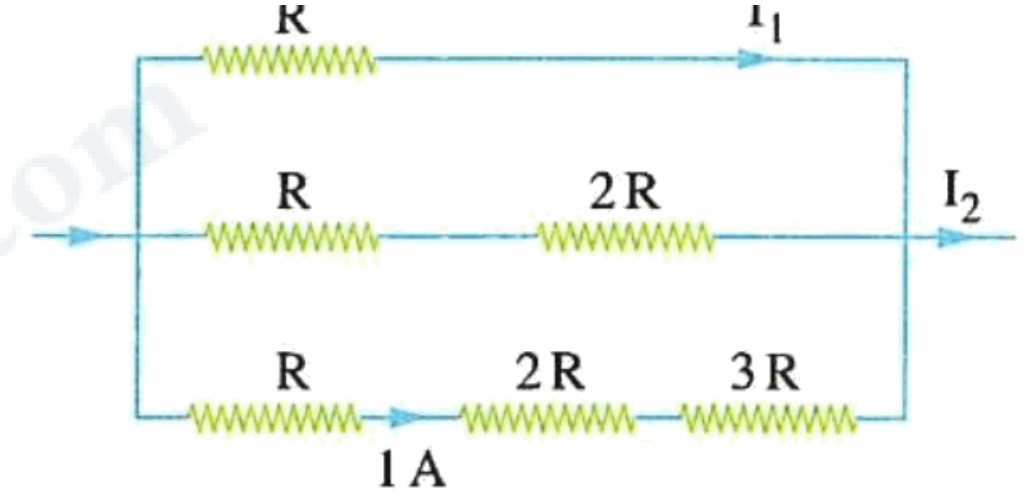
(A) I_1 = 4 A, I_2 = 6 A
(B) I_1 = 4 A, I_2 = 3 A
(C) I_1 = 1 A, I_2 = 4 A
(D) I_1 = 1 A, I_2 = 5 A

85 In the opposite figure, the currents I_1 and I_2 are .....



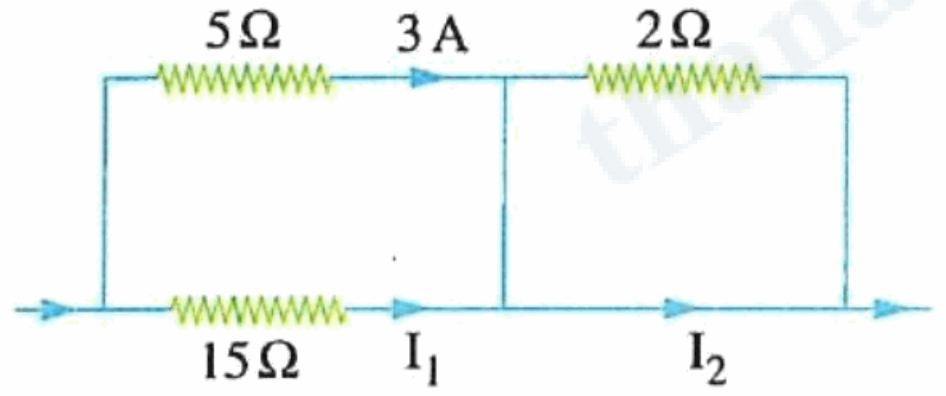
(A) I_1 = *1/2* A, I_2 = *3/2* A
(B) I_1 = *1/2* A, I_2 = *5/3* A
(C) I_1 = *2/3* A, I_2 = *5/3* A
(D) I_1 = *2/3* A, I_2 = *1/2* A

86 In the opposite figure, the currents I_1 and I_2 are .....



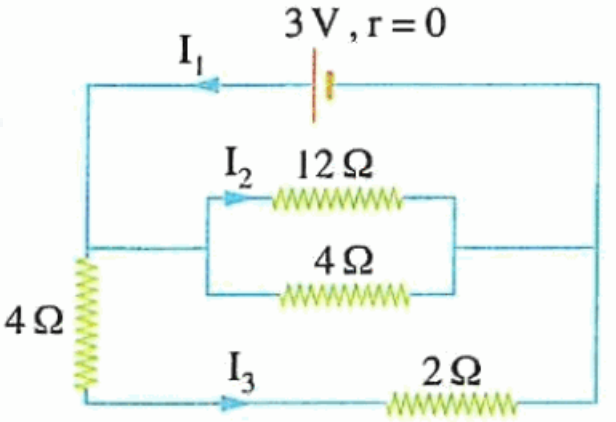
(A) $I_1 = 6$ A, $I_2 = 5$ A
(B) $I_1 = 6$ A, $I_2 = 9$ A
(C) $I_1 = 12$ A, $I_2 = 5$ A
(D) $I_1 = 12$ A, $I_2 = 9$ A

87 In the opposite figure, the currents I_1 and I_2 are .....



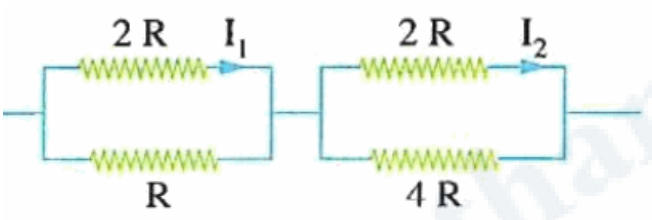
(A) $I_1 = 0.5$ A, $I_2 = 2$ A
(B) $I_1 = 1$ A, $I_2 = 2$ A
(C) $I_1 = 0.5$ A, $I_2 = 4$ A
(D) $I_1 = 1$ A, $I_2 = 4$ A

88 In the opposite electric circuit, the ratio (I_2/I_3) is .....



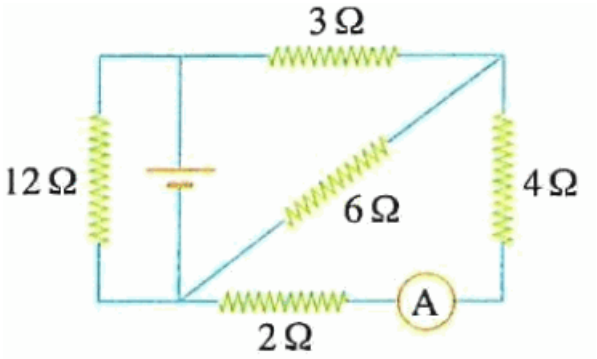
(A) *1/4* (B) *1/3* (C) *1/2* (D) *3/4*

89 The opposite figure represents part of an electric circuit. The ratio between the two currents (I_1/I_2) equals .....



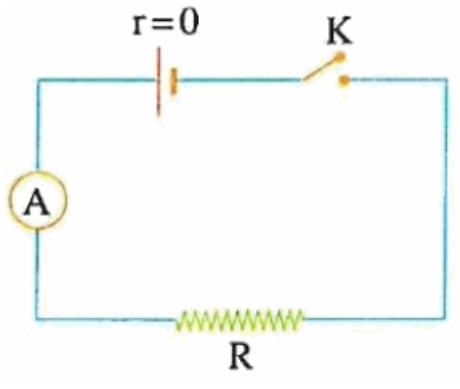
(A) *1/1* (B) *2/1* (C) *1/2* (D) *1/4*

90 In the opposite figure, if the ammeter reading is 1 A, the current through the 12 Ω resistor equals .....



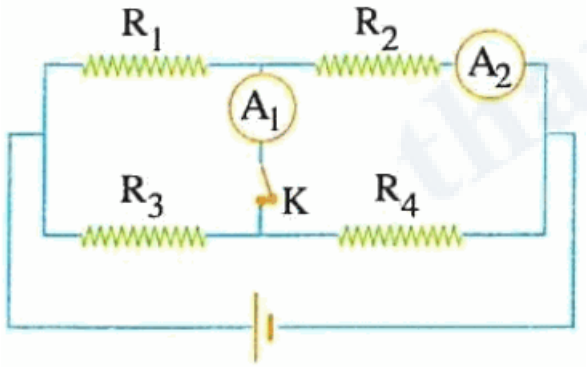
(A) 0.5 A (B) 1 A (C) 1.5 A (D) 2 A

91 The opposite figure shows a simple electric circuit. When switch K is closed, the ammeter reading is 5 A. When a 2 Ω resistor is connected in series with resistor R in the circuit, the ammeter reading decreases to 4 A. The value of resistance R is .....



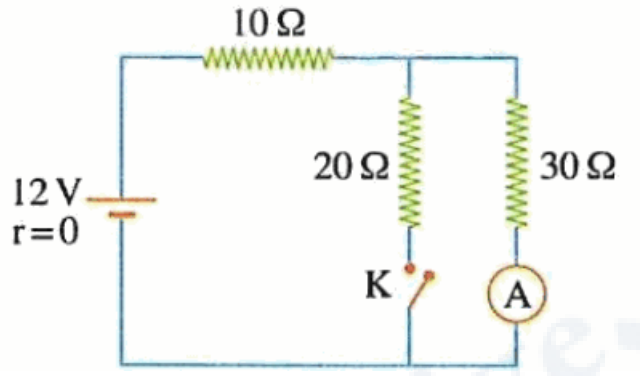
(A) 4 Ω (B) 8 Ω (C) 12 Ω (D) 16 Ω

92 In the opposite circuit, if the reading of ammeter A_1 is zero, then when switch K is opened, the reading of ammeter A_2 .....



(A) increases (B) decreases (C) does not change (D) becomes zero

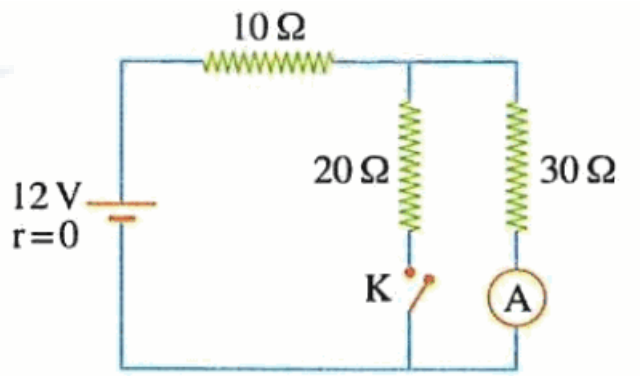
93 In the opposite circuit:
what is the ammeter reading when switch K is open?



(A) 0.21 A (B) 0.3 A (C) 0.43 A (D) 1.6 A

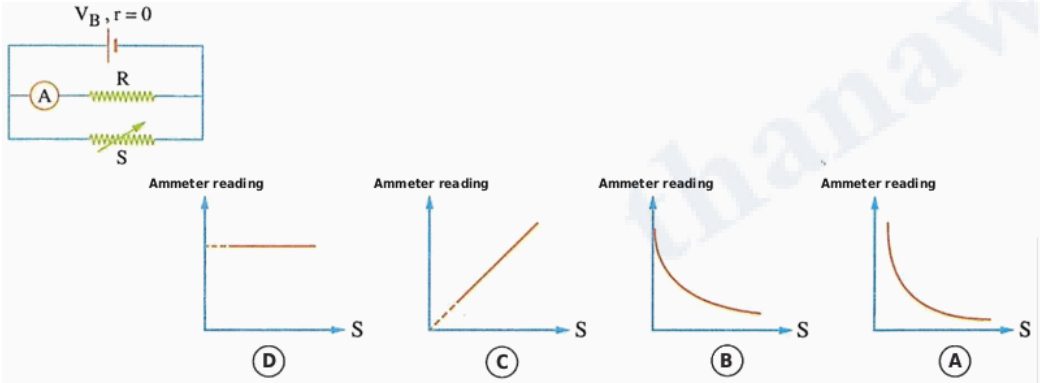
94 In the opposite circuit:

what is the ammeter reading when switch K is closed?



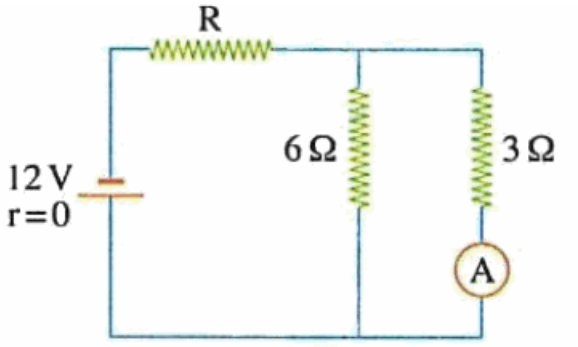
(A) 5.4 A (B) 1.52 A (C) 0.34 A (D) 0.22 A

95 Which of the following graphs represents the relation between the ammeter reading and the value of the rheostat S?



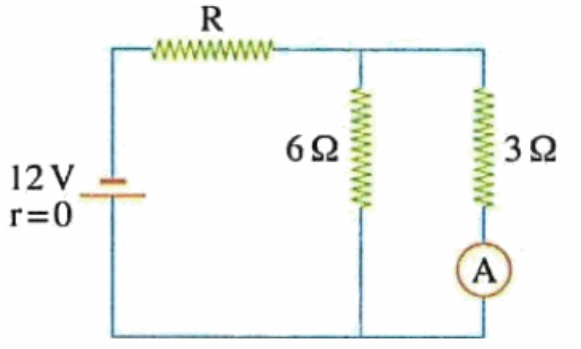
96 If the ammeter reading in the opposite circuit is 2 A, then:

the current in the circuit equals .....



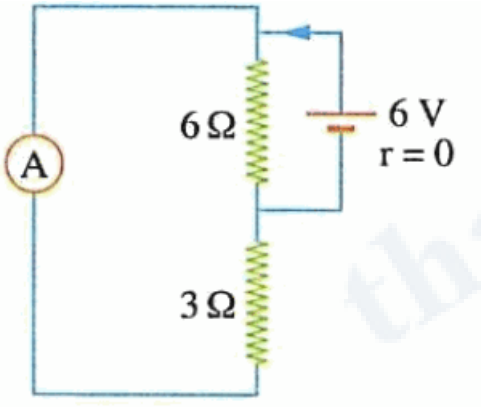
(A) 6 A (B) 9 A (C) 5 A (D) 3 A

97 If the ammeter reading in the opposite circuit is 2 A, then:
the value of resistance R equals .....



(A) 4 Ω (B) 2 Ω (C) 1 Ω (D) 0.5 Ω

98 In the electric circuit shown, the reading of ammeter (A) equals .....

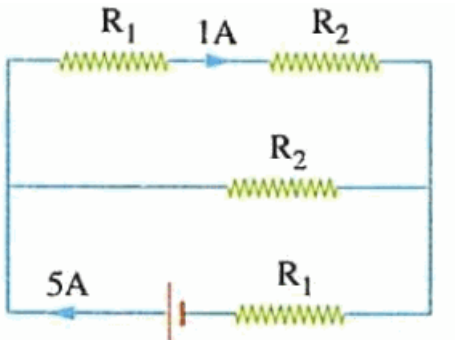


(A) 1 A (B) 2 A (C) 3 A (D) 4 A

99 Three resistors of 6 Ω, 3 Ω and 1 Ω are connected to an electric source, and the currents through them are 0.1 A, 0.2 A and 0.3 A, respectively. The equivalent resistance of the electric circuit equals .....

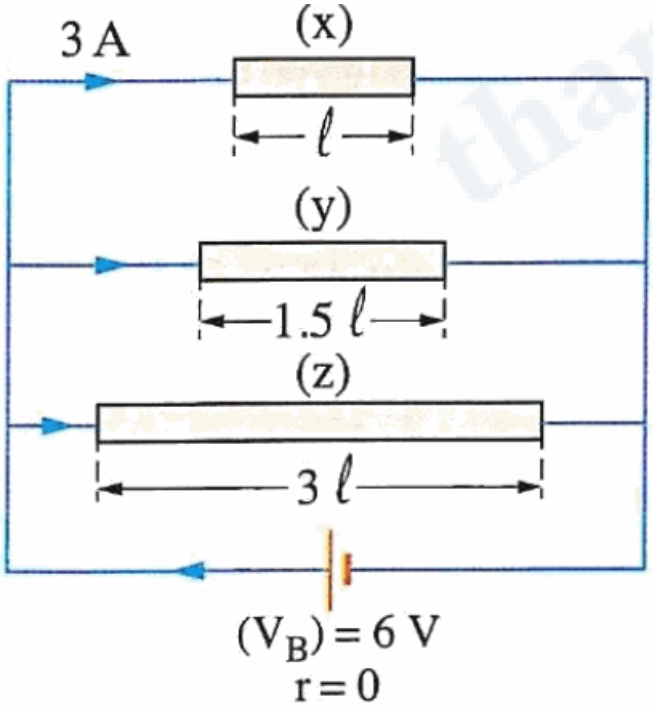
(A) 1 Ω (B) 2 Ω (C) 3 Ω (D) 4 Ω

100 In the opposite circuit, the ratio (R_1/R_2) is .....



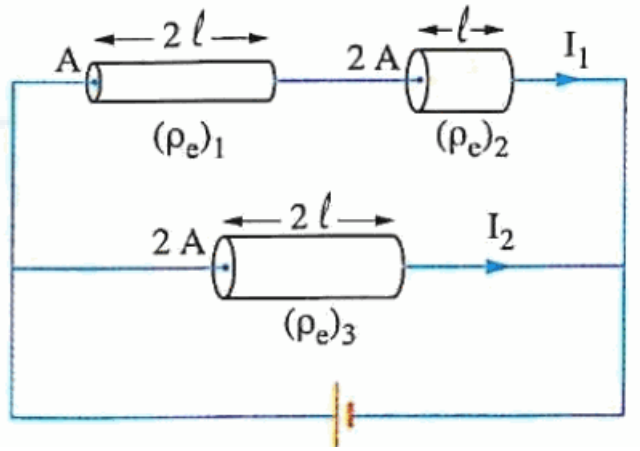
(A) 3/2 (B) 3/1 (C) 4/1 (D) 4/3

101 Three conductors (x), (y), (z) of the same metal and the same cross-sectional area but of different lengths are connected together in parallel, then to a battery of emf 6 V and negligible internal resistance as in the opposite circuit. If the current in conductor (x) is 3 A, the current in the circuit when the conductors are connected together in series to the same battery equals .....



(A) 2/11 A (B) 3/11 A (C) 6/11 A (D) 9/11 A

102 In the opposite electric circuit, if $I_1 = I_2$, then .....



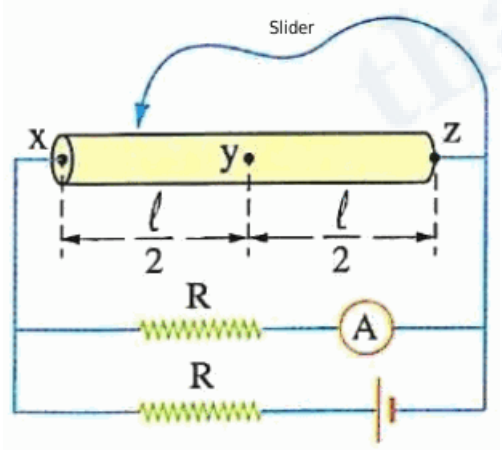
(A) $(\rho_e)_3 = (\rho_e)_1 + (\rho_e)_2$

(B) $(\rho_e)_3 = (\rho_e)_1 + 2(\rho_e)_2$

(C) $(\rho_e)_3 = 2(\rho_e)_1 + ((\rho_e)_2)/2$

(D) $(\rho_e)_3 = \sqrt{((\rho_e)_1 + (\rho_e)_2)}$

103 A metal rod (xyz) of uniform cross-section, length ℓ and electric resistance R is connected in an electric circuit as in the opposite figure. At which of the positions shown on the rod should the slider be placed so that the ammeter gives the greatest possible reading?



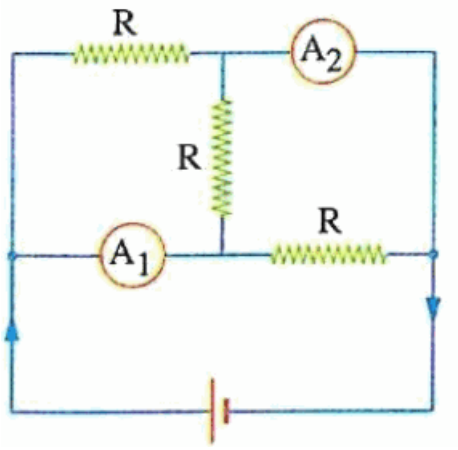
(A) At position (x)

(B) At position (y)

(C) At position (z)

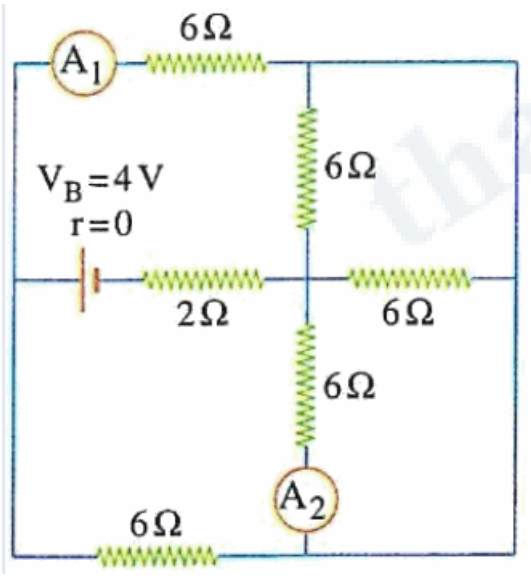
(D) The ammeter readings are equal at the three positions

104 In the circuit shown, the ratio between the readings of the two ammeters (A_1/A_2) is .....



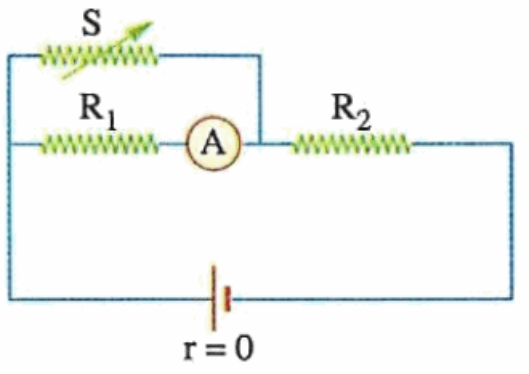
(A) 1/2 (B) 2/3 (C) 1/1 (D) 3/2

105 The ratio between the readings of the two ammeters (A_1/A_2) in the opposite electric circuit equals .....



(A) 1/1 (B) 2/1 (C) 3/1 (D) 3/2

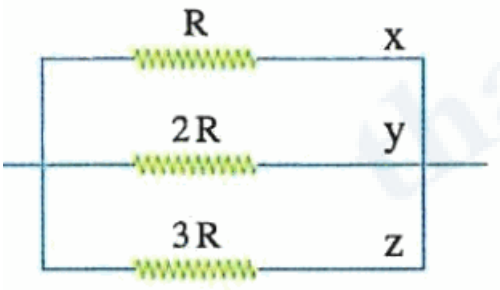
106 In the opposite circuit, when the value of the rheostat S is increased, the ammeter reading .....



(A) increases
(B) becomes zero
(C) does not change
(D) decreases but does not become zero

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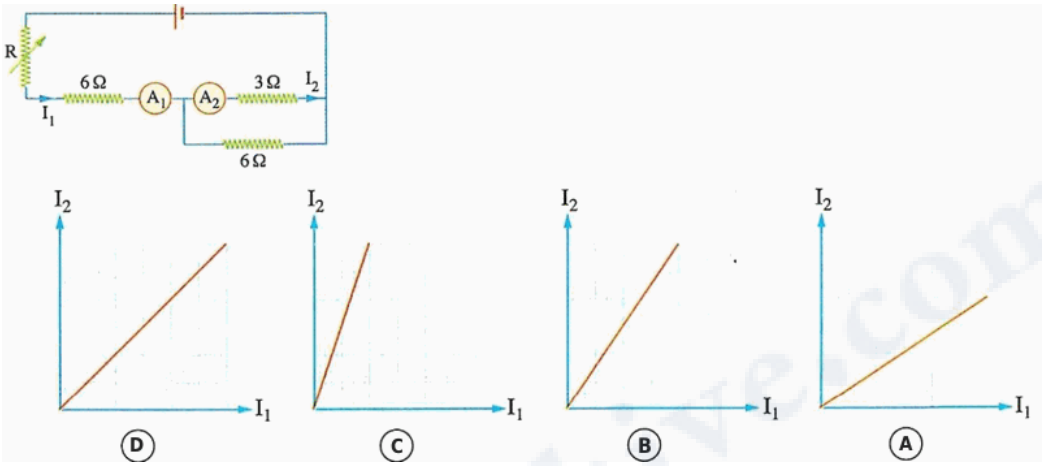
107 The opposite figure shows three resistors x, y, z connected together in parallel. The ratio of the currents through them $I_x : I_y : I_z$ is .....



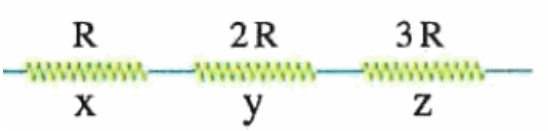
(A) 6 : 3 : 2
(B) 3 : 2 : 1
(C) 2 : 3 : 1
(D) 2 : 3 : 6

---

108 Which of the following graphs represents the relation between the reading of ammeter A_1 and the reading of ammeter A_2 when the value of resistance R in the opposite electric circuit is changed? (Note: I_1 and I_2 are drawn to the same scale)

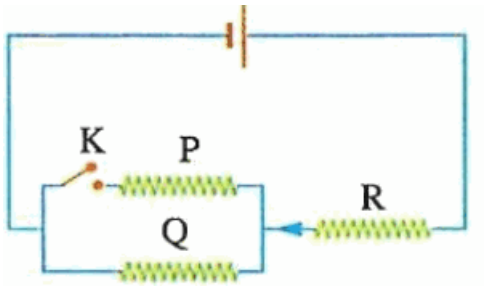


109 The opposite figure shows three resistors x, y, z connected together in series. The ratio of the potential differences across them $V_x : V_y : V_z$ equals .....



(A) 3 : 2 : 1 (B) 2 : 3 : 1 (C) 1 : 1 : 1 (D) 1 : 2 : 3

110 In the opposite electric circuit, three identical resistors are connected to an electric source. When switch K is closed .....



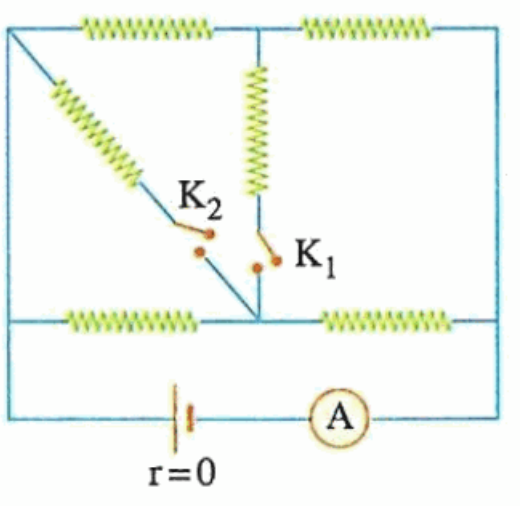
(A) the current in R decreases and the current in Q increases

(B) the current in R decreases and the current in Q decreases

(C) the current in R increases and the current in Q decreases

(D) the current in R increases and the current in Q increases

111 In the opposite electric circuit, if the electric resistors are identical, what happens to the ammeter reading when only switch K_1 is closed, and when only switch K_2 is closed?



(A) Closing K_1 only: decreases, closing K_2 only: increases

(B) Closing K_1 only: decreases, closing K_2 only: does not change

(C) Closing K_1 only: does not change, closing K_2 only: increases

(D) Closing K_1 only: does not change, closing K_2 only: does not change

---

112 A current of 3 mA flows in a wire ab. If another wire of the same material, the same length and three times the diameter of wire ab is connected in parallel with it, the total current that must flow so that the potential difference across wire ab stays constant is .....

(A) 0.02 A (B) 0.1 A (C) 0.03 A (D) 0.5 A

---

113 Two wires A and B have the same length and are made of the same material. The cross-sectional area of wire A is double that of wire B. They are connected together in parallel in an electric circuit, and when the circuit is closed the current in the circuit is 3 A. The currents through them I_A and I_B, respectively, are .....

(A) I_A = 2 A, I_B = 1 A

(B) I_A = 2 A, I_B = 3 A

(C) I_A = 3 A, I_B = 3 A

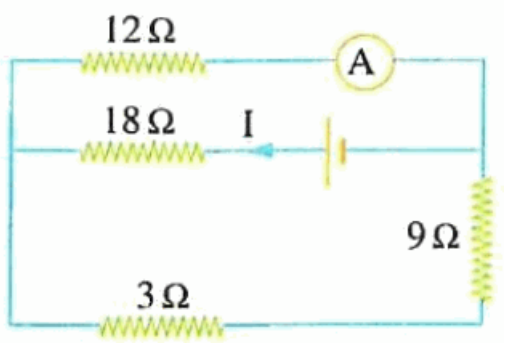
(D) I_A = 2 A, I_B = 2 A

---

114 An electric circuit consists of a DC source of negligible internal resistance and a thin metal wire, and a current of 8 mA flows in it. If another wire of the same length and the same metal is connected in parallel with this wire in the same circuit, a current of 10 mA flows. The ratio between the radii of the two wires (r_1/r_2) equals .....

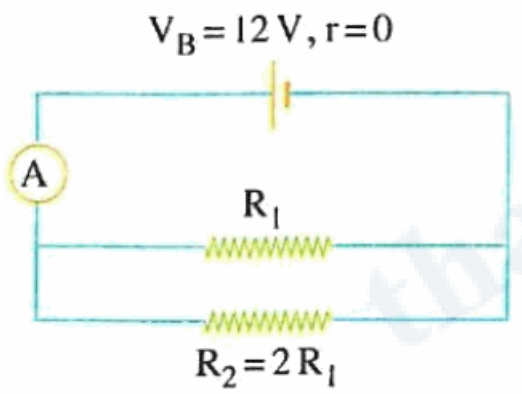
(A) *1/2* (B) *3/2* (C) *2/1* (D) *5/3*

115 In the circuit shown in the figure, the ammeter reading equals .....



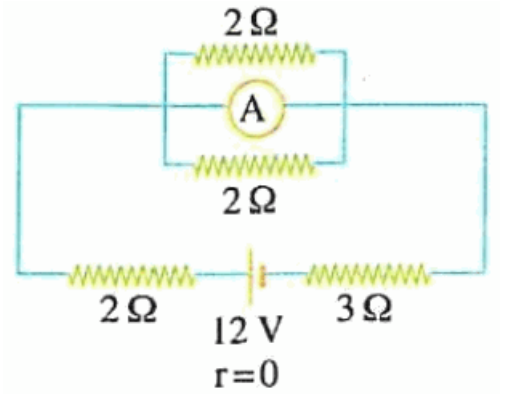
(A) I (B) *I/2* (C) *I/3* (D) *I/6*

116 In the opposite figure, if the current through resistor R_1 is 2 A, the equivalent resistance of the circuit equals .....



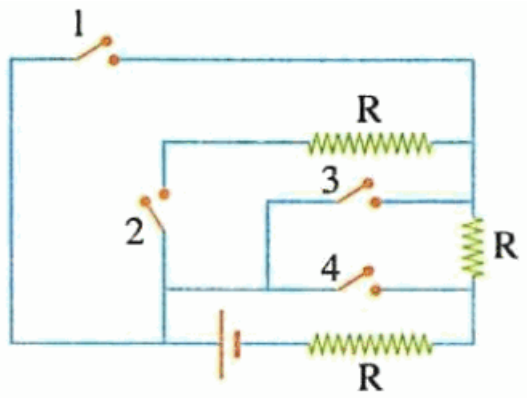
(A) 3 Ω (B) 4 Ω (C) 6 Ω (D) 12 Ω

117 The ammeter reading in the opposite electric circuit equals ..... (Note: the resistance of the ammeter is negligible)



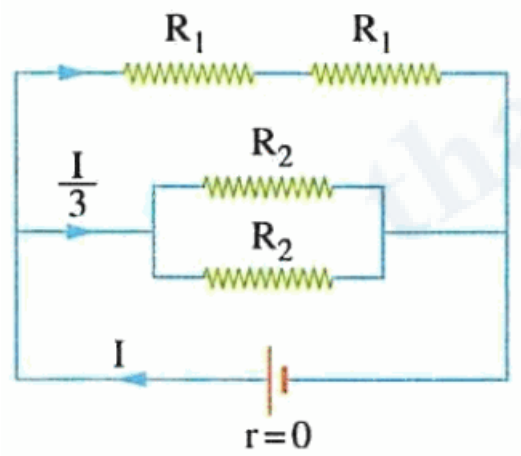
(A) 1 A (B) 1.2 A (C) 2 A (D) 2.4 A

118 In the electric circuit shown, the current through the battery has its smallest value when switch ..... is closed.



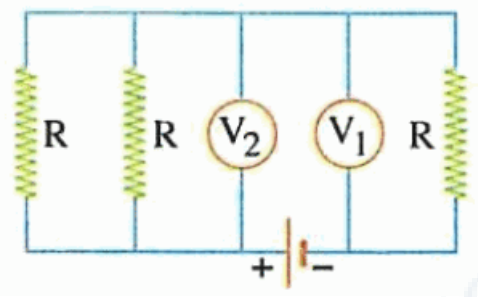
(A) 1 (B) 2 (C) 3 (D) 4

119 In the opposite electric circuit, the ratio between the values of the two resistors (R_1/R_2) equals .....



(A) *1/2* (B) *1/4* (C) *1/8* (D) *1/16*

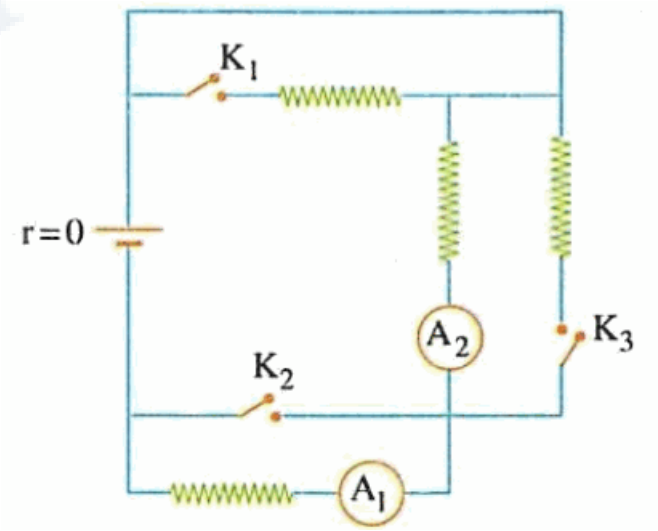
120 In the opposite figure, the ratio between the readings of the two voltmeters (V_1/V_2) equals .....



(A) *1/2* (B) *1/3* (C) *2/1* (D) *3/1*

121 In the opposite electric circuit, what happens to the readings of the two ammeters A_1 and A_2, respectively, when:

only switch K_1 is closed?

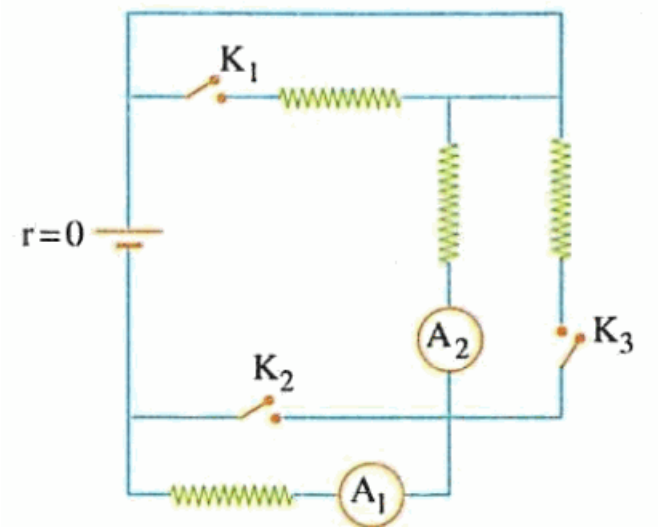


(A) does not change, increases
(B) decreases, does not change
(C) does not change, does not change
(D) increases, decreases

---

122 In the opposite electric circuit, what happens to the readings of the two ammeters A_1 and A_2, respectively, when:

only switch K_2 is closed?

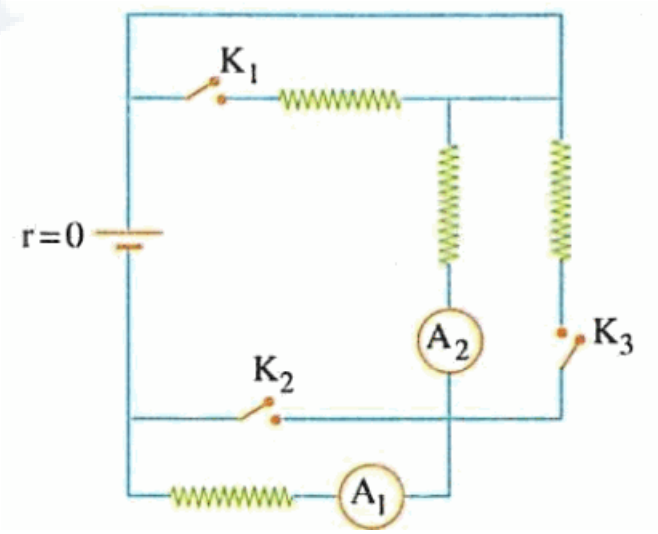


(A) increases, becomes zero
(B) decreases, becomes zero
(C) becomes zero, decreases
(D) becomes zero, increases

---

123 In the opposite electric circuit, what happens to the readings of the two ammeters A_1 and A_2, respectively, when:

only switch K_3 is closed?



(A) increases, decreases

(B) increases, does not change

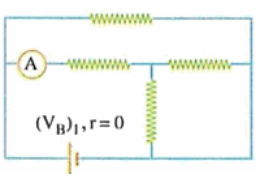
(C) does not change, increases

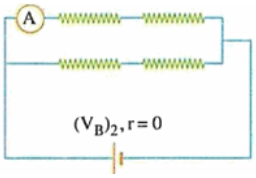
(D) decreases, increases

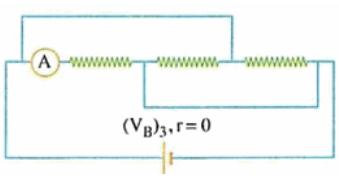
---

124 Each of the following electric circuits consists of a battery of negligible internal resistance, a number of identical resistors and an ammeter.

If the ammeter reading is the same in all of them, the correct order of the emfs of these batteries is .....







(A) $(V_B)_1 > (V_B)_2 > (V_B)_3$

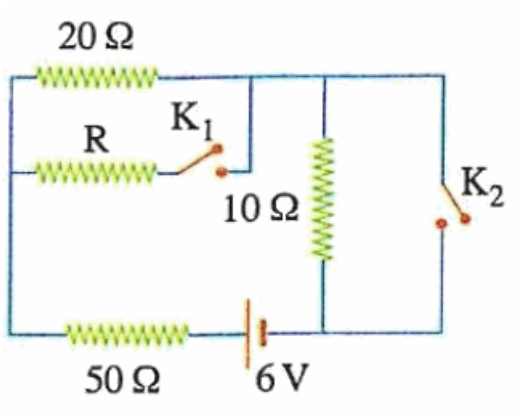
(B) $(V_B)_3 > (V_B)_2 > (V_B)_1$

(C) $(V_B)_2 > (V_B)_1 > (V_B)_3$

(D) $(V_B)_2 > (V_B)_3 > (V_B)_1$

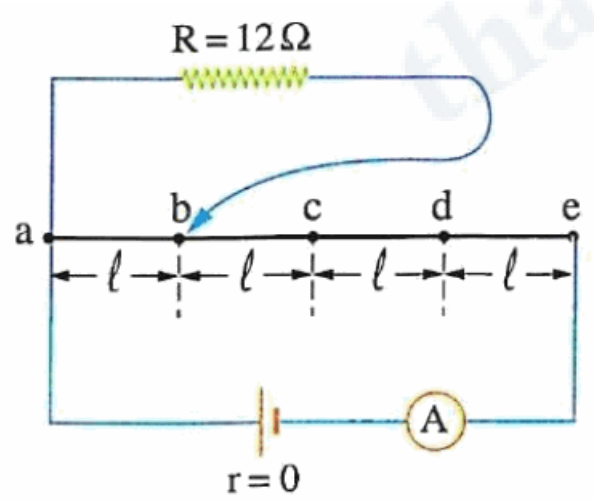
---

125 In the electric circuit shown in the figure, the current through the 20 Ω resistor does not change whether the two switches K_1 and K_2 are both closed or both open. Resistance R equals .....



(A) 50 Ω (B) 100 Ω (C) 150 Ω (D) 200 Ω

126 In the opposite electric circuit, wire ae has a uniform cross-section and a resistance of 24 Ω, and the ammeter reading is (I_1). When the slider is moved from position b to position d, the ammeter reading becomes (I_2). The ratio (I_1/I_2) equals .....



(A) *1/2* (B) *2/1* (C) *3/5* (D) *5/3*

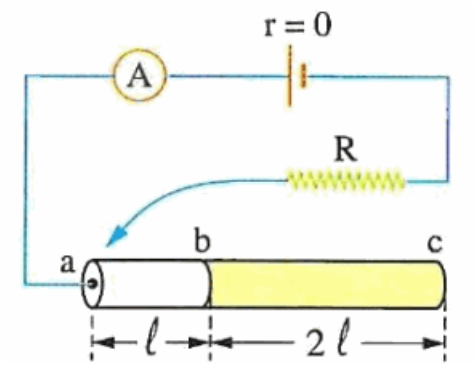
127 Two uninsulated metal conductors (ab) and (bc) have the same cross-sectional area, lengths ℓ and 2ℓ, and resistivities of their materials (ρ_e) and $(2\rho_e)$, respectively. The two conductors are connected together in an electric circuit as in the following figure, and the following table shows how the ammeter reading changes with the position of the slider in the circuit:

Slider at a: ammeter reading I

Slider at b: ammeter reading $1/2$ I

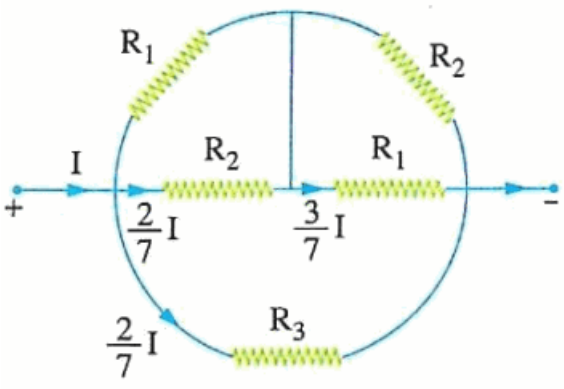
Slider at c: ammeter reading ?

The ammeter reading when the slider is at position (c) becomes .....



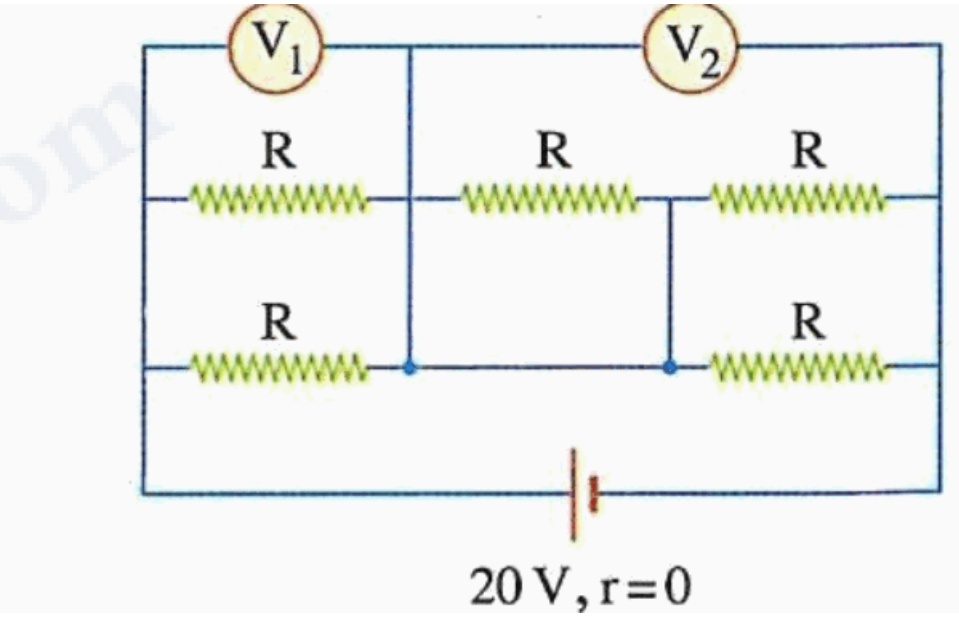
(A) $1/3$ I (B) $1/4$ I (C) $1/6$ I (D) $1/8$ I

128 Several electric resistors are connected together and carry currents as shown in the opposite figure. The correct order of the resistors R_1, R_2, R_3 by value is .....



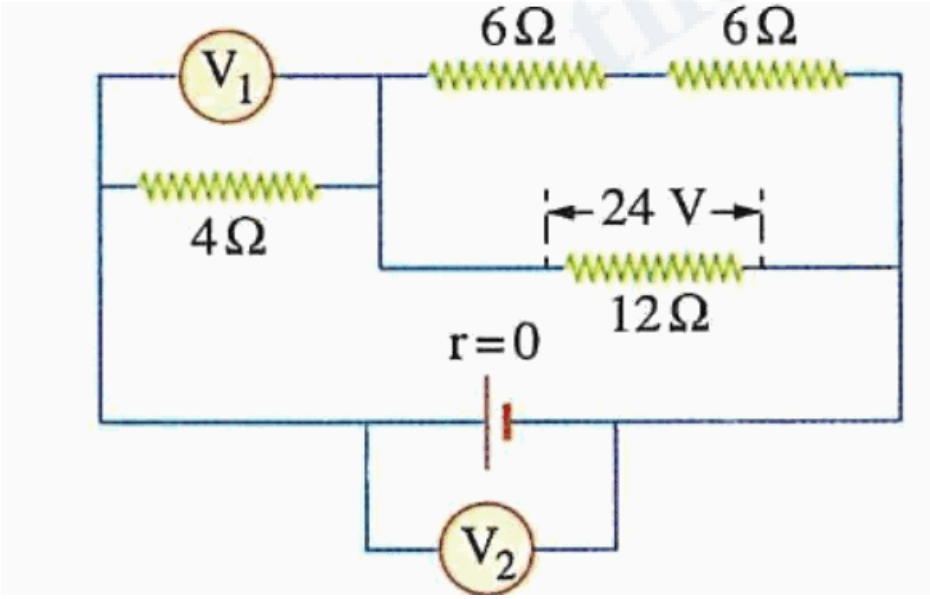
(A) $R_3 < R_2 < R_1$ (B) $R_3 > R_2 > R_1$ (C) $R_3 = R_2 > R_1$ (D) $R_3 = R_2 < R_1$

129 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....



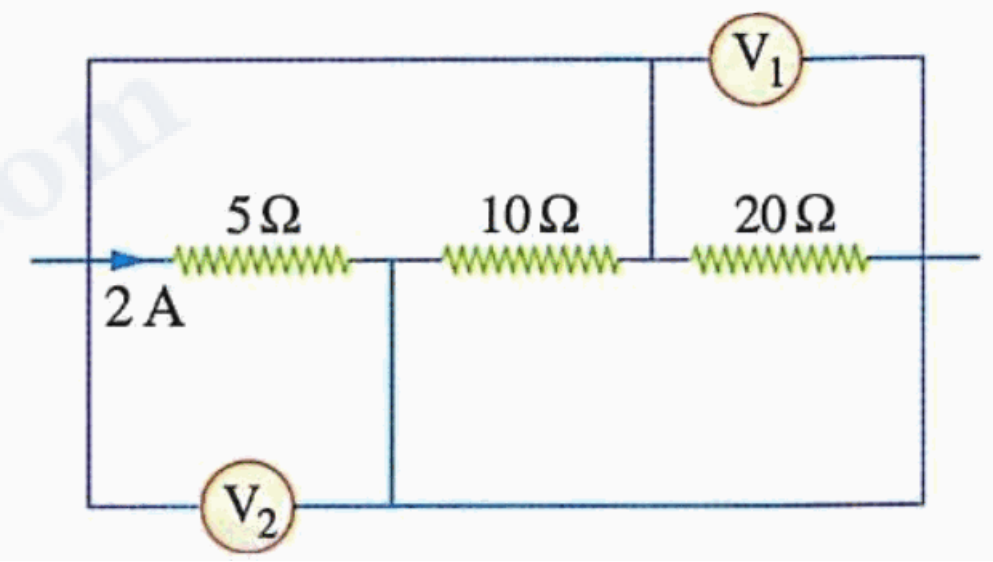
(A) V_1 = 10 V, V_2 = 10 V
(B) V_1 = 10 V, V_2 = 20 V
(C) V_1 = 20 V, V_2 = 10 V
(D) V_1 = 20 V, V_2 = 20 V

130 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....



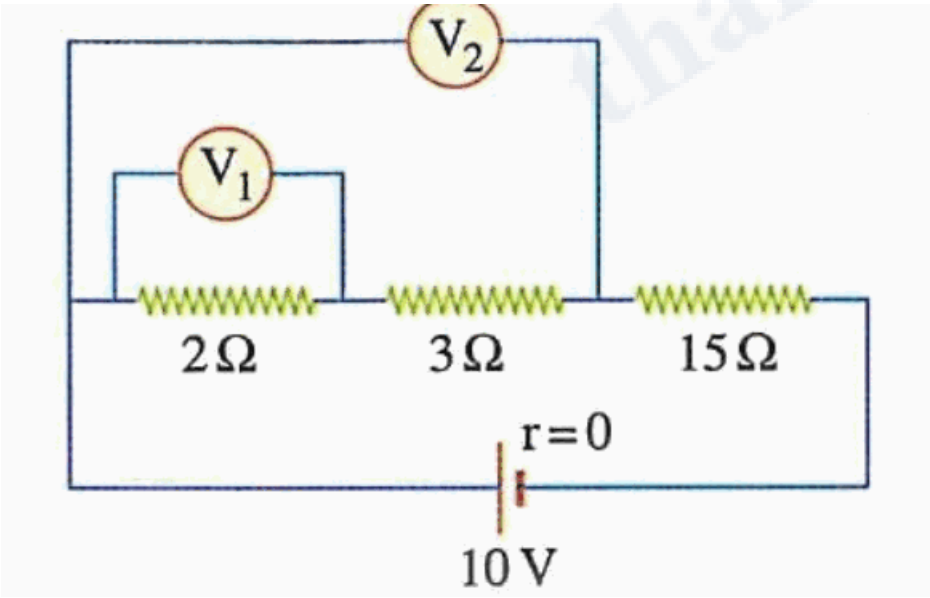
(A) V_1 = 16 V, V_2 = 36 V
(B) V_1 = 16 V, V_2 = 40 V
(C) V_1 = 36 V, V_2 = 36 V
(D) V_1 = 36 V, V_2 = 40 V

131 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....



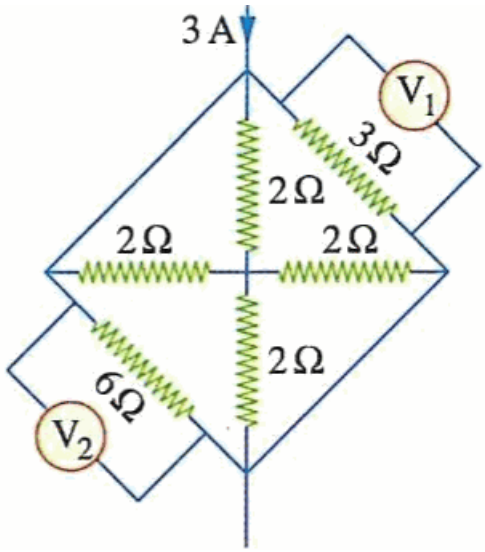
(A) V_1 = 10 V, V_2 = 10 V
(B) V_1 = 10 V, V_2 = 40 V
(C) V_1 = 40 V, V_2 = 10 V
(D) V_1 = 40 V, V_2 = 40 V

132 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....



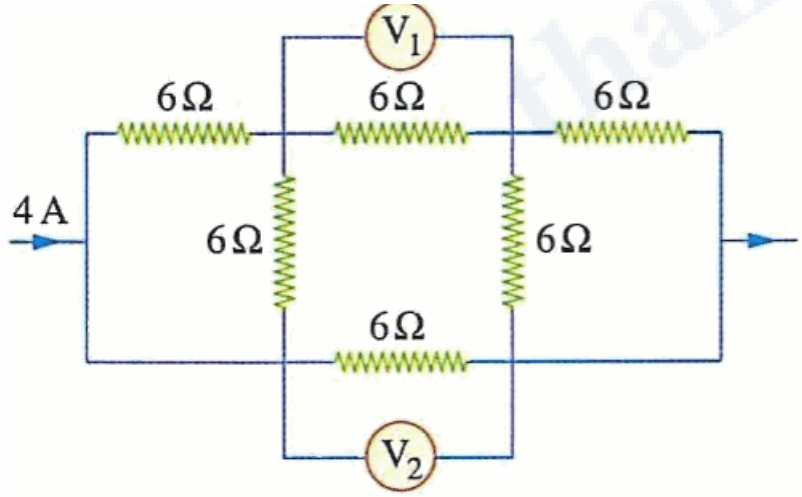
(A) V_1 = 1 V, V_2 = 1.5 V
(B) V_1 = 1 V, V_2 = 2.5 V
(C) V_1 = 2 V, V_2 = 1.5 V
(D) V_1 = 2 V, V_2 = 2.5 V

133 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....



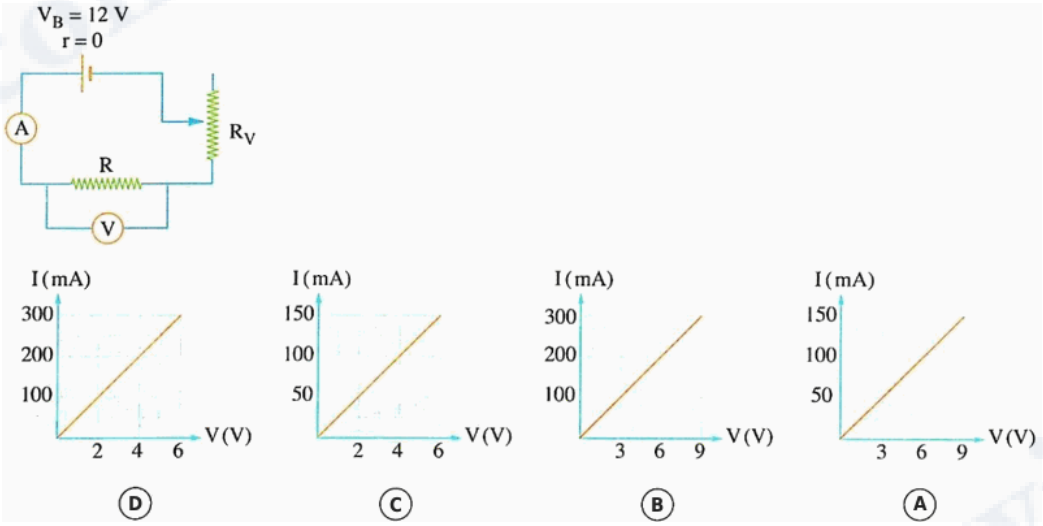
(A) $V_1 = 1.5$ V, $V_2 = 3$ V
(B) $V_1 = 1.5$ V, $V_2 = 1.5$ V
(C) $V_1 = 3$ V, $V_2 = 6$ V
(D) $V_1 = 3$ V, $V_2 = 3$ V

134 In the opposite circuit, the readings of the two voltmeters V_1 and V_2 are .....

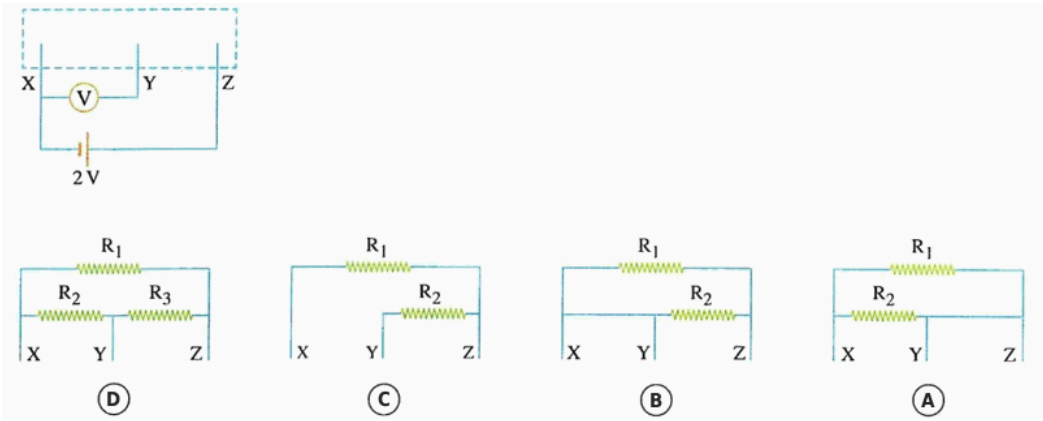


(A) $V_1 = 12$ V, $V_2 = 12$ V
(B) $V_1 = 4$ V, $V_2 = 12$ V
(C) $V_1 = 16$ V, $V_2 = 16$ V
(D) $V_1 = 8$ V, $V_2 = 16$ V

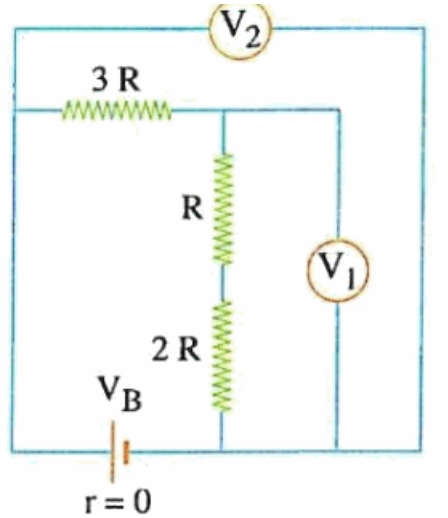
135 In an experiment to verify Ohm's law practically using the opposite electric circuit, when the resistance taken from the rheostat was 20 Ω, the ammeter reading was 150 mA. Which of the following graphs correctly represents the relation between the ammeter reading (I) and the voltmeter reading (V) in this circuit?



136 The opposite figure represents part of an electric circuit consisting of a battery of emf 2 V and negligible internal resistance, and a voltmeter. Which of the following figures completes this circuit at points X, Y, Z so that the voltmeter reads 1.5 V? (Consider the voltmeter resistance infinite)

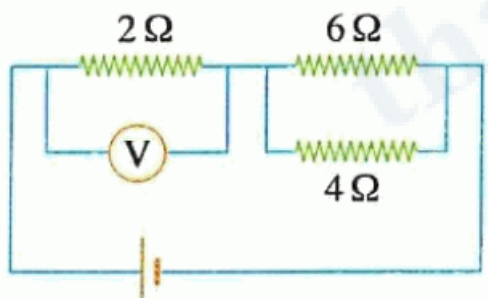


137 In the electric circuit shown in the opposite figure, the ratio between the readings of the two voltmeters (V_1/V_2) is .....



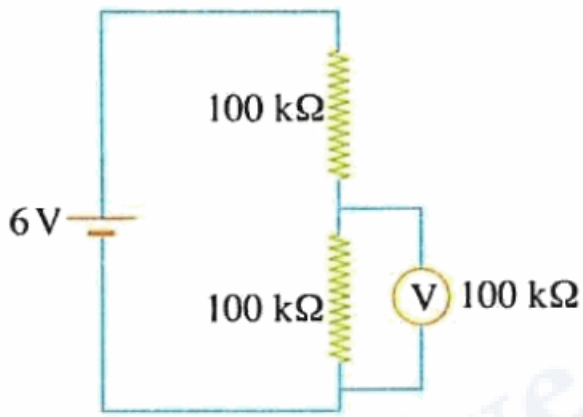
(A) *1/1* (B) *1/2* (C) *1/3* (D) *1/6*

138 In the electric circuit shown in the figure, if the voltmeter reading is 4 V, the electric current through the 6 Ω resistor equals .....



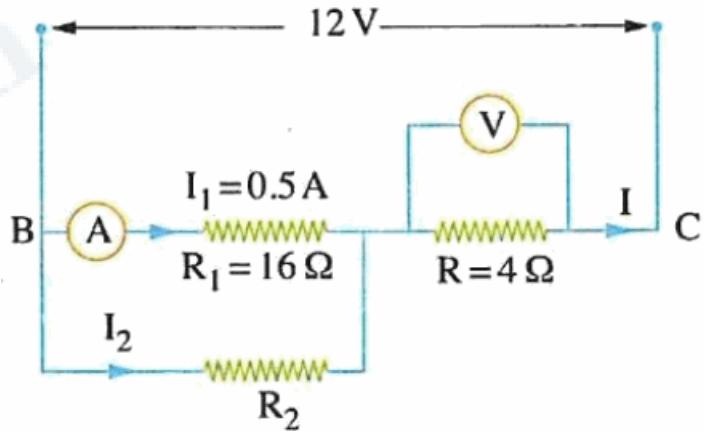
(A) 0.8 A (B) 1 A (C) 1.2 A (D) 2 A

139 If the resistance of the voltmeter in the figure is 100 kΩ, what is its reading?



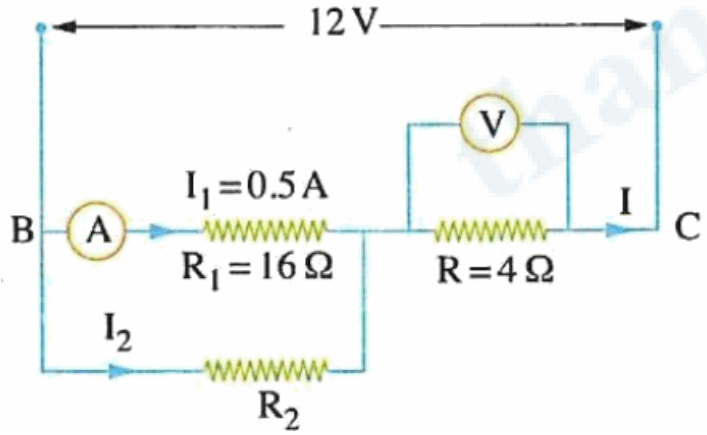
(A) 0 (B) 2 V (C) 3 V (D) 4 V

140 The opposite figure represents part of an electric circuit. Then:
the voltmeter reading (V) equals .....



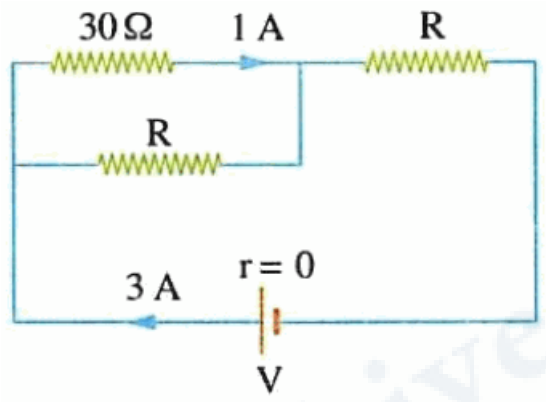
(A) 8 V (B) 4 V (C) 2.5 V (D) 1.3 V

141 The opposite figure represents part of an electric circuit. Then:
the value of resistance R_2 equals .....



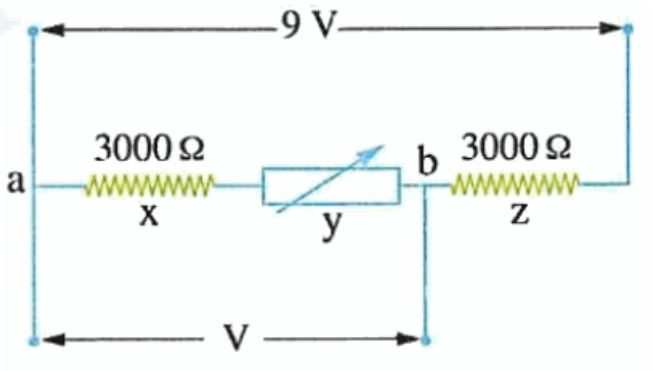
(A) 3 Ω (B) 5 Ω (C) 9 Ω (D) 16 Ω

142 From the opposite circuit, the potential difference across the source (V) is .....



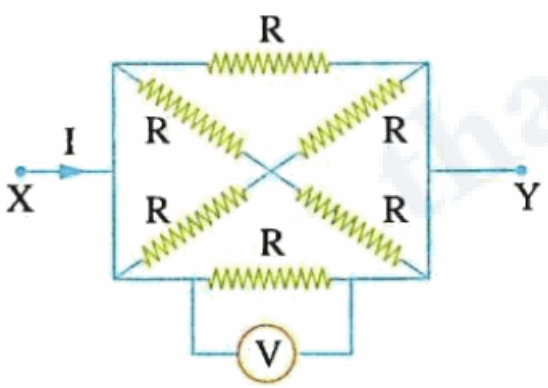
(A) 25 V (B) 50 V (C) 75 V (D) 100 V

143 In the opposite figure, there are two fixed resistors x and z and a variable resistor y whose range is from zero to 3000 Ω. The range of the potential difference between points a and b is from .....



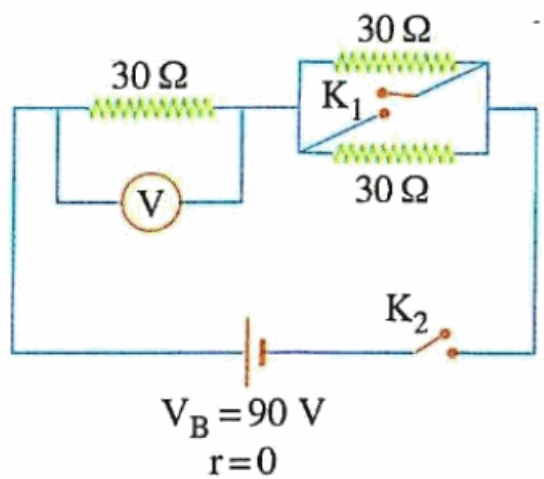
(A) 0 to 6 V (B) 3 V to 6 V (C) 4.5 V to 6 V (D) 4.5 V to 9 V

144 The opposite figure represents part of an electric circuit. If the voltmeter reads 1 V, the potential difference between points X and Y equals .....



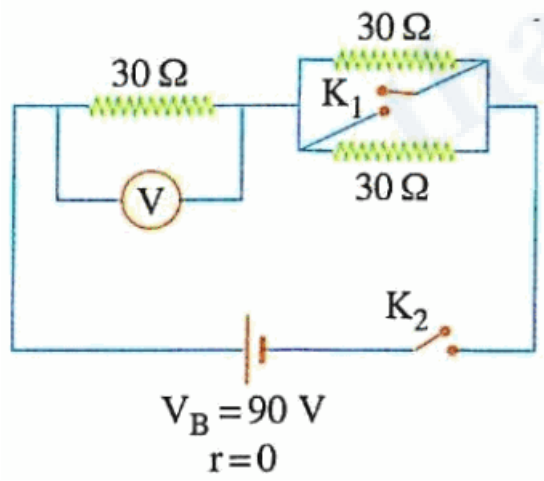
(A) 1 V (B) 2 V (C) 3 V (D) 4 V

145 In the figure in front of you, the voltmeter reading when:
switch K_2 is closed and switch K_1 is open equals .....



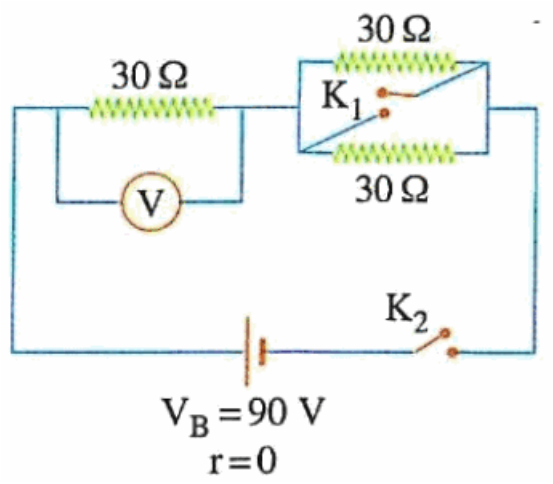
(A) 20 V (B) 30 V (C) 60 V (D) 40 V

146 In the figure in front of you, the voltmeter reading when:
switch K_2 is closed and switch K_1 is closed equals .....



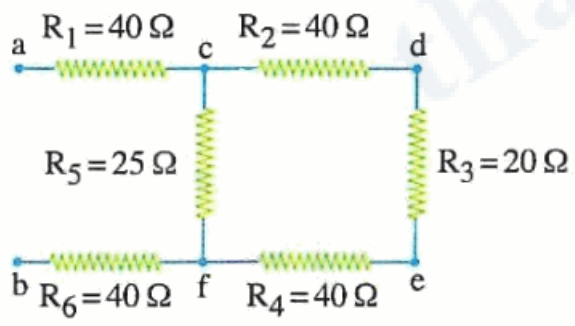
(A) 30 V (B) 40 V (C) 90 V (D) 60 V

147 In the figure in front of you, the voltmeter reading when:
switch K_2 is open and switch K_1 is closed equals .....



(A) 0 (B) 20 V (C) 40 V (D) 60 V

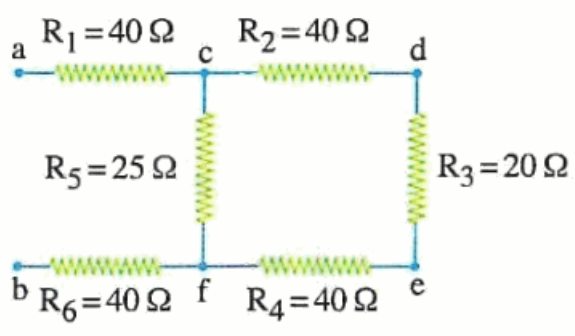
148 The opposite figure represents part of an electric circuit. If the potential difference V_{ab} is 200 V, then:
the equivalent resistance of this part equals .....



(A) 100 Ω (B) 80 Ω (C) 75 Ω (D) 54 Ω

149 The opposite figure represents part of an electric circuit. If the potential difference V_{ab} is 200 V, then:

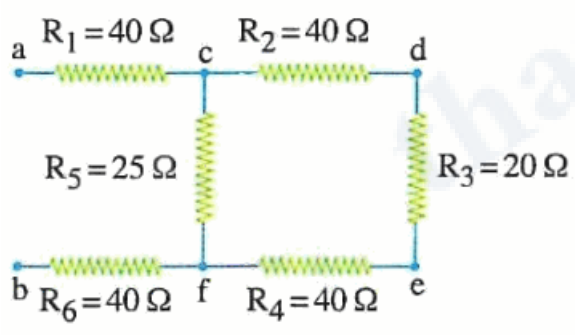
the current through resistor R_1 equals .....



(A) 5 A (B) 3.5 A (C) 2 A (D) 1.6 A

150 The opposite figure represents part of an electric circuit. If the potential difference V_{ab} is 200 V, then:

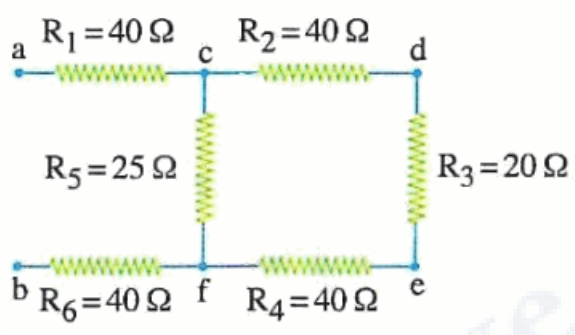
the current in resistor R_5 equals .....



(A) 0.1 A (B) 0.4 A (C) 1.4 A (D) 1.6 A

151 The opposite figure represents part of an electric circuit. If the potential difference V_{ab} is 200 V, then:

the potential difference between points d and e equals .....



(A) 16 V (B) 12 V (C) 10 V (D) 8 V

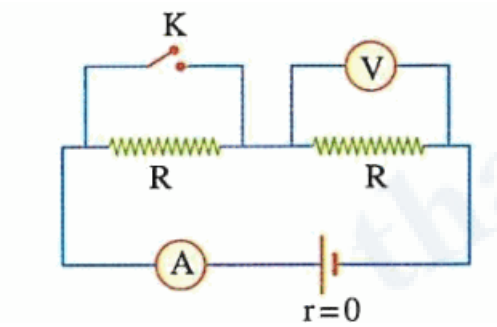
152 Three resistors of 20 Ω, 40 Ω and 60 Ω are connected to a source of electric current. If the potential differences across them are 50 V, 20 V and 30 V, respectively, the equivalent resistance of the circuit equals .....

(A) 16.67 Ω (B) 12.23 Ω (C) 10.53 Ω (D) 9.75 Ω

153 A voltmeter of resistance 500 Ω is connected in parallel with an unknown resistance, then an ammeter of negligible resistance is connected in series with them. When the two ends of the group are connected to an electric cell, the ammeter reading is 0.01 A and the voltmeter reading is 3 V. The value of the unknown resistance is .....

(A) 900 Ω (B) 800 Ω (C) 750 Ω (D) 620 Ω

154 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when switch K is closed?



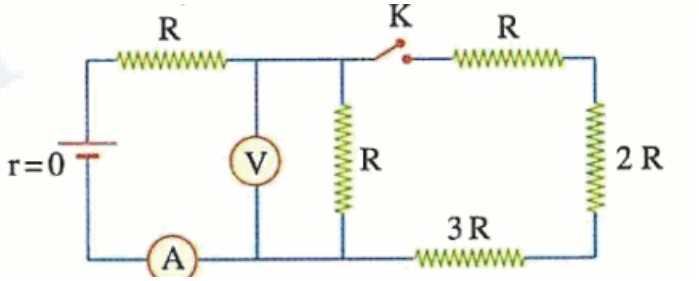
(A) Ammeter reading increases, voltmeter reading increases

(B) Ammeter reading decreases, voltmeter reading decreases

(C) Ammeter reading decreases, voltmeter reading increases

(D) Ammeter reading increases, voltmeter reading decreases

155 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when switch K is closed?



(A) Ammeter reading increases, voltmeter reading increases

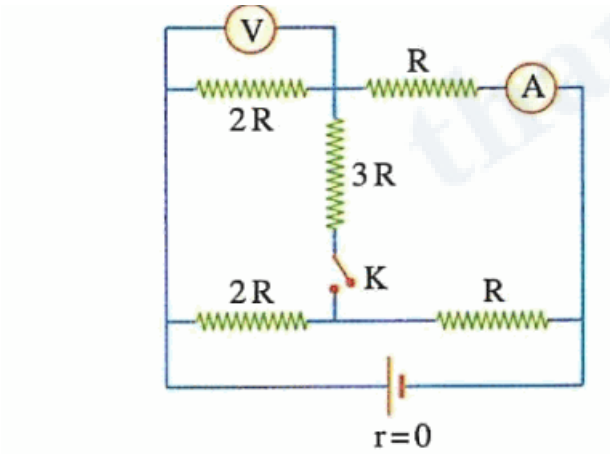
(B) Ammeter reading decreases, voltmeter reading does not change

(C) Ammeter reading increases, voltmeter reading decreases

(D) Ammeter reading does not change, voltmeter reading does not change

---

156 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when switch K is closed?



(A) Ammeter reading increases, voltmeter reading increases

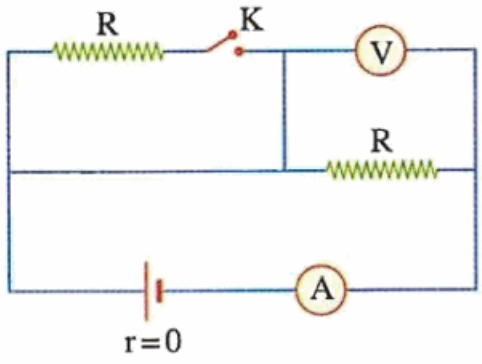
(B) Ammeter reading decreases, voltmeter reading does not change

(C) Ammeter reading does not change, voltmeter reading decreases

(D) Ammeter reading does not change, voltmeter reading does not change

---

157 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when switch K is closed?



(A) Ammeter reading increases, voltmeter reading increases

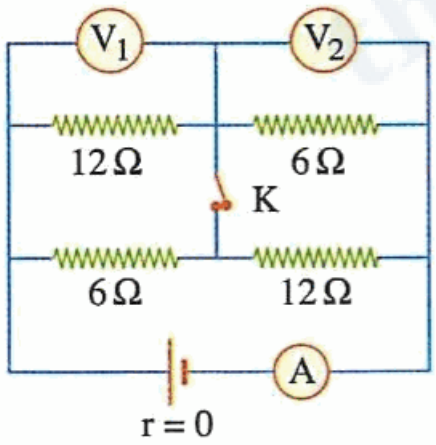
(B) Ammeter reading decreases, voltmeter reading does not change

(C) Ammeter reading does not change, voltmeter reading decreases

(D) Ammeter reading does not change, voltmeter reading does not change

---

158 In the opposite electric circuit, what happens to the readings of the ammeter (A) and the two voltmeters (V_1) and (V_2) when switch (K) is opened?



(A) Ammeter decreases, V_1 increases, V_2 increases

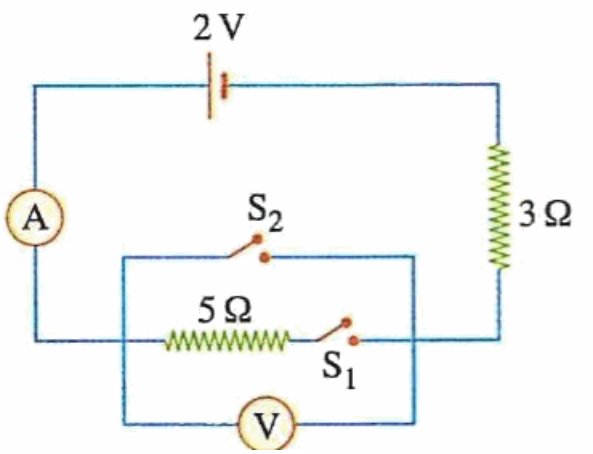
(B) Ammeter decreases, V_1 increases, V_2 decreases

(C) Ammeter increases, V_1 increases, V_2 increases

(D) Ammeter increases, V_1 decreases, V_2 decreases

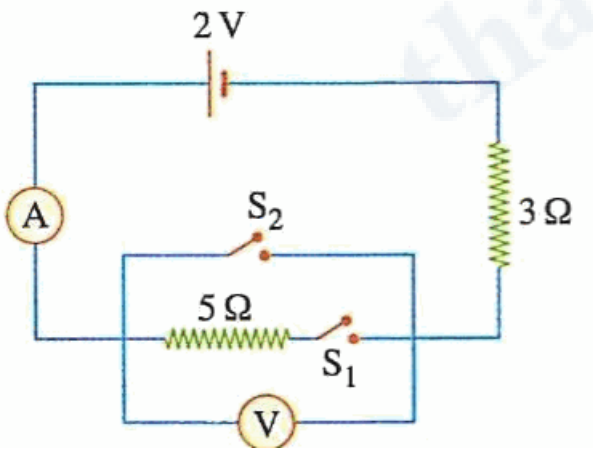
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159 In the opposite figure, the readings of the ammeter and the voltmeter, respectively, when: the two switches S_2 and S_1 are both closed are .....



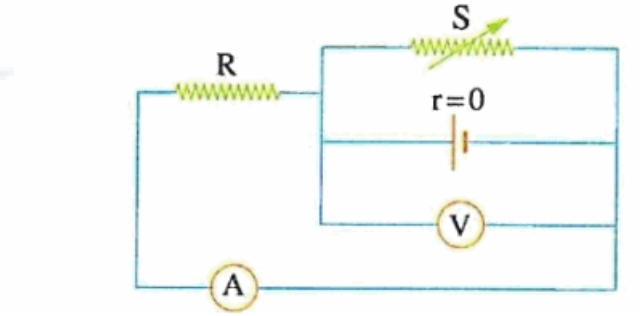
(A) Ammeter 0.67 A, voltmeter 0.2 V
(B) Ammeter 0, voltmeter 0.3 V
(C) Ammeter 0.67 A, voltmeter 0
(D) Ammeter 0.5 A, voltmeter 0.3 V

160 In the opposite figure, the readings of the ammeter and the voltmeter, respectively, when: switch S_1 is closed and switch S_2 is open are .....



(A) Ammeter 3.2 A, voltmeter 1.2 V
(B) Ammeter 0.25 A, voltmeter 1.25 V
(C) Ammeter 1.25 A, voltmeter 3.2 V
(D) Ammeter 0.25 A, voltmeter 2.05 V

161 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when the value of the rheostat S is increased?



(A) Ammeter reading decreases, voltmeter reading decreases

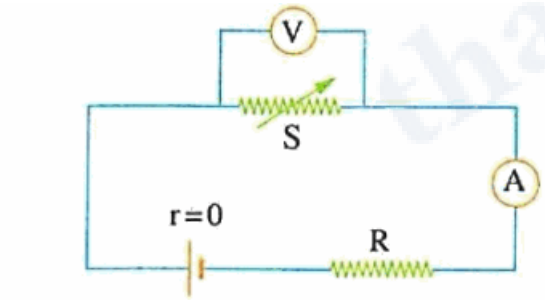
(B) Ammeter reading decreases, voltmeter reading does not change

(C) Ammeter reading does not change, voltmeter reading increases

(D) Ammeter reading does not change, voltmeter reading does not change

---

162 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when the value of the rheostat S is increased?



(A) Ammeter reading decreases, voltmeter reading decreases

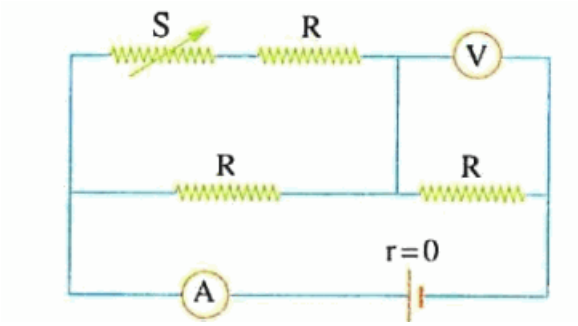
(B) Ammeter reading decreases, voltmeter reading increases

(C) Ammeter reading increases, voltmeter reading decreases

(D) Ammeter reading increases, voltmeter reading increases

---

163 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when the value of the rheostat S is increased?



(A) Ammeter reading decreases, voltmeter reading decreases

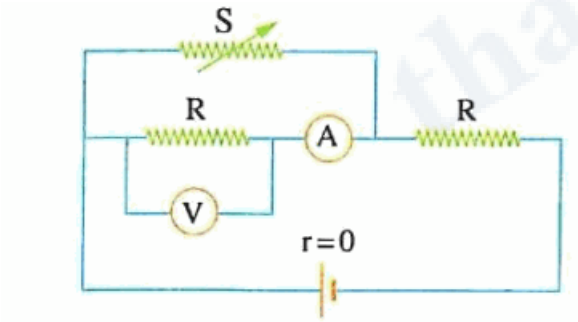
(B) Ammeter reading decreases, voltmeter reading increases

(C) Ammeter reading increases, voltmeter reading decreases

(D) Ammeter reading increases, voltmeter reading increases

---

164 In the opposite electric circuit, what happens to the readings of the ammeter and the voltmeter, respectively, when the value of the rheostat S is increased?



(A) Ammeter reading decreases, voltmeter reading decreases

(B) Ammeter reading decreases, voltmeter reading increases

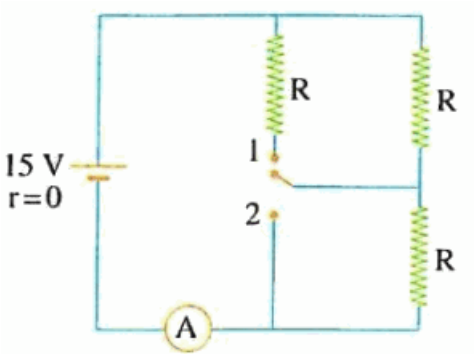
(C) Ammeter reading increases, voltmeter reading decreases

(D) Ammeter reading increases, voltmeter reading increases

---

165 In the opposite figure:

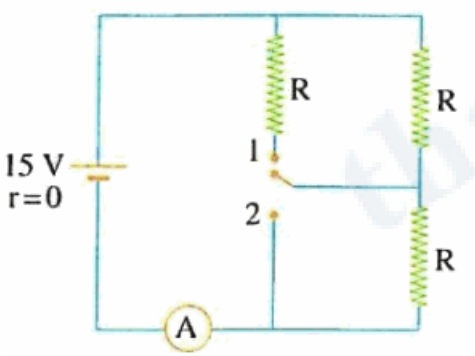
when the switch is closed in direction (1), a current of 2 A flows in the ammeter, so the value of resistance R is .....



(A) 30 Ω (B) 5 Ω (C) 7.5 Ω (D) 2.5 Ω

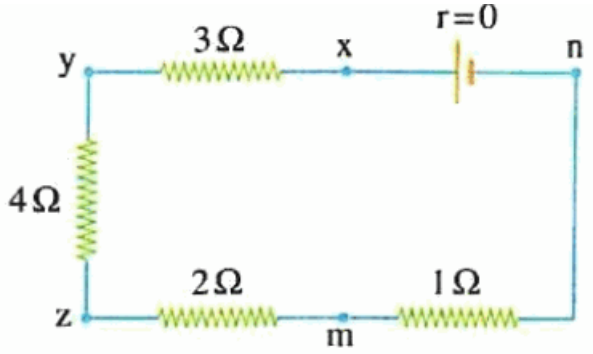
166 In the opposite figure:

when the switch is closed in direction (2), the current in the ammeter is .....



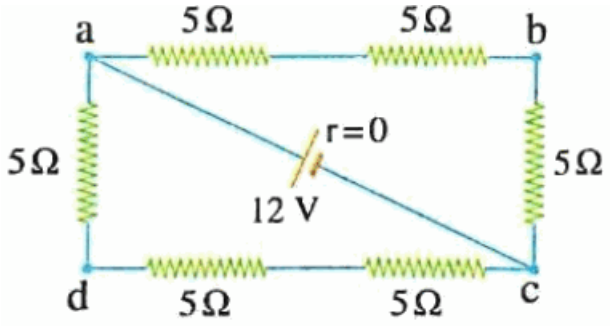
(A) 1 A (B) 2 A (C) 3 A (D) 4 A

167 In the opposite electric circuit, between which two points does moving a free electron require the greatest work done?



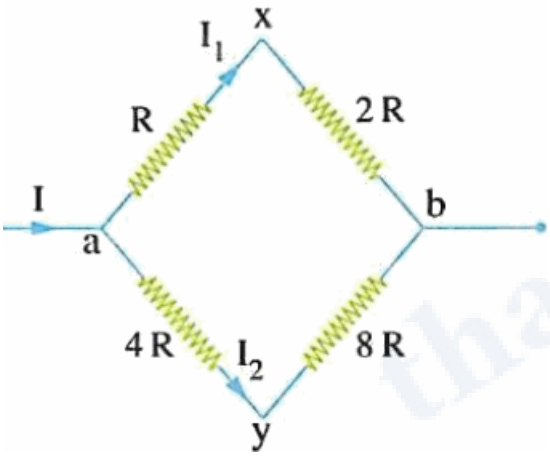
(A) x and y (B) y and z (C) z and m (D) z and n

168 In the electric circuit shown, the potential difference between points b and d equals .....



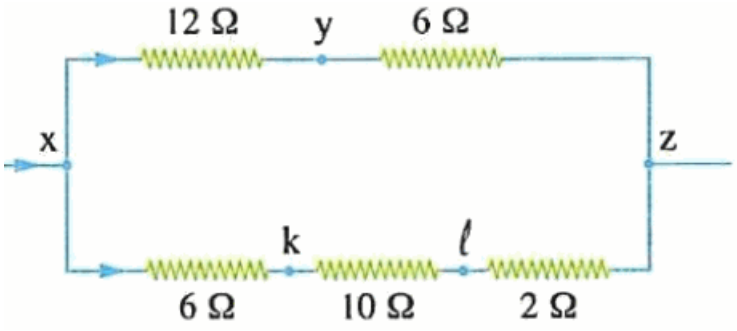
(A) 2 V (B) 4 V (C) 6 V (D) 8 V

169 In the opposite figure, the potential difference between x and y equals .....



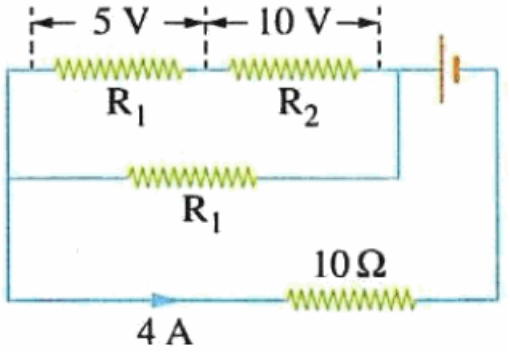
(A) 0 (B) 3 IR (C) 6 IR (D) IR

170 The figure shows part of an electric circuit. Which of the following relations is correct for the potential differences between the points shown in the figure?



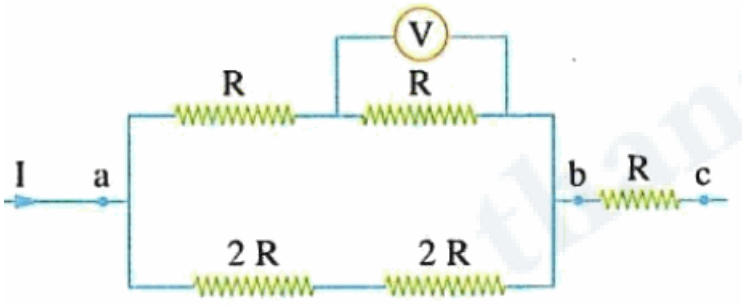
(A) $V_{k\ell} > V_{xy}$ (B) $V_{yz} > V_{xk}$ (C) $V_{xy} = V_{kz}$ (D) $V_{xz} = 2\,V_{\ell z}$

171 In the opposite electric circuit, the values of R_1 and R_2, respectively, are .....



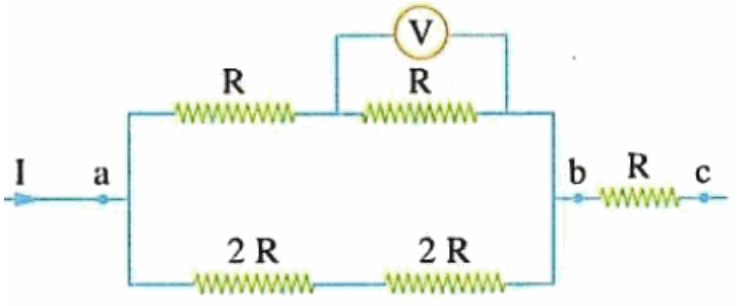
(A) $R_1 = 2.5\ \Omega, R_2 = 5\ \Omega$
(B) $R_1 = 2.5\ \Omega, R_2 = 10\ \Omega$
(C) $R_1 = 5\ \Omega, R_2 = 2.5\ \Omega$
(D) $R_1 = 5\ \Omega, R_2 = 10\ \Omega$

172 In the opposite figure, if the voltmeter reading is 4 V:
what is its reading when it is connected between points c and b?



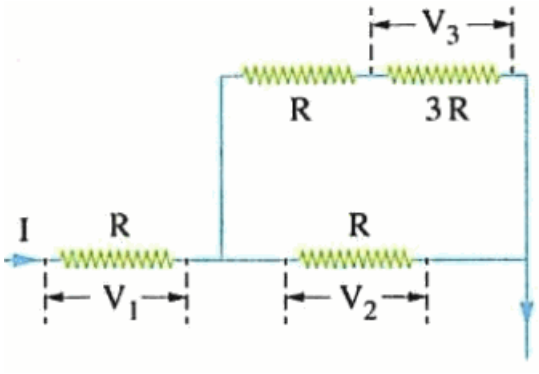
(A) 10 V (B) 8 V (C) 6 V (D) 2 V

173 In the opposite figure, if the voltmeter reading is 4 V:
what is its reading when it is connected between points c and a?



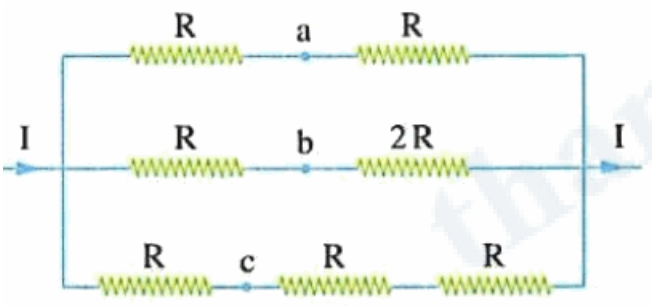
(A) 14 V (B) 15 V (C) 16 V (D) 17 V

174 The opposite figure shows part of an electric circuit. The correct mathematical relation between the potential differences V_1, V_2, V_3 is .....



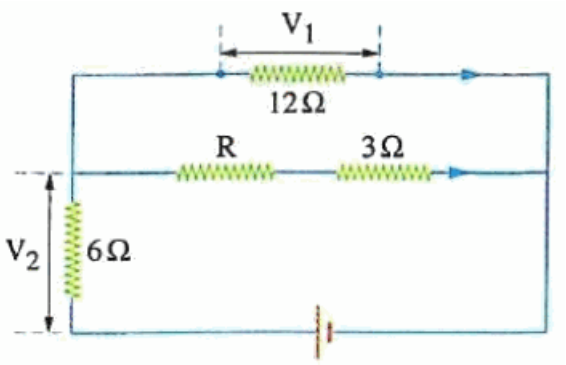
(A) $V_1 = V_2 > V_3$ (B) $V_1 = V_2 < V_3$ (C) $V_1 > V_3 > V_2$ (D) $V_1 > V_2 > V_3$

175 The opposite figure represents part of an electric circuit. Which of the following mathematical relations is the correct relation between the electric potentials at points a, b, c?



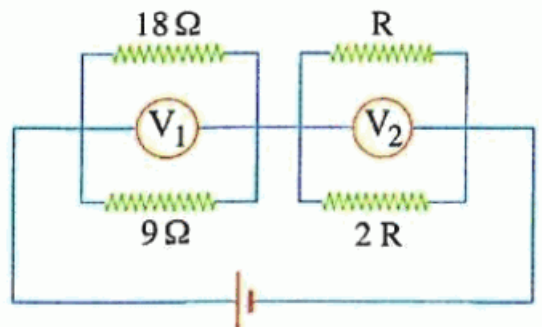
(A) $V_a > V_b > V_c$ (B) $V_a < V_b < V_c$ (C) $V_a > V_b = V_c$ (D) $V_a < V_b = V_c$

176 The opposite figure shows a closed electric circuit. If $V_1 = V_2$, the value of resistance R equals .....



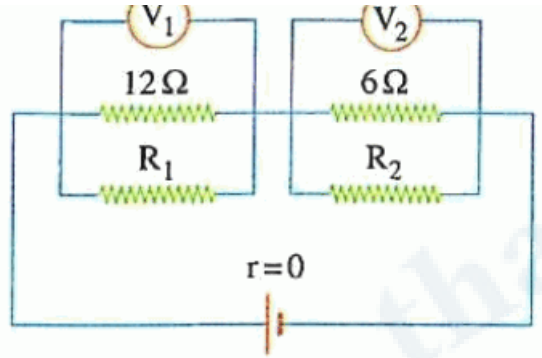
(A) 3 Ω (B) 9 Ω (C) 12 Ω (D) 15 Ω

177 In the circuit shown, if $(V_1/V_2 = 3/4)$, the value of resistance R equals .....



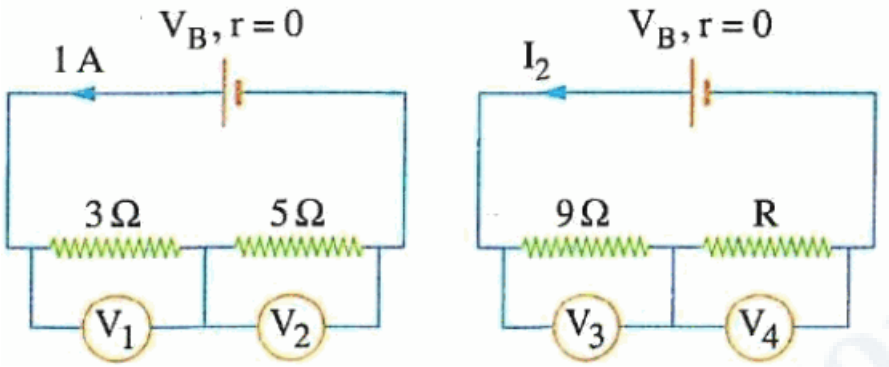
(A) 6 Ω (B) 12 Ω (C) 18 Ω (D) 24 Ω

178 In the opposite electric circuit, the readings of the two voltmeters V_1 and V_2 are equal. The relation between R_1 and R_2 is .....



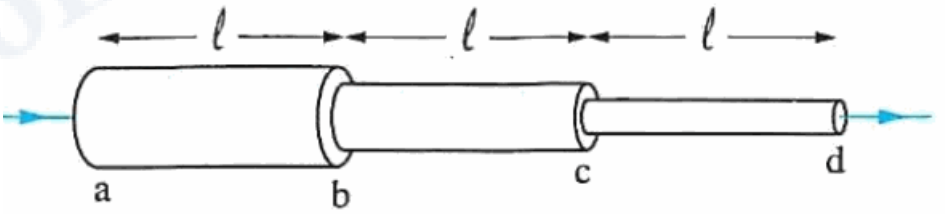
(A) $R_1 = R_2$ (B) $R_1 > R_2$
(C) $R_1 < R_2$ (D) The answer cannot be determined

179 In the two opposite circuits, if the readings of voltmeters V_1 and V_3 are equal and the readings of voltmeters V_2 and V_4 are equal, then .....



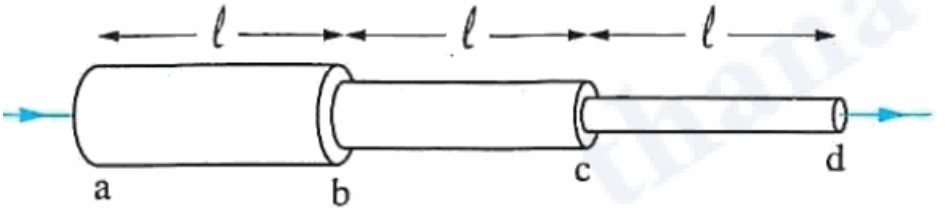
(A) R = 6 Ω, $I_2 = 2/3$ A (B) R = 6 Ω, $I_2 = 1/3$ A
(C) R = 15 Ω, $I_2 = 2/3$ A (D) R = 15 Ω, $I_2 = 1/3$ A

180 Three solid conductors ab, bc, cd are made of the same metal, have the same length (ℓ) and uniform cross-sections, and their cross-sectional areas are 3A, 2A and A, respectively, as in the opposite figure. The ratio between:
the potential differences $((V_{cd})/(V_{bc}))$ equals .....



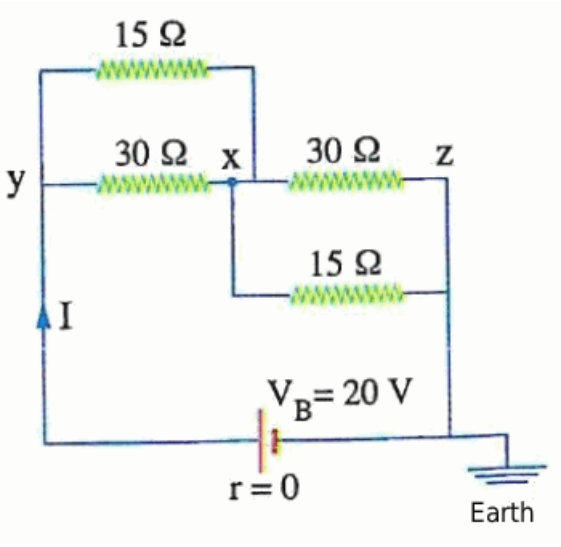
(A) 1/2 (B) 2/1 (C) 2/3 (D) 3/2

181 Three solid conductors ab, bc, cd are made of the same metal, have the same length (ℓ) and uniform cross-sections, and their cross-sectional areas are 3A, 2A and A, respectively, as in the opposite figure. The ratio between:
the potential differences $((V_{bc})/(V_{ad}))$ equals .....



(A) 11/3 (B) 3/11 (C) 5/22 (D) 22/5

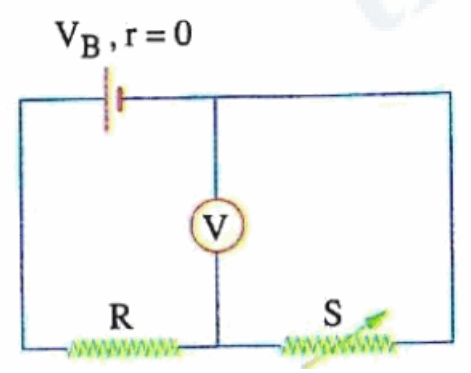
182 In the electric circuit shown in the figure, given that the potential of the earthed point = zero, then .....



(A) I = *1/2* A, potential of point x = 10 V
(B) I = *1/2* A, potential of point x = 5 V
(C) I = 1 A, potential of point x = 5 V
(D) I = 1 A, potential of point x = 10 V

---

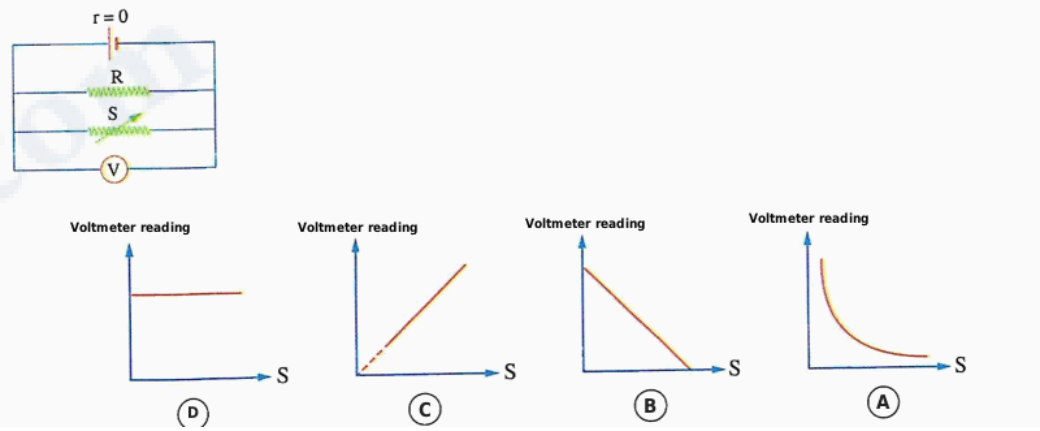
183 The opposite figure shows a closed electric circuit. When the rheostat (S) is doubled, the voltmeter reading .....



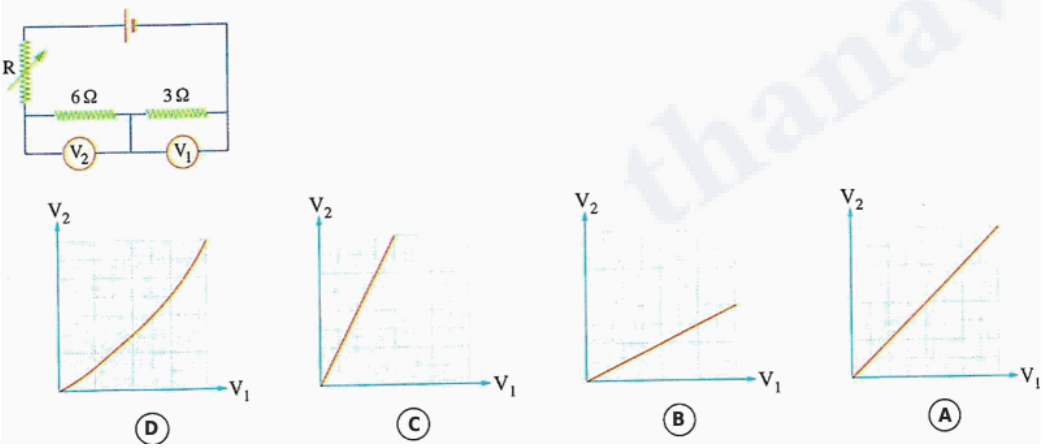
(A) increases but does not reach double its first value
(B) doubles
(C) decreases but does not reach half its first value
(D) decreases to half

---

184 Which of the following graphs represents the relation between the voltmeter reading and the value of the rheostat S in the opposite electric circuit?



185 Which of the following graphs represents the relation between the reading of voltmeter V_1 and the reading of voltmeter V_2 when the value of the rheostat R in the opposite electric circuit is changed? (Note: V_1 and V_2 are drawn to the same scale)



186 Figure (1) represents graphically the relation between the current (I) in the circuit shown in figure (2) and the reading of voltmeter (V_1) in it.
Which of the following can be a possible value of the readings of the ammeter (A) and the voltmeter (V_2) at different values of the rheostat?

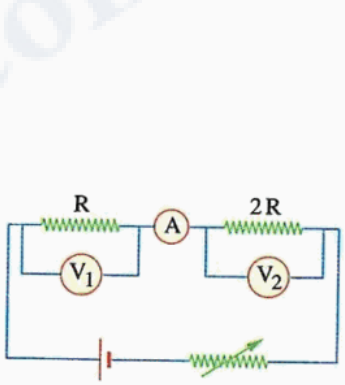


Figure (2)

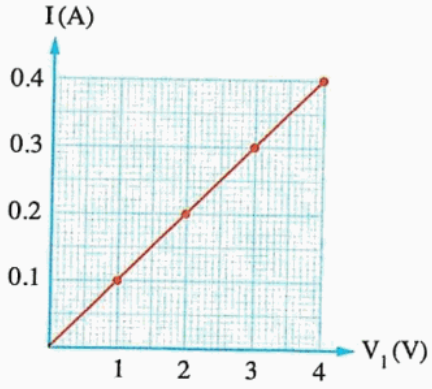
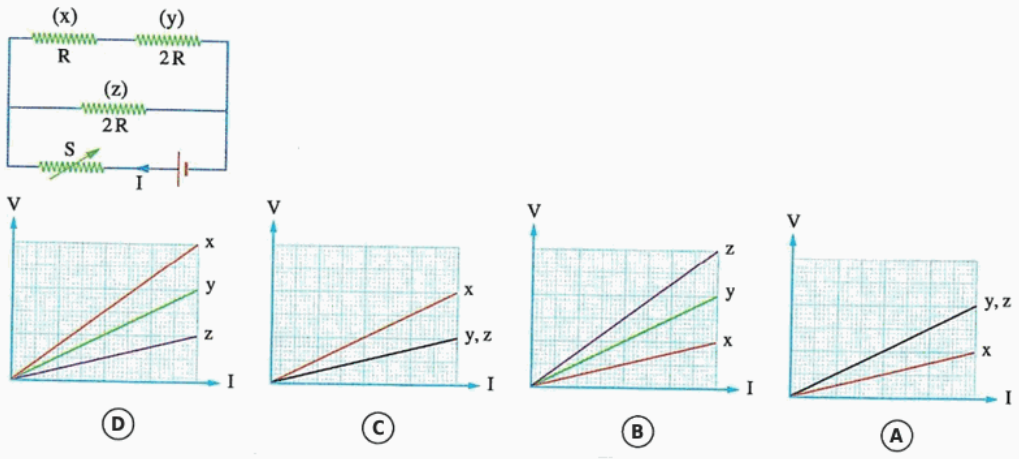


Figure (1)

(A) Ammeter 1 A, voltmeter V_2 2 V
(B) Ammeter 0.8 A, voltmeter V_2 8 V
(C) Ammeter 0.6 A, voltmeter V_2 3 V
(D) Ammeter 0.5 A, voltmeter V_2 10 V

187 Which of the following graphs represents the relation between the total current (I) in the circuit shown in the opposite figure and the potential difference (V) across each of the three resistors x, y, z?



188 Graph (1) represents the electric potential differences across the parts of the electric circuit shown in figure (2). From your study of figures (1) and (2):
the ammeter reading equals .....

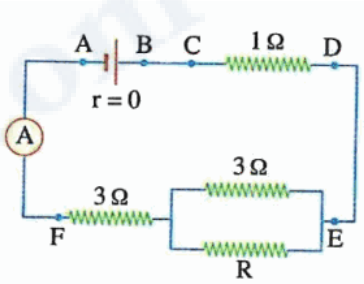


Figure (2)

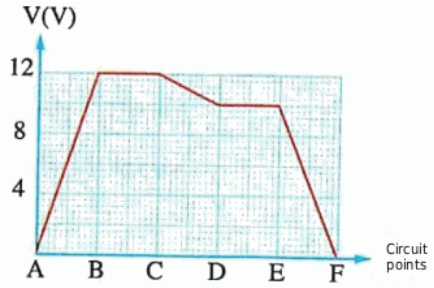


Figure (1)

(A) 1 A (B) 2 A (C) 3 A (D) 4 A

189 Graph (1) represents the electric potential differences across the parts of the electric circuit shown in figure (2). From your study of figures (1) and (2):
the value of resistance R is .....

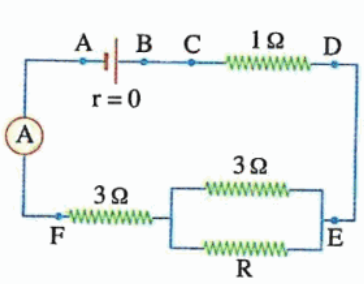


Figure (2)

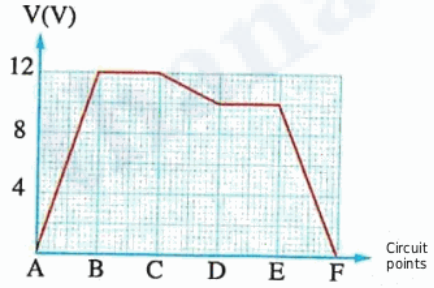
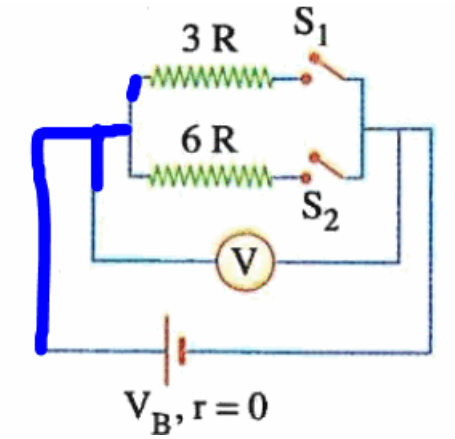


Figure (1)

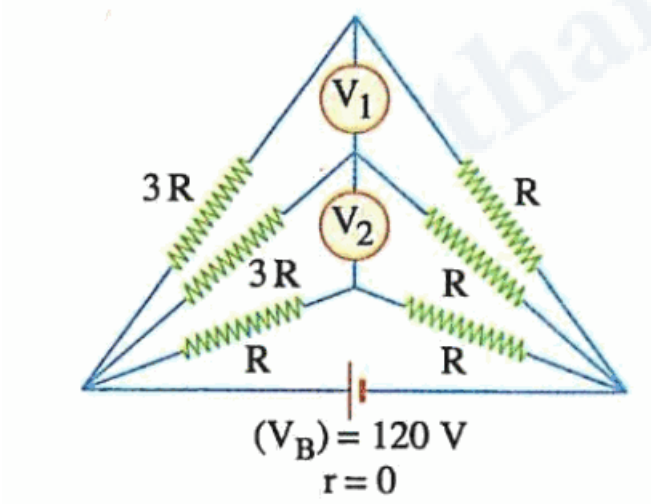
(A) 10 Ω (B) 9 Ω (C) 6 Ω (D) 4 Ω

190 In the electric circuit shown, when only switch S_1 is closed the voltmeter reading is V_1, when only switch S_2 is closed the voltmeter reading is V_2, and when both switches S_1 and S_2 are closed the voltmeter reading is V_3. Then .....



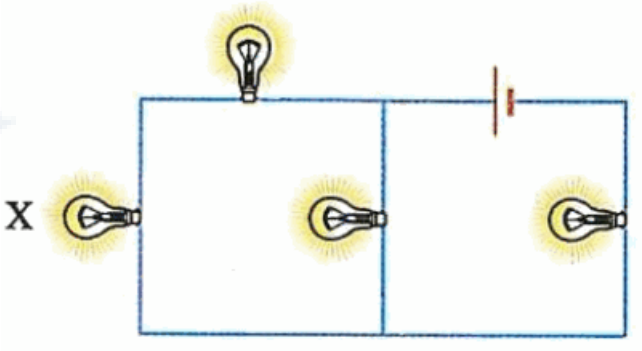
(A) $V_3 > V_2 > V_1$ (B) $V_2 > V_1 > V_3$ (C) $V_3 > V_1 > V_2$ (D) $V_1 > V_2 > V_3$

191 In the opposite electric circuit, the readings of the two voltmeters (V_1) and (V_2), respectively, are .....



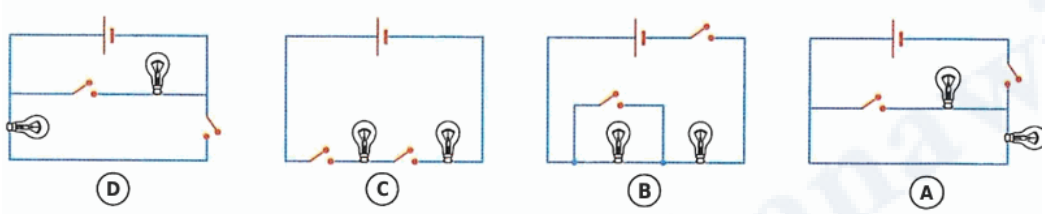
(A) $V_1 = 0, V_2 = 0$ (B) $V_1 = 0, V_2 = 30$ V
(C) $V_1 = 30$ V, $V_2 = 30$ V (D) $V_1 = 30$ V, $V_2 = 60$ V

192 In the electric circuit shown, four lamps are lit. If lamp X burns out, how many lamps stay lit?

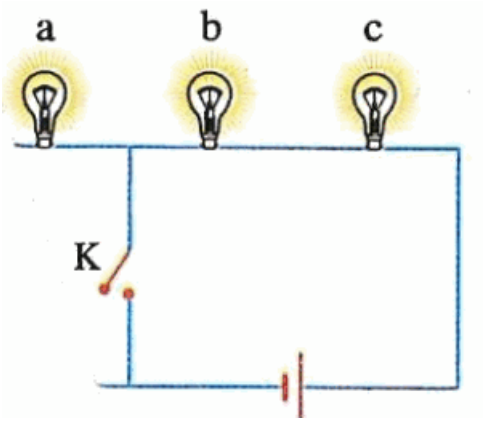


(A) 0 (B) 1 (C) 2 (D) 3

193 In which of the following electric circuits does one of the two lamps light up when both switches are closed?

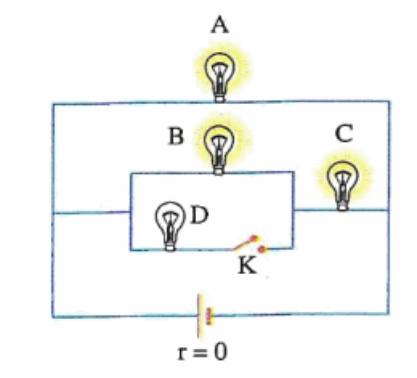


194 In the electric circuit shown in the figure, when switch K is closed, the brightness of each of lamps a and b .....



(A) Lamp a: increases, lamp b: decreases
(B) Lamp a: goes out, lamp b: increases
(C) Lamp a: increases, lamp b: increases
(D) Lamp a: goes out, lamp b: decreases

195 In the opposite electric circuit, given that the four lamps A, B, C, D are identical, what happens to the brightness of lamps A and B when switch K is closed?



(A) Lamp A: increases, lamp B: decreases

(B) Lamp A: stays constant, lamp B: increases

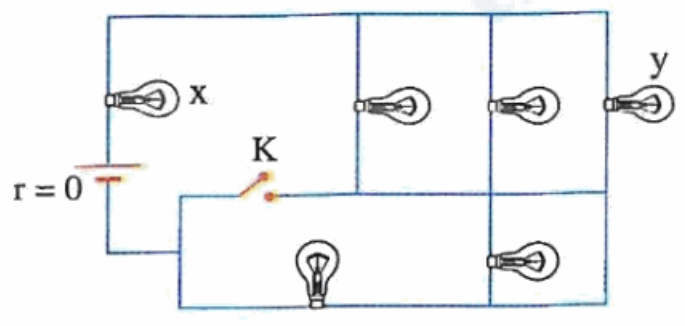
(C) Lamp A: stays constant, lamp B: decreases

(D) Lamp A: decreases, lamp B: increases

---

196 Six identical lamps, a DC source and a switch (K) are connected together as in the opposite figure:

the number of lit lamps when switch (K) is open is .....

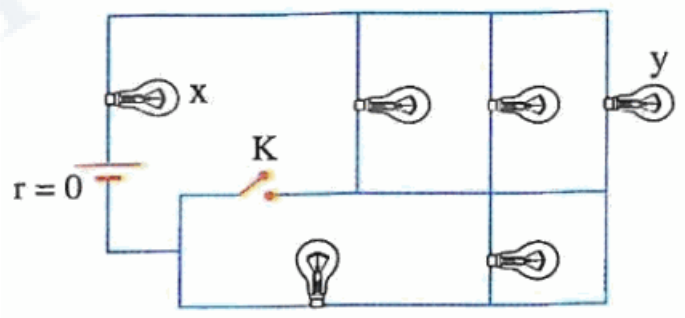


(A) 3 (B) 4 (C) 5 (D) 6

---

197 Six identical lamps, a DC source and a switch (K) are connected together as in the opposite figure:

the number of lit lamps when switch (K) is closed is .....

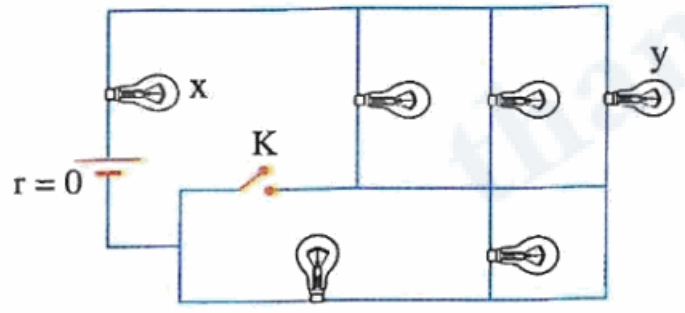


(A) 3 (B) 4 (C) 5 (D) 6

---

198 Six identical lamps, a DC source and a switch (K) are connected together as in the opposite figure:

what happens to the brightness of lamps x and y, respectively, when switch (K) is closed?



(A) Lamp x: increases, lamp y: does not change

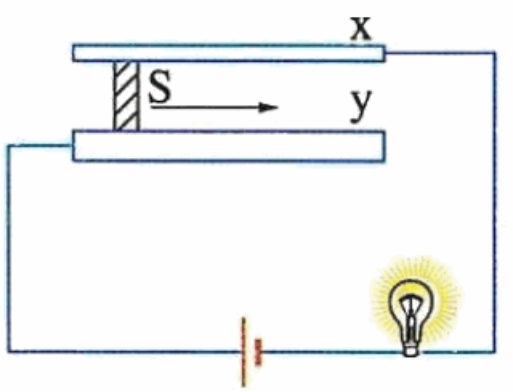
(B) Lamp x: increases, lamp y: increases

(C) Lamp x: decreases, lamp y: increases

(D) Lamp x: does not change, lamp y: decreases

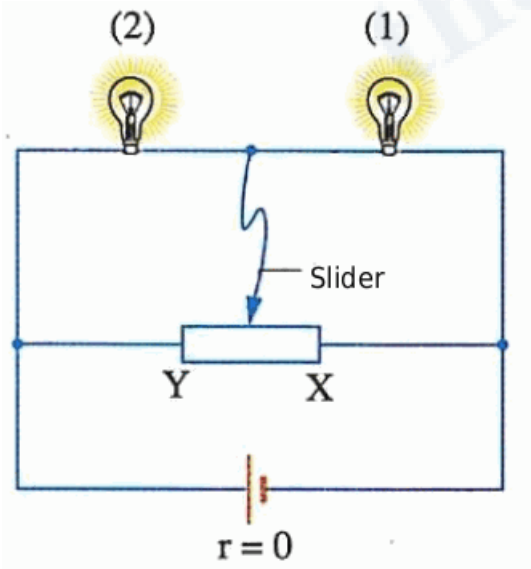
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199 In the opposite electric circuit, two rods x and y of the same metal have the same length, and the cross-sectional area of y is double that of x. They are connected together by a copper slider S. If the slider moves in the direction shown in the figure, the brightness of the lamp .....



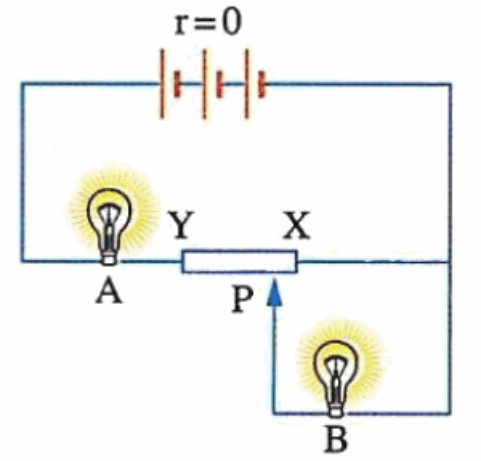
(A) increases
(B) decreases until it goes out
(C) does not change
(D) decreases but does not go out

200 In the opposite electric circuit, when the slider is at the middle of resistance wire XY, the two identical lamps (1) and (2) are equally bright. If the slider is moved a little towards X, what happens to the brightness of the two lamps?



(A) Lamp (1): increases, lamp (2): increases
(B) Lamp (1): increases, lamp (2): decreases
(C) Lamp (1): decreases, lamp (2): increases
(D) Lamp (1): decreases, lamp (2): decreases

201 In the circuit shown, rod XY has a resistance of 10 Ω and two identical lamps A and B each have a resistance of 10 Ω. What happens to the brightness of lamps A and B while the slider P moves from its position towards point Y?



(A) Lamp A: does not change, lamp B: increases

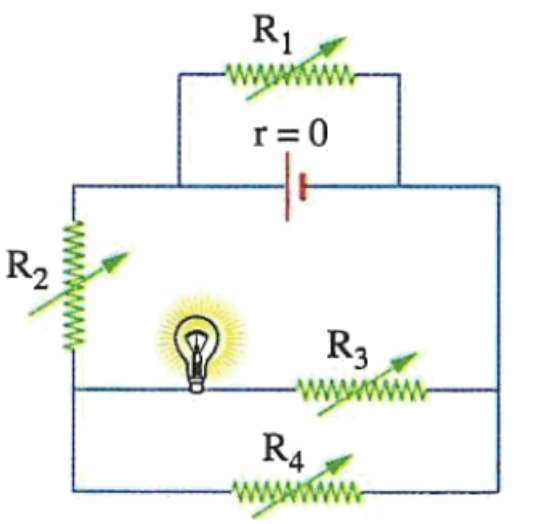
(B) Lamp A: increases, lamp B: increases

(C) Lamp A: decreases, lamp B: does not change

(D) Lamp A: increases, lamp B: decreases

---

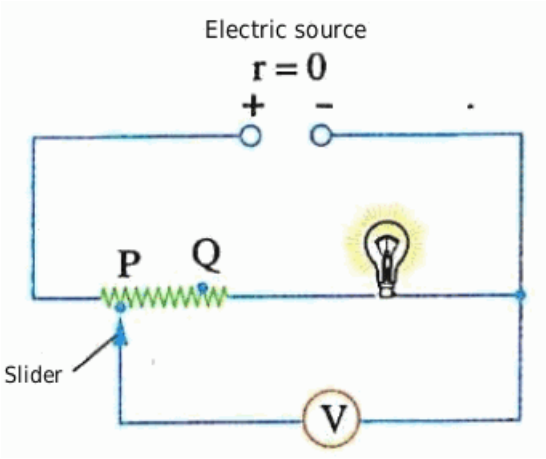
202 In the opposite electric circuit, which of the variable resistors shown increases the brightness of the lamp when its value is increased?



(A) Resistor (R_1) (B) Resistor (R_2) (C) Resistor (R_3) (D) Resistor (R_4)

---

203 In the opposite electric circuit, what happens to the brightness of the lamp and the voltmeter reading when the slider is moved from P to Q?



(A) Lamp brightness: increases, voltmeter reading: decreases

(B) Lamp brightness: increases, voltmeter reading: increases

(C) Lamp brightness: does not change, voltmeter reading: decreases

(D) Lamp brightness: does not change, voltmeter reading: increases

---

204 Two lamps (1) and (2) of resistances R_1 and R_2, respectively, are connected together in series with an electric source. If $R_1 < R_2$, then .....

(A) Lamp (1) is brighter

(B) Lamp (2) is brighter

(C) The two lamps are equally bright

(D) The answer cannot be determined

---

205 Two lamps (1) and (2) of resistances R_1 and R_2, respectively, are connected together in parallel with an electric source. If $R_1 > R_2$, then .....

(A) Lamp (1) is brighter

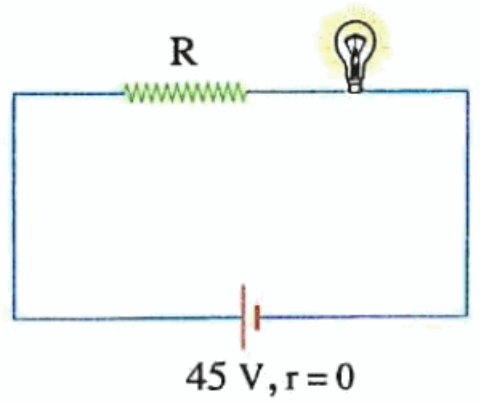
(B) Lamp (2) is brighter

(C) The two lamps are equally bright

(D) The answer cannot be determined

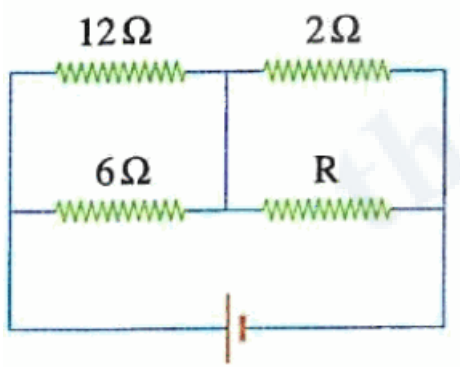
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206 In the electric circuit shown in the figure, an electric lamp is marked (30 V, 45 W). The value of resistance R that makes the lamp light at its rated voltage and power equals .....



(A) 1.5 Ω (B) 10 Ω (C) 15 Ω (D) 67.5 Ω

207 In the opposite electric circuit, if the electric power consumed in the 12 Ω and 2 Ω resistors is 48 W and 32 W, respectively, the electric power consumed in resistor (R) equals .....

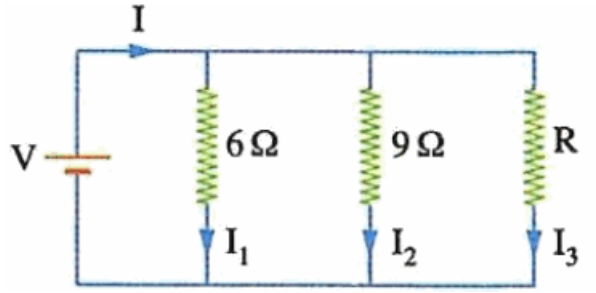


(A) 16 W (B) 64 W (C) 75 W (D) 81 W

208 Three resistors x, y, z of values R, 2R and 0.5R, respectively, are connected together in series in a closed electric circuit. The ratio of the power consumed in them $(P_w)_x : (P_w)_y : (P_w)_z$, respectively, is .....

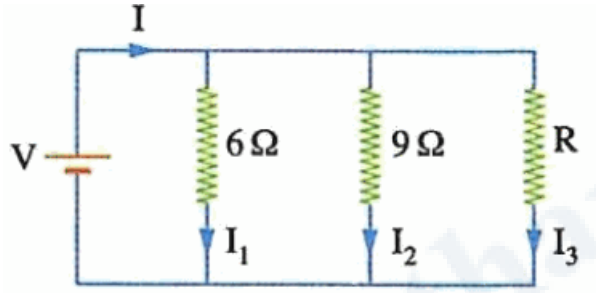
(A) *4 : 2 : 1* (B) *2 : 3 : 1* (C) *2 : 4 : 1* (D) *2 : 3 : 4*

209 In the circuit shown, if the power consumed in resistor R is 12 W and $I_1 = 2$ A, then: the potential difference across the battery equals .....



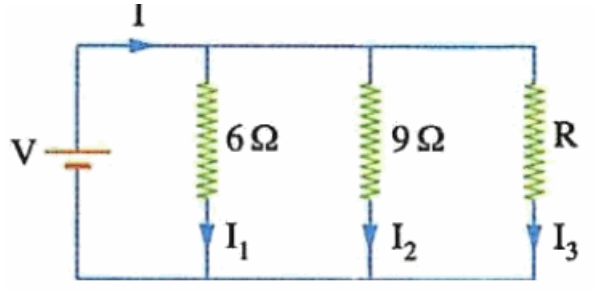
(A) 24 V (B) 12 V (C) 6 V (D) 3 V

210 In the circuit shown, if the power consumed in resistor R is 12 W and $I_1 = 2$ A, then: the total current in the circuit equals .....



(A) *4/3* A (B) *13/3* A (C) *7/3* A (D) 1 A

211 In the circuit shown, if the power consumed in resistor R is 12 W and $I_1 = 2$ A, then: the value of resistance R equals .....



(A) 24 Ω (B) 18 Ω (C) 12 Ω (D) 9 Ω

212 When two resistors R and 4R are connected in parallel with a battery, the power consumed in resistor R is ..... the power consumed in resistor 4R

(A) four times (B) double (C) equal to (D) a quarter of

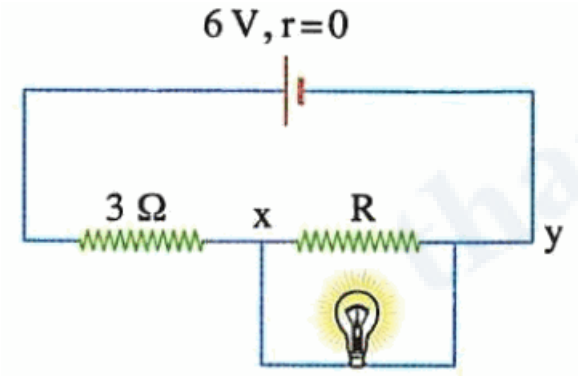
213 Two resistors 10 Ω and R: the power consumed in them when connected together in parallel with a battery of negligible internal resistance is four times the power consumed in them when connected together in series with the same battery. The value of R equals .....

(A) 10 Ω (B) 7.5 Ω (C) 5 Ω (D) 2.5 Ω

214 Two conductors of the same metal are connected together in parallel to a potential difference of 220 V. If the length of the first conductor is double that of the second and the diameter of the first is double that of the second, the ratio between the power consumed in the two conductors $(((P_w)_1)/((P_w)_2))$ equals .....

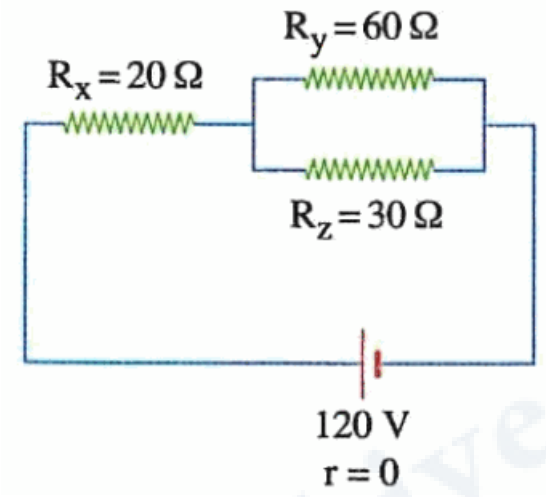
(A) *4/1* (B) *2/1* (C) *1/2* (D) *1/4*

215 In the electric circuit shown, if the potential difference across the lamp is 1.5 V, the equivalent resistance between points x and y equals .....



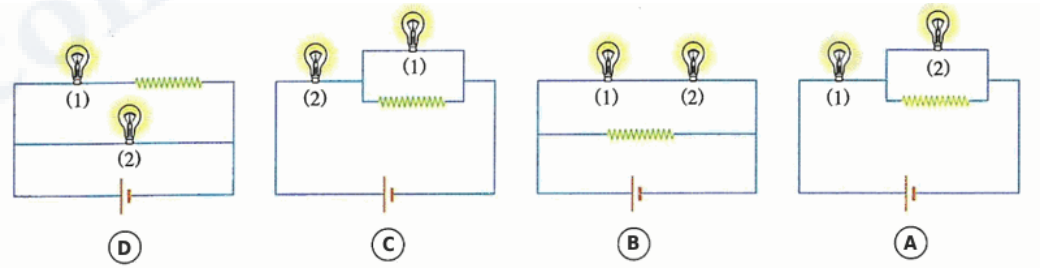
(A) 0.45 Ω (B) 1 Ω (C) 5 Ω (D) 3 Ω

216 In the opposite circuit:
the total power consumed in the circuit equals .....

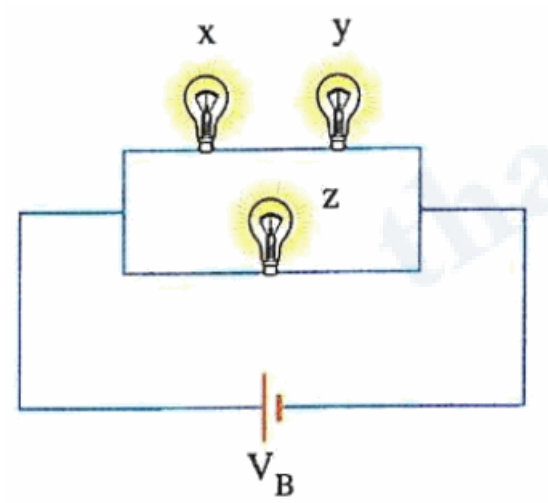


(A) 120 W (B) 240 W (C) 360 W (D) 480 W

217 Two lamps (1) and (2) are connected together and with a resistor and a battery in several ways as in the following electric circuits. If lamp (1) is marked (120 V – 60 W) and lamp (2) is marked (120 V – 120 W), in which of the following circuits can the two lamps work at their rated power?



218 In the opposite circuit, three identical lamps x, y, z are connected together to a battery of negligible internal resistance. The ratio between the power consumed in the three lamps $(P_w)_x : (P_w)_y : (P_w)_z$, respectively, is .....

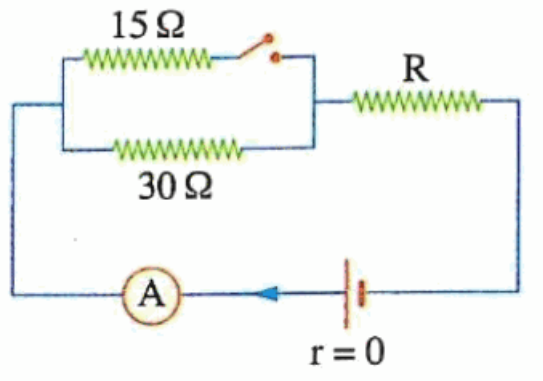


(A) *1 : 1 : 4* (B) *1 : 1 : 1* (C) *4 : 4 : 1* (D) *1 : 1 : 2*

219 Three identical lamps are connected once in series and once again in parallel to the same potential difference. The ratio of the power consumed in the series case to the power consumed in the parallel case equals .....

(A) *4/3* (B) *9/5* (C) *1/9* (D) *3/4*

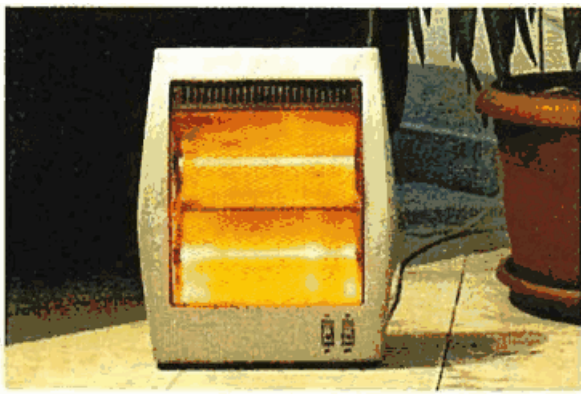
220 In the opposite circuit, given that when the switch is closed the power consumed in the circuit doubles, the value of R is .....



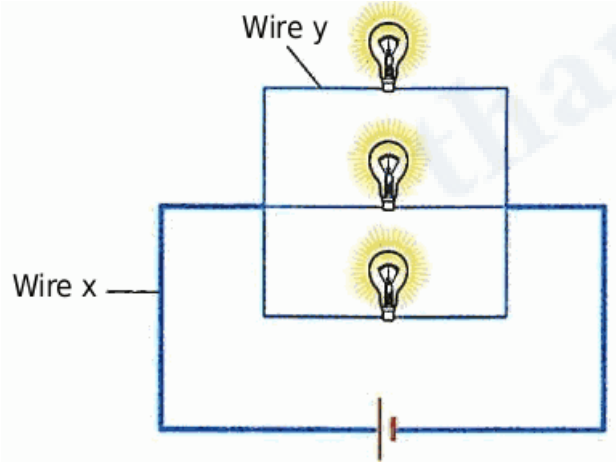
(A) 3 Ω (B) 6 Ω (C) 8 Ω (D) 10 Ω

Essay questions — 29 questions

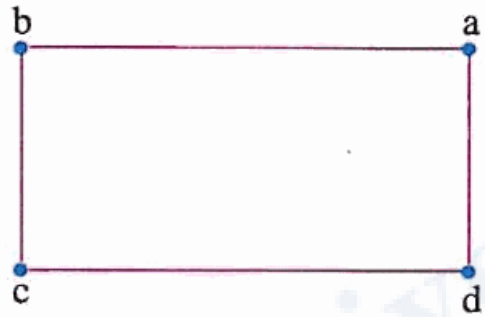
1 The opposite figure shows an electric heater with two heating elements. Are the two elements connected together in series or in parallel? Why?



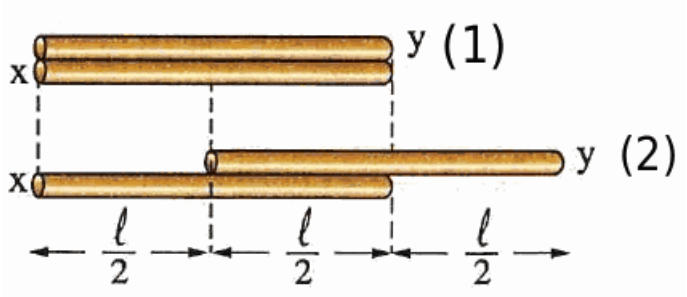
2 The opposite figure represents an electric circuit. Explain why it is better for wire x to be thicker than wire y.



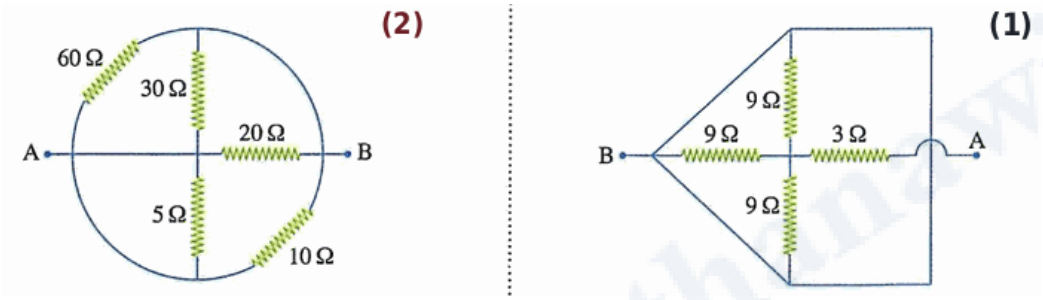
3 A wire of uniform cross-section and resistance R is bent into a rectangle abcd whose length ab is double its width bc, as in the opposite figure. To which two points should an electric source be connected to get the greatest equivalent resistance?



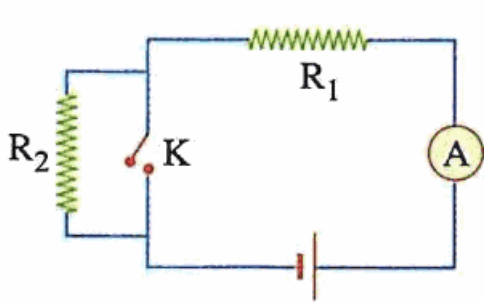
4 Two identical uninsulated wires of uniform cross-section, each of length ℓ and electric resistance R, are placed in contact side by side in two ways (1) and (2) as shown in the opposite figure. What is the ratio between the equivalent resistances between ends x and y in the two cases R_1/R_2?



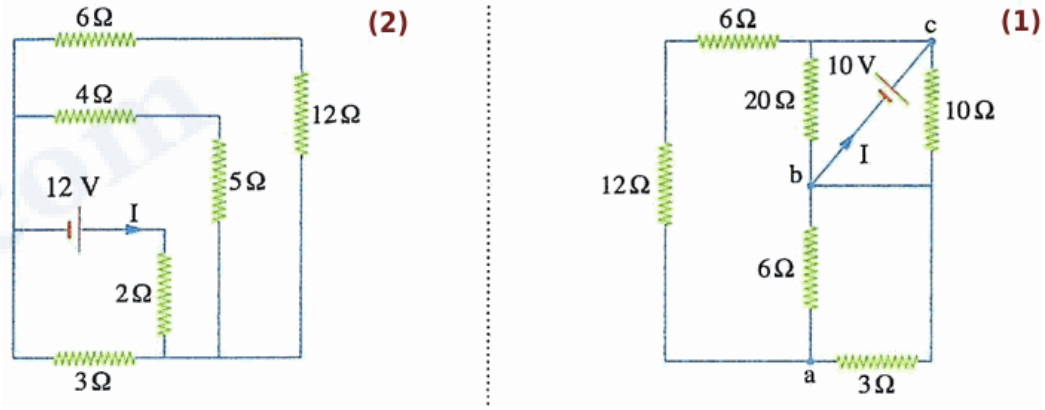
5 In the following two figures, calculate the equivalent resistance between points A and B:



6 In the electric circuit shown, explain what happens to the ammeter reading when switch K is closed.



7 Calculate the current (I) in each of the following two circuits:

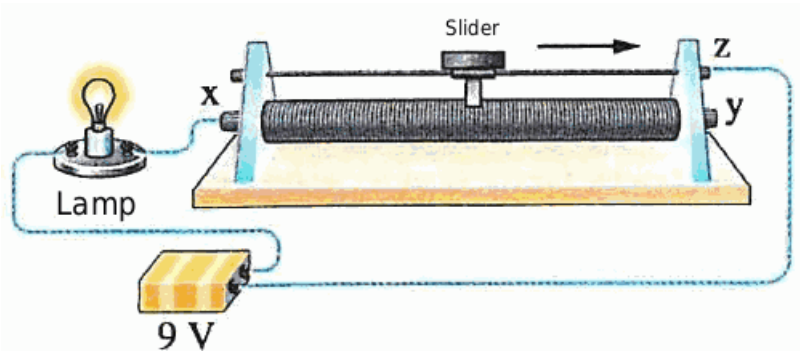


8 An electric circuit consists of a voltage source of emf 130 V and negligible internal resistance, connected to two resistors *300* Ω and *400* Ω connected together in series. Calculate the reading of a voltmeter of resistance *200* Ω if it is connected across:

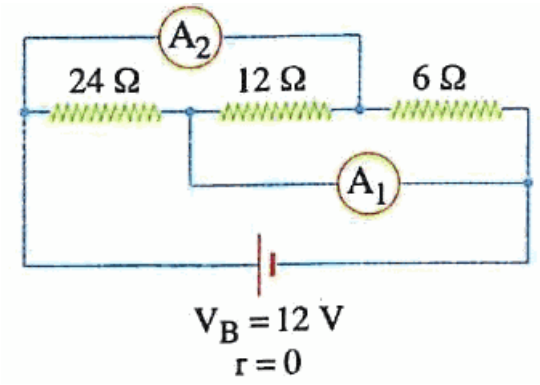
(1) the *300* Ω resistor

(2) the *400* Ω resistor

9 The opposite figure shows a sliding rheostat connected in series with an electric lamp and a 9 V battery of negligible internal resistance. What happens to the potential difference between ends x and z when the slider is moved towards end z? Why?



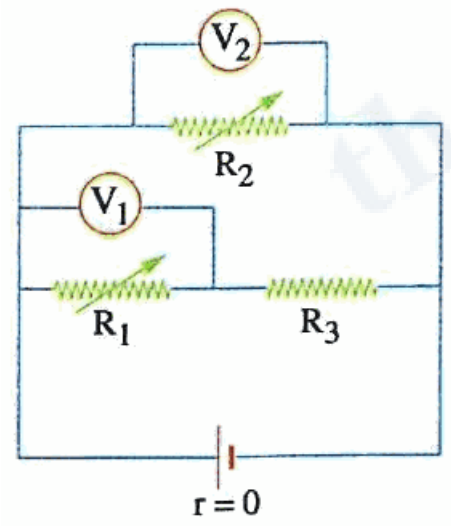
10 In the electric circuit shown in the opposite figure, calculate the ratio between the readings of the two ammeters A_1/A_2



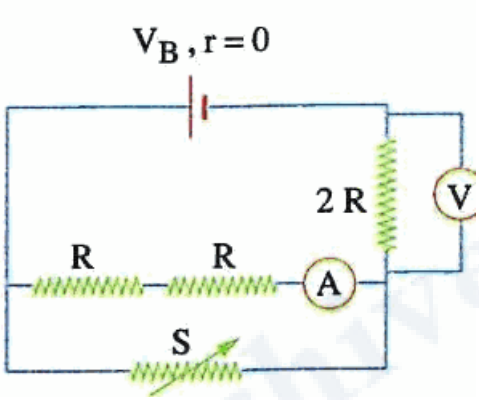
11 In the opposite electric circuit, explain what happens to the readings of the two voltmeters V_1 and V_2 when:

(1) the variable resistor R_1 is increased

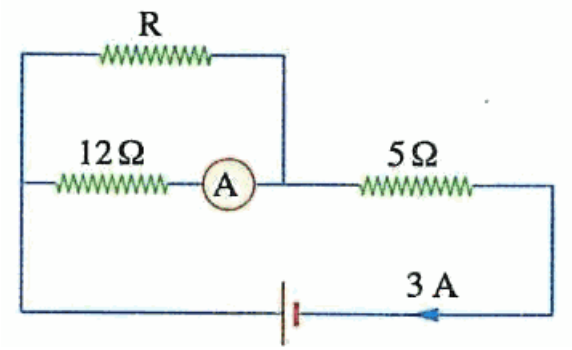
(2) the variable resistor R_2 is increased



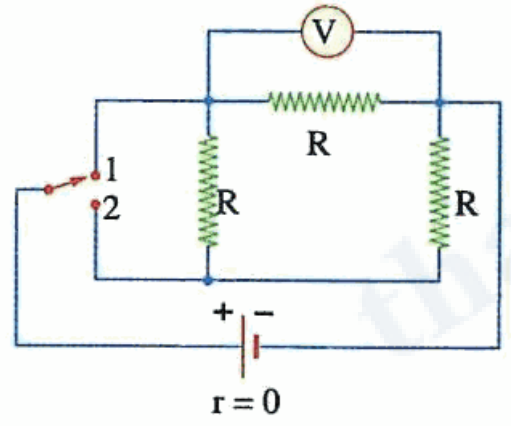
12 The opposite figure shows a closed electric circuit. Explain why the readings of the ammeter and the voltmeter change when the rheostat (S) is increased.



13 In the opposite circuit, if the ammeter reading is 1 A, calculate the equivalent resistance of the circuit.



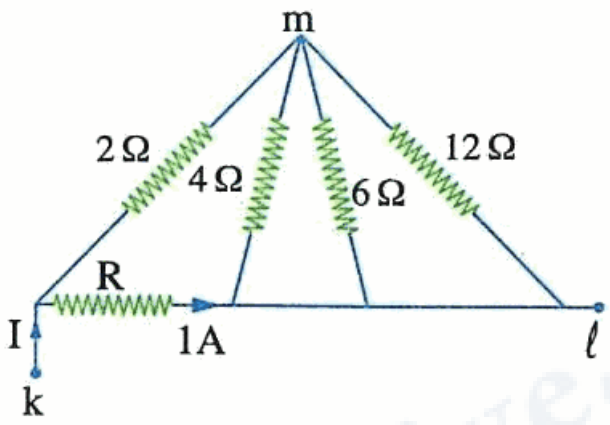
14 In the opposite electric circuit, explain what happens to the voltmeter reading when the switch is changed from position (1) to position (2).



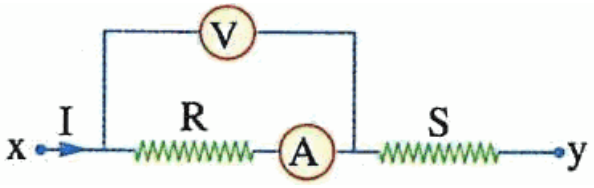
15 The opposite figure represents part of an electric circuit, where the potential difference between points k and ℓ is 50 V and the current in resistor R is 1 A. Calculate:

(1) the potential difference between points k and m

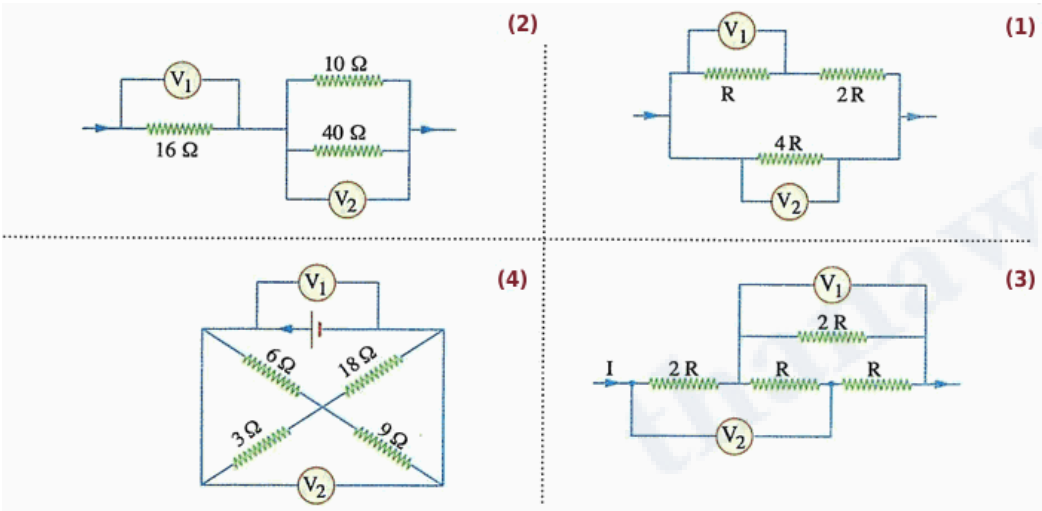
(2) the value of resistance R



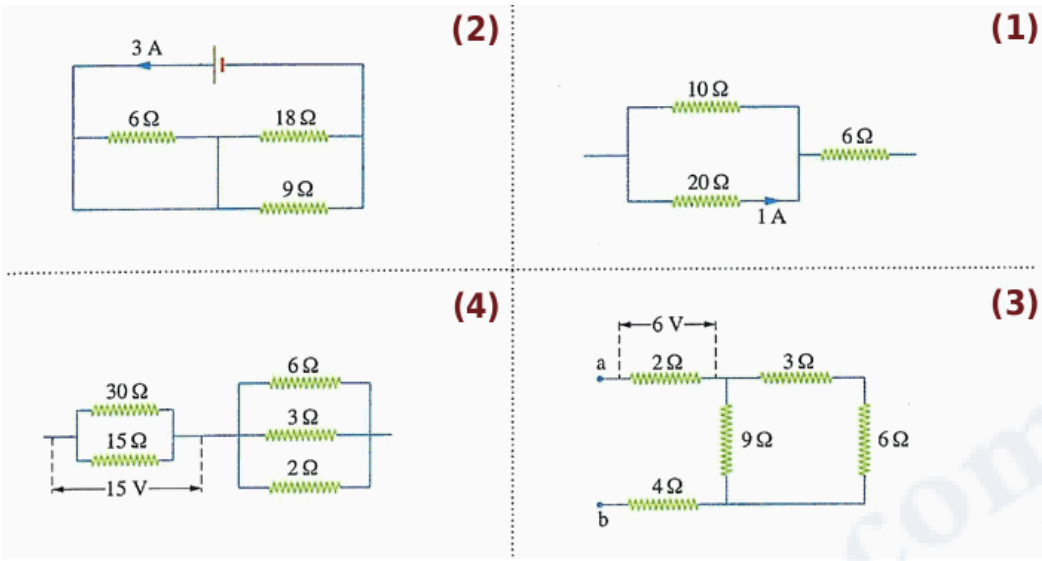
16 In the opposite figure, if the potential difference between points x and y is 20 V, the ammeter reading is 1 A and the voltmeter reading is 5 V, calculate the value of each of the two resistances R and S.



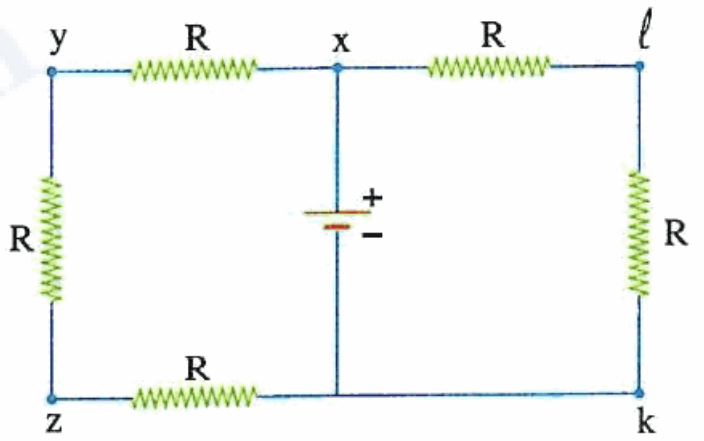
17 In each of the following figures, if the reading of voltmeter V_1 is 12 V, calculate the reading of voltmeter V_2:



18 Calculate the current (I) in the $6\ \Omega$ resistor in each of the following figures:



19 In the opposite electric circuit, arrange points x, y, z, k, ℓ in descending order of their electric potential, with explanation.



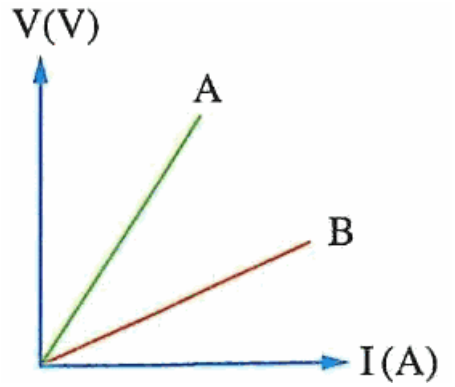
20 Six identical electric lamps, each working on a maximum potential difference of 100 V, are to be operated using a source whose terminal potential difference is 200 V. Show how these lamps can be connected together so that each of them carries the maximum current it can withstand.

21 Three resistors of *10* Ω, *20* Ω and *40* Ω are connected together in a certain way with an electric source, and currents of 0.4 A, 0.5 A and 0.1 A flow in these resistors, respectively. What is their equivalent resistance?

22 The opposite graph shows the relation between the potential difference (V) across each of two wires A and B and the current (I) in each of them:

(1) Which of the two wires has the greater electric resistance? Why?

(2) If the two wires are connected together in parallel with an electric source, which of them consumes more power? Why?

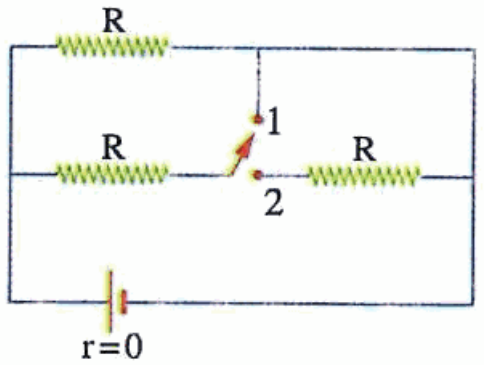


23 Four lamps, each of resistance $6\ \Omega$, are connected together in parallel, then the group is connected to a battery of emf 12 V and negligible internal resistance. Calculate:

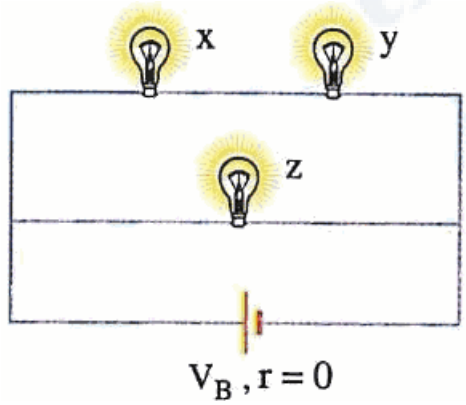
(1) the total charge leaving the battery in 10 s

(2) the electric energy consumed in each lamp in 10 s

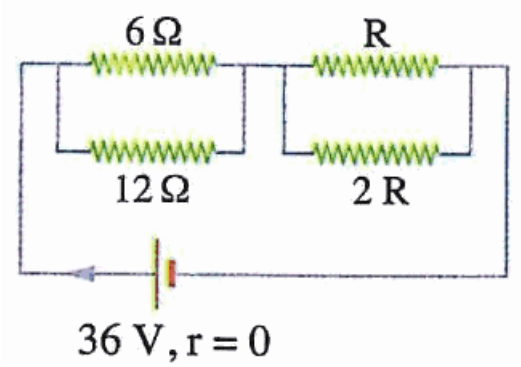
24 In the opposite circuit, calculate the ratio between the power consumed in the circuit when the switch is closed in position (1) and when it is closed in position (2).



25 Three lamps x, y, z of resistances R, 2R and 4R, respectively, are connected to an electric source V_B of negligible internal resistance as in the opposite figure. Determine, with explanation, which of the three lamps consumes the greatest electric power.



26 In the circuit shown, if the power consumed in the 6 Ω resistor is 24 W, calculate the power consumed in resistor R.



27 Two students (M) and (N) each built an electric circuit using three identical lamps, a switch and an electric source as shown in the following two figures:

(1) Compare the brightness of the lamps in the two circuits when switch K is closed.

(2) What happens to the brightness of the lamps in each circuit when one of them is damaged?

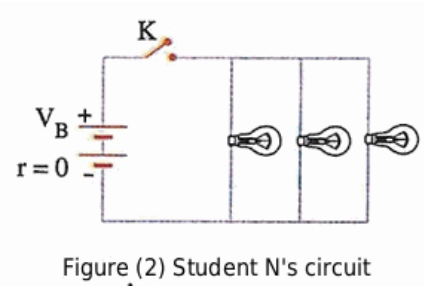


Figure (2) Student N's circuit

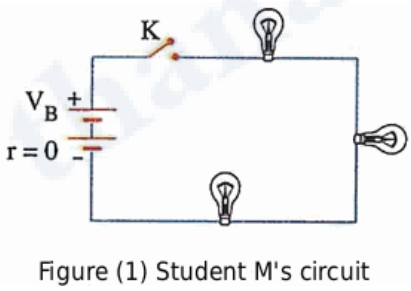
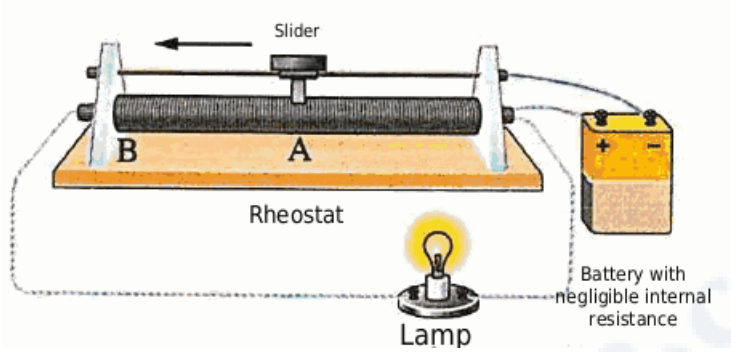


Figure (1) Student M's circuit

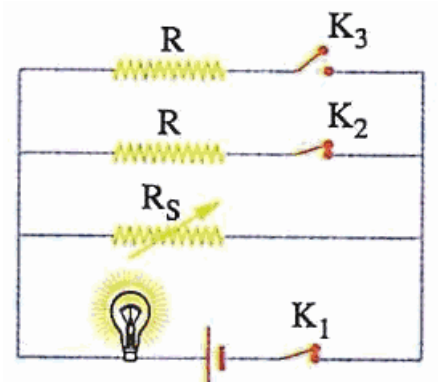
28 Explain what happens in the opposite electric circuit to the brightness of the lamp when:

(1) the slider of the rheostat is moved from position A to position B

(2) the positions of the lamp and the battery are exchanged and the slider is moved from A to B

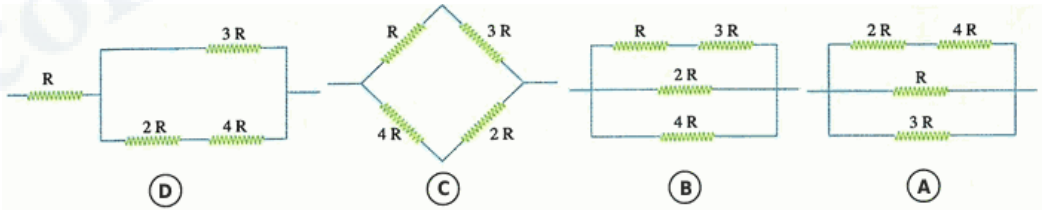


29 In the electric circuit shown in the figure, how can the brightness of the lamp be increased in two different ways?

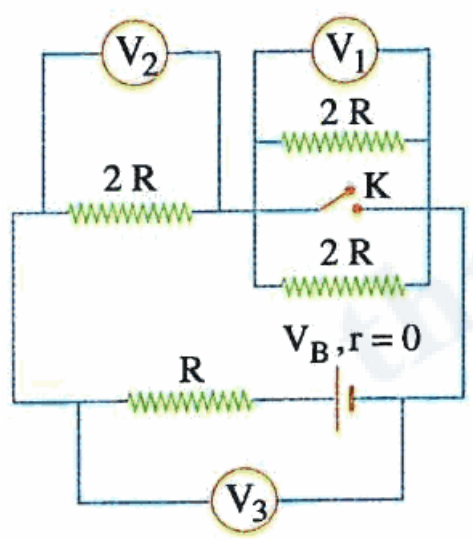


Past exam questions — 32 questions

1 Which of the following groups of resistors gives a total resistance of R? (Trial exam / May 2021)



2 Which row of the following table expresses what happens to the readings of the voltmeters V_1, V_2, V_3 when switch (K) is closed in the circuit shown? (Trial exam / May 2021)



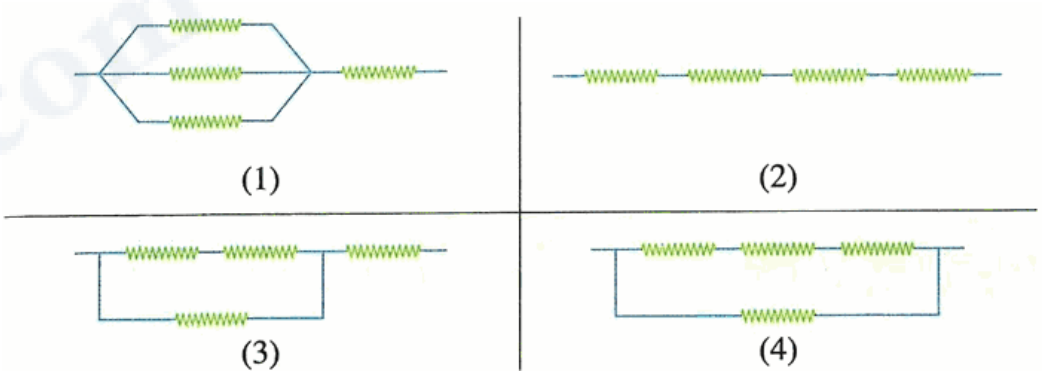
(A) V_1 becomes zero, V_2 increases, V_3 decreases

(B) V_1 increases, V_2 increases, V_3 decreases

(C) V_1 becomes zero, V_2 decreases, V_3 increases

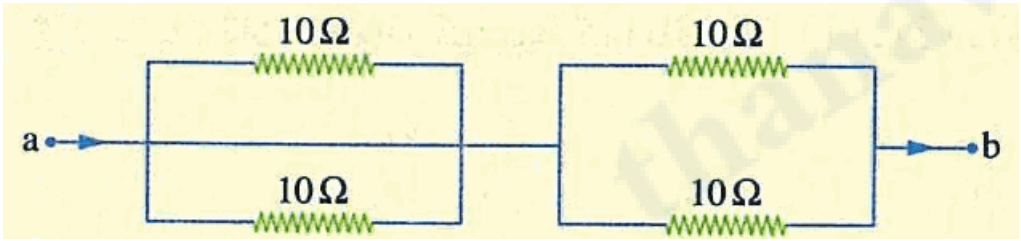
(D) V_1 increases, V_2 increases, V_3 increases

3 Four identical resistors are connected together as in the figures shown. The order of the figures according to the equivalent resistance of these four resistors from the greatest to the smallest is ..... (Trial exam / June 2021)



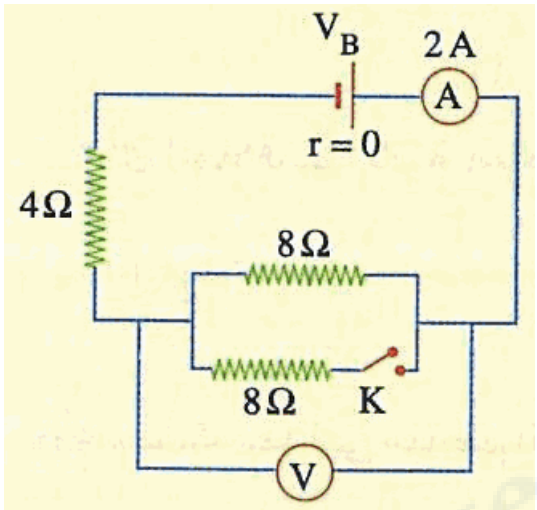
(A) $4 < 3 < 2 < 1$ (B) $1 < 2 < 3 < 4$ (C) $4 < 1 < 3 < 2$ (D) $1 < 4 < 2 < 3$

4 In front of you is part of an electric circuit. The equivalent resistance between points a and b equals ..... (Trial exam / June 2021)



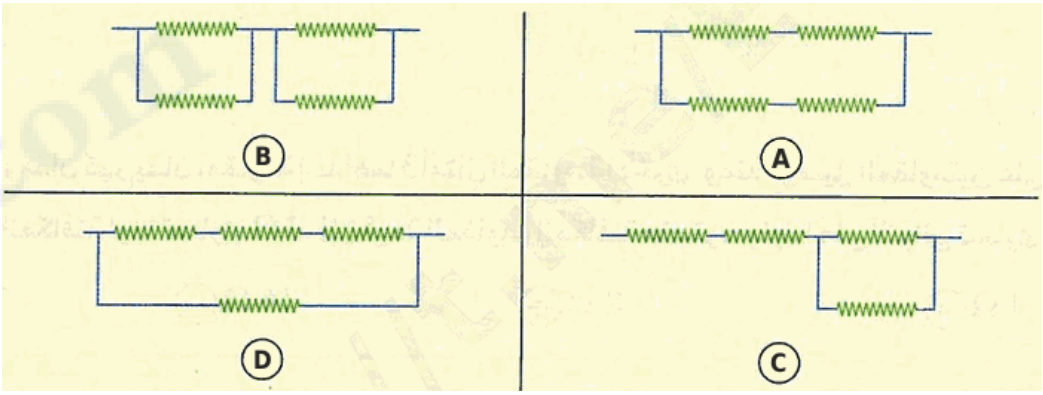
(A) 5 Ω (B) 10 Ω (C) 20 Ω (D) 40 Ω

5 In the circuit shown in the figure, when switch (K) is closed, the voltmeter reading equals ..... (Trial exam / June 2021)

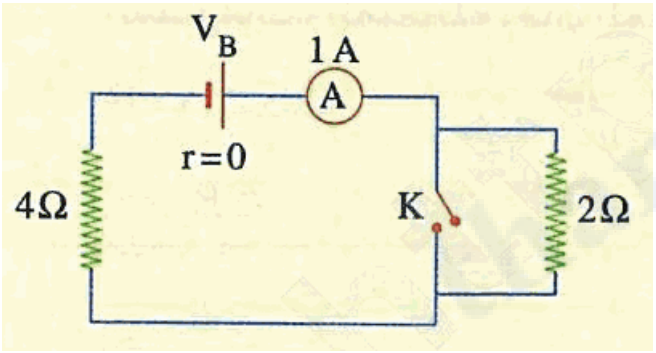


(A) 12 V (B) 8 V (C) 6 V (D) 4 V

6 Four equal resistors are connected together as in the following figures. Which figure gives the smallest equivalent resistance? (1st session 2021)

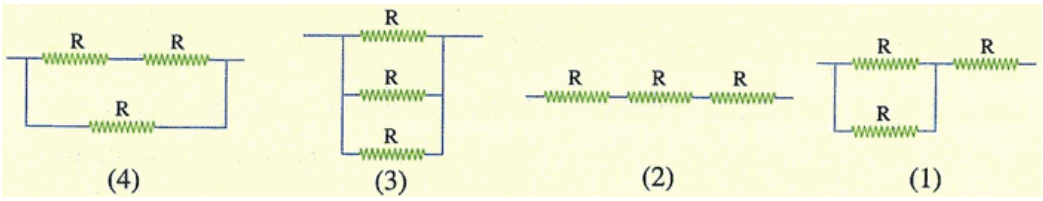


7 In the circuit shown in the figure, when switch (K) is closed, the ammeter reading becomes ..... (1st session 2021)



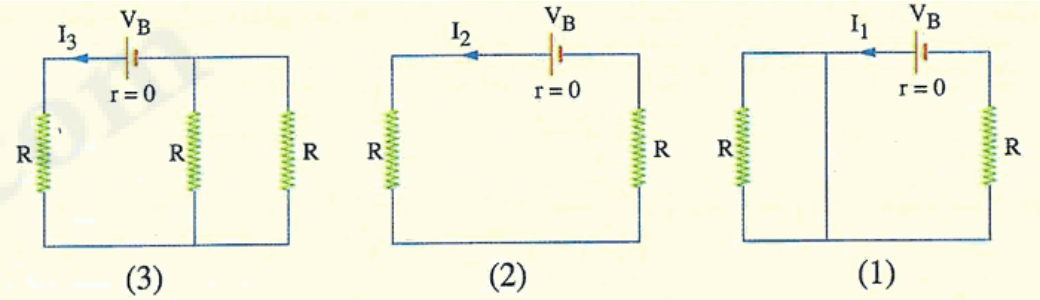
(A) 0.5 A (B) 1.5 A (C) 2 A (D) 0.75 A

8 What is the correct order of the following figures according to the equivalent resistance of the group of resistors from the smallest to the greatest? (2nd session 2021)



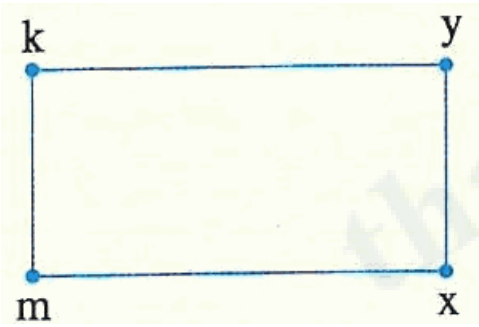
(A) $2 > 1 > 4 > 3$ (B) $1 > 3 > 4 > 2$ (C) $2 > 4 > 3 > 1$ (D) $1 > 2 > 3 > 4$

9 You have three electric circuits as in figures (1), (2), (3). Which of the following relations is correct? (2nd session 2021)



(A) $I_1 = I_2$ (B) $I_1 > I_3$ (C) $I_2 > I_3$ (D) $I_3 > I_1$

10 A metal wire of uniform cross-section is bent into a rectangle kyxm whose length (ky) is double its width (mk), as in the opposite figure. To get the greatest electric resistance, the electric source must be connected to points ..... (1st session 2022)

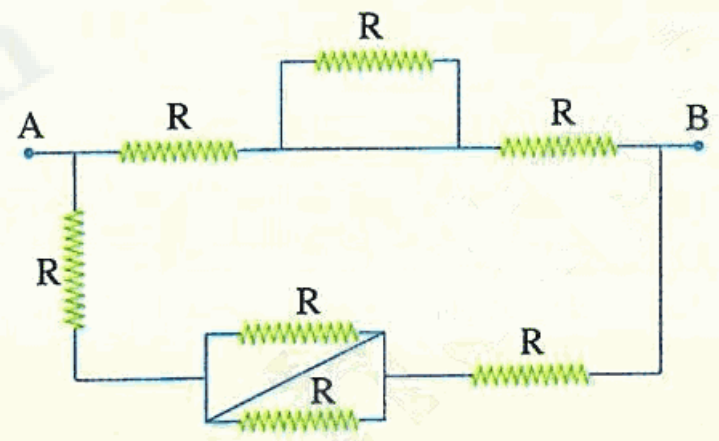


(A) m, k (B) k, y (C) x, y (D) k, x

11 You have two electric resistors; the resistance of one of them is 3 times the other. When the two resistors are connected in parallel, their equivalent resistance is $3\ \Omega$. The equivalent resistance when they are connected in series equals ..... (1st session 2022)

(A) $12\ \Omega$ (B) $16\ \Omega$ (C) $8\ \Omega$ (D) $4\ \Omega$

12 The figure represents part of an electric circuit containing a group of identical resistors. The equivalent resistance between points A and B equals ..... (2nd session 2022)

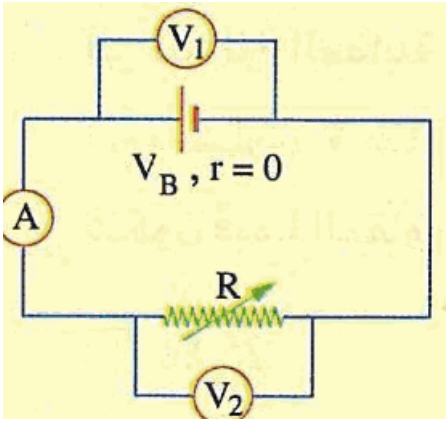


(A) $6R/5$ (B) $5R/4$ (C) $3R/2$ (D) R

13 You have three resistors $R_1 = 3R, R_2 = 4R, R_3 = 6R$. When they are connected in parallel, the equivalent resistance is $4\ \Omega$, so the equivalent resistance when they are connected in series equals ..... (2nd session 2022)

(A) $9\ \Omega$ (B) $27\ \Omega$ (C) $13\ \Omega$ (D) $39\ \Omega$

14 In the electric circuit in front of you, when the value of resistance (R) is increased, the reading of V_1 ..... and the reading of V_2 ..... (2nd session 2022)



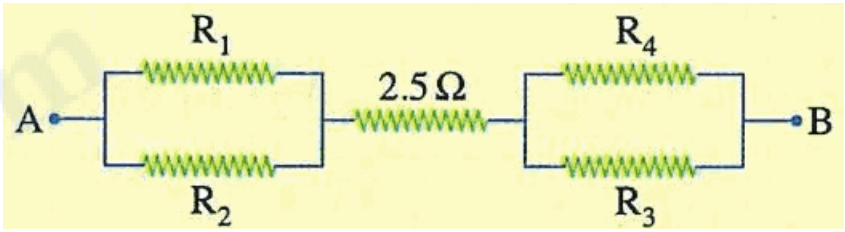
(A) V_1 does not change, V_2 does not change

(B) V_1 increases, V_2 increases

(C) V_1 increases, V_2 does not change

(D) V_1 does not change, V_2 increases

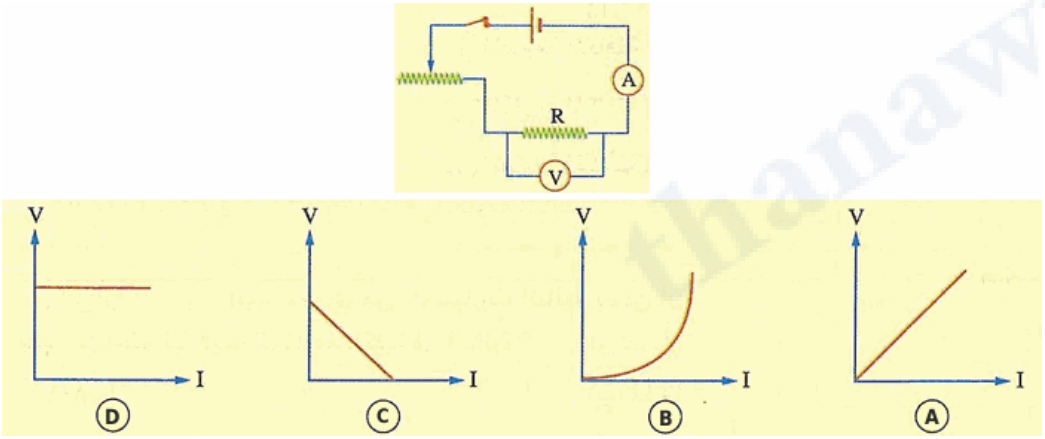
15 Which of the resistance values in the following choices makes the equivalent resistance between points (A) and (B) in the opposite figure equal to $5\ \Omega$? (Trial exam 2023)



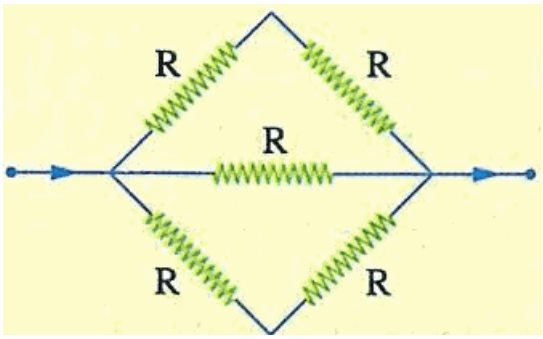
(A) $R_1 = 2, R_2 = 9, R_3 = 8, R_4 = 2.5$ (B) $R_1 = 1, R_2 = 9, R_3 = 2, R_4 = 8$

(C) $R_1 = 1, R_2 = 2, R_3 = 8, R_4 = 9$ (D) $R_1 = 8, R_2 = 1, R_3 = 9, R_4 = 5$

16 The opposite figure shows the electric circuit used to determine the value of the fixed resistance (R). Which of the following graphs represents the correct relation between the voltmeter reading (V) and the ammeter reading (I) at constant temperature? (1st session 2023)

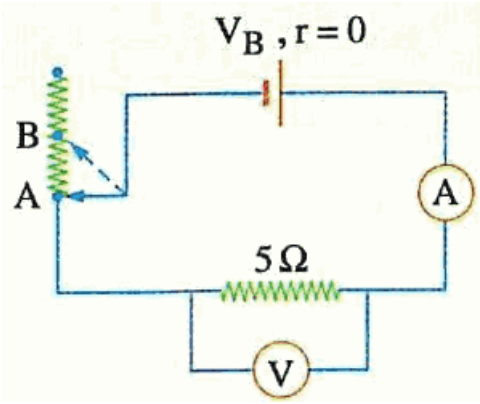


17 The figure shows part of an electric circuit. The equivalent resistance of the group of resistors shown equals ..... (1st session 2023)



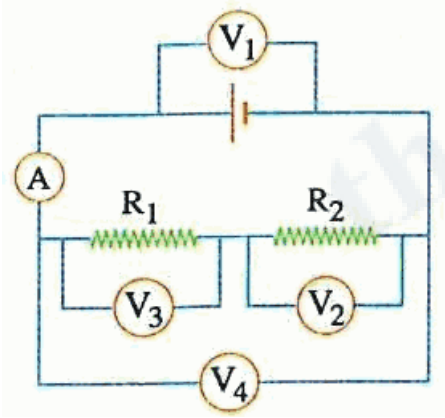
(A) R (B) 2R (C) $R/2$ (D) $3R/5$

18 In the opposite circuit, if the voltmeter reading is 12 V when the slider of the rheostat is at point (A), and its reading becomes 3 V when the slider is moved to point (B), the value of the resistance taken from the rheostat is ..... (1st session 2023)



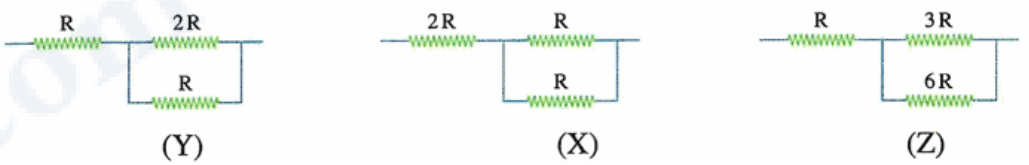
(A) *25 Ω* (B) *30 Ω* (C) *15 Ω* (D) *20 Ω*

19 In the electric circuit shown, which two voltmeters have the same reading? (2nd session 2023)



(A) V_3 , V_2 (B) V_4 , V_2 (C) V_1 , V_2 (D) V_4 , V_1

20 Each figure shows a group of different resistors connected together. Which of the following choices is correct when comparing the equivalent resistances of these groups? (1st session 2024)



(A) The equivalent resistance in figure (X) equals the equivalent resistance in figure (Y)

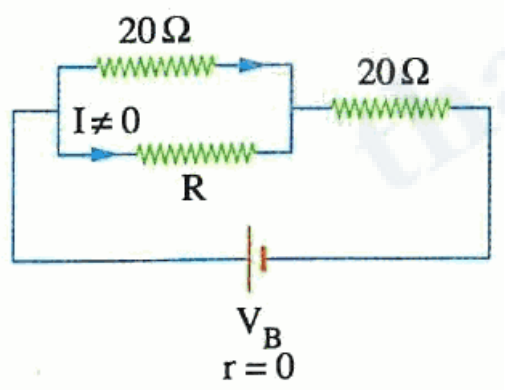
(B) The equivalent resistance in figure (X) is less than the equivalent resistance in figure (Y)

(C) The equivalent resistance in figure (Z) is less than the equivalent resistance in figure (X)

(D) The equivalent resistance in figure (Z) is greater than the equivalent resistance in figure (Y)

---

21 From the opposite electric circuit, which of the following choices can be a possible value of the total resistance of the circuit? (2nd session 2024)



(A) *19 Ω* (B) *25 Ω* (C) *15 Ω* (D) *40 Ω*

---

22 When two different resistors are connected together in parallel, their equivalent resistance is ..... (Sample exam 2025)

(A) equal to the sum of the two resistances

(B) between the values of the two resistances

(C) less than the smaller resistance

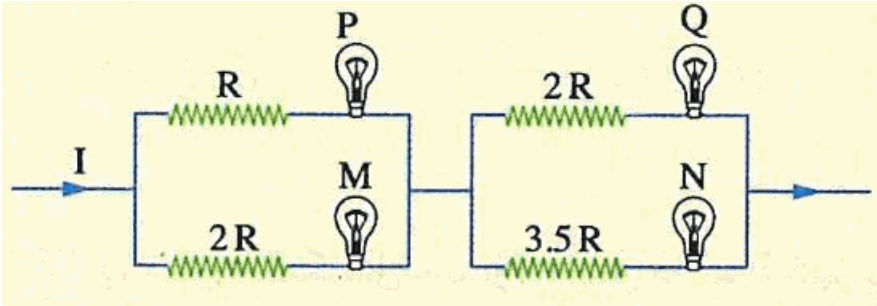
(D) greater than the larger resistance

---

23 A wire of uniform cross-section and resistance $120\ \Omega$ is cut into equal lengths, and the pieces are connected together in parallel, giving a total resistance of $1.2\ \Omega$. The number of pieces the wire was divided into equals ..... (Sample exam 2025)

(A) 6 (B) 10 (C) 12 (D) 24

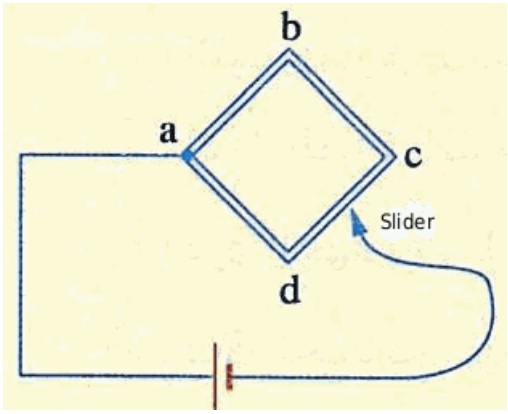
24 Four identical lamps Q, P, M, N, each with a filament resistance R, are connected with several resistors as shown in the opposite figure. The brightness is the same ..... (Sample exam 2025)



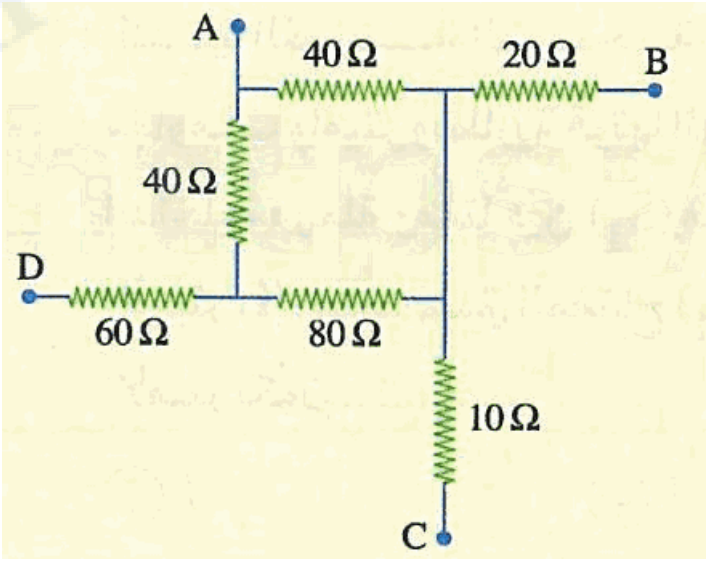
(A) for lamps Q and M (B) for lamps M and N

(C) for lamps P and N (D) for all the lamps

25 A wire of uniform cross-section is bent into a square frame abcd, each side of which has resistance R. One terminal of a battery is connected to point a on the frame as in the opposite figure. The point which, if the other terminal of the battery is connected to it, gives the smallest current in the circuit is ..... (Sample exam 2025)

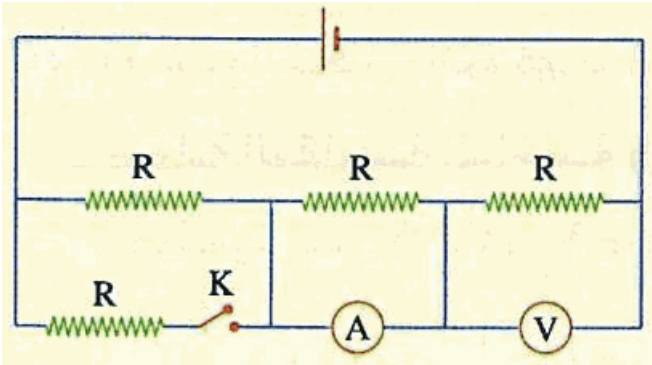


26 Several resistors are connected as in the opposite figure. To which two of the following points should the terminals of a battery be connected to get the smallest equivalent resistance? (Sample exam 2025)



(A) B, C (B) A, B (C) C, D (D) A, D

27 In the opposite electric circuit, if the voltmeter resistance is infinite and the ammeter resistance is negligible, what happens to the ammeter reading and the voltmeter reading, respectively, when switch (K) is closed? (Sample exam 2025)



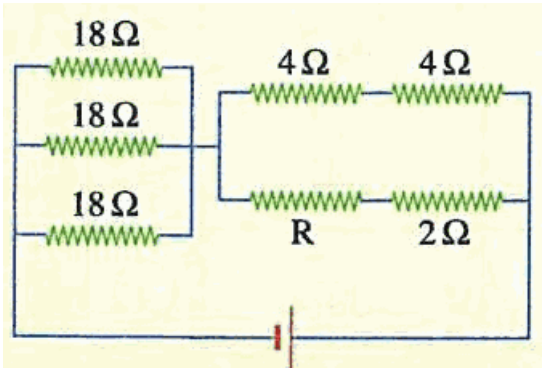
(A) Ammeter increases, voltmeter increases

(B) Ammeter decreases, voltmeter decreases

(C) Ammeter decreases, voltmeter increases

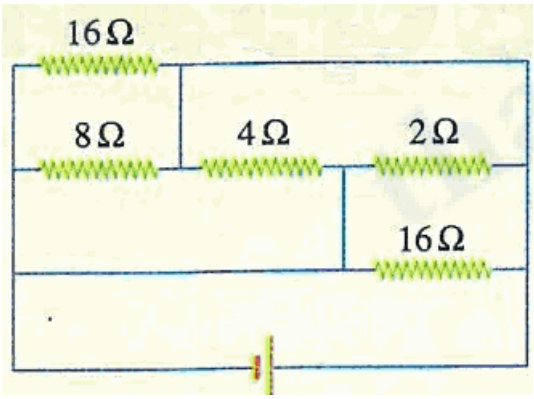
(D) Ammeter increases, voltmeter decreases

28 The figure shows several resistors connected together. If their equivalent resistance is *10* Ω, the value of resistance (R) equals ..... (1st session 2025)



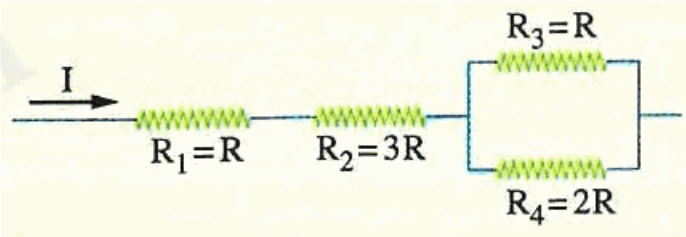
(A) *4* Ω (B) *2* Ω (C) *6* Ω (D) *8* Ω

29 Several resistors are connected in an electric circuit as in the opposite figure. Using the resistance values shown, the equivalent resistance of the group of resistors equals ..... (2nd session 2025)



(A) *6* Ω (B) *1* Ω (C) *8* Ω (D) *16* Ω

30 The figure represents part of an electric circuit with four resistors R_1, R_2, R_3, R_4. Which of the following statements is correct? (Sample exam 2026)



(A) The current in resistor (R_1) equals the current in resistor (R_3)

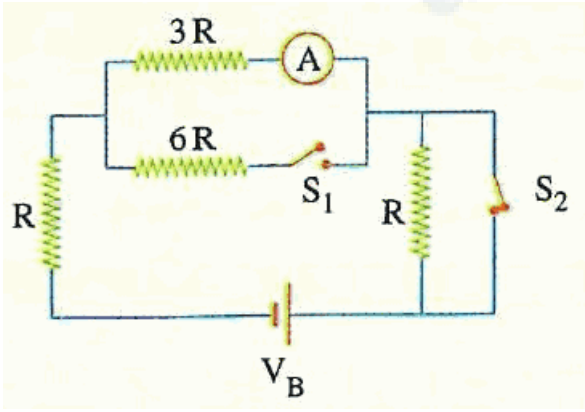
(B) The current in resistor (R_2) is three times the current in resistor (R_4)

(C) The potential difference across resistor (R_2) is three times the potential difference across resistor (R_3)

(D) The potential difference across resistor (R_1) equals the potential difference across resistor (R_4)

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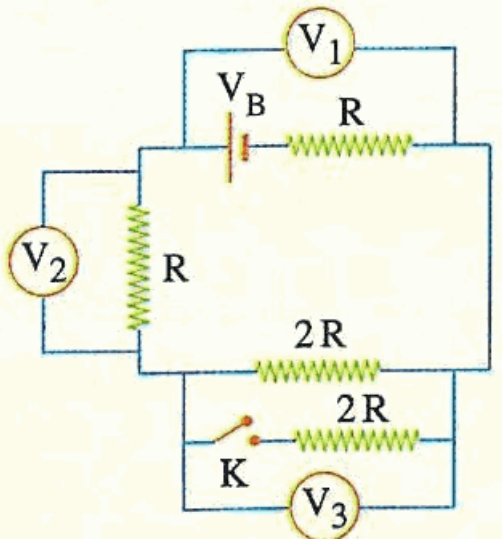
31 The electric circuit shown in the figure contains several resistors, an ammeter, a battery of emf (V_B) and negligible internal resistance, and two switches, (S_1) open and (S_2) closed, and the ammeter reading is (I). When switch (S_1) is closed and switch (S_2) is opened, the ammeter reading becomes ..... (Sample exam 2026)



(A) I (B) 2/3 I (C) 1/2 I (D) 1/3 I

---

32 The figure shows a closed electric circuit containing several resistors, a battery of negligible internal resistance and an open switch (K). What happens to the readings of the voltmeters V_1, V_2, V_3 when switch (K) is closed? (Sample exam 2026)



(A) V_1 stays constant, V_2 increases, V_3 decreases

(B) V_1 increases, V_2 decreases, V_3 increases

(C) V_1 decreases, V_2 decreases, V_3 increases

(D) V_1 decreases, V_2 increases, V_3 decreases

Answer key and solutions

Multiple choice questions

1 A	2 B	3 B	4 B	5 C	6 D	7 A	8 B	9 B	10 D
11 B	12 B	13 D	14 C	15 B	16 C	17 D	18 C	19 D	20 D
21 C	22 D	23 A	24 B	25 C	26 C	27 D	28 B	29 A	30 C
31 C	32 C	33 A	34 D	35 C	36 A	37 A	38 B	39 B	40 D
41 B	42 C	43 C	44 A	45 D	46 A	47 B	48 C	49 D	50 B
51 B	52 C	53 A	54 C	55 B	56 C	57 D	58 B	59 B	60 A
61 C	62 D	63 C	64 B	65 C	66 C	67 D	68 D	69 C	70 B
71 A	72 D	73 D	74 B	75 B	76 C	77 A	78 B	79 C	80 B
81 B	82 B	83 C	84 D	85 C	86 B	87 D	88 C	89 C	90 B
91 B	92 C	93 B	94 D	95 D	96 D	97 B	98 B	99 C	100 B
101 C	102 C	103 C	104 C	105 D	106 A	107 A	108 A	109 D	110 C
111 C	112 C	113 A	114 C	115 B	116 B	117 D	118 B	119 C	120 C
121 C	122 D	123 A	124 C	125 B	126 C	127 C	128 B	129 A	130 B
131 A	132 B	133 D	134 D	135 A	136 D	137 B	138 A	139 B	140 B
141 D	142 C	143 C	144 A	145 C	146 C	147 A	148 A	149 C	150 D
151 D	152 A	153 C	154 A	155 C	156 D	157 D	158 B	159 C	160 B
161 D	162 B	163 A	164 D	165 B	166 C	167 B	168 B	169 A	170 C

171 D	172 C	173 A	174 D	175 D	176 B	177 B	178 C	179 D	180 B
181 B	182 D	183 A	184 D	185 C	186 D	187 B	188 B	189 C	190 B
191 B	192 C	193 B	194 B	195 C	196 C	197 B	198 B	199 A	200 C
201 B	202 D	203 C	204 B	205 B	206 B	207 A	208 C	209 B	210 B
211 C	212 A	213 A	214 B	215 B	216 C	217 C	218 A	219 C	220 D

1. Answer (A)
2. Answer (B)
3. Answer (B)
4. Answer (B)
5. Answer (C)
6. Answer (D)
7. Answer (A)
8. Answer (B)
9. Answer (B)
10. Answer (D)
11. Answer (B)
12. Answer (B)
13. Answer (D)
14. Answer (C)
15. Answer (B)

16 Answer (C)

17 Answer (D)

18 Answer (C)

19 Answer (D)

20 Answer (D)

21 Answer (C)

22 Answer (D)

23 Answer (A)

24 Answer (B)

25 Answer (C)

26 Answer (C)

27 Answer (D)

28 Answer (B)

29 Answer (A)

30 Answer (C)

31 Answer (C)

32 Answer (C)

33 Answer (A)

34 Answer (D)

35 Answer (C)

36 Answer (A)

37 Answer (A)

38 Answer (B)

39 Answer (B)

40 Answer (D)

41 Answer (B)

42 Answer (C)

43 Answer (C)

44 Answer (A)

45 Answer (D)

46 Answer (A)

47 Answer (B)

48 Answer (C)

49 Answer (D)

50 Answer (B)

51 Answer (B)

52 Answer (C)

53 Answer (A)

54 Answer (C)

55 Answer (B)

56 **Answer (C)**

57 **Answer (D)**

58 **Answer (B)**

59 **Answer (B)**

60 **Answer (A)**

61 **Answer (C)**

62 **Answer (D)**

63 **Answer (C)**

The ammeter reads zero → balanced bridge

$4/6 = 8/R$

$R = 12\ \Omega$

64 **Answer (B)**

65 **Answer (C)**

66 **Answer (C)**

67 **Answer (D)**

$R_{part} = R/4$

$R_{eq} = (R/4)/3 + R/4 = R/3$

68 **Answer (D)**

69 **Answer (C)**

70 **Answer (B)**

71 **Answer (A)**

72 **Answer (D)**

73 **Answer (D)**

Resistors in parallel → the total current is the sum of the currents

$I = 150 + 45 + 14 + 4 = 213\ mA$

$R = 9.2/0.213 \approx 43.19\ \Omega$

74 **Answer (B)**

The largest resistor is the one carrying the smallest current

$4\ mA \rightarrow 2\ mA$

$I = 213\text{-}4 + 2 = 211\ mA$

75 **Answer (B)**

The first ammeter measures the current in the 5Ω resistor

$I = 20/5 = 4\ A$

76 **Answer (C)**

The total current divides inversely with the resistance

$I_{10\Omega} = 4 \times 30/(10 + 30) = 3\ A$

77 **Answer (A)**

78 **Answer (B)**

79 **Answer (C)**

80 **Answer (B)**

$I_{4\Omega} = 3 \times 2/(2 + 4) = 1\ A$

$V = 1 \times 4 = 4\ V$

81 **Answer (B)**

The current is inversely proportional to the resistance of the branch

$I_1/I = 2/(4 + 2) = 1/3$

82 **Answer (B)**

83 **Answer (C)**

84 **Answer (D)**

The current divides into two halves between the two resistors R

$I_{top} = 2 + 2 = 4\ A$

The two branches have the same potential difference

$4 \times R = I_1 \times 4R$

$I_1 = 1\ A$

$I_2 = 4 + 1 = 5\ A$

85 **Answer (C)**

86 **Answer (B)**

The three branches have the same potential difference

$V = 1 \times 6R = 6R$

$I_1 = 6R/R = 6\ A$

$I_2 = 6 + 2 + 1 = 9\ A$

87 **Answer (D)**

88 **Answer (C)**

89 **Answer (C)**

$R_1 = (2R \times R)/3R = 2R/3$

$I_1 = (I \times 2R/3)/2R = I/3$

$I_2 = (I \times 4R/3)/2R = 2I/3$

$I_1/I_2 = 1/2$

90 **Answer (B)**

91 **Answer (B)**

$5R = 4(R + 2)$

$R = 8\ \Omega$

92 **Answer (C)**

93 **Answer (B)**

The switch is open → the 20Ω branch is out of the circuit

$I = 12/(10 + 30) = 0.3\ A$

94 **Answer (D)**

The switch is closed → 20Ω and 30Ω are in parallel

$R_p = (20 \times 30)/50 = 12\ \Omega$

$I_{tot} = 12/(10+12) \approx 0.545\ A$

$I_{30\Omega} = 0.545 \times 20/50 \approx 0.22\ A$

95 **Answer (D)**

96 **Answer (D)**

The ammeter measures the current of the 3Ω resistor

$V_{par} = 2 \times 3 = 6\ V$

$I_{6\Omega} = 6/6 = 1\ A$

$I = 2 + 1 = 3\ A$

97 **Answer (B)**

The p.d. across R equals the battery voltage minus the p.d. across the parallel part

$R = (12\text{-}6)/3 = 2\ \Omega$

98 **Answer (B)**

99 **Answer (C)**

100 **Answer (B)**

The two branches have the same potential difference

$(R_1 + R_2) \times 1 = R_2 \times 4$

$R_1 = 3R_2$

101 **Answer (C)**

Conductors in parallel → the resistance is proportional to the length

$R_x = 6/3 = 2\ \Omega$

$R_y = 3\ \Omega,\ R_z = 6\ \Omega$

$I = 6/(2+3+6) = 6/11\ A$

102 **Answer (C)**

103 **Answer (C)**

104 **Answer (C)**

105 **Answer (D)**

106 **Answer (A)**

107 **Answer (A)**

The current is inversely proportional to the resistance

$1:1/2:1/3=6:3:2$

108 **Answer (A)**

109 **Answer (D)**

110 **Answer (C)**

111 **Answer (C)**

112 **Answer (C)**

Three times the diameter → nine times the area → the resistance becomes 9 times smaller

$I_2=9\times3=27\ mA$

$I=3+27=30\ mA=0.03\ A$

113 **Answer (A)**

The area of A is double that of B → the resistance of A is half that of B

$I_A=2\ A,\ I_B=1\ A$

114 **Answer (C)**

$I_2=10\text{-}8=2\ mA$

The current is proportional to the cross-sectional area

$I_1/I_2=(r_1^2)/(r_2^2)=4$

$r_1/r_2=2$

115 **Answer (B)**

116 **Answer (B)**

$R_1=12/2=6\ \Omega,\ R_2=12\ \Omega$

$R_{eq}=(6\times12)/(6+12)=4\ \Omega$

117 **Answer (D)**

The ammeter resistance is negligible → it short-circuits the two 2Ω resistors

$I = 12/(2+3) = 2.4\ A$

118 **Answer (B)**

119 **Answer (C)**

120 **Answer (C)**

121 **Answer (C)**

122 **Answer (D)**

123 **Answer (A)**

124 **Answer (C)**

125 **Answer (B)**

126 **Answer (C)**

127 **Answer (C)**

128 **Answer (B)**

129 **Answer (A)**

130 **Answer (B)**

131 **Answer (A)**

132 **Answer (B)**

133 **Answer (D)**

134 **Answer (D)**

135 **Answer (A)**

136 **Answer (D)**

137 **Answer (B)**

138 **Answer (A)**

The voltmeter is connected across the 2Ω resistor

$I_{tot} = 4/2 = 2\ A$

$I_{6\Omega} = 2 \times 4/(4+6) = 0.8\ A$

139 **Answer (B)**

The voltmeter resistance is taken in parallel with the resistor it is connected across

$R_p = (100 \times 100)/200 = 50\ k\Omega$

$V = 6 \times 50/(50+100) = 2\ V$

140 **Answer (B)**

141 **Answer (D)**

142 **Answer (C)**

143 **Answer (C)**

144 **Answer (A)**

145 **Answer (C)**

146 **Answer (C)**

147 **Answer (A)**

148 **Answer (A)**

149 **Answer (C)**

150 **Answer (D)**

151 **Answer (D)**

152 **Answer (A)**

153 Answer (C)

154 Answer (A)

155 Answer (C)

156 Answer (D)

157 Answer (D)

158 Answer (B)

159 Answer (C)

160 Answer (B)

161 Answer (D)

162 Answer (B)

163 Answer (A)

164 Answer (D)

165 Answer (B)

166 Answer (C)

167 Answer (B)

168 Answer (B)

169 Answer (A)

170 Answer (C)

171 Answer (D)

172 Answer (C)

173 Answer (A)

174 Answer (D)

175 Answer (D)

176 Answer (B)

177 Answer (B)

178 Answer (C)

179 Answer (D)

180 Answer (B)

181 Answer (B)

182 Answer (D)

183 Answer (A)

184 Answer (D)

185 Answer (C)

186 Answer (D)

187 Answer (B)

188 Answer (B)

189 Answer (C)

190 Answer (B)

191 Answer (B)

192 Answer (C)

193 Answer (B)

194 Answer (B)

195 Answer (C)

196 Answer (C)

197 Answer (B)

198 Answer (B)

199 Answer (A)

200 Answer (C)

201 Answer (B)

202 Answer (D)

203 Answer (C)

204 Answer (B)

205 Answer (B)

206 Answer (B)

207 Answer (A)

208 Answer (C)

209 Answer (B)

210 Answer (B)

211 Answer (C)

212 Answer (A)

213 **Answer (A)**

214 **Answer (B)**

215 **Answer (B)**

216 **Answer (C)**

217 **Answer (C)**

218 **Answer (A)**

219 **Answer (C)**

220 **Answer (D)**

Essay questions

1 **Model answer**

The two heating elements of the heater are connected together in parallel, so that each of them can be switched on separately by its own switch, and so that each of them works on the potential difference of the source.

2 **Model answer**

In a parallel connection, the total current divides into branch currents, each flowing in a lamp. So the current in wire x, connected to the source, is greater than the current in wire y, connected to each lamp. It is better for wire x to have a larger cross-section, so that it has a smaller resistance and can carry the high current.

3 **Model answer**

When an electric source is connected to any two points, we get two resistances connected in parallel, and the equivalent resistance is greatest when the two resistances are equal.
This is done by connecting the source to points c and a, or to points d and b.

4 **Model answer**

$R_1 = R/2$
$R_2 = R/2 + (1/2R)/2 + R/2 = 1.25R$
$R_1/R_2 = 0.5R/1.25R = 2/5$

5 **Model answer**

(1) The three $9\ \Omega$ resistors are in parallel between B and C, then in series with $3\ \Omega$:

$R_{AB} = 3 + 9/3 = 6\ \Omega$

(2) The $5\ \Omega$ resistor has a connecting wire across its ends, so it is cancelled, and the resistors $60\ \Omega$, $30\ \Omega$, $20\ \Omega$, $10\ \Omega$ are connected in parallel:

$1/(R_{AB}) = 1/60 + 1/30 + 1/20 + 1/10 = 1/5$, $R_{AB} = 5\ \Omega$

6 **Model answer**

When the switch is closed, the current flows in the connecting wire and not in resistor R_2, so the total resistance of the circuit decreases and the current in it increases, so the ammeter reading increases.

7 **Model answer**

(1) $3\ \Omega$ and $6\ \Omega$ in parallel = $2\ \Omega$, and in series with $12\ \Omega$ and $6\ \Omega$ = $20\ \Omega$

In parallel with $20\ \Omega$ and $10\ \Omega$: $1/R_t = 1/20 + 1/20 + 1/10 = 1/5$, $R_t = 5\ \Omega$

$I = 10/5 = 2\ A$

(2) $6\ \Omega$ and $12\ \Omega$ in series = $18\ \Omega$, and $4\ \Omega$ and $5\ \Omega$ in series = $9\ \Omega$

In parallel with $3\ \Omega$: $1/R = 1/18 + 1/9 + 1/3 = 1/2$, $R = 2\ \Omega$

In series with $2\ \Omega$: $R' = 4\ \Omega$, $I = 12/4 = 3\ A$

8 **Model answer**

(1) $R_1' = (300 \times 200)/500 + 400 = 520\ \Omega$, $I_1 = 130/520 = 0.25\ A$

$V_{300} = 0.25 \times 120 = 30\ V$

(2) $R_2' = 300 + (400 \times 200)/600 = 1300/3\ \Omega$, $I_2 = 0.3\ A$

$V_{400} = 0.3 \times (400 \times 200)/600 = 40\ V$

9 **Model answer**

It increases, because when the slider is moved towards end z, the resistance of the rheostat included in the circuit increases. The rheostat and the lamp are in series, so the potential difference divides in the ratio of their resistances $V \propto R$; the potential difference across the rheostat increases and the potential difference across the lamp decreases.

10 **Model answer**

The three resistors are connected in parallel with the battery:

$I_{24} = 12/24 = 0.5\ A$, $I_{12} = 1\ A$, $I_6 = 2\ A$

$I_1 = I_{24} + I_{12} = 1.5\ A$, $I_2 = I_{12} + I_6 = 3\ A$

$I_1/I_2 = 1/2$

11 **Model answer**

(1) When R_1 is increased, the total resistance of the lower branch (R_1 and R_3 in series) increases, while the total potential difference of the branch is constant = V_B, so the voltage divides in the ratio of the resistances and the reading of V_1 increases.

The reading of V_2 is always constant and equals the emf of the source.

(2) When R_2 is increased, the potential difference across it stays constant and equals the source voltage, so the reading of V_2 stays constant; V_1 is also constant because R_1 and R_3 are constant and connected across the source.

12 **Model answer**

When S is increased, the total resistance increases and the total current decreases $I = V_B/(R')$, so the potential difference across $2R$ decreases, i.e. the voltmeter reading decreases.

So the potential difference across S and the upper branch (R, R) increases, and the current in the upper branch increases, i.e. the ammeter reading increases.

13 **Model answer**

Current of $12\ \Omega$ = 1 A, and the total current is 3 A, so a current of 2 A flows in R

$V_R = V_{12} : 2R = 12\ , R = 6\ \Omega$

$R' = (6 \times 12)/18 + 5 = 9\ \Omega$

14 **Model answer**

In position (1), the voltmeter is connected across the source: $V_1 = V_B$

In position (2): $V_2 = 1/2\ V_B$

So the voltmeter reading decreases to half.

15 **Model answer**

(1) The resistors $12\ \Omega$, $6\ \Omega$, $4\ \Omega$ are in parallel: $R_{m\ell} = 2\ \Omega = R_{km}$

$V_{km} = (V_{k\ell})/2 = 25\ V$

(2) $R = (V_{k\ell})/I = 50/1 = 50\ \Omega$

16 **Model answer**

$R = V/I = 5/1 = 5\ \Omega$

$V_S = 20 - 5 = 15\ V\ , S = 15/1 = 15\ \Omega$

17 **Model answer**

(1) $V_R = V_1 = 12\ V$, $V_{2R} = 24\ V$, $V_2 = 36\ V$

(2) $10\ \Omega$ and $40\ \Omega$ in parallel = $8\ \Omega$, $V_1/16 = V_2/8$, $V_2 = 6\ V$

(3) $V_R = 6\ V$, $V_1 = I/2 \times 2R$, $I = 12/R$, $V_{2R} = 24\ V$, $V_2 = 24 + 6 = 30\ V$

(4) $V_1 = V_2 = 12\ V$

18 **Model answer**

(1) $I_{10} \times 10 = 1 \times 20$, $I_{10} = 2\ A$, $I = 2 + 1 = 3\ A$

(2) The $6\ \Omega$ resistor is connected across a connecting wire, so no current flows in it: $I = 0$

(3) $I_{total} = 6/2 = 3\ A$, and the two branches $3\ \Omega + 6\ \Omega$ and $9\ \Omega$ are equal, so the current divides equally: $I = 1.5\ A$

(4) $R_1' = 10\ \Omega$, $I_{total} = 15/10 = 1.5\ A$, $R_2' = 1\ \Omega$, $I_6 = (1.5 \times 1)/6 = 0.25\ A$

19 **Model answer**

The potential difference of the source (V) divides between the two resistances $R_{x\ell}$ and $R_{\ell\,k}$: $V_{x\ell} = V_{\ell\,k} = 1/2\ V$

and divides between the resistances R_{xy}, R_{yz}, R_{zk}: each gets $1/3\ V$

So the descending order is: x, then y, then ℓ, then z, then k

20 **Model answer**

The lamps are connected in three parallel branches, each branch containing two lamps connected in series, so that the potential difference across each lamp becomes 100 V.

21 **Model answer**

Potential differences: $10\ \Omega$: 4 V, $20\ \Omega$: 10 V, $40\ \Omega$: 4 V

So the two resistors $10\ \Omega$ and $40\ \Omega$ are in parallel, and the sum of their currents equals the current of $20\ \Omega$, so it is in series with them.

$R_{eq} = (10 \times 40)/50 + 20 = 28\ \Omega$

22 **Model answer**

(1) The resistance of wire A is greater, because the slope of the graph line of wire A is greater (slope = $(\Delta V)/(\Delta I) = R$).

(2) The power consumed in wire B is greater, because the power is inversely proportional to the resistance at constant potential difference $P_w = (V^2)/R$

23 **Model answer**

(1) $R' = 6/4 = 1.5\ \Omega$, $I = 12/1.5 = 8\ A$

$Q = It = 8 \times 10 = 80\ C$

(2) $W = (V^2\ t)/R = (144 \times 10)/6 = 240\ J$

24 **Model answer**

Position (1): $R_1' = R/2$, position (2): $R_2' = 2/3R$

$P_w = (V^2)/R$ and V is constant: $((P_w)_1)/((P_w)_2) = (R_2')/(R_1') = 4/3$

25 **Model answer**

Lamps x and y are in series: $I_x = I_y = V_B/3R$, and lamp z is across the source: $I_z = V_B/4R$

$(P_w)_x = (V_B{}^2)/9R$, $(P_w)_y = (2V_B{}^2)/9R$, $(P_w)_z = (V_B{}^2)/4R$

Lamp z consumes the greatest electric power.

26 **Model answer**

$V_6{}^2 = 6 \times 24 = 144$, $V_6 = 12\ V$

$6\ \Omega$ and $12\ \Omega$ in parallel = $4\ \Omega$, $I = 12/4 = 3\ A$

R and 2R in parallel = $2/3R$, $V_R = 36 - 12 = 24\ V$, $2/3R = 24/3$, $R = 12\ \Omega$

$(P_w)_R = (24^2)/12 = 48\ W$

27 **Model answer**

(1) The brightness of the lamps in the circuit of student M (series) is less than the brightness of the lamps in the circuit of student N (parallel).

(2) Circuit of student M: the other two lamps go out. Circuit of student N: the other two lamps stay lit with the same brightness.

28 **Model answer**

(1) When the slider is moved gradually from A to B, the potential difference across the lamp increases until it equals the potential difference of the source, so the brightness of the lamp increases $P_w = (V^2)/R$

(2) After exchanging the positions of the lamp and the battery, when the slider is moved from A to B, the potential difference across the lamp increases until it equals the potential difference of the source, so its brightness increases.

29 **Model answer**

To increase the brightness of the lamp, the current must be increased by decreasing the total resistance of the circuit:

1- Closing switch K_3

2- Decreasing resistance R_s

Past exam questions

1	2	3	4	5	6	7	8	9	10
B	A	C	A	A	D	B	A	B	D
11	12	13	14	15	16	17	18	19	20
B	D	D	A	B	A	C	C	D	D
21	22	23	24	25	26	27	28	29	30
B	C	B	B	C	A	A	C	B	B
31	32								
B	D								

1 **Answer (B)**

In (B): the upper branch $R + 3R = 4R$ is connected in parallel with $2R$ and $4R$

$1/(R') = 1/4R + 1/2R + 1/4R = 1/R$, $R' = R$

2 **Answer (A)**

When K is closed, it short-circuits the group measured by V_1, so its reading becomes zero.

The total resistance decreases so the current increases, so the reading of V_2 across $2R$ increases and V_3 measures V_B - IR, so it decreases.

3 **Answer (C)**

(1): $R/3 + R = 4/3R$, (2): $4R$

(3): $(2R \times R)/3R + R = 5/3R$, (4): $(3R \times R)/4R = 3/4R$

Ascending: 4, then 1, then 3, then 2, i.e. from the greatest: 2, then 3, then 1, then 4

4 **Answer (A)**

Each two $10\ \Omega$ resistors in parallel = $5\ \Omega$

The two groups in series: $5 + 5 = 10\ \Omega$

5 **Answer (A)**

Before closing K: $R' = 4 + 8 = 12\ \Omega$, $V_B = 2 \times 12 = 24\ V$

After closing K: the two $8\ \Omega$ resistors in parallel = $4\ \Omega$, $R' = 8\ \Omega$

$I = 24/8 = 3\ A$, $V = 3 \times 4 = 12\ V$

6 **Answer (D)**

(A): R , (B): R , (C): $2.5R$

(D): $(3R \times R)/4R = 0.75R$, which is the smallest.

7 **Answer (B)**

Before closing K: $V_B = 1 \times (4 + 2) = 6\ V$

When K is closed, the $2\ \Omega$ resistor is short-circuited: $I = 6/4 = 1.5\ A$

8 **Answer (A)**

(1): $R/2 + R = 1.5R$, (2): $3R$, (3): $R/3$, (4): $2R/3$

From the smallest to the greatest: 3, then 4, then 1, then 2

9 **Answer (B)**

(1): one of the two resistors is short-circuited by a wire: $I_1 = V_B/R$

(2): $I_2 = V_B/2R$, (3): $I_3 = V_B/(R + R/2) = V_B/1.5R$

$I_1 > I_3$

10 **Answer (D)**

The resistance is greatest when the wire is divided into two equal halves in parallel.

Between the opposite corners k and x, each path is half the wire.

11 **Answer (B)**

$(R \times 3R)/4R = 3R/4 = 3$, $R = 4\ \Omega$

Series: $4 + 12 = 16\ \Omega$

12 **Answer (D)**

The upper middle resistor is short-circuited by a wire, so the upper branch is $2R$

The two slanted resistors are short-circuited by the diagonal wire, so the lower branch is $2R$

$R' = 2R/2 = R$

13 **Answer (D)**

$1/(R') = 1/3R + 1/4R + 1/6R = 3/4R$, $4R/3 = 4$, $R = 3\ \Omega$

Series: $13R = 39\ \Omega$

14 **Answer (A)**

V_1 is connected across the battery of negligible resistance, so its reading does not change.

Resistance R is alone in the circuit, so $V_2 = V_B$ and it does not change.

15 **Answer (B)**

(B): $(1 \times 9)/10 + 2.5 + (2 \times 8)/10 = 0.9 + 2.5 + 1.6 = 5\ \Omega$

16 **Answer (A)**

The resistance is constant at constant temperature, so the relation between V and I is a straight line passing through the origin.

17 **Answer (C)**

The bridge is balanced (all resistors are equal), so the upper and lower paths are each $2R$ and the middle resistor is directly between the entry and exit points.

$1/(R') = 1/2R + 1/2R + 1/R = 2/R$, $R' = R/2$

18 **Answer (C)**

At A: $V_B = 12\ V$

At B: $I = 3/5 = 0.6\ A$, $R' = 12/0.6 = 20\ \Omega$

Rheostat resistance = $20 - 5 = 15\ \Omega$

19 **Answer (D)**

V_1 measures the battery voltage, and V_4 measures the potential difference across R_1 and R_2 together.

The ammeter has negligible resistance, so both equal V_B

20 **Answer (D)**

(X): $2R + R/2 = 2.5R$, (Y): $R + 2R/3 = 5/3R$

(Z): $R + (3R \times 6R)/9R = 3R$

The equivalent resistance in (Z) is greater than in (Y).

21 **Answer (B)**

$R' = 20 + 20R/(20 + R)$ and a current flows in R

So the total resistance is greater than $20\ \Omega$ and less than $40\ \Omega$: $25\ \Omega$

22 **Answer (C)**

The equivalent resistance of resistors in parallel is less than the smallest of them.

23 **Answer (B)**

The resistance of each piece is $120/N$, and in parallel: $120/(N^2) = 1.2$

$N = 10$

24 **Answer (B)**

In the first group: the branch of P has resistance $2R$ and the branch of M has resistance $3R$, so two fifths of the current flow in M.

In the second group: the branch of Q has resistance $3R$ and the branch of N has resistance $4.5R$, so two fifths of the current flow in N.

Current of M = current of N, so they are equally bright.

25 **Answer (C)**

When connected to the opposite corner c, the frame is divided into two paths of $2R$ in parallel, so the resistance is the greatest possible, R

So the current is the smallest possible.

26 **Answer (A)**

Between B and C: $20 + 10 = 30\ \Omega$

Between A and B: $(40 \times 120)/160 + 20 = 50\ \Omega$, between A and D: $30 + 60 = 90\ \Omega$, between C and D: $110\ \Omega$

So the smallest resistance is between B and C

27 **Answer (A)**

The ammeter short-circuits the middle resistor and carries the total current, and the voltmeter measures the potential difference across the right resistor.

Closing K connects R in parallel with the left resistor, so the total resistance decreases and the current increases.

So the ammeter reading increases and the voltmeter reading increases $V = IR$

28 **Answer (C)**

The three $18\ \Omega$ resistors in parallel = $6\ \Omega$

$6 + (8(R + 2))/(R + 10) = 10$

$8R + 16 = 4R + 40$, $R = 6\ \Omega$

29 **Answer (B)**

All the resistors are connected in parallel across the battery.

$1/(R') = 1/16 + 1/8 + 1/4 + 1/2 + 1/16 = 1$

$R' = 1\ \Omega$

30 **Answer (B)**

The total current I flows in R_1 and R_2

and divides between $R_3 = R$ and $R_4 = 2R$: $I_4 = I/3$

$I_2 = I = 3\,I_4$

31 **Answer (B)**

First case: the right R is short-circuited: $R' = R + 3R = 4R$, $I = V_B/4R$

Second case: $3R$ and $6R$ in parallel = $2R$, $R' = R + 2R + R = 4R$, total current $V_B/4R = I$

The ammeter in the $3R$ branch carries $6/9$ of the current: $2/3\,I$

32 **Answer (D)**

Before closing K: $R' = 4R$, and after closing it: $2R$ and $2R$ in parallel = R , $R' = 3R$, so the current increases.

$V_2 = IR$ increases , $V_1 = V_B$ - IR decreases

V_3: before $V_B/4R \times 2R = V_B/2$, after $V_B/3R \times R = V_B/3$, so it decreases.