1. (a) Initially : Resistance of given cable

 ... (i)

Finally : Resistance of each insulated copper wire is

. Hence equivalent resistance of cable ….(ii)

*l*

*ρ*

9 *mm*

*l*

*ρ*

On solving equation (i) and (ii) we get *Req* = 7.5 Ω

1. (a)  ⇒  ⇒ 

When *RA* and *RB* are connected in parallel then equivalent resistance 

If  then  *i.e.* option (a) is correct.

1. (c) The given circuit can be simplified as follows

*A*

*B*

*C*

*D*

∴

1. (c) Suppose *n* resistors are used for the required job. Suppose equivalent resistance of the combination is *R*' and according to energy conservation it's current rating is 

Energy consumed by the combination = *n* × (Energy consumed by each resistance)

⇒ ⇒ 

1. (c) Resistance across 

*R*

*R*1

*R*

*A*

*B*



and 

On solving,



1. (b) No current flows through the capacitor branch in steady state. Total current supplied by the battery

*i* .

Current through 2 Ω resistor 

1. (d) At time *t* = 0 *i.e.* when capacitor is charging, current 

When capacitor is full charged, no current will pass through it, hence current through the circuit 

1. (d) Current in the bulb 

Current in 1 Ω resistance 

Hence total current from the cell 

By using ⇒ 

1. (d) Equivalent resistance of the circuit 

∴ Main current 

0*.*5 *A*

1 *A*

3Ω

8Ω

8Ω

2Ω

9*V*

2Ω

2Ω

4Ω

2Ω

2Ω

0.25 *A*

After proper distribution, the current through 4Ω resistance is 0.25 *A*.

1. (b) Maximum number of resistance 
2. (d) The given circuit can be simplified as follows.

*A*

*B*

*r*

*r*

*r*

*r*

*r*

*r*

*r*

⇓

*A*

*r*

*r*

*r*

*r*

*r*

*r*

*r*

*B*

⇒

*B*

2*r*

2*r/*3

*r*

*r*

*A*

⇐

2*r*

**

*A*

*B*

**

*A*

*B*

⇒

1. (b) The given circuit can be redrawn

*E*1

*A*

*R*1

*R*2

*E*3

*E*2

*B*

*Eeq*

*Req*

*E*2

*B*

*A*

*i*

⇒

 and

. Current  from *A* to *B* through *E*2.

1. (b) Applying Kirchhoff’s law for the loops (1) and (2) as shown in figure

*E*2 *=* 6*V*

*i*1

*R*1 *=* 2Ω

*E*1 *=* 4*V*

*R*3 *=* 2Ω

*i*1

*i*2

*R*2 *=* 4Ω

*i*2

(*i*1 – *i*2)

**1**

**2**

For loop (1)

 ⇒  …(i)

For loop (2)

 ⇒  …(ii)

On solving equation (i) and (ii) .

1. (b) To convert a galvanometer into an ammeter, a shunt  is connected in parallel with it. To convert a galvanometer into a voltmeter, a resistance  is connected in series with it.
2. (a) The given circuit can be redrawn as follows

*X*

*Y*

3Ω

*i*

20Ω

30Ω

60Ω

*i*

*A*

*B*

1Ω

*i*

24Ω

8Ω

48 *V*

10Ω

6Ω

Resistance between *A* and *B* 

Current between *A* and *B* = Current between *X* and *Y* 

Resistance between *X* and *Y* 

⇒ Potential difference between *X* and *Y* = 8 × 20 = 160 *V*

1. (b) The given circuit can be simplifies as follows

*r*

*Q*

*P*

*r*

*r*

*r*

*r*

*r*

*r*

*r*

⇒

⇒

*r*

*P*

*Q*

*r*

*r*

*r*

*r*

*r*

2*r*

*P*

*Q*

2*r*

2*r*

.

1. (b) *dQ* = ⇒ 

= = (9 – 4) + (27 – 8) = 5 + 19 = 24*C*.

1. (d) 

.

1. (a) Balancing length is independent of the cross sectional area of the wire.
2. (a) ⇒⇒

Also  ⇒  ⇒ 

1. (b) The given circuit can be simplified as follows

10Ω

*A*

5Ω

10Ω

8Ω

3Ω

6Ω

6Ω

*B*

5Ω

*A*

3Ω

*B*

8Ω

⇒

3Ω

5Ω

Now it is a balance Wheatstone bridge.

8Ω

8Ω

So,

⇒



≡

*E*

4Ω

2*R*

*R*

2*R*

4*R*

*E*

4Ω

*R*

*R*

*R*

*R*

*R*

4*R*

6*R*

1. (c) The equivalent network is

Clearly, the network of resistances is a balanced Wheatstone bridge. So  is given by

 ⇒ 

For maximum power transfer ⇒ 

1. (c) The given circuit can be redrawn as follows

*i*

6Ω

*B*

*A*

4Ω

6*V,* 1Ω

***V***

***A***

Current 

P.D. between *A* and *B*, .

1. (a) By using  here 

Outer radius *r*2 = 5*cm*

Inner radius *r*1 = 5 – 0.5 = 4.5 *cm*

10 *cm*

*r*1

5 *mm*

*r*2

So 



1. (a) Here  

and 



1. (d) Battery is short circuited so potential difference is zero.
2. (a) Let *V* be the potential of the junction as shown in figure. Applying junction law, we have

4Ω

2Ω

*B*

*i*3

2Ω

5 *V*

*A*

20 *V*

*i*1

*i*2

0 *V*

or 

or 40 – 2*V* + 5 – *V* = 2*V* or 5*V* = 45 ⇒ *V* = 9*V*

∴ 

1. (a) ⇒ .
2. (b) When bulb glows with full intensity, then voltage across it will be 1.5 *V* and voltage across 3 Ω resistance will be 4.5 *V*.

*R*

*Y*

6 *V*

3Ω

*X*

*B*

1.5 *V*

4.5 *V*

Current through 3 Ω resistance 

Same current will flow between *X* and *Y*

So  ⇒  ⇒ 

1. (b) Voltage sensitivity 

⇒ .

Here  Full scale deflection current .

*V* = Voltage to be measured = 150 × 1 = 150 *V*.

Hence .