3 - CURRENT ELECTRICITY

1) Resistance of silver wire is 3 Ω at 30 °C and at 100 °C, it is 3.5 Ω. Find its temperature coefficient of resistance. [March, 2003]
(Ans: 2.44×10^{-3} °C^{-1})

2) Resistance of a wire is 10.5 Ω at 21 °C and at 147 °C it is 16.5 Ω. Find its temperature coefficient of resistance. [April, 2002]
(Ans: 4.56×10^{-3} °C^{-1})

3) A conducting wire has a resistance of 20 ohm. Its length is now stretched to increase by 2 %. Calculate the resulting value of the resistance of the wire. [March, 2002]
(Ans: 20.8 Ω)

4) 5 metre long wire is connected with cell. The e. m. f. and internal resistance of the cell are 2.5 V and 0.5 Ω. The resistance of wire is 2 Ω. Find the potential gradient on the wire. [October, 1998]
(Ans: 0.4 V / m)

5) Two resistors 15 Ω and B Ω are connected in parallel. This combination is connected in series to a 5 Ω resistor and a battery of e. m. f. 5 volt. If the current through B ohm resistor is 1 / 3 A, find the value of B. [March, 1998]
(Ans: 7.5 Ω)

6) A pyramid is constructed from six conductive wires each of resistance ' R '. Calculate the effective resistance between any two vertices of the pyramid.
(Ans: R / 2) [October, 1997, October, 1996]

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7) Three batteries E_1 = 1.5 V, E_2 = 2.5 V and E_3 = 3.5 V and a resistance R = 10 Ω are connected in series to make a loop of closed circuit. In this E_2 and E_3 are in helping position and E_1 is in opposite position. Now 5 Ω resistance is connected in parallel to E_2. Find the current passing through 10 Ω and 5 Ω resistance and battery E_2.
(Ans: 0.45 A, 0.5 A and 0.95 A) [March, 1997]

8) An electron of mass 9×10^{-28} gm and charge of 1.6×10^{-19} C moves in a conductor with acceleration of 10^{12} m /s^2. Find potential gradient of the conductor. [March, 1996]
(Ans: 5.625 V / m)

9) Unknown resistance X is joined parallel to a resistance of 20 Ω. To this combination a battery of 2 volt and resistance of 10 Ω are joined in series. If the current passing through X is 0.05 amp, find the value of X. [March, 1992]
(Ans: 20 Ω)

10) A cell of e. m. f 1.5 volts is connected in parallel with two resistances of 5 Ω and 12 Ω. Determine the current flowing from the cell as well as the current flowing through the two resistances. [March, 1987]
(Ans: 0.425 A , 0.3 A , 0.125 A)

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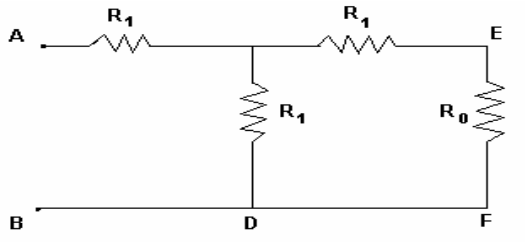
11) The resistances of the four arms AB, BC, CD and DA of a balanced Wheatstone bridge are respectively 10, 20, 30 and x ohms. Find the value of the unknown resistance x.
(Ans: 15 Ω) [May, 1986]

12) Find input resistance R_{AB} between points A and B in forms of R_0 and R_1 in the adjoining circuit. [October, 1990]

[Ans: $R_1 + R_1 (R_1 + R_0) / (2 R_1 + R_0)$]



13) Find the resistance of a copper wire 30 m long and 1 mm in diameter. Resistivity of copper = 1.7×10^{-6} ohm-cm.
(Ans: 0.65 Ω)

14) The resistance of a wire 2.5 m long and 0.9 mm in diameter is 0.07 ohm. What is the resistivity of the material of the wire ?
(Ans: 1.8×10^{-6} ohm-cm)

15) The resistance of a coil of copper wire is 5 Ω at 25 ° C . Determine its resistance at 0° C and 100° C. Temperature coefficient of resistivity of copper = 4.3×10^{-3} / °C (α_{20}) .
(Ans: 4.47 Ω, 6.58 Ω)

16) A standard resistance coil marked 5 Ω is found to have a resistance of 5.2 Ω at 40° C. Find the temperature at which the marking is correct. Temperature coefficient of resistivity of the material of the wire = 0.005 per °C (α_{20}) .
(Ans: 31.5 ° C)

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17) Calculate the loss in watts per kg of a current carrying conductor in terms of the resistivity ρ μΩ - cm, the current density σ amp / mm^2 and specific gravity S.
(Ans: $10 \sigma^2 \rho / S$)

18) A copper and an iron conductor are connected in parallel. If the same current flows through each at 0 ° C, what proportion of current will flow through each at 100 ° C ? Temperature coefficient of resistivity of copper and iron are 0.0043 and 0.0063 per °C .
(Ans: 53.9 % through copper wire and 46.1 % through iron wire)

19) What equal lengths of iron wire and a constantan wire, each of 1 mm diameter must be joined in parallel to give an equivalent resistance of 2 ohm ? Resistivities of iron and constantan are 10 and 49 microohm-cm respectively. (Ans: 18.9 m)

20) Calculate the specific resistance of the material of a wire 24 cm in length, 0.003 cm in diameter and having a resistance of 162 ohm. Also find to what length the wire must be drawn to give it a resistance of 288 ohm. Assume that no change in specific resistance and density occurs in such process.
(Ans: 4.77×10^{-5} ohm-cm, 32 cm)

21) Determine the length l and diameter d of a cylinder of copper in terms of the volume x, resistivity ρ and the resistance between opposite ends, r.
(Ans: $l = (r x / \rho)^{1/2}$, $d = (16 x \rho / \pi^2 r)^{1/4}$)

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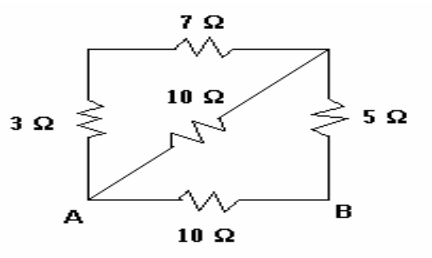
22) Resistances of 60 Ω and 40 Ω are connected in series with a 9 V battery. A voltmeter connected in parallel with 60 Ω resistance shows 4.5 volt. (1) Find the resistance of the voltmeter. (2) What will be the deflection in the voltmeter if it is connected in parallel with 40 Ω resistance ? (3) What will be the potential difference across the 40 Ω resistance if no voltmeter is connected ? (4) How much less will the voltmeter show from the true value ?
(Ans: (1) 120 Ω, (2) 3 V, (3) 3.6 V, (4) 0.6 V)

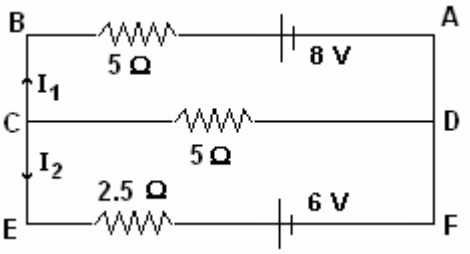
23) When two resistors are connected in series, their equivalent resistance is 18 Ω and when they are connected in parallel, the equivalent resistance is 4 Ω. Find their resistances. (Ans: 12 Ω, 6 Ω)

24) Five resistances are connected as shown in the diagram. Find the equivalent resistance between the points A and B.
(Ans: 5 Ω)



25) Determine the current through each branch in the adjoining circuit.

(Ans: I_1 = 0.6 A, I_2 = 0.4 A)



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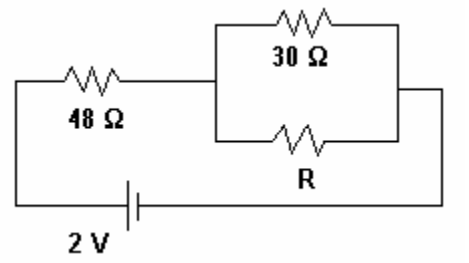
26) A resistance is made by joining two wires of the same material. The radii of the two wires are 1 mm and 3 mm respectively, while their lengths are 3 cm and 5 cm respectively. A battery of emf 16 volt and negligible internal resistance is connected across the resistance. What is the potential drop along the shorter wire ?
(Ans: 13.5 V)

27) In the circuit shown, when R is removed, additional resistance of 72 ohm must be inserted in series with the battery in order to keep the current in the 30 ohm resistor unaltered. Find the value of R.
(Ans: 20 Ω)



28) Two resistances, 60 Ω and 80 Ω are connected in series with a dynamo supplying an emf of 34 volt. When a voltmeter of resistance R Ω is connected across the 80 Ω resistance, it reads 16 volt. (a) Calculate the resistance of the voltmeter. (b) If this voltmeter is connected across 60 Ω resistance, what will be its reading ?
(Ans: (a) 160 Ω, (b) 12 V)

29) 24 identical cells each of emf 2 volt and intenal resistance 2 ohm are arranged to send current through an external resistance of 3 ohm. Find the best arrangement of cells. Find also the maximum current through the external resistance.
(Ans: 4 rows with 6 cells in a row; 2 ampere)