Exercise - III (Subjective Problems)

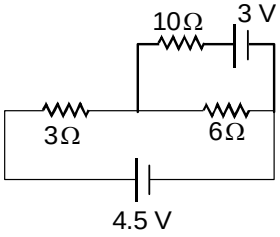
1. A current of 0.50 ampere is passing through a $CuSO_4$ solution. How many Cu^{++} ions will be deposited on cathode in 10 seconds ?

2. A copper wire of radius 0.1 mm and resistance 1 kΩ is connected across a power supply of 20 V. (a) How many electrons are transferred per second between the supply and the wire at one end ? (b) Write down the current density in the wire.

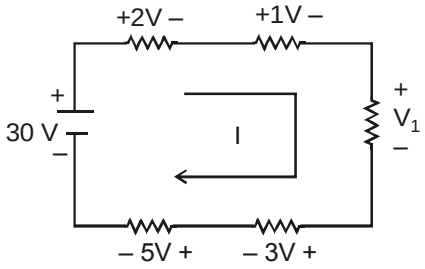
3. A wire has a length of 2.0 m and a resistance of 5.0 Ω. Find the electric field existing inside the wire if it carries a current of 10 A.

4. (a) A car has a fresh storage battery of emf 12 V and internal resistance 5.0×10^{-2} Ω. If the starter draws a current of 90 A, what is the terminal voltage of the battery when the starter is on ?
(b) After long use, the internal resistance of the storage battery increases to 500 Ω. What maximum current can be drawn from the battery ? Assume the emf of the battery to remains unchanged.
(c) If the discharged battery is charged by an external emf source, is the terminal voltage of the battery during charging greater of less than its emf 12 V ?

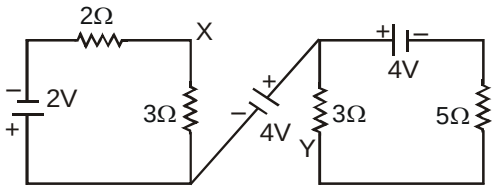
5. Find the current through the 10 Ω resistor shown in figure.



6. For the circuit shown in figure, determine the unknown voltage drop V_1.

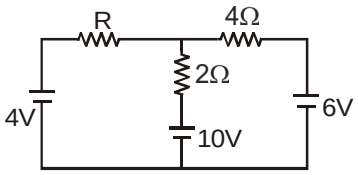


7. (a) Determine the potential difference between X and Y in the circuit shown in figure.

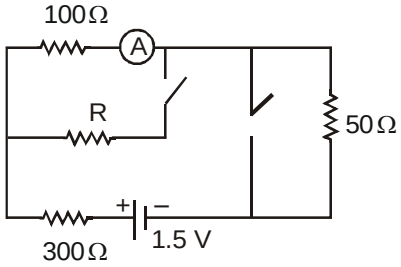


(b) If intermediate cell has internal resistance r = 1 Ω then determine the potential difference between X and Y.

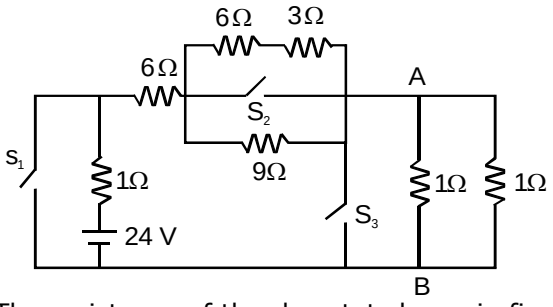
8. For what value of R in circuit, current through 4Ω resistance is zero.



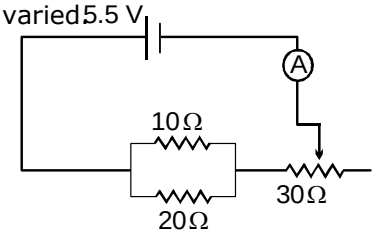
9. In the circuit shown in figure the reading of ammeter is the same with both switches open as with both 0closed. Then find the resistance R. (ammeter is ideal)



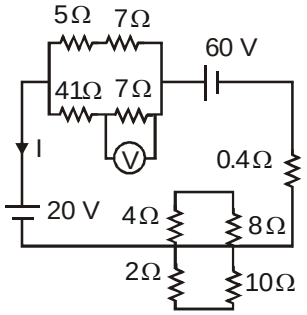
10. If the switches S_1, S_2 and S_3 in the figure are arranged such that current through the battery is minimum, find the voltage across points A and B.



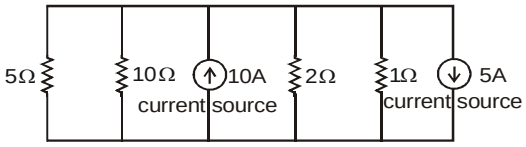
11. The resistance of the rheostat shown in figure is 30 Ω. Neglecting the meter resistance, find the minimum and maximum currents through the ammeter as the rheostat is varied5.5 V



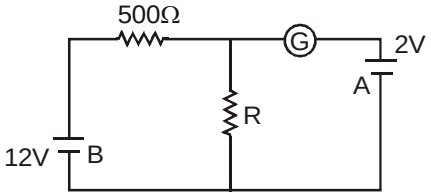
12. Find the current I & voltage V in the circuit shown.



13. For the circuit shown in the figure, find the voltage across 10 Ω resistor and the current passing through it.

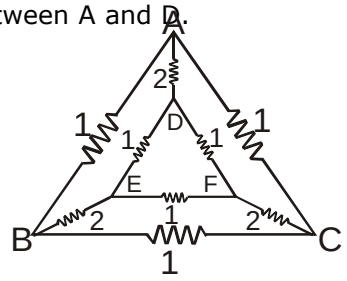


14. In the circuit, the galvanometer G shows zero deflection. If the batteries A and B have negligible internal resitance, the value of the resistor R will be :

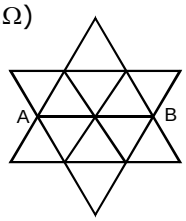


(A) 200 Ω (B) 100 Ω
(C) 500 Ω (D) 1000 Ω

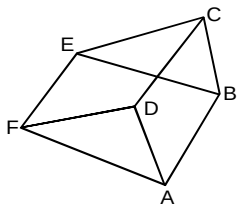
15. A network of nine conductors connects six points A, B, C, D, E and F as shown in figure. The figure denotes resistances in ohms. Find the equivalent resistance between A and D.



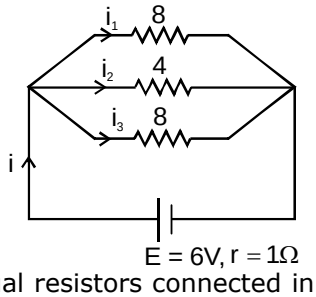
16. Find the equivalent resistance of the circuit between points A and B shown in figure is : (each branch is of resistance = 1Ω)



17. In the circuit shown in figure, all wires have equal resistance r. Find the equivalent resistance between A and B.

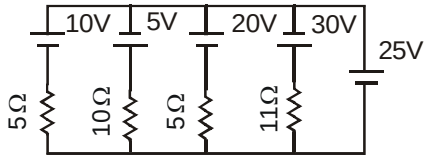


18. In given circuit determine.
(a) The rate at which the chemical energy of the cell is consumed
(b) The rate at which heat is generated inside the battery
(c) Electric power output
(d) Which resistance consumes maximum power
(e) Power dissipated across 4Ω resistance



19. Three equal resistors connected in series across a source of emf together dissipate 10 watts of power. What would be the power dissipated if the same resistors are connected in parallel across the same source of emf ?

20. Find the current through 25V cell & power supplied by 20V cell in the figure shown.

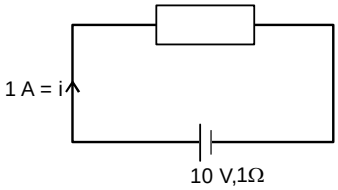


21. If a cell of constant E.M.F. produces the same amount of the heat during the same time in two in dependent resistors R_1 and R_2, when they are separately connected across the terminals of the cell, one after the another, find the internal resistance of the cell.

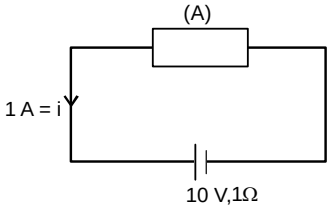
22. One kilowatt electric heater is to be used with 220 V.D.C supply.
(a) What is the current in the heater
(b) What is its resistance.
(c) What is the power dissipated in the heater.
(d) How much heat in calories is produced per second.
(e) How many grams of water at 100ºC will be converted per minute into steam at 100ºC with the heater. [(latent heat of vaporisation of water = 540 cal/g)]

23. The efficiency of a cell when connected to a resistance R is 60%. What will be its efficiency if the external resistance is increased to six times.

24. In following diagram boxes may contain resistor or battery or any other element



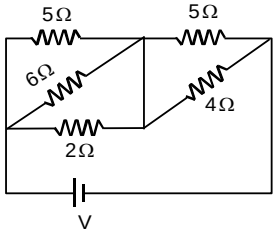
(A)



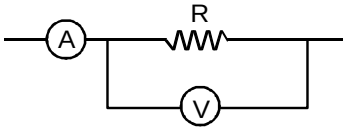
(B)

then determine in each case
(A) E.m.f of battery
(B) Battery is acting as a source or load
(C) Potential difference across each battery.
(D) Power input to the battery or output by the battery.
(E) The rate at which heat is generated inside the battery.
(F) The rate at which the chemical energy of the cell is consumed or increased.
(G) Potential difference across box.
(H) Electric power output across box.

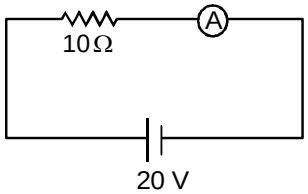
25. Find the resistor in which maximum heat will be produced.



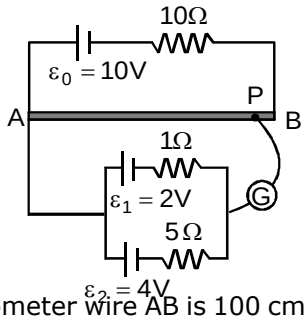
26. A part of a circuit is shown in figure. Here reading of ammeter is 5 ampere and voltmeter is 96V & voltmeter resistance is 480 ohm. Then find the resistance R



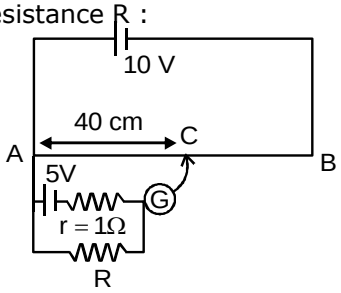
27. The ammeter shown in figure consists of a 480 Ω coil connected in parallel to a 20 Ω shunt. Find the reading of the ammeter.



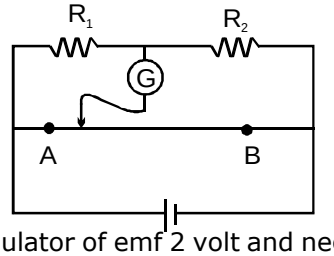
28. A battery of emf ε_0 = 10 V is connected across a 1m long uniform wire having resistance 10Ω/m. Two cells of emf ε_1 = 2V and ε_2 = 4V having internal resistances 1Ω and 5Ω respectively are connected as shown in the figure. If a galvanometer shows no deflection at the point P, find the distance of point P from the point a.



29. A potentiometer wire AB is 100 cm long and has a total resistance of 10ohm. If the galvanometer shows zero deflection at the position C, then find the value of unknown resistance R :



30. In the figure shown for which values of R_1 and R_2 the balance point for Jockey is at 40 cm from A. When R_2 is shunted by a resistance of 10Ω, balance shifts to 50 cm. Find R_1 and R_2. (AB = 1m)



31. An accumulator of emf 2 volt and negligible internal resistance is connected across a uniform wire of length 10m and resistance 30Ω. The appropriate terminals of a cell of emf 1.5 Volt and internal resistance 1Ω is connected to one end of the wire, and the other terminal of the cell is connected through a sensitive galvanometer to a slider on the wire. What length of the wire will be required to produce zero deflection of the galvanometer ? How will the balancing change (a) when a coil of resistance 5Ω is placed in series with the accumulator, (b) the cell of 1.5 volt is shunted with 5Ω resistor ?

Sol.