RESISTORS IN SERIES AND PARALEL CONNECTION

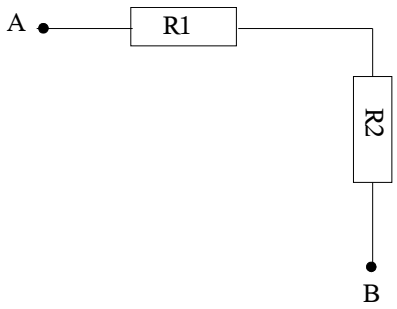
by Cecil Sie

Note :

1. Two resistors are in series when
   - they are connected with only one hand
   - the connection between the two resistors is not connected to any other object.

2. Two resistors are in paralel when :
   - they are connected with two hands.

(1)R_1 and R_2 are combined to form R_{AB}.

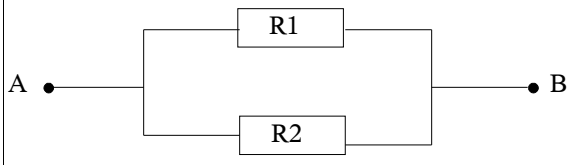


Are R_1 and R_2 connected by one hand only ? _____ .

Is the connection between R_1 and R_2 connected to other object ? _____ .

Are R_1 and R_2 connected in series ? _____ .

(2)R_1 and R_2 are combined to form R_{AB}.



Are R_1 and R_2 connected by two hands ? _____ .

Are R_1 and R_2 connected in paralel ? _____ .

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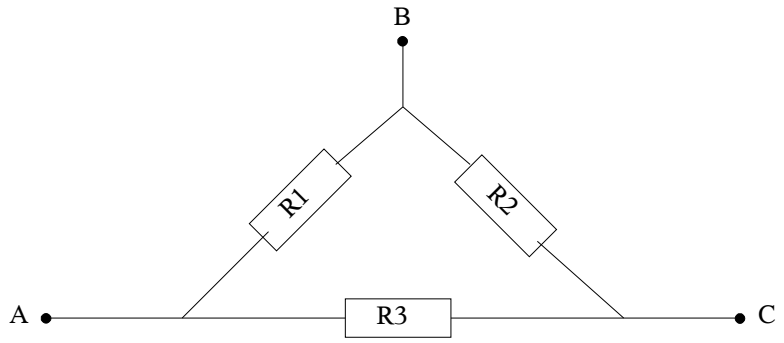
(3)R_1 ,R_2 and R3 are combined to form R_{AC}.



Are R_1 and R_3 connected by one hand only ? _____ .
Is the connection between R_1 and R_3 connected to other object ? _____ .
What is the object ? _____ .
Are R_1 and R_3 connected in series ? _____ .
Are R_1 and R_3 connected by two hands ? _____ .
Are R_1 and R_3 connected in paralel ? _____ .

Are R_2 and R_3 connected by one hand only ? _____ .
Is the connection between R_2 and R_3 connected to other object ? _____ .
What is the object ? _____ .
Are R_2 and R_3 connected in series ? _____ .
Are R_2 and R_3 connected by two hands ? _____ .
Are R_2 and R_3 connected in paralel ? _____ .

Are R_1 and R_2 connected by two hands ? _____ .
Are R_1 and R_2 connected in paralel ? _____ .
Are R_1 and R_2 connected by one hand only ? _____ .
Is the connection between R_1 and R_2 connected to other object ? _____ .
Why “point B is not considered as “other object” ? _____.
Are R_1 and R_2 connected in series ? _____ .

Note :

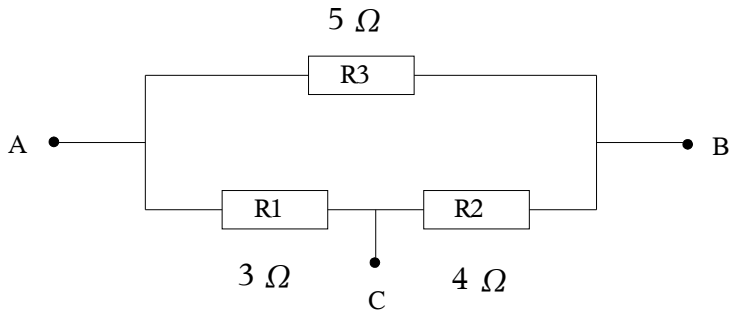
1. Formula to combine resistors connected in series :

$$R_1 + R_2 = R_{12}$$

2. Formula to combine resistors connected in paralel :

$$R_{12} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

(4) R_1, R_2 and R_3 are combined to produce R_{AB} .



Are R_1 and R_2 connected by two hands ? _____ .
Are R_1 and R_2 connected in paralel ? _____ .
Are R_1 and R_2 connected by one hand only ? _____ .
Is the connection between R_2 and R_3 connected to other object ? _____ .
Why "point C" is not considered as "other object" ? _____.
Are R_1 and R_2 connected in series ? _____ .

R_{12} = _____ Ω .

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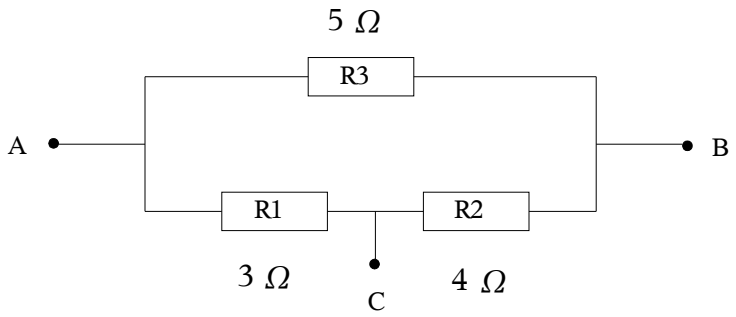
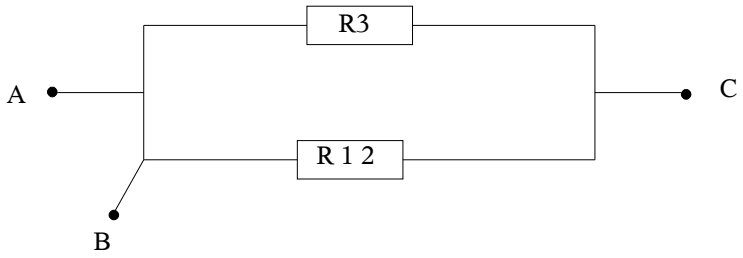
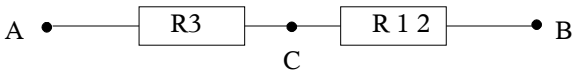


When the above diagram is redrawn with R_1 and R_2 combined, the result is :

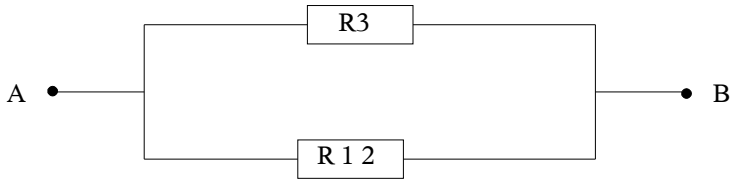
(a)



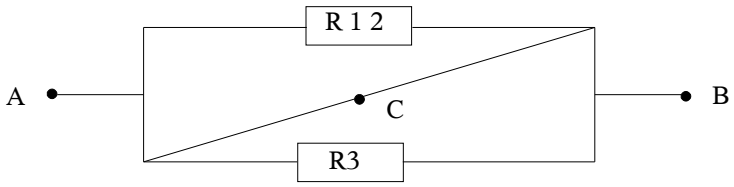
(b)



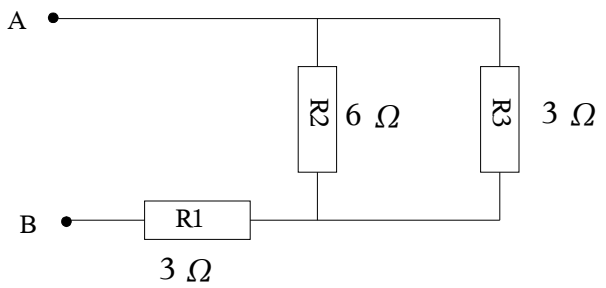
(c)



(d)



(5) R_1, R_2 and R_3 are combined to produce R_{AB} .



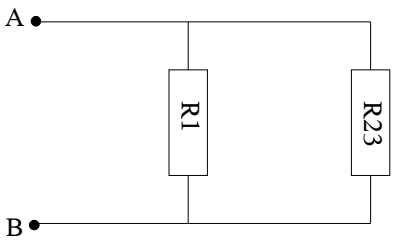
(a)Are R_1 and R_2 connected by one hand only ? _____ .
Is the connection between R_1 and R_2 connected to other object ? _____ .
What is the object ? _____.
Are R_1 and R_2 connected in series ? _____ .
Are R_1 and R_2 connected by two hands ? _____ .
Are R_1 and R_2 connected in paralel ? _____ .
Can you combine R_1 and R_2 to become R_{12} ? _____ .
Why ? _____ .

(b)Are R_1 and R_3 connected by one hand only ? _____ .
Is the connection between R_1 and R_3 connected to other object ? _____ .
What is the object ? _____.
Are R_1 and R_3 connected in series ? _____ .
Are R_1 and R_3 connected by two hands ? _____ .
Are R_1 and R_3 connected in paralel ? _____ .
Can you combine R_1 and R_3 to become R_{13} ? _____ .
Why ? _____ .

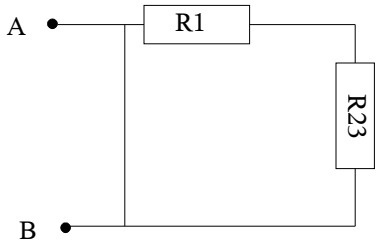
(c) Are R_2 and R_3 in series ? _____ .
Are R_2 and R_3 in paralel ? _____ .
R_{23} = _____ Ω

(d) When the above diagram is redrawn with R_1 and R_2 combined, the result is :

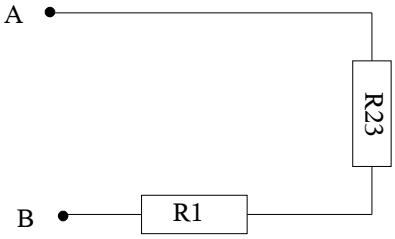
(a)



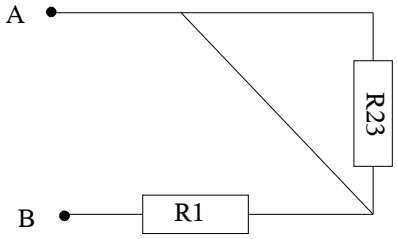
(c)



(b)



(d)



(e) Are R_{23} and R_1 in series ? _____ .
Are R_{23} and R_1 in paralel ? _____ .
R_{123} = _____ Ω

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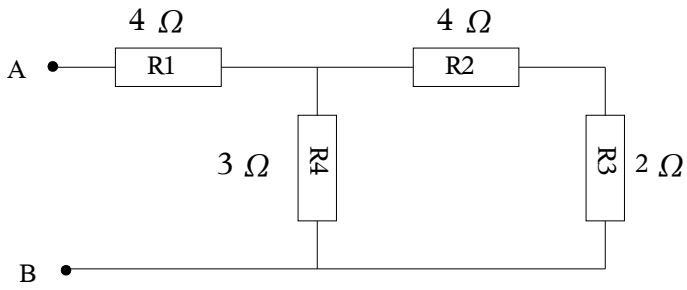
(6) R_1, R_2, R_3 and R_4 are combined to produce R_{AB} .



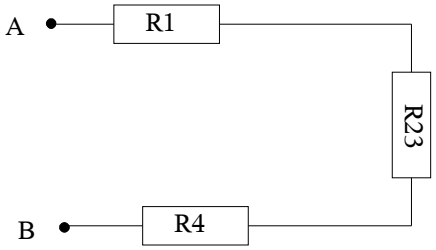
(a) Are R_1 and R_2 in series ? _____ .
Are R_1 and R_2 in paralel ? _____ .
Can you combine R_1 and R_2 to become R_{12} ? _____ .

(b) Are R_1 and R_4 in series ? _____ .
Are R_1 and R_4 in paralel ? _____ .
Can you combine R_1 and R_4 to become R_{14} ?

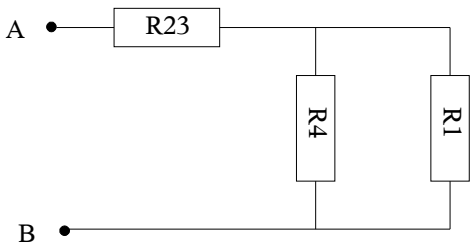
(c) Are R_2 and R_3 in series ? _____ .
Are R_2 and R_3 in paralel ? _____ .
Can you combine R_2 and R_3 to become R_{23} ? _____ .
R_{23} = _____ Ω

(d) When the above diagram is redrawn with R_2 and R_3 combined, the result is :

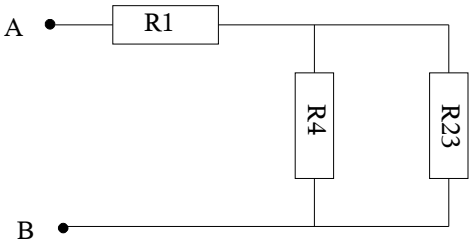
(A)



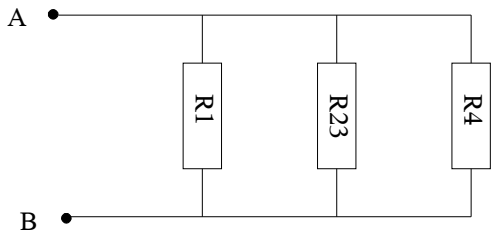
(C)



(B)



(D)

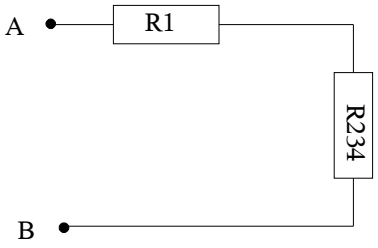


(e) Are R_1 and R_{23} in series ? _____ .
Are R_1 and R_{23} in paralel ? _____ .
Can you combine R_1 and R_{23} to become R_{123} ? _____ .

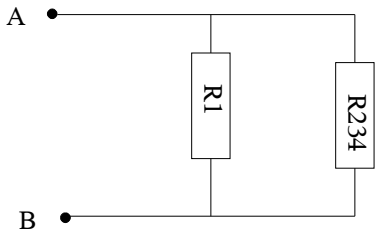
(f) Are R_{23} and R_4 in series ? _____ .
Are R_{23} and R_4 in paralel ? _____ .
Can you combine R_{23} and R_4 to become R_{234} ? _____ .
R_{234} = _____ Ω

(g) When the above diagram is redrawn with R_{23} and R_4 combined, the result is :

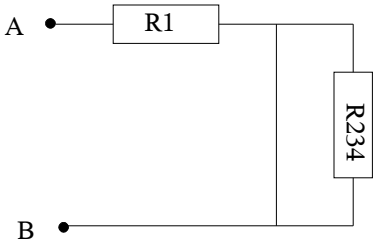
(A)



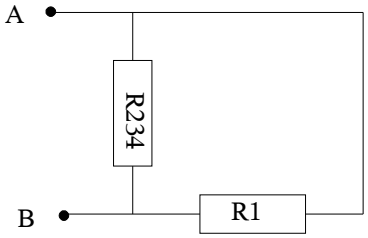
(C)



(B)

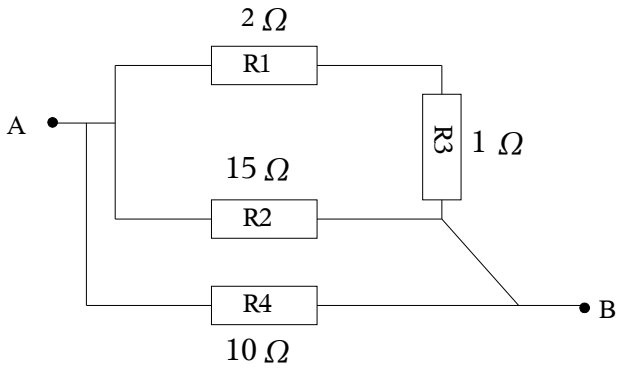


(D)



(h) Are R_1 and R_{234} in series ? _____ .
Are R_1 and R_{234} in paralel ? _____ .
Can you combine R_1 and R_{234} to become R_{1234} ? _____ .
R_{1234} = _____ Ω
R_{AB} = _____ Ω

(7) R_1, R_2, R_3 and R_4 are combined to produce R_{AB} .



(a) Are R_1 and R_2 in series ? _____ .
Are R_1 and R_2 in paralel ? _____ .
Can you combine R_1 and R_2 to become R_{12} ? _____ .

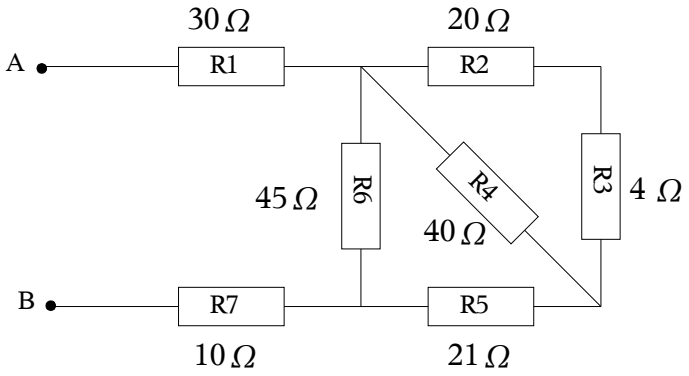
(b) Are R_3 and R_4 in series ? _____ .
Are R_3 and R_4 in paralel ? _____ .
Can you combine R_3 and R_4 to become R_{34} ? _____ .

(c) Are R_1 and R_3 in series ? _____ .
Are R_1 and R_3 in paralel ? _____ .
Can you combine R_1 and R_3 to become R_{13} ? _____ .
R_{13} = _____ Ω

(d) Redraw the above diagram with R_1 and R_3 combined as R_{13} !

(e) Are R_2 and R_4 in series ? _____ .
Are R_2 and R_4 in paralel ? _____ .
Are R_2 and R_{13} in paralel ? _____ .
Are R_2 ,R_{13} and R_4 in paralel ? _____ .
R_{1234} = _____ Ω
R_{AB} = _____ Ω

(8) R_1 , R_2 ,R_3 ,R_4 ,R_5 ,R_6 , and R_7 are combined to produce R_{AB} .



(a) Can you calculate R_{12} ? _____ .
Can you calculate R_{25} ? _____ .
Can you calculate R_{23} ? _____ .
R_{23} = _____ Ω
Redraw the above diagram with R_2 and R_3 combined as R_{23} !

(b) Can you calculate R_{123} ? _____ .
Can you calculate R_{235} ? _____ .
Can you calculate R_{234} ? _____ .
R_{234} = _____ Ω
Redraw the above diagram with R_{23} and R_4 combined as R_{234} !

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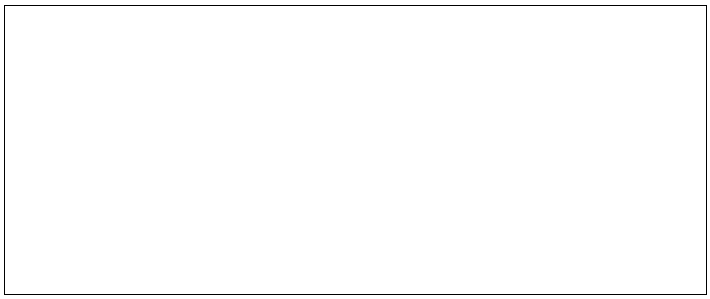
(c) Can you calculate R_{1234} ? _____ .
Can you calculate R_{2346} ? _____ .
Can you calculate R_{2345} ? _____ .
R_{2345} = _____ Ω
Redraw the above diagram with R_{234} and R_5 combined as R_{2345} !

(d) Can you calculate R_{12345} ? _____ .
Can you calculate R_{23457} ? _____ .
Can you calculate R_{23456} ? _____ .
R_{23456} = _____ Ω
Redraw the above diagram with R_{2345} and R_6 combined as R_{23456} !



(e)R_{123456} = _____ Ω
$R_{1234567}$ = _____ Ω
R_{AB} = _____ Ω

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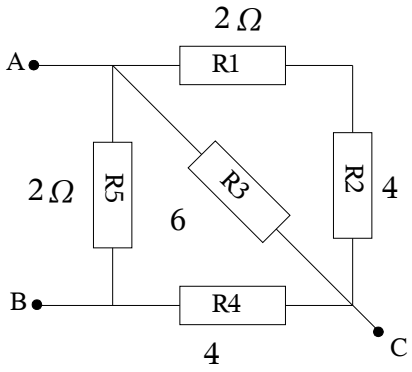
(9)



When R_1, R_2, R_3, R_4, and R_5 are combined to produce R_{AB} :

R_{12} = _____ Ω

R_{123} = _____ Ω

R_{1234} = _____ Ω

R_{12345} = _____ Ω

R_{AB} = _____ Ω

When R_1, R_2, R_3, R_4, and R_5 are combined to produce R_{AC} :

R_{12} = _____ Ω

R_{45} = _____ Ω

R_{12345} = _____ Ω

R_{AC} = _____ Ω

Why R_{AB} is not equal to $R_{AC.}$? _____ .