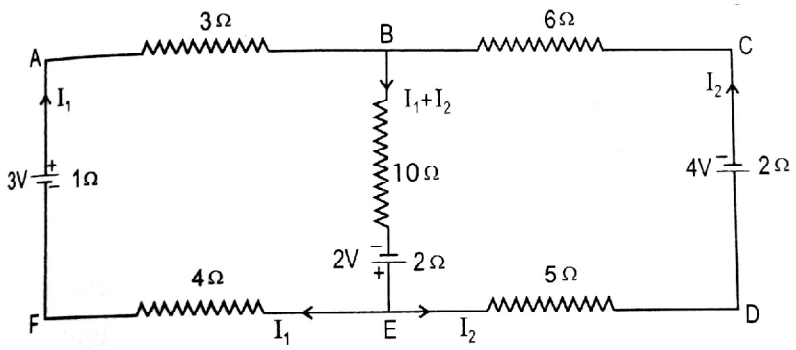
Current Electricity

1. A battery of e.m.f. 4 volts & internal resistance 1Ω is connected in parallel with another battery of e.m.f 1 volt & internal resistance 1Ω Combination is used to send current through an external resistance 2Ω. Calculate current through external resistance & potential difference across external resistance (Ans : V = 2 volts)

2. Two cells of emf 1.5 V & 2 V having internal resitance 1Ω & $2\ \Omega$ respectively are connected in parallel, so as to send the current in same direction through an external resistance of 5Ω. Find current through external resistnce & P. D. across external resistance. (Ans : V= 1.4706 volts)

3. Three cells are connected in parallel with their like poles connected together with wires of negligible resitance. The e.m.f.s of the cells are 2V, 3V and 4V respectively and their internal resistance are 1Ω, 2Ω, 3Ω respectively. Find the current through each branch (or each cell). (Ans : $I_2 = +\frac{2}{11}A$)

4. Find the currents through different branches and P.D. across 10Ω resistor in the network / circuit shown in fig. What is the P.D. across BE ? (Ans : $V_{BE} = -0.35V$)



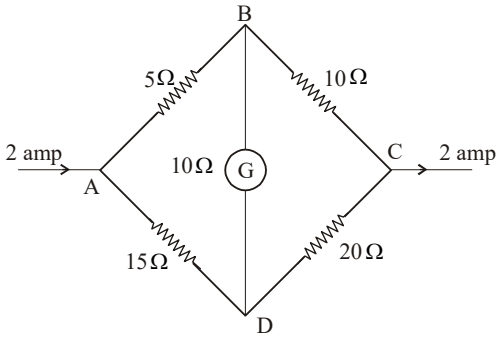
5. Twelve equal vires, each of resistance r Ω are connected to form a cube. Find the resistance betn two diagonally opposite corners of cube (Ans : $R = \frac{5}{6}r$)

6. A skeleton cube is made of 12 conductors, eacxh of resistance 6 Ω and connected to cell of e.m.f E and of neglibible internal resistance. Use Kirchhoff's laws to find the resistance between two diagonally opposite corners of the cube.

(Ans : $R_{AH} = R' = 5\Omega$)

7. A skeleton cube is made of 12 wires each of resistance $R\Omega$ connected to a cell of e.m.f. E and of negligible internal resistance. Use Kirchhoff's laws to find the resistance between (a) adjacent corners of the cube ie. between two ends of any wire or across any one edge. (b) the diagonally opposite corners of same face of cube ie. across face diagonal. (Ans : (a) $\frac{7}{12}R$ (b) $\frac{5}{6}R$)

8. Determine the current flowing through the galvanometer (G) show in fig.



Ans : Ig = $\frac{1}{11}$

9. Find the current through galvanometer in the following fig. if resistance of galvanometer is $20\,\Omega$. (Ans : $I_g = 0.011923A$)

10. A wire of resistance $25\,\Omega$ is uniformly stretched until its length becomes 3 times its original length what will be new resistance ? (Ans : $(R_1 = 25\,\Omega)$

11. Two diametrically opposite points of a metal ring are connected to two terminals of the left gap of meter bridge. In the right gap, resistance of 15Ω is introduced. If the null point is obtained at a distance of 40 cm from the left end, find the resistance of the wrie bent in the shape of the ring. (Ans : $X = 40\Omega$)

12. With unknown resistance x in right gop and 50Ω resistance in left gop of meter bridge. Null point is obtained at 40 cm from the left end of the wire. If another resistance of 25Ω be added in the left gap, how much will be shift of null point ? also find unknown resistance. (Ans : $l = 50\text{cm}$

13. Two tesistances prepared from the wire of the same material having diameters in the ratio 3 : 1 and lengths in the ratio 3 : 1 are connected in the left and right gap of Wheatstone's meter-bridge. Determine the distance of null point from the left end of wire. (Ans : $l = 25cm$)

14. Equal lengths of mangnin (ρ_1) and nichrome (ρ_2) are joined in the left gap and right gap of meter bridge. The null point uis at 40 cm from the lefr end. Compare the diameters of the wire. The specific resistances are $\rho_1 = 4.8\times10^{-8}\Omega m$, $\rho_2 = 10^{-6}\ \Omega$

(Ans : $\frac{d_1}{d_2} = 0.2683$)

15. Two resistance X and Y in the two gaps of a meter-bridge give a null point dividing the wire in the ratio 2 : 3. If each resistane is increased by 30Ω, the null point divides the wire in the ratio 5 : 6 calculate each resistance,
(Ans : X = 20Ω, Y = 30Ω)

16. In meter bridge experiment with resistance R_1 in left gap and resistance x in right gap. The null point is obtained at 40 cm from the left end with resistance R_2 in left gap and same resistance in right gap null point is obained at 50 cm from the left end. where will be null point, if R_1 and R_2 are put in series in left gap, right gap containg x.

(Ans : i = 62.5)

17. In meter bridge experiment with unknown resistance x in the left gap and known resistance of 60Ω in right gap. Null point is obtained at cm from the left end. If unknown resistance is shunted by an eqal resistance. What should be the value of resistance in the right gap in order to get null point at the same place ?

(Ans : $R = 30\Omega$)

18. Two resistances of values 20Ω and 30Ω are connected in left and right gap of meter bridge. Determine shift in null point, when resistance of 20Ω is shunted by another resistance of 20Ω. (Ans $l = 25\text{cm}$, 15 cm towards right.)

19. With an unknown resistance X in the left gap and a resistance of 30Ω in the right gap of meter-bridge the null point is obtained at 40 cm from the left end of the wire. Find (i) the unknown resistance and (ii) the shift in the position of the null point

(a) When the resistances in both the gaps are increased by 15Ω and

(Ans : Shift $= l_x' - l_x' = 3.75$ cm towards right)

(b) When the resistance in each gap is shunted by a resistance of $8\ \Omega$

(Ans : Shift $= l_x' - l_x' = 47.5 - 40 = 7.5$cm towards right)

20. Two coils are connected in series in one gap of the wheatstone's meterbridge and null point is obtained at the centre with the resistance of 100Ω in the other gap. When two coils are connected in parallel in same gap the known resistance is to be charged by 84Ω to obtain the null point at the centre again. Calculate resistances of the coils. (Ans : 80Ω and 20Ω)

21. With a resistance R_1 in the left gap and a resistance R_2 in the right gap at a meter bridge, the null point is obtained at a distance of 70 cm from the left end. When R_1 is reduced by 2Ω the neutral point is obtained at 30 cm from the left end. Find the values of resistances R_1 & R_2 (Ans : $R_1 = 3.5\Omega$, $R_2 = 1.5\ \Omega$)

22. A uniform wire is cut into two pieces such that one piece is twice as long as the other. The two pieces are connected in parallel in the left gap of a meter-bridge. When a resistance of $20\ \Omega$ is connected in the right gap, the neutral point is obtained at a distance of 60 cm from the right end of the wire. Find the resistance of the wire before it was cut into two pieces. (Ans : $60\ \Omega$)

23. The resistances p = 10 Ω , Q = 15 Ω , R = 25 Ω and s = 50 Ω are connected in the arms AB, BC, CD and DA respectively of a wheatstone's network ABCD. The cell is conneced between points A and C. What resistance has to be connected in the parallel with 5 to balance the network (Ans : X = 25Ω)

24. The resistance of a potentiometer wire is 8Ω and its length is 8 m. A resistance box and a 2V battery are connected in series with it. What should be the resistance in the box, if it is desired to have a potential drop of 1 μ V/mm ?
(Ans : 1992 Ω)

25. A potential wire of length 4m has resistance 4 Ω . What resistance must be connected in series with this wire and acccumulatiar of emf 2v, so as to get potential difference of 10^{-3} v/cm of the wire. (Ans : $r = 16\Omega$)

26. A potentiometer wire has a length of 4m and resistance of 4Ω. What resistance must be connected in series with thepotentiometer wire and a cell of e.m.f. 2V having internal resistance 2Ω to get a potential drop of 10^{-3} V/cm along the wire ?

(Ans : $R_S = 194\Omega$)

27. Potentiometer wire of length 10m and resistance 9Ω is connected to a battery of emf 2.1V having internal resistance 1.5Ω. Find the potential gradient along the wire and balancing length of a cell of emf 1.08V (Ans : $l = 6m$)

28. The length of potentiometer wire is 10 m and is connected in series with an accumulator. The emf. of a cell galances against 250 cm length of wire. If the length of potentiometer wire is increased by 1m, calculate the new balancing length of wire. (Ans : $l_2 = 2.75m$)

29. Potentiometer wire of length 4m has resistance $8\,\Omega$. It is connected in series with battery of emf 2v & negligible internal resistance. If emf of cell balances against 217 cm. Find emf of cell when cell is shunted by resistance of $15\,\Omega$, balancing length is reduced to 200 cm. Find internal resistance of cell. (Ans : $r = 1.275\ \Omega$)

30. A resistance of $5\,\Omega$ is connected across a cell, its teminal potential difference is balanced by 150 cm of potentiometer wire when resistor of $10\ \Omega$ resistance is connected across the cell terminal potential difference is balanced by 175 cm of potentiometer wire. Calculated internal resistance of cell. (Ans : $r = 2\Omega$)

31. Voltmeter has resistance $100\ \Omega$ what will be its reading. When it is connected across a cell of emf 2V and internal resistance $20\,\Omega$? (Ans : $V = 1.66$ volts)