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Q1. According to the law of combination of resistances in series, the combined resistance of any number of resistances connected in series is equal to the sum of the individual resistances.

Q2. As per the law of combination of resistances in series,

$R=R_1+ R_2+ R_3+ R_4+ R_5$

R=0.2+0.2+0.2+0.2+0.2=1ohm.

Q3. According to the law of combination of resistance in parallel, the reciprocal of the combined resistance of a number of resistances connected in parallel is equal to the sum of the reciprocals of all the individual resistances.

Q4.

$$R_1 = R_2 = R_3 = 3\Omega$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1$$

$$\therefore R = 1\Omega$$

Q5. Since the resultant resistance is less than the individual resistances, so the resistances should be connected in parallel.

Q6. In case of parallel combination, the resultant resistance will be less than either of the individual resistances.

Q7.

R_1=2ohm, R_2=6ohm

Case I: (Parallel combination)

$1/R = 1/R_1 + 1/R_2$

1/R = 1/2 + 1/6 = 4/6

R = 6/4 = 1.5ohm

Case II: (Series combination)

$R = R_1 + R_2$ = 2+6 = 8ohm

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Q8. (a) By connecting in parallel: Since equivalent resistance will be

1/ R = 1/4 + 1/4 = 2/4 = 1/2

Therefore, R = 2 ohm

(b) By connecting in series : Since equivalent resistance will be
R = 4 ohm + 4 ohm = 8 ohm.
Q9. Resistance of arrangement A is 10 ohm.
Combined resistance of arrangement B is caculated as follows:
1/R = 1/10 + 1/1000 = (100+1)/1000
R = 1000/101 = 9.9 ohm
Therefore, arrangement B has lower combined resistance.
Q10. Resistance of each part is R/2.
Resultant resistance R′ is given by
1/R′ = 2/R+2/R
R′=R/4.
Q11.

(a) R_1=500ohm, R_2=1000ohm

As per given figure,

$R=R_1+R_2$=500+1000=1500ohm.

(b) R_1=2ohm, R_2=2ohm

As per given figure,

$1/R=1/R_1+1/R_2$

1/R=1/2+1/2

R=1ohm

(c) R_1=4ohm, R_2=4ohm, R_3=3ohm

As per given figure,
$1/R=1/R_1+1/R_2$

1/R=1/4+1/4

R=2ohm

Total resistance $=R+R_3$

=2+3=5ohm

Q12.

R_1=6ohm, R_2=4ohm V=24V

The two resistances are connected in parallel.

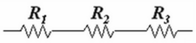
Current across $R_1=I_1=V/R_1$=24/6=4amp
Current across $R_2=I_2=V/R_2$=24/4=6amp

Q13.

(i) Series combination

When two or more resistances are connected end to end consecutively, they are said to be connected in series combination. The combined resistance of any number of resistances connected in series in equal to the sum of the individual resistances.

$R=R_1+R_2+......$

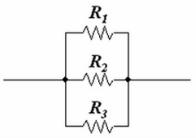


The resultant resistance is more than either of the individual resistances.

(ii) Parallel combination

When two or more resistances are connected between the same two points, they are said to be connected in parallel combination. The reciprocal of the combined resistance of a number of resistances connected in parallel is equal to the sum of the reciprocals of all the individual resistances.

$1/R=1/R_1+1/R_2+.......$

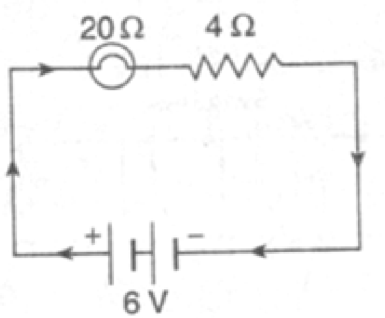


The resultant resistance is less than either of the individual resistances.

Q14.

R_1=0.2ohm, R_2=0.4ohm, R_3=0.3ohm, R_4=0.5ohm, R_5=12ohm, V=9V
Resultant resistance=$R_1+ R_2+ R_3+ R_4+ R_5$
R=0.2+0.4+0.3+0.5+12=13.4ohm
Thus the current flow through 12ohm resistance will be=V/R
I=9/13.4
I=0.67amp.

Q15.



(a) Total resistance of the circuit=R_1+R_2=20+4=24ohm

(b) We know that

V=IR

Therefore,

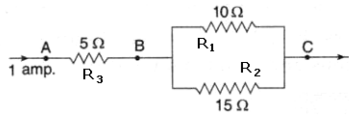
6=I x 24

I=6/24=0.25amp

(c) p.d. across bulb=IR_1=0.25X20=5V

(d) p.d. across resistance wire=IR_2=0.25X4=1V

Q16.



According to the diagram,
(i) Total current I=1amp is entering the parallel combination of R_1 and R_2. Let I_1 current flow through R_1 and I_2 current flow through R_2.
Then

$$I_1 = \frac{IR_2}{R_1 + R_2}$$
$$= \frac{1 \times 15}{10 + 15} = 0.6A$$
$$I_2 = \frac{IR_1}{R_1 + R_2}$$
$$= \frac{1 \times 10}{10 + 15} = 0.4A$$

(ii) p.d. across AB = IR_3 = 1 x 5 = 5V
Equivalent resisyance between B and C is
$1/R' = 1/R_1 + 1/R_2 = 1/10 + 1/15$
1/R' = 5/30
R' = 6 ohm
Total resistance between A and C is R = 5+6 = 11 ohm
p.d. across AC = IR = 1x11 = 11V

(iii) Total resistance = R_3 + R' = 5 + 6 = 11 ohm

Q17.

As per the circuit
V= 4 V
Total resistance in line 1=R_1 = 6 + 3 = 9 ohm
Total resistance in line 2=R_2= 12 + 3 = 15 ohm

(i) Current through 6Ω resistor = current through line 1=$\frac{V}{R_1} = \frac{4}{9} = 0.44\Omega$

(ii) p.d. across line 2 is 4V
current through line 2=$\frac{V}{R_2} = \frac{4}{15}\Omega$

p.d. across 12Ω resistor=$\frac{4}{15} \times 12 = 3.2V$

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Q18. Given: Two resistors with resistances R_1=5 ohm and R_2=10 ohm, V=6volt
(a) For minimum current these two should be connected in series.
For maximum current these two should be connected in parallel.
(b) In series,
Total resistance = 5+10 = 15 ohms
Therefore total current drawn = V/R = 6/15 = 0.4amps
In parallel,
Total resistance R is given as
$1/R=1/R_1+1/R_2$
1/R=1/5+1/10
1/R=3/10
R=10/3ohm
Therefore total current drawn by the circuit = V/R = 6/(10/3) =1.8amps.
Q19. (i) Total resistance of two resistors that are connected in parallel is
1/R′ = 1/3+1/6
1/R′ = 3/6
R′ = 2ohms
Total resistance of the circuit = 2+4ohms = 6ohms
(ii) Total current flowing through the circuit=V/total resistance
I = 12/6 = 2amps
(iii) Potential difference across R_1=R_1 x I = 4 x 2 = 8V.
Q20. Given,
1 amp current is flowing through 5ohm resistor.
We know that in case of parallel connection, the p.d. across each resistor is same and is equal to the voltage applied.
Therefore, applied voltage, V = IR = 1 x 5 = 5V
So,
Current through 4 ohm resistor = V/R = 5/4 = 1.25 A
Current through 10 ohm resistor = V/R = 5/10 = 0.5 A
Q21.

$I = 5A$

$V = 220V$

$$R = \frac{V}{I} = \frac{220}{5} = 44\,\Omega$$

Required resistance is less than 176Ω, so the resistors should be connected in parallel.

Let the required no. be n.

$$R_{eq} = \frac{176}{n} = 44$$

$$n = \frac{176}{44} = 4$$

Q22.

Given V=220V

$R_A = R_B = 24$ ohm

(a) Current drawn when only coil A is used:

$I = V/R_A = 220/24$

=9.16amps

(b) Current drawn when coils A and B are used in series:

Total resistance, $R = R_A + R_B = 24+24 = 48$ohms

$I = V/R = 220/48$

=4.58amps

(c) Current drawn when coils A and B are used in parallel:

Total resistance, $1/R = 1/R_A + 1/R_B = 1/24 + 1/24 = 2/24 = 1/12$

R=12ohms

$I = V/R = 220/12$

=18.33amps

Q23.

(i) Equivalent resistance of 10 Ω and 40 Ω reistances (connected in parallel) is R_1, given as:

$$\frac{1}{R_1} = \frac{1}{10} + \frac{1}{40} = \frac{5}{40}$$

$R_1 = 8\,\Omega$

Equivalent resistance of 30 Ω, 20 Ω and 60 Ω reistances (connected in parallel) is R_2, given as:

$$\frac{1}{R_2} = \frac{1}{30} + \frac{1}{20} + \frac{1}{60} = \frac{6}{60}$$

$R_2 = 10\,\Omega$

R_1 and R_2 are connected in series.

$\therefore$ Total resistance in the circuit is $R = R_1 + R_2 = 8 + 10 = 18\,\Omega$

(ii) Total current flowing in the circuit, $I = \frac{V}{R} = \frac{12}{18} = 0.67$ A

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Q24.

V=12V

R_1, R_2 and R_3 are connected in parallel.

(a) Current through $R_1 = V/R_1 = 12/5 = 2.4$ A

Current through $R_2 = V/R_2 = 12/10 = 1.2$ A

Current through $R_3 = V/R_2 = 12/30 = 0.4$ A

(b) Total current in the circuit = 2.4 + 1.2 + 0.4 = 4 A

(c) Total resistance in the circuit=R

$1/R = 1/R_1 + 1/R_2 + 1/R_3$

$1/R = 1/5 + 1/10 + 1/30$

$1/R = 10/30$

R = 3 ohm

Q25.

V = 4V,

R_1 = 6 ohm, R_2 = 8 ohm (in series)

(a) Combined resistance, $R = R_1 + R_2 = 6+2 = 8$ohm

(b) Current flowing, I = V/R = 4/8=0.5amp

(c) p.d. across 6ohm resistor = I x R_1 = 0.5 x 6 = 3 V

Q26.

V = 6V

R_1 = 3 ohm, R_2 = 6 ohm (in parallel)

(a) Combined resistance,

$1/R = 1/R_1 + 1/R_2$

$1/R = 1/3 + 1/6 = 3/6 = 1/2$

R = 2 ohm

(b) Current flowing in the main circuit, I = V/R = 6/2 = 3 A

(c) Current flowing in 3 ohm resistor = V/R_1 = 6/3 = 2 A

Q27.

$I = 6V$

$R_1 = 2\,\Omega,\ R_2 = 3\,\Omega$

(a) Combined resistance, $R_{tot} = 2 + 3 = 5\,\Omega$

(b) $I = \dfrac{V}{R_{tot}} = \dfrac{10}{5} = 2\text{ A}$

(c) p.d. across $2\,\Omega$ resistor $= I \times R_1 = 2 \times 2 = 4\text{ V}$

(d) p.d. across $3\,\Omega$ resistor $= I \times R_2 = 2 \times 3 = 6\text{ V}$

Q28.

Total current flowing through circuit, I = 6 A

R_1 = 3 ohm, R_2 = 6 ohm

(a) Combined resistance R is

1/R=1/3+1/6

1/R=3/6

R=2ohms

(b) p.d. across the combined resistance = IR = 6 x 2 = 12 V

(c) p.d. across the 3 ohm resistor = p.d. across the combined resistance = 12 V

(d) Current flowing through the 3 ohm resistor = V/R_1 = 12/3 = 4 A

(e) Current flowing through the 6 ohm resistor = V/R_2 = 12/6 = 2 A

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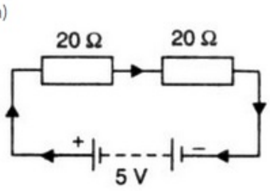
Q29.

(a)



(b) Effective resistance = 20 + 20 = 40 ohms

(c) Current flowing through the circuit = I = V/R = 5/40 = 0.125 amps

(d) p.d. across each resistance = I x R = 0.125 x 20 = 2.5 V

Q30.

V=6V, R_1=2ohms, R_2=3ohms

(a) Resistors are connected in parallel

(b) p.d. across each resistor is same and is equal to 6V.

(c) 2 ohms resistance have bigger share of current because of its lower resistance.

(d) Effective resistance=R

1/R=1/2+1/3

1/R=5/6

R=1.2ohms

(e) Current flowing through battery, I=V/R=6/1.2=5amps

Q31.

4Ω and 2Ω coil are connected in parallel.

Combined resistance is R

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{2} = \frac{3}{4}$$

$$R = \frac{4}{3}\Omega$$

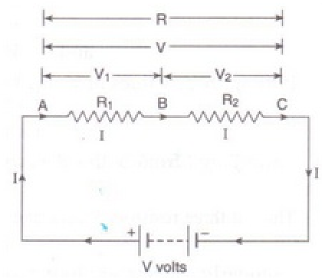
Total current $I = \frac{V}{R} = 3\Omega$

$$\frac{V}{4/3} = 3$$

$$V = 3 \times \frac{4}{3} = 4V$$

Current through 2Ω coil $= \frac{V}{2} = \frac{4}{2} = 2A$

Q32.



(a) Fig shows two resistances R_1 and R_2 connected in series with a battery of V volts.

Let the p.d. across R_1 is V_1 and the p.d. across R_2 is V_2.

s.t. $V = V_1 + V_2$ -----------(1)

Let the equivalent resistance be R and current flowing through whole circuit is I.

By Ohm's law,

$$\frac{V}{I} = R$$

$V = I \times R$ ---------(2)

Applying Ohm's law to both R_1 and R_2,

$V_1 = I \times R_1$ ---------(3)

$V_2 = I \times R_2$ ---------(4)

From eqs. (1), (2), (3) and (4), we get

$I \times R = I \times R_1 + I \times R_2$

$I \times R = I \times (R_1 + R_2)$

$R = R_1 + R_2$

(b)

(i) Current through 5Ω resistor $= \frac{10}{5} = 2A$

(ii) Since 5Ω resistor and R are connected in series, so same current flows through them.

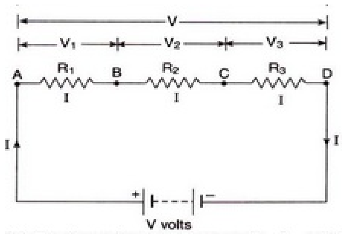
So, Current through R=2A

(iii) V=IR

$$R = \frac{V}{I} = \frac{6}{2} = 3\Omega$$

(iv) V=10+6=16V

Q33.



(a) Fig shows three resistances R_1, R_2 and R_3 connected in series with a battery of V volts.
Let the p.d. across R_1, R_2 and R_3 is V_1, V_2 and V_3 respectively.
s.t. $V=V_1+V_3+V_2$ -----------(1)
Let the equivalent resistance be R and current flowing through whole circuit is I.
By Ohm's law,

$$\frac{V}{I}=R$$

$V=I\times R$ ---------(2)
Applying Ohm's law to both R_1, R_2 and R_3,
$V_1=I\times R_1$ ---------(3)
$V_2=I\times R_2$ ---------(4)
$V_3=I\times R_3$ ---------(5)
From eqs. (1), (2), (3), (4) and (5), we get

$$I\times R=I\times R_1+I\times R_2+I\times R_3$$
$$I\times R=I\times(R_1+R_2+R_3)$$
$$R=R_1+R_2+R_3$$

(b) Let $5\Omega=R_1$, $10\Omega=R_2$, $30\Omega=R_3$

(i) Current through $R_1=I_1=\frac{V}{R_1}=\frac{6}{5}=1.2A$

Current through $R_2=I_2=\frac{V}{R_2}=\frac{6}{10}=0.6A$

Current through $R_3=I_3=\frac{V}{R_3}=\frac{6}{30}=0.2A$

(ii) Total current in the circuit=1.2+0.6+0.2=2A
(iii) Effective resistance R is given as

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$$
$$=\frac{1}{5}+\frac{1}{10}+\frac{1}{30}$$
$$=\frac{6+3+1}{30}=\frac{10}{30}$$
$$R=\frac{30}{10}=3\Omega$$

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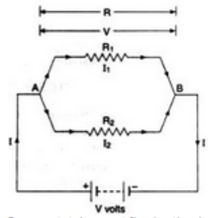
Q34.

(a)



Suppose total current flowing the circuit is I, then the current passing through resistance R_1 will be I_1 and current passing through resistance R_2 will be I_2.

Total current $=I=I_1+I_2$

Let resultant resistance of this parallel combination is R. By applying the Ohm's law to the whole circuit, we get that I=V/R

Since the potential difference across the both the resistances is same, so applying the Ohm's law to each resistance we get that

$I_1=V/R_1$

$I_2=V/R_2$

Putting these eq in the above one, we get that

$V/R=V/R_1+V/R_2$

$1/R=1/R_1+1/R_2$

If two resistance are connected in parallel than, the resultant resistance will be

$1/R=1/R_1+1/R_2$

(b)

(i) Total reisitance=R

$1/R=1/R_1+1/R_2$

R_2=3+2=5ohms

R_1=5ohms

1/R=1/5+1/5

1/R=2/5

R=2.5ohms

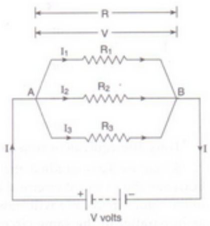
(ii) Current flowing through the circuit

I=V/R=4/(2.5)

=1.6amps

Q35.

(a)



Suppose total current flowing in the circuit is I, then the current passing through resistance R_1 will be I_1, current passing through resistance R_2 will be I_2 and current passing through resistance R_3 will be I_3.

Total current $= I = I_1 + I_2 + I_3$

Let resultant resistance of this parallel combination is R. By applying the Ohm's law to the whole circuit, we get that

$I = V/R$

Since the potential difference across all the resistances is same, so applying the Ohm's law to each resistance we get that

$I_1 = V/R_1$

$I_2 = V/R_2$

$I_3 = V/R_3$

Putting these eqs. in the above one, we get

$V/R = V/R_1 + V/R_2 + V/R_3$

$1/R = 1/R_1 + 1/R_2 + 1/R_3$

If two resistance are connected in parallel, then the resultant resistance will be

$1/R = 1/R_1 + 1/R_2 + 1/R_3$

(b) If switch is open, then only upper two resistances (connected in parallel) are in the circuit.

Effective resistance is $1/R_{eq} = 1/R + 1/R = 2/R$
$R_{eq} = R/2$

So the current $= I = V/(R/2) = 0.6A$ (given)

$V/R = 0.3$ A

When the switch closes, the third resistance also comes in the circuit. The effective resistance of the circuit becomes R/3

Hence, Current $I = V/(R/3) = 3\,(V/R) = 3 \times 0.3 = 0.9$ A

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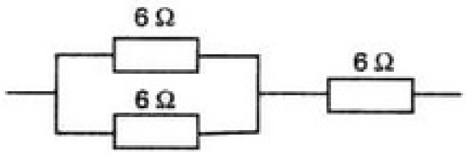
Q43.

(i)



Resultant resistance for parallel circuit=R

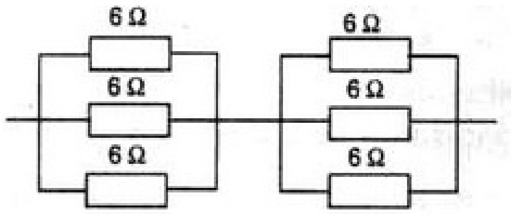
1/R=1/6+1/6

1/R=2/6

R=3

Effective resistance=6+3=9ohms

(ii)



Resultant resistance for each parallel circuit=R

1/R=1/6+1/6+1/6

1/R=3/6

R=2

Therefore effective resistance=2+2=4ohms.

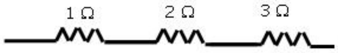
Q44.

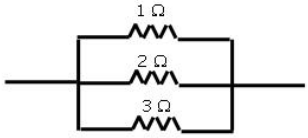
Two resistances when connected in series, resultant value is 9ohms.
Two resistances when connected in parallel, resultant value is 2ohms.
Let the two resistances be R_1 and R_2.
If connected in series, then
$9=R_1+R_2$
$R_1=9-R_2$
If connected in parallel, then
$1/2=1/R_1+1/R_2$
From above equations we get that
$1/2=(R_1+R_2)/R_1R_2$
$1/2=9/(9-R_2)\ R_2$
$9R_2-R_2^2=18$
$R_2^2-9R_2+18=0$
$(R_2-6)\ (R_2-3)=0$
$R_2=6,3$
So if R_2=6ohms, then R_1=9-6=3ohms.
If R_2=3ohms, then R_1=9-3=6ohms.

Q45.

Given:
A resistor of 8ohm is connected in parallel with a resistor of X.
And resultant is 4.8.
Then X=?
We know that for parallel case
$1/R=1/R_1+1/X$
1/4.8=1/8+1/x
1/4.8 - 1/8 = 1/x
After solving we get that
X=12ohms

Q46.

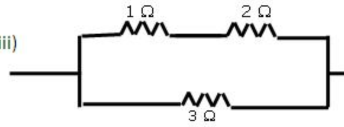
(i)  Equivalent resistance = $1\Omega + 2\Omega + 3\Omega = 6\Omega$

(ii) 

Equivalent resistance

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3} = \frac{6+3+2}{6} = \frac{11}{6}$$

$$\therefore \quad R = \frac{6}{11}\,\Omega$$

(iii) 

Equivalent resistance of first line
$= 1\ \Omega + 2\ \Omega = 3\ \Omega$
Resistance of the second line = $3\ \Omega$
Equivalent resistance

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

$$\therefore \quad R = \frac{3}{2} = 1.5\ \Omega$$

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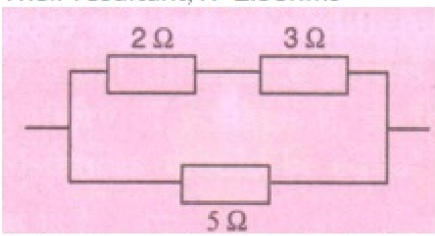
Q47.

Given: Three resistances of 2ohms, 3ohms, 5ohms.
Their resultant, R=2.5ohms



Resistance of first line = 2+3 = 5 ohm
So, 1/R = 1/5 + 1/5
On solving we get that
R=2.5ohms

Q48.

(a) Connect 2ohms resistor in series with a parallel combination of 3ohms and 6ohms.
(b) Connect 2ohms, 3ohms, and 6ohms in parallel.

Q49

(a) For obtaining the highest resistance by combining the given resistances, we must connect them in series.

We get,

R=4+8+12+24=48ohms

(b) For obtaining the lowest resistance by combining the given resistances, we must connect them in parallel.

We get,

1/R=1/4+1/8+1/12+1/24

On solving we get, R=2ohms

Q50.

The three resistance of 20 ohm, 10 ohm and 20 ohm on the extreme right side are in series.
So, the resultant of these three resistances = 20+20+10 = 50ohms.
This 50ohms is in parallel with 30ohms. So resultant of these two will be
1/R=1/30+1/50
1/R=80/1500
R=18.75ohms
Now, the resistances 10 ohms, 18.75 ohms and 10 ohms are in series.
Therefore, resultant resistance = 18.75+10+10 = 38.75ohms.

Q51.

Given: n=100, R=1 ohm
For obtaining the smallest resistance, these resistances are connected in parallel:
Equivalent resistance = 1/1 + 1/1 + 1/1.....100 times = 100/1
R_{eq} = 1/100 = 0.01 ohm
For obtaining the largest resistance, these resistances are connected in series:
Equivalent resistance = 1 + 1 + 1.....100 times = 100
R_{eq} = 100 ohm

Q52.

For obtaining 250ohms, connect two 100ohms in series with a parallel combination of two 100ohms.

Q53.

R_{eq} = R+R+R+R = 4R ohm
Total current in the circuit, I = V/R = 12/4R = 3/R
Reading of voltmeter A = Voltage across R_1 = I x R_1 = 3/R x R = 3V
Reading of voltmeter B= Voltage across R_2 = I x R_2 = 3/R x R = 3V
Reading of voltmeter C= Voltage across the series combination of R_3 and R_4 = I x (R_3+R_4) = 3/R x 2R = 6V

Q54.

Resultant resistance of a parallel combination of four 16 ohm resistances is
1/R = 1/16 + 1/16 + 1/16 + 1/16 = 4/16
R = 4 ohm
Four such combinations are connected in series, so total resistance = 4+4+4+4 = 16 ohm.

Q55.

The total current of 0.5 A flowing in the circuit distributes equally in the two arms having lamps (since the lamps have same resistances). So the current through each of these arms is 0.25 A. Hence A_2, A_3, A_4 and A_5, all will read 0.25 A.

*********** END **********