PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

CURRENT ELECTRICITY

Examples

1. Current I flows through a wire depends on time t as follows$I = 3t^2 + 2t + 5$ How much

charge flows through the cross section of the wire from t=0 to t=2 s ?

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2. If a current $I = 4\pi \sin \pi t$ ampere flows through a wire, then find the amount of charge that flows through the wire in (i) t=0 to t=1s and (ii) t=1 s to t=2s.

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3. A battery is charged at potential of 15 V for 8 h by means of a current of 10A. While discharging it supplies a current 5A for 15h at a potential difference of 14 V. Calculate the watt-hour efficiency of the battery.

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4. The length,radius and resistivity of two wires are each in the ratio 1:3. The resistance of the comparatively thin wire is 20Ω. Determine the resistance of the other wire.

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5. IF the length of a copper wire is increased by 0.1%, show that the resistance of the copper wire will increase by 0.2%.

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6. A lump of copper of mass 10 g and of density $9g.\,cm^{-3}$ is given, what should be the length and cross section of the wire made from it so

that its resistance is 2 ohm. (Given ,specific resistance of copper $1.8 \times 10^{-6} \Omega cm$).

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7. A wire of resistance 5Ω is stretched 20%. IF the volume remains constant , find the new resistance.

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8. A lump of copper is stretched into a wire 5mn in diameter. Another wire of 1 cm diameter is made from another lump of copper of the same mass. Find the ratio of the resistances of the two wires.

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9. The length of a wire of cylindrical cross section is increased by 100%. Find out the percentage change is the resistance,taking into

account the consequent decrease in the diameter of the wire.

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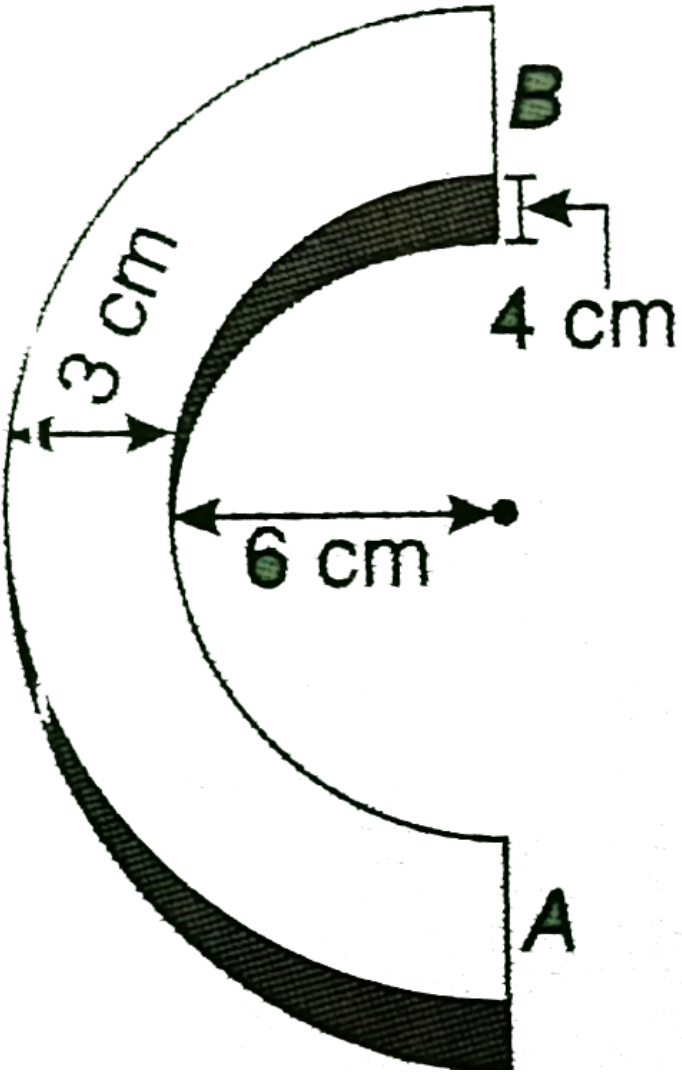
10. What will be the resistance of a semicircle. [fig.1.7] between points A and B? Given that radial thickness =3cm, axial thickness=4 cm, inner radius=6 cm and resistivity $= 4 \times 10^{-6}\Omega$

cm.



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11. The temperature coefficient of resistance of copper is $42.5 \times 10^{-4^{\circ}} C^{-1}$. The resistance of a coll of copper at $30^{\circ} C$ is 8Ω.What is the resistance at $100^{\circ} C$?

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12. IF ρ is the resistivity at temperature T, then the temperature coefficient of resistivity is defined as $\alpha = \frac{1d\rho}{\rho dT}$, which is a constant physical quantity for a given metal, show that

$\rho = \rho_0 e^{a(T-T_0)}$, where ρ_0 = resistivity at temperature T_0.

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13. Three resistance of magnitudes $20\Omega, 30\Omega$ and 40Ω are connected in series.(i) What is the equivalent resistance? (ii) IF the potential difference across the resistance 20Ω is 1V, calculate the potential differences across the other two resistances and also the total potential difference across the combination.

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14. ρ_1 and ρ_2 are the resistivities of the materials of two wires of the same dimensions, what will be the equivalent resistvity of the series combination of the two wires?

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15. The equivalent resistance of two coils connected in series and in parallel are 12Ω and

$\frac{5}{3}\Omega$ respectively. Calculate the value of each resistance.

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16. A 5 ampere current is distibuted in three branches. The ratio of the lengths of the wires in the three branches is 1:2:3.Determine the magnitude of current in each branch. The material and the cross sectional area of each wire are the same.

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17. Current is allowed to pass in a circuit formed by two wires of the same material connected in a parallel combination.The ratio of the lengths and the radii of the two wires are 4:3 and 2:3 respectively, Determine the ratio of the current flowing through the two wires.

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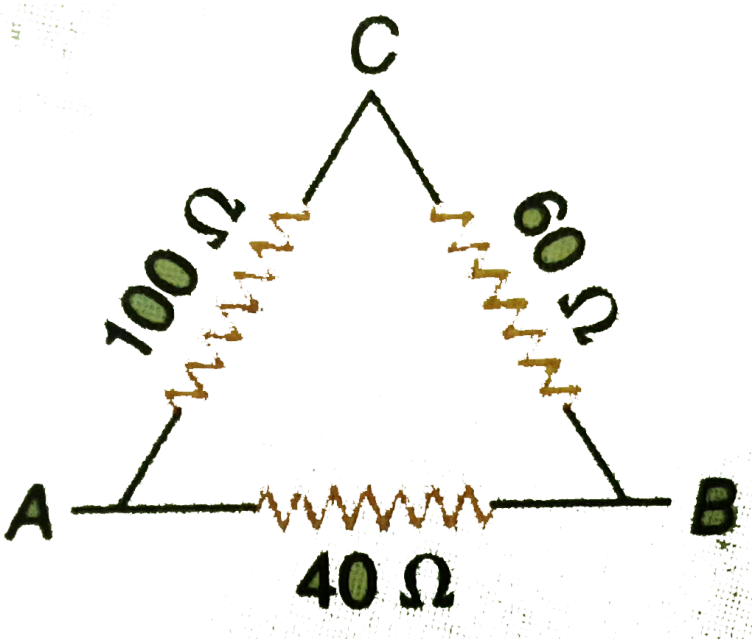
18. ABC is a traingle formed by wires. The resistance of the sides AB,BC and CA are respectively $40\Omega, 60\Omega \text{ and } 100\Omega$. What is the

equivalent resistance between the point A and B?



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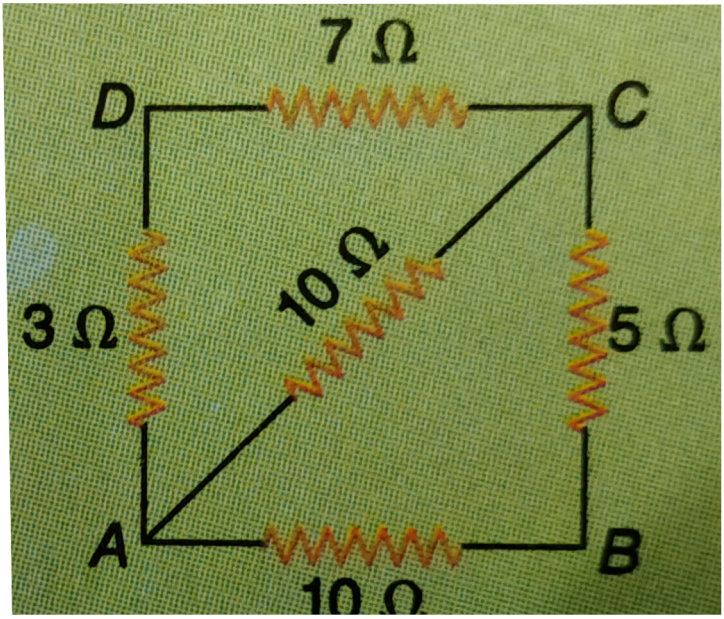
19. Determine the equivalent resistance between the points A and B [fig.1.13]



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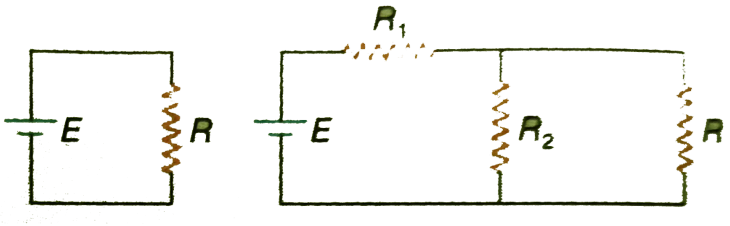
20. The two circuits in the fig.1.14 draw equals currents from the battery.But the current through the resistance R in the second circuit is $\frac{1}{10}$th of that in the first circuit, Determine the

values of R_1 and R_2.



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21. You are given several identical resistances,each of value $R = 10\Omega$ and each capable of carrying a maximum current of 1A. It is required to make a suitable combination of these resistances to obtain a resistance of 5Ω which can carry a current of 4A, FInd the

mninimum number of resistances of the type R that will be required.

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22. A wire of uniform cross section and length l has a resistance of 16Ω. It is cut into four equal parts.Each part is stretched uniformly to length l and all the four streteched parts are connected in parallel. Calculate the total resistance of the combination so formed. Assume that stretching of wire does not cause any change in the density of its material.

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23. A resistor is fabricated by connecting two wires of the same material .The radii of the two wires are 1 mm and 3mm respectively and their lengths are 3 cm and 5 cm respectively. IF the two ends of the resistor are connected to the two terminals of a battery of emf 16 V and of negligible Internal resistance, what will be the potential difference between the two ends of the wire of shorter length?

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24. A heater of resistance 140Ω capable of carrying a current of $1.2A$ is put in a dc mains of 210 V. Find out the minimum value of an additional resistance to be added to run the heater.

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25. To the parallel combination of two resistances 3Ω and 1Ω, a series combination of resistances 2.15Ω and 1Ω and a battery are

connected. The interval resistance of the battery is 0.1Ω and the emf is 2V. Determine the values of current flowing through the resistances. Draw the diagram of the circuit.

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26. The electromotive force of a cell is 2V. The potential difference becomes 1.5 V when a resistance of 15Ω is added to the two ends of the cell. Determine the internal resistance of the cell and the lost volt.

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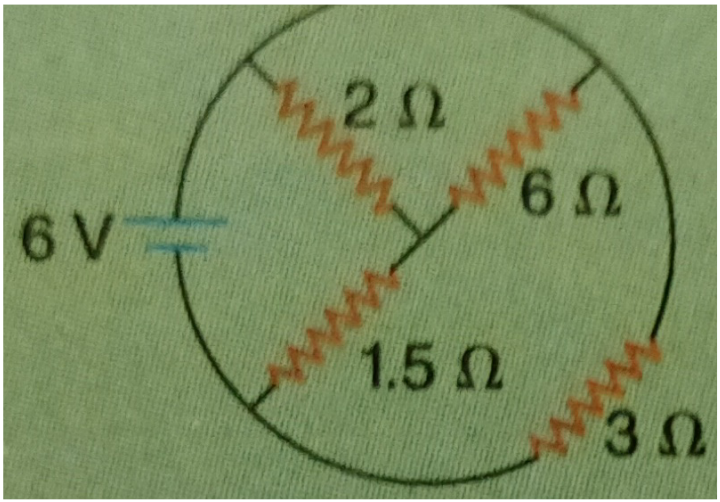
27. In the given diagram [Fig.1.17 (a)], What is the current sent by the battery?



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28. To reduce the action of the galvanometer by 25 times,a shunt is added to it. IF the galvanometer resistance is 1000Ω what is the resistance of the stunt?

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29. If a stunt of 1Ω is connected to a galvanometer of resistance 99Ω, what fraction of the main current will flow through the galvanometer?

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30. A battery of internal resistances zero is connected to a galvanometer of resistance 80Ω and a resistance of 20Ω in series . A current flows through the galvanometer If a shunt of 1Ω resistance is connected to the galvanometer, show that the current that will now flow through the galvanometer becomes $\frac{1}{17}$ of the previous current.

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31. The internal resistance of a battery of 100 V is 5Ω. When the emf of the battery is measured by a voltmeter $20\ \%$ error is found. What is the resistance of the voltmeter?

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32. In a supply line of 100 V there is a resistance of 1000Ω. In between our terminal of the resistance and its mid point, a voltmeter is connected which gives a reading of 40 V. determine the resistance of the voltmeter.

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33. When a voltmeter of resistance $100\Omega$is connected with an electric cell, the reading of the voltmeter is 2V. When the cell is connected with a resistance of 15Ω. An ammeter of resistance 1Ω given the reading of 0.1 A.Determine the emf of the cell.

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34. Two identical cells each of emf 1.5V are connected in series. IF this combination of cells is connected to a resistance and a galvanometer in series, the current that flows through the circuit is 1A.If the cells are connected in parallel the current becomes 0.6 A, Determine the internal resistance of each cell.

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35. 48 similar cells each of emf 1.5V and internal resistance 2Ω are used for sending current through a resistance of 6Ω. What will be the current if the cells are connected in the following way: 6 rows and 8 cells in a row

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36. 48 similar cells each of emf 1.5V and internal resistance 2Ω are used for sending current through a resistance of 6Ω. What will be the

current if the cells are connected in the following way: 4 rows and 12 cells in a row

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37. What is the minimum number of cells each of emf 10 V and internal resistance 1Ω to pass a current of 10 A through a resistance R of 3Ω ? What is the discharging power of R?

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38. Electromotive forces of E_1 and E_2 [fig:1.28] are respectively 4V and 8V, $r_1 = 0.5\Omega$, $r_2 = 1\Omega$, Determine the current and the terminal potential difference for each cell.

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39. A 100V battery has an internal resistance 3Ω . What is the reading of a voltmeter having resistance 200Ω, when placed across the terminals of the battery? What should be the minimum value of the voltmeter resistance so

that the error in finding the emf of the battery may not be more than 1%?

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40. A wire of resistance 10Ω is used to form a circular ring of circumference 10 cm. IF two current carrying conductors are connected at any two points, the sub circuit so formed has a resistance of 1Ω. Find the positions of the two points.

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41. 12 cells each having the same emf are connected in series and are kept in a closed box. Some of the cells are wrongly connected. This battery is connected in series with an ammeter and two similar cells . The current is 3A when the two cells aid the battery and is 2A when the cells and the battery oppose each other. How many cells in the battery are wrongly connected?

42. A cell of emf 1.4V and internal resistance 2Ω is connected in series with a resistance of 100Ω and an ammeter. The resistance of the ammeter is $\frac{4}{3}\Omega$.To measure the potential difference between the two ends of the resistance a voltmeter is connected .Draw the circuit

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43. A cell of emf 1.4V and internal resistance 2Ω is connected in series with a resistance of 100Ω and an ammeter. The resistance of the ammeter

is $\frac{4}{3}\Omega$.To measure the potential difference between the two ends of the resistance a voltmeter is connected IF the reading of the ammter is 0.02 A.what is the resistance of the voltmeter?

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44. A cell of emf 1.4V and internal resistance 2Ω is connected in series with a resistance of 100Ω and an ammeter. The resistance of the ammeter is $\frac{4}{3}\Omega$.To measure the potential difference between the two ends of the resistance a

voltmeter is connected IF the reading of the voltmeter is 1.10V, what will be its error?

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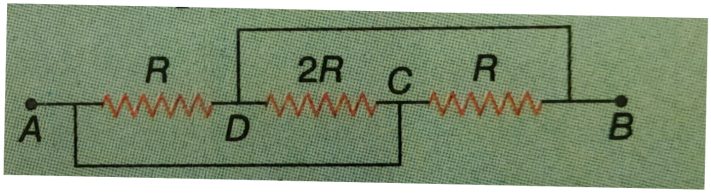
45. In the given fig.1.32 what is the equivalent resistance between the two points A and B?



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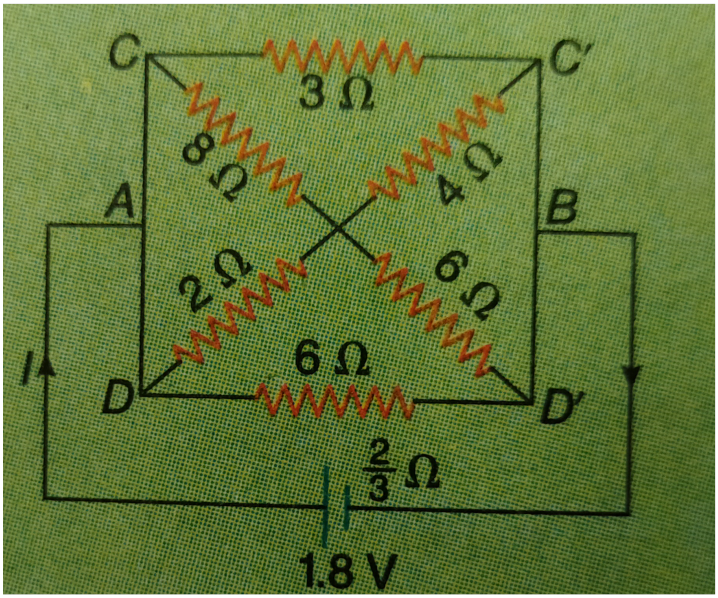
46. A circuit is given in fig.1.34 The emf of the battery is 1.8 V and internal resistance is $\frac{2}{3}\Omega$ .Calculate the current through the 3Ω resistance.What is the amount of dissipated energy in the whole circuit?



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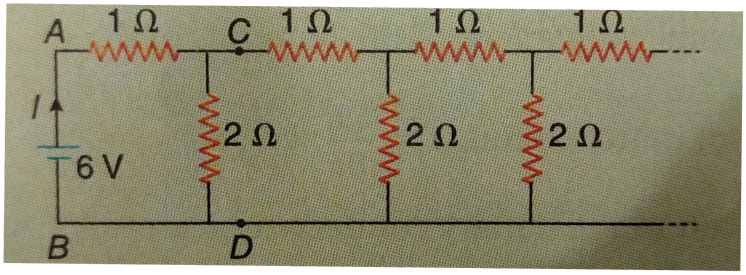
47. An infinite ladder network of resistances is constructed with 1Ω and 2Ω resistances as shown in fig. 1.36. The 6V battery A and B has negligible internal resistance. (i) Show that the effective resistance between A and B is 2Ω (ii) What is the current that passes through the 2Ω resistance nearest to the battery?



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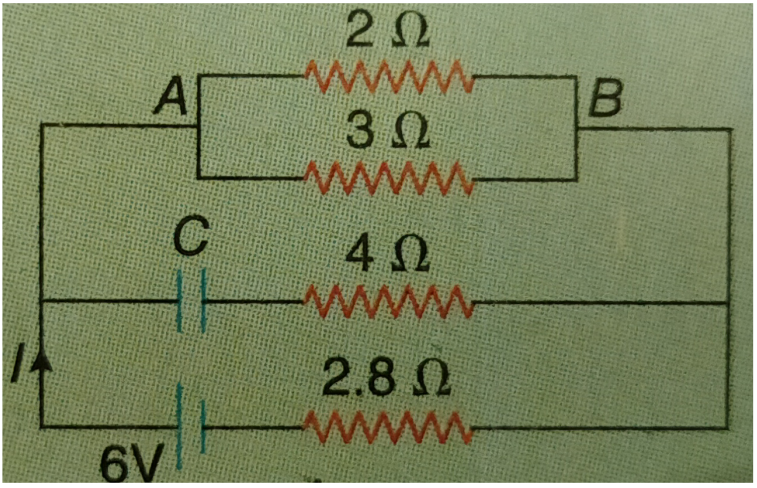
48. In the circuit shown in the fig.1.38,calculate the first current (dc) through the 2Ω resistance. The internal resistance of the battery is negligible and $C = 0.2\mu F$.



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49. Three resistances A , B and C are connected in such a way that their combined equivalent resistance is equal so that of B. IF A and B are 10Ω and 30Ω respectively, find the three possible values of C and draw the corresponding circuits.

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50. Two cells one of emf 1.4 V and internal resistance 0.6Ω the other of emf 2.5. V and internal resistance 0.3Ω are connected in

parallel and the combination is connected in series with an external resistance of 4Ω. What is the current through this resistance?

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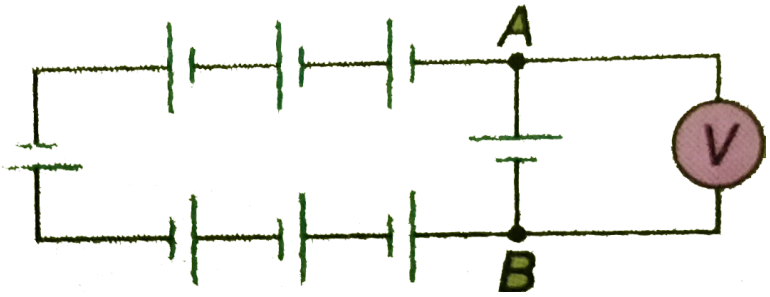
51. In the circuit fig.1.41 shown, each battery is 5V and has an internal resistance of 0.2Ω If the voltmeter is an ideal one, what is its reading?



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52. A few storage cells in series are to be charged from a 200 V dc supply. The emf of each cell is 2.5 V, Internal resistance 0.1Ω and the charging current is 8A. In this arrangement how many cells can be charged and what extra resistance is required to be conncted in the circuit?

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53. A copper wire of cross-sectional area $1mm^2$ carries a current of 0.21A Find the drift velocity of free electrons. Given density of free electrons in copper $= 8.84 \times 10^{24} m^{-3}$ and electronic charge $e = 1.6 \times 10^{-19} C$.

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54. A copper wire of diameter $\frac{2}{3\sqrt{\pi}} mm$ is carrying a current of 1 amp. Calculate the number of free electrons which flow past any cross section of the wire per sec Also find the

average speed with which free electrons are flowing in the copper wire assuming that there is one free electron per atom of copper. Number of atmos per cm^3 of copper $= 9 \times 10^{22}$, electronic charge $= 1.6 \times 10^{-19}$ coulomb.

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55. Estimate the average drift speed of conduction electrons in a copper wire of cross sectional area $1 \times 10^{-7} m^2$ carrying a current of 1.5 A.Assume that each copper atom

contributes one conduction electron. The density of copper is $9 \times 10^3 kg.\, m^{-3}$ and its atomic mass is $63.5u$.

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56. Compare the drift speed obtained above with (a) thermal speed of electrons carrying the current at room temperature and (b) speed of propagation of electric field along the conductor which causes the drift motion.Avogadro's number=6.0×10^{26} per kg atom. Boltzmann constant ,

$k = 1.38 \times 10^{-23} J.K^{-1}$ mass of electron $= 9.1 \times 10^{-31} kg.$

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57. When an iron wire of diameter 1 cm is copper plated uniformly. Resistance of iron reduces to $\frac{1}{3}$ of its original value. Calculate the thickness of copper plating, Resistivities of copper and iron are $1.8 \times 10^{-6} \Omega$.cm and $1.98 \times 10^{-5} \Omega$.cm respectively.

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58. In an aluminimum (Al) bar of square cross section, a square hole is drilled and is filled with iron (Fe) as shown in the figure. The electrical resistivities of AL and Fe are $2.7 \times 10^{-8}\Omega$.m and $10 \times 10^{-8}\Omega$ m respectively. Calculate the electrical resistance between the two faces P and Q of the composite bar.

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59. A conductor of resistance 20Ω having uniform cross sectional area is bent in the form of a closed ring. A cell of emf 1.5 V and of negligible internal resistance is joined to the ring between two points dividing the circumference of the ring in the ratio 3:1 Find the currents flowing through the two parts of the ring .

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Higher Order Thinking Skill Hots Question

1. On which factors (i) emf of an electric cell and (ii) electrical energy supplied by the cell depend on?

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2. The electromotive force of a primary cell and a secondary or storage cell are equal.Which one of the cells can supply more current?

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3. Where does the emf of a cell exist?

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4. The capacity of a secondary cell is 30 A.h what do you mean by the statement? How much electric charge can be drawn from if without damaging it?

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5. What will happen if the electrodes of a cell are placed closer to each other and if their size is made larger?

6. What is a storage cell?What does it store and how?

7. Force and electromotive force are different physical quantities-explain.

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8. A metallic wire has a definite resistance . IF the wire is stretched in such a way that its length becomes doubled then what will be the resistance of the wire? Consider the volume and the resistivity of the wire remains unchanged.

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9. A conductor in series with an ammeter and a semiconductor in series with another ammeter are connected in parallel. At a certain voltage both the ammeters register the same current. Will this condition remains as such if the voltage of the dc source is increased? Explain your answer.

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10. Show that when a number of resistance are connected in parallel their equivalent resistance is smaller than the smallest of them .

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11. An electric lamp is connected with a battery of emf 10 V and it is found that 0.01A current is flowing through it. But if the lamp is connected with 220 volt mains, a constant current of 0.05A flows through it. Explain the apparent anomaly with Ohm's law.

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12. Show that if a resistance connected in a parallel combination is much smaller than the other resistance of the combination,then the equivalent resistance of the combination is almost equal to the small resistance.

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13. By mistake, a voltmeter is connected in series and an ammeter in parallel with a

resistance in an electric circuit. What will happen to the measurements?

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14. Equal number of identical cells are joined first in series and then in parallel in a circuit with resistance R to send a current through it. Under what condition, the currents in both the cases will be the same.

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15. Two cells each of emf e but internal resistances r_1 and r_2 are connected in series through an external resistance R. IF the potential difference across the first cell is zero while current flows,the relation of R in terms of r_1 and r_2 is

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16. For n number of resistors of magnitude r connected in parallel, the equivalent resistance in R. What will be the value of the equivalent

resistance when they are connected in series?

Or, show that if n identical conductors are joined in series, the combined resistance is n^2 times as great as when they are joined in parallel.

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17. A closed circuit consists of n cells connected in series. Each cell has an emf e and internal resistance r. The resistance of the connecting wires is assumed to be zero. What will be the reading of voltmeter connected to the

terminals of one of the cells? It is assumed that the voltmeter has an infinitely high resistance as usual. Can it be real in practice?

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18. A student connect a cell to a circuit and measures the current in the circuit as I_1. When he joins a second identical cell In seris with the first, the current becomes I_2. When he connects the cells in parallel, the current through the circuit is I_3. show that $3I_2I_3 = 2I_1(I_2 + I_3)$.

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19. State the condition under which Ohm's law is not obeyed in a conductor.

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20. The current -voltage graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the fig.1.46 Is the temperature T_2 greater than T_1?

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21. The equivalent resistance of series ad parallel combinations of two cells are S and P respectively. IF S=nP , then find out the minimum possible value of n.

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22. A resistor of 36Ω resistance is bent in the form of a circle is shown in the figure. Prove that the equivalent resistance between A and B

is 5Ω.

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23. Two concentric conducting spherical shells of radii a and b (where $a < b$) have a medium of resistivity $\rho = \frac{k}{r}$ filled in the space between the shells, where k is a constant and r is the distance from the common centre. If current flows from inner to outer sphere,calculate the equivalent resistance of the arrangement .

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24. A cylindrical conductor of length l and inner and outer radii r_2 and r_1 respectively has specific resistance ρ, A cell of emf e is connected across the two lateral faces (inner and outer) of the conductor. What current should be drawn from the cell?

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25. The cross section of a cylindrical conductor is A. The resistivity of the material of the cylinder depends only on distance r from the axis of the conductor as $\rho = \frac{k}{r^2}$ where k is a constant. Find the resistance per unit length of such a conductor.

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26. Figure shows a conductor of length l having a circular cross section. The radius of cross section of the conductor varies linearly from r_1

to r_2 along its length. IF the specific resistance of the material of the conductor be ρ, find the resistance of the conductor.

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Ncert Textbook Question With Answer Hint

1. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2A which settles after a few seconds to a steady value of 2.8A. What is the stready

temperature of the heating element if the room temperature is $27^{\circ}C$? Temperature coefficient of resistance of nichrome averages over the temperature range involved is $1.70 \times 10^{-4^{\circ}} C^{-1}$.

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2. A storage battery of emf 8.0 V and internal resistance 0.5Ω is being charged by a 120 V dc supply using a series resistor of 15.5Ω.What is the terminal voltage of the battery during

charging? What is the purpose of using the series resistor in the charging circuit?

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3. The earth's surface has a negative surface charge density of $10^{-9}C.m^{-2}$. The potential difference of 400kV between the top of the atmosphere and the surface results (due to the low conductivity of the lower atmosphere) in a current of only 1800 A over the entire globe. If there wre no mechanism of sustaining atmospheric,electric field, how much time

(roughly) would be required to neutralise earth's surface? [Radius of earth $=6.37 \times 10^6 m$]

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4. Two wires of equal length , one of aluminimum and the other of copper have the same resistance.Which of the two wires is lighter? Hence explain why aluminium when are preferred for over head power cables .

$[\rho_{Al} = 2.63 \times 10^{-8} \Omega . m, \rho_{Ca} = 1.72 \times 10^{-8} \Omega . m$

relative density of Al=2.7 of Cu=8.9].

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Ncert Exemplar Question With Answer Hint Mcq 1

1. Consider a current carrying wire (Current I) in the shape of a circle. Note that as the current progresses along the wire, the direction of current density $\vec{j}$ changes in an exact manner,while the current j remains unaffected the agent that is essentially responsible for it is

A. source of emf

B. electric field produced by charges accumlated on the surface of wire

C. the charges just behind a given segment of wire which push them just the right way by repulsion

D. the charges ahead

Answer: B

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2. Two batteries of emf e_1 and $r_2(e_2 > e_1)$ and internal resistances r_1 and r_2 respectively are connected in parallel as shown in fig.1.53.

The equivalent emf of the two cells e_{eq}).

A. $e_1 < e_{eq} < e_2$

B. $e_{eq} < e_1$

C. $e_{eq} = e_1 + e_2$

D. e_{eq} is independent of r_1 and r_2

Answer: A

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Ncert Exemplar Question With Answer Hint Mcq 2

1. Temperature dependence of resistivity $\rho(T)$ of semiconductors,insulators and metals is significally based on which of the following factors?

A. number of charge carriers can change with temperature T

B. time interval between two successive collisions can depend on T

C. length of material can be a function of T

D. mass of carriers is a function of T

Answer: A::B

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Exercise Multiple Choice Question

1. The current in a conductor varies with time t as $I = 2t + 3t^2$, where I is in ampere and t in second. Electric charge flowing through a section of the conductor during t=3 s and t=3 s is

A. 10C

B. 24 C

C. 33 C

D. 44 C

Answer: B

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2. Emf of a lead-acid accumulator during its prolonged discharging is

A. 1.08 V

B. 1.5 V

C. 2.0 V

D. 2.2 V

Answer: C

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3. What energy transformation occurs during discharging of an accumulator?

A. electrical energy to chemical energy

B. chemical energy to electrical energy

C. electrical energy to mechanical energy

D. mechanical energy to electrical energy

Answer: B

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4. What is the nature of energy conversion during changing of a secondary cell?

A. electrical energy to chemical energy

B. chemical energy to electrical energy

C. electrical energy to mechanical energy

D. mechanical energy to electrical energy

Answer: A

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5. Which of the following graphs represents the variation of current (I) through a metallic conductor with its terminal potential difference (V)?

A. 

B. 

C. 

D. 

Answer: A

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6. The dimension of resistance is

A. $ML^2T^{-3}I^{-1}$

B. $ML^2T^{-1}I^{-1}$

C. $ML^2T^{-3}I^{-2}$

D. $ML^2T^{-1}I^{-1}$

Answer: C

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7. Resistivity of copper is $1.76 \times 10^{-6}\Omega$ cm. What will be the resistance between two opposite faces of a copper cube of side 1 m?

A. $1.76 \times 10^{-4}\Omega$

B. $1.76 \times 10^{-6}\Omega$

C. $1.76 \times 10^{-8}\Omega$

D. $1.76 \times 10^{-12}\Omega$

Answer: C

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8. A block has dimensions 1 cm, 2cm, 3cm Ratio of the maximum and minimum resistance between any two points of opposite faces of this block is

A. $1:6$

B. $1:9$

C. $9:1$

D. $18:1$

Answer: C

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9. A conductor with rectangular cross section has dimensions $(a \times 2a \times 4a)$ as shown in fig.1.54 Resistance across AB is R_1, across CD is R_2 and across EF is R_3. Then

A. $R_1 = R_2 = R_3$

B. $R_1 > R_2 > R_3$

C. $R_2 > R_3 > R_1$

D. $R_1 > R_3 > R_2$

Answer: D

View Text Solution

10. A wire of resistance 4Ω is bent through 180° at its mid point and the two halves are twisted together. Then the resistance is

A. 1Ω

B. 2Ω

C. 5Ω

D. 8Ω

Answer: B

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11. The temperature coefficient of resistance of a metal is $0.004^{\circ}C^{-1}$. If a wire has resistance 1Ω at $0^{\circ}C$ then what will be the value of that resistance at $100^{\circ}C$?

A. 0.6Ω

B. 0.96Ω

C. 1.04Ω

D. 1.4Ω

Answer: D

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12. A carbon resistor has a resistance of $10^6\Omega$.

The colour of its third band is

A. yellow

B. green

C. blue

D. violet

Answer: B

Watch Video Solution

13. The resistance of a wire is 5Ω at $50^\circ C$ and 6Ω at $100^\circ C$. The resistance of the wire at $0^\circ C$ will be

A. 1Ω

B. 2Ω

C. 3Ω

D. 4Ω

Answer: D

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14. If three resistances connected in series,are related as $R_1 > R_2 > R_3$ then what is the relation between the currents flowing through them?

A. $I_1 = I_2 = I_3$

B. $I_1 > I_2 > I_3$

C. $I_1 < I_2 < I_3$

D. $I_1 > I_3 > I_2$

Answer: A

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15. IF three resistances are connected in parallel and the relation between then is $R_1 > R_2 > R_3$, then the relation between the currents flowing through them is

A. $I_1 = I_2 = I_3$

B. $I_1 > I_2 > I_3$

C. $I_1 < I_2 < I_3$

D. $I_1 > I_3 > I_2$

Answer: C

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16. Two resistances of 6Ω and 3Ω are connected in parallel and this combination is connected to

a battery of emf 2V. What will be the current flowing through the 6Ω resistance?

A. $\frac{1}{3}A$

B. $\frac{2}{3}A$

C. $1A$

D. $2A$

Answer: A

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17. A series combination of three resistances $1\Omega, 2\Omega$ and 3Ω is connected with a cell of emf 1.5 V and of negligible internal resistance. What is the terminal potential difference across the third resistance?

A. $\frac{1}{4}A$

B. $\frac{1}{2}V$

C. $\frac{3}{4}V$

D. $1V$

Answer: C

Watch Video Solution

18. A uniform metal wire of resistance R is stretched to twice its length. Now this wire is halved, and the two halves are connected in parallel. The equivalent resistance is

A. $\frac{R}{2}$

B. R

C. 2R

D. 4R

Answer: B

19. A set of n identical resistors,each of resistance R ohm when connected in series, have effective resistance X ohm and when connected in parallel the effective resistance is y Ohm. The relation between R,X and Y is given by

A. $R = \sqrt{XY}$

B. $R = Y\sqrt{X}$

C. $R = X\sqrt{Y}$

D. $\sqrt{R} = XY$

Answer: A

View Text Solution

20. An uniform wire of resistance 36Ω is bent in the form of a circle. The equivalent resistance across the points A and B is

A. 36Ω

B. 18Ω

C. 9Ω

D. 2.75Ω

Answer: D

View Text Solution

21. A ring is made of a wire having a resistance $R_0 = 12\Omega$. Find the points A and B as shown in the fig.1.61 at which a current carrying

conductor should be connected so that the resistance R of the sub circuit between these points is equal to $\frac{8}{3}\Omega$.

A. $\frac{I_1}{I_2} = \frac{5}{8}$

B. $\frac{I_1}{I_2} = \frac{1}{3}$

C. $\frac{I_1}{I_2} = \frac{3}{8}$

D. $\frac{I_1}{I_2} = \frac{1}{2}$

Answer: D

View Text Solution

22. When a resistance of 12Ω is conencted with a cell of emf $1.5V$, 0.1 A current flows through the resistance internal resistance of the cell is

A. 1Ω

B. 3Ω

C. 5Ω

D. 1.5Ω

Answer: B

Watch Video Solution

23. When a resistance of 12Ω is conencted with a cell of emf $1.5V$, 0.1 A current flows through the resistance internal resistance of the cell is

A. 1Ω

B. 3Ω

C. 5Ω

D. 15Ω

Answer: B

Watch Video Solution

24. A shunt of resistance 1Ω is connected with a galvanometer of resistance 100Ω. What part of the main current will flow through the galvanometer?

A. $\frac{1}{99}$

B. $\frac{1}{100}$

C. $\frac{1}{101}$

D. $\frac{1}{98}$

Answer: C

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25. A galvanometer of resistance R is connected to an electric circuit. The main current in the circuit is k times the maximum current that the galvanometer can withstand. The maximum value of the stunt resistance that should be used across the galvanometer is

A. kR

B. $(k-1)R$

C. $\frac{R}{k}$

D. $\frac{R}{k-1}$

Answer: D

Watch Video Solution

26. Two electric cells each of emf 1.5 V and internal resistance 2Ω are connected in parallel and this combiantion of cells is connected with an external distance of 2Ω. What will be the current in the external circuit?

A. $\frac{1}{4}A$

B. $\frac{1}{3}A$

C. $\frac{1}{2}A$

D. $1A$

Answer: C

Watch Video Solution

27. n identical cells, each of emf e and internal resistance r, are first connected in series and then in parallel. What will be the ratio of the emfs and of the internal resistances of these two cell combinations?

A. n,n

B. n, n^2

C. n^2, n

D. $\frac{1}{n}, n$

Answer: B

Watch Video Solution

28. Two cells each emf e but of internal resistance r_1 and r_2 are connected in series through and external resistance R. IF the

potential difference across the first cell is zero while current flows the value of R in terms of r_1 and r_2 is

A. $R = r_1 + r_2$

B. $R = r_1 - r_2$

C. $R = \frac{1}{2}(r_1 + r_2)$

D. $R = \frac{1}{2}(r_1 - r_2)$

Answer: B

Watch Video Solution

29. A galvanometer connected with an unknown resistor and two identical cells in series each of emf 2V,shows a current of 1A. If the cells are connected in parallel, it shows 0.8 A. Then the internal resistance of the cell is

A. 1Ω

B. 2.8Ω

C. 0.7Ω

D. 1.4Ω

Answer: A

Watch Video Solution

30. In a metallic conductor, the number of free electrons per unit volume is n and the drift velocity of those electrons is v_d. Then

A. $v_d \propto n$

B. $v_d \propto \frac{1}{n}$

C. $v_d \propto n^2$

D. $v_d \propto \frac{1}{n^2}$

Answer: B

Watch Video Solution

Watch Video Solution

31. When a current of 1 A flows through a copper wire of cross sectional area $1mm^2$ the drift velocity of free electrons becomes v, What will be the drift velocity of free electrons when the same current flows through a copper wire of cross sectional area $2mm^2$?

A. $\frac{v}{2}$

B. v

C. 2v

D. 4v

Answer: A

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32. Two copper wires have a ratio of $1:4$ between their diameters. IF the same current passes through both of them, the drift velocity of the electrons will be in the ratio of

A. $16:1$

B. $4:1$

C. $1:4$

D. $1:16$

Answer: A

Watch Video Solution

Exercise Very Short Answer Type Question

1. For What property of conductors, current will flow through a wire connecting them?

Watch Video Solution

2. Does the emf of a standard electric cell depend on the volume of the cell?

Watch Video Solution

3. What kind of cell should be preferred to get a high current?

Watch Video Solution

4. Lead oxide is used as___ electrode in a lead - acid accumulator as an active component [Fill in the blanks]

Watch Video Solution

5. Spongy lead is used as_____ electrode in a lead-acid accumulator as an active component [Fill in the blanks]

Watch Video Solution

6. Which active electrolyte is used in a lead-acid accumulator?

Watch Video Solution

7. Internal resistance of the secondary cell_____ than that of a primary cell [Fill in the blanks]

Watch Video Solution

8. If a current of 1mA flows through a conductor having potential difference of 1V between its

two ends ,what will be the resistance of the conductor?

Watch Video Solution

9. For a metallic conductor, what is the nature of the graph of current strength vs. potential difference?

Watch Video Solution

10. Resistance of a conductor is 200Ω and the current through it is 10 mA,What is the potential difference across the two ends of the conductor?

Watch Video Solution

11. Resistivity of copper is $1.76 \times 10^{-6}\Omega$.cm. Express it in ohm.m.

Watch Video Solution

12. Resistivity of copper is $1.76 \times 10^{-6} \Omega$.cm. Determine the resistance of a copper rod having length 10 cm and cross sectional area $1 cm^2$.

Watch Video Solution

13. Two conducting wires of lenghts l and 2l have the same cross-sectional area.Compare their resistances.

Watch Video Solution

14. Two wires A and B are of the same metal and of the same length. Their areas of cross section are in the ratio of $2:1$. IF the same potential difference is applied across each wire is turn,what will be the ratio of the currents flowing in A and B?

Watch Video Solution

15. What will be the change in the resistance of the Eureka wire,when its radius is halved and

length is reduced to one-fourth of its original length?

Watch Video Solution

16. Two wires A and B of the same metal have the same across sectional area and have their lengths in the ratio $2:1$ What will be the ratio of currents flowing through them respectively, when the same potential difference is applied across each of them?

Watch Video Solution

17. Name a substance whose resistance decreases with in the increases in temperature.

Watch Video Solution

18. What is the unit of temperature coefficient of resistance?

Watch Video Solution

19. The temperature coefficient of resistance for the material of a conductor is $38 \times 10^{-4^{\circ}} C^{-1}$ .What will be its value $in^{\circ} F^{-1}$? Range of rise in temperature can be assumed small.

Watch Video Solution

20. A carbon resistor is coloured with four different bands=brown,black,orange and silver respectively. Find the range of its probable resistance.

Watch Video Solution

21. Resistance of a carbon resistor is $6.8k\Omega$ .What is the first three colour bands on it.

Watch Video Solution

22. Of metals and alloys,which has greater value of temperature coefficient of resistance?

Watch Video Solution

23. How are different electrical appliances connected In domestic electric connection?

Watch Video Solution

24. Two resistances 1Ω and 2Ω are connected in series and a potential difference of 6V is applied across the ends of this combination. What will be the terminal potential difference across the second resistance?

Watch Video Solution

25. Two resistances 1Ω and 2Ω are connected in parallel and a potential difference of 6V is applie across the ends this combination, Calculate the current through the second conductor.

Watch Video Solution

26. What is the value of I in the circuit of Fig.1.64?

Watch Video Solution

27. Equivalent resistance in a parallel combination is ..... than each of the component resistances [Fill in the blanks].

Watch Video Solution

28. Two resistance of 6Ω and 3Ω are connected in parallel when current is sent through this combination,compare the currents through the resistances.

Watch Video Solution

29. A metallic wire of resistance R is folded into two equal parts and then wound well, what will be new resistance then?

Watch Video Solution

30. The resistance of an electrical appliance is 200Ω and it can withstand a maximum current of 1A. To operate the appliance on a dc source of 220 V what minimum resistance should be connected in series with it?

Watch Video Solution

31. The equivalent resistance of two resistances in series is four times the equivalent resistance when they are in parallel. If one of the resistances is R, then what would be the resistance of the other?

Watch Video Solution

32. Three resistances,each of 4Ω, are connected in the form of an equilateral triangle.Find the

effective resistance between its two corners.

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33. Name the quantity for which the potential difference of a cell becomes less than its emf due to its internal resistance.

Watch Video Solution

34. What is the maximum value of current available from a cell of emf 1.5 V and internal

resistance 1Ω?

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35. IF the _____through a circuit or the _____of a cell be zero, then the value of the lost volt becomes zero [Fill in the blanks]

Watch Video Solution

36. Emf, of a cell is $1.5V$and its internal resistance is 1Ω When the cell sends current in

an external circuit having resistance 2Ω, then what will be the value of lost volt?

Watch Video Solution

37. When a stunt of 1Ω is connected in parallel with a galvanometer 1% of the main current flows through the galvanometer .Determine the resistance of the galvanometer.

Watch Video Solution

38. If the current through a galvanometer of resistance G is to be reduced n times, what should be the shunt resistance?

Watch Video Solution

39. A shunt of 1Ω is connected in parallel with a galvanometer of resistance 99Ω. IF the main current of the circuit be 1A, then what will be the galvanometer current?

Watch Video Solution

40. n electric cells having emf e and internal resistance r each are connected in parallel.What is the emf of this combination?

Watch Video Solution

41. n electric cells of emf e and internal resistance r each are connected in series.What is the emf of this combination.

Watch Video Solution

42. In metallic conductor of conventional current is___ to the direction of flow of free electrons [Fill in the blanks]

Watch Video Solution

43. Velocity of electric current is much more___ than the drift velocity of free electrons in a metallic conductor [Fill in the blanks].

Watch Video Solution

44. The potential difference across a given copper wire is increased.What happens to the drift velocity of the charge carriers?

Watch Video Solution

Exercise Short Answer Type Question I

1. Keeping the components of an electric cell unchanged, if their amounts be increased then which property of the celll will change?

Watch Video Solution

Watch Video Solution

2. Force and electromotive force are two different physical quantities'-explain the statement.

Watch Video Solution

3. When the two electrodes of an electric cell are connected directly with a voltmeter,it gives a reading of 1.2 V,State whether this value can be called the emf of the cell?

Watch Video Solution

4. Show that if the two electrodes of an electric cell are short circuited then no potential difference will exist between them.

Watch Video Solution

5. Show that in a closed circuit the potential difference between the two ends of a cell is less than the emf of that cell.

Watch Video Solution

6. In household electrical wiring how are the lights and fans are connected-in series or in parallel? Give reason of your answer.

Watch Video Solution

7. Show that the terminal potential difference of a cell connected in a closed circuit is , in general,less than its emf.

Watch Video Solution

8. Show that the equivalent resistance of a series combination is greater than every individual resistance of that combination.

Watch Video Solution

9. Show that the equivalent resistance of a parallel combination is less than every individual resistance of that combination.

Watch Video Solution

10. IF two resistor are connected in parallel,their equivalent resistance would be less than even the lower resistance of the two - prove it.

Watch Video Solution

11. You are given 'n' resistors,each of resistance 'r'.These are first connected to get minimum possible resistance.In the second,case these are again connected differently to get maximum possible resistance.Compute the ratio between

the minimum and maximum values of resistances so obtained.

Watch Video Solution

12. The capacity of a secondary cell is 30 A.h what is the meaning of this statement? How much electric charge would be available without damaging the cell?

Watch Video Solution

13. Due to a mistake in the designing an ammeter is joined is parallel to a resistance of a circuit amd a voltmeter in series with it.What will be the consequences?

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14. IF the electron drift speed is so small and the electron's charge is also small,then how can we still obtain a large amount of current in a conductor?

Watch Video Solution

15. A carbon resistor of $41k\Omega$ is to be marked with rings of different colours for its identification.Write the sequence of colours.

Watch Video Solution

16. IF the current supplied to a variable resistor is constant, draw a graph between voltage and resistance.

Watch Video Solution

17. Name any one material having a small value of temperature coefficient of resistance.Write one use of this material.

Watch Video Solution

18. How does the conductance of a semiconducting material change with rise in temperature?

Watch Video Solution

19. The electron drift speed is estimated to be only a few $mm.\ s^{-1}$ for currents in the range of a few ampere.How then is current established almost the instant a circuit is closed?

Watch Video Solution

20. Draw a graph to show the variation of resistance of a metal wire as a function of its diameter,keeping length and temperature constant.

Watch Video Solution

21. What happends to the drift velocity of electrons and to the resistance,if length of conductor is doubled keeping potential difference unchanged?

Watch Video Solution

22. IF potential differences V applied across a conductor is increased to 2V,how will the drift velocity of electrons change?

Watch Video Solution

23. Draw the graph showing variation of resistivity with temperautre for silicon.

Watch Video Solution

Exercise Short Answer Type Question Ii

1. What changes will be observed in an electric cell if the electrodes used in it are brought very

close to each other and if their size are increased?

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2. When an electric lamp is connected with a 10 V electric cell, it is seen that a 0.01 A current flows through it. But if that lamp is connected with 220 V mains , then a steady current of 0.05 A flows through it.Explain the apparent discrepancies with ohm's law.

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3. The potential difference between the two ends of a conducting coil is made twice,but it is seen that the current strength is not doubled.Explain the reason.

Watch Video Solution

4. The emf of each of two cell is E and their internal resistances are r_1 and r_2 respectively. They are connected in series and the combination is connected to a resistance R such that the terminal potentail difference

across the plates of the first cell is zero. Calculate the value of R.

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5. you have several identical electric cells. IF the internal resistance of the cells be (i) very much greater (ii) very much smaller than external resistance, then how should the cells be connected with that resistance to increase the current through it?

Watch Video Solution

6. Currents are passing through a metallic conductor in one circuit and through an electrolyte in another. What will be effect on these currents,if the temperature of both the metallic conductor and the electrolyte are increased?

Watch Video Solution

7. A semiconductor -resistor is connected in parallel with a variable resistance.This combination is joined in series with an electric

cell and a milliammeter . If the temperature increases,how would you keep the milliammeter reading to a constant value? Justify your answer.

Watch Video Solution

Exercise Problem Set I

1. The current flowing through a wire depends on time as $l = 9t^2 + 4t + 1$. What will be the

amount of charge flowing through the cross section of wire in time t=1s to t=2s?

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2. In a closed circuit,the current I(in ampere) at an instant of time t(in seconds) is given by $I = 4 - 0.08t$. What will be the number of electrons flowing in 50 s through the cross section of the conductor ? (charge of an electron=$1.6 \times 10^{-19} C$)

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3. What is the resistance of a relay coil which draws a current of 35 mA when the voltage applied to it is 14 V.

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4. An electric kettle has a resistance of 160Ω. What current will flow when it is connected to a 240 V supply?

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5. IF a wire of length 1 m and diameter 1.5 mm, a potential difference of 5 mV is applied between its two ends and the current through it is 500 mA.Determine the specific resistance for the material of the wire.

Watch Video Solution

6. The resistance of a uniform metallic wire is 1Ω,its radius is 0.1 mm and resistivity of its material is $1.8 \times 10^{-6}\Omega$.cm. Determine the length of the wire.

Watch Video Solution

7. The lengths diameters and resistances of two wire are in the ratio of $1:2$ Determine the ratio of the resistivities for their materials.

Watch Video Solution

8. A wire of radius 5 mm is produced from a lump of copper. Another wire of the same mass but of diameter 1 cm is produced from another

lump of copper. Determine the ratio of the resistances of the two wires.

Watch Video Solution

9. A metal wire has a resistances of 5Ω . If its length is doubled by stretching,what would be its resistance? Suppose the volume and resistivity of the wire do not change.

Watch Video Solution

10. A 1 m long metal wire has a cross sectional area of $0.1mm^2$. Find out the resistance of the wire if the resistivity of the metal is $1.8 \times 10^{-6}\Omega . cm.$

Watch Video Solution

11. The lengths,resistances and resistivities of materials of two wires-each is in the ratio of $1:2$ What is the ratio between their diameters?

Watch Video Solution

12. A nichrome wire of resisitivity $'\rho'$ is stretched to make it 10% longer .What is the percentage change in its resistance?

Watch Video Solution

13. A wire with a resistances 5Ω is drawn out so that its new length is three times its original length. Find the resistance of the longer wire. What would be the effect on resistivity?

Watch Video Solution

14. A wire of resistance 32Ω is melted and drawn into a wire of half of its original length.Calculate the resistance of the new wire.What is the percentage change in resistance?

Watch Video Solution

15. The resistance of a copper wire at $20^{\circ}C$ is 3Ω and at 100° is 3.94Ω.Determine the temperature coefficient of resistance of copper.

Watch Video Solution

16. The temperature coefficient of resistance of copper is $42.5 \times 10^{-5} C^{-1}$. What would be the resitance of a copper wire at $100^{\circ} C$ if it is 4Ω at $30^{\circ} C$?

Watch Video Solution

17. A voltage of 30 V is applied across a carbon resistor with first,second and third rings of blue,black and yellow colours respectively.

Calculate the value of current , in mA,through the resistor.

Watch Video Solution

18. The resistance of a platinum wire of platinum resistance thermometer at the ice point is 5Ω and at steam point is 5.23Ω When the thermometer is inserted in a hot bath,the resistance of the platinum wire is 5.795Ω .Calculate the temperature of the both.

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19. A carbon resistor is marked in coloured bands in the sequence blue,green ,orange and gold. What is the resistance and tolerance value of the resistor?

Watch Video Solution

20. The sequence of bands market on a carbon resistor are yellow,red,orange and silver.What is its (i) resistance and (ii) tolerance?

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21. What percent will be the equivalent resistance of two resistances 2Ω and 3Ω in their parallel combination with respect to their equivalent resistance in series combination?

Watch Video Solution

22. With two resistances 2Ω and 3Ω In parallel a third resistance of 4Ω is connected in series.Find their equivalent resistance.

Watch Video Solution

23. Equivalent resistances of two resistors in their series and parallel combinations are 10Ω and 2.1Ω respectively.Find out the values of two resistances.

Watch Video Solution

24. The equivalent resistances of two resistances in parallel combination is one-fourth of their equivalent resistance in series combination.If one of the resistance is 10Ω then find the other.

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25. There are 14 resistances each of magnitude 1Ω. Keeping three of them in series in each row,four rows are arranged in parallel. The remaining two resistances are connected in series with the previous combination.Determine the equivalent resistance of the whole network.

Watch Video Solution

26. The resistance of an electrical appliance is 200Ω and it can withstand a maximum current of 0.1A.A dc source ,which can send 1A main current,is connected with this appliance,How much resistance should be connected In parallel with the appliance to run it with safety?

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27. The ratio of three resistances is $1:2:3$ if the greatest resistance be 12 ohm then what will be the equivalent resistance of the three

resistances in their (i) series combination and (ii) Parallel combination?

Watch Video Solution

28. Emf of an electric cell is 2.1 V and its internal resistance is 0.1Ω. When the two poles of the cell are connected with an external resistance, a potential difference of 2.08 V is obtained. Determine the value of the external resistance.

Watch Video Solution

29. Emf of an electric cell is 1.5 V and its internal resistance Is 2Ω. With this cell 1Ω, 2Ω and 10Ω resistances are arranged in series .Determine the terminal potential differences of the resistances and the lost volt.

Watch Video Solution

30. A cell of emf 2.1 V and 0.1Ω internal resistance sends 100 mA current in an external circuit. Determine the external resistance,terminal potential difference across

that resistance and internal potential drop of the cell.

31. Electric current is sent through a resistance of 20Ω from a battery of emf 2V and of negligible internal resistance .During measurements of current with the help of an ammeter , 20% error is incurred.What is the resistance of the ammeter?

32. Internal resistance of an electric cell is 1Ω. Error is incurred during the measurement of its emf with the help a voltmeter.What is the resistance of the voltmeter?

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33. Current is sent from an electric cell of emf 30 V and of negligible internal resistance through a resistance of 200Ω. When an ammeter is introduced into the circuit is given a reading of 147 mA. Determine the resistance

of the ammeter and also the percentage error in the measurements of current.

Watch Video Solution

34. An electric cell of emf 2V and of negligible internal resistance is connected in series with a coil of resistance a 20Ω and a galvanometer of resistance 200Ω, a 20Ω resistances is parallel with the galvanometer,find out the galvanometer current.

Watch Video Solution

35. Internal resistance of each of 30 identical cells is 3Ω. To get the maximum current through an external resistance of 10Ω,the cells are arranged in m rows such that eah row contains n cells Determine m and n.

Watch Video Solution

36. Emf of each of 15 cells is 2V and internal resistance of each is 0.1Ω. The cells are arranged in a parallel combination containing 3 rows of 5 cells each. Determine the emf and

internal resistance of the entire combination of cells.

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37. 5 electric cells are connected in series .Emf of each cell is 1.5 V and internal resistance is 0.1Ω.When this combination of cells is connected with an external circuit of resistance 4Ω, what will be the current through that resistance? What resistance should be connected instead of 4Ω so that the current will be halved?

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38. When a resistance of 4.5Ω is connected with 10 identical cells in series, a current of 2.5 A flows through it . IF a 10.5Ω resistance replaces the 4.5Ω resistance , then the current becomes half the previous value,Determine the emf and internal resistance of each cell.

Watch Video Solution

39. Calculate the number of electrons crossing a given cross section in 1 second to constitute a current of 1A.Given charge of an electron- $1.6 \times 10^{-19} C$.

Watch Video Solution

40. The number of free electrons per unit volume in a metallic conductor is $10^{22} cm^{-3}$.The area of cross section of the conductor is $1 mm^2$ and the strength of current through the conductor is 1A. Determine the drift velocity of

the free electrons,(Given that the charge of an electron $-1.6 \times 10^{-19} C$)

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41. Estimate the average drift speed of conduction electrons in a copper wire of cross sectional area $1.0 \times 10^{-7} m^2$ carrying a current of 1.5 A.Assume that the number density of conduction electrons is $9 \times 10^{25} m^{-3}$ charge of an electron $=-1.6 \times 10^{-19} C$.

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Exercise Problem Set Ii

1. A metallic wire is stretched to increase its length by 20% .What will be the percentage change of its resistance?

Watch Video Solution

2. A wire of unifrom cross section is made from 1g of copper whose resistance is 0.2Ω Determine the length and cross sectional area of the wire. Given the density of copper

$= 9g.\ cm^{-3}$ and its resistivity $= 1.8 \times 10^{-6}\Omega.\ cm.$

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3. A wire of 15Ω resistance is gradually stretched to double its length . IT is then cut into two equal parts. These parts are then connected in parallel across a 3.0 volt battery .Find the current drawn from the battery.

Watch Video Solution

4. According to the definition of International ohm, the resistance of a uniform column of mercury of length $106.3cm$ and of mass $14.4521g$. When kept is melting ice, becomes 1Ω

(i) IF the temperature coefficient of resistance of mercury be $9 \times 10^{-4^\circ} C^{-1}$. then what will be the resistance of that mercury column in boiling water?

(ii) IF the density of mercury be 13.59 g.cm^{-3} and its coefficient of volume expansion be $1.8 \times 10^{-4^\circ} C^{-1}$. then what will be the resistivity of mercury at the temperature of boiling water.

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5. The coefficient of linear equation of copper is $17 \times 10^{-6} / {}^{\circ} C$ and its temperature coefficient of resistance is $42.5 \times 10^{-4^{\circ}} C^{-1}$. IF the resistivity of copper at $0^{\circ} C$ be $1.55 \times 10^{-6} \Omega$ cm. then what will be its resistivity at $100^{\circ} C$?

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6. Two wires are of lengths 1 cm and 2 cm and their diameters are 1 mm and 2 mm

respectively. The wires are joined in series and on this combination a potential difference of 4.5 V is applid.If both the wires are made of the same material , determine the terminal potential difference across the shorter wire.

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7. With a series combination of 1Ω and 2Ω resistances another series combination of resistances 5Ω and 7Ω cell is joined and the main current of the circuit becomes 0.5 A.What

is the terminal potential differences across the 1Ω resistances?

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8. A quadrilateral ABCD is made of conducting wires $AB = 3\Omega, BC = 2\Omega, CD = 4\Omega$ and $AD = 6\Omega$ .The points A and B are connected with an electric cell and a mains current of 200 mA is obtained.What is the potential difference between C and D?

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9. 5A current is divided into three parallel branches in a circuit.The ratio of the lengths of the wires in the branches is $2:3:4$ and that of their diameters is $3:4:5$ IF the wires are made of the same materials,find the current in each branch.

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10. An electric cell of emf 10 V and of internal resistance 1Ω is connected in series with the parallel combination of three resistances of

$3\Omega, 5\Omega$ and 8Ω.Calculate the currents through the three resistances.

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11. Three resistances $8\Omega, 20\Omega$ and 40Ω are connected in parallel and the combination is joined to a cell of emf 2.1 V. IF current through the lowest resistances is 0.25A, determine the terminal resistance of the cell.

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12. An electric cell is sending electric currents through a resistance of 10Ω. IF a shunt of 1Ω is connected with that resistance then the current through the 10Ω resistance becomes half of the previous value.What is the resistance of the cell?IF the current through the shunt be 0.9A, then what will be the emf of the cell?

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13. A parallel combination of three resistances of $6\Omega, 12\Omega \text{ and } 12\Omega$ is connected in series with

an electric cell of emf 1.5 V and internal resistance2Ω. Find out the currents through the three resistances.

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14. Three resistances of $4\Omega, 5\Omega$ and 12Ω are connected in parallel.A battery of emf 10 v and internal resistance 0.5Ω. Is connected with that combination .Find out the currents through this battery and through each of this three resistances.

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15. The resistances of a galvanometer is 200Ω and full-scale deflection is obtained for a current of 5mA. The galvanometer is connected with a source of electricity through a resistance of 58Ω in series. The emf of the cell is 30V and its internal resistance is negligibly small .Find out the resistance of the shunt that should be connected with the galvanometer in parallel.

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16. Current is sent through a galvanometer of resistance 50Ω from a battery of emf 30V and of negligible internal resistance.There is a shunt of resistance 2Ω connected in parallel with the galvanometer.Find out the resistance that should be connected in series with the battery to get a current of 10mA through the galvanometer.

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17. A shunt is connected with a galvanometer in such a way that $\frac{1}{90}$ part of the main current flows through the galvanometer.IF another shunt replaces the previous one then galvanometer current decreases by 10%. IF the main current in each case be the same then what percent of the first will be the resistance of the second shunt?

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18. A resistor of magnitude 45Ω is connected to an electric cell of emf 12V and of 3Ω internal resistance. An ammeter of resistance 4.5Ω and a voltmeter of resistance 405Ω are properly connected with the resistor.What percentage errors is flowing current and potential difference will occur?

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19. Two resistor of magnitudes 300Ω and 400Ω are connected with a source of 60 V emf in

series. A voltmeter connected across 400Ω reads 30V.What will be the voltmeter reading when it is connected across 300Ω.

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20. A number of cells of negligible resistance are connected with battery of 12V with two resistances in series.A voltmeter of resistances 5000Ω while connected with these two resistances reads 4V and 6V respectively.Find the magnitude of the resistances.

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21. A cell AB of resistance 500Ω is connected to a battery of emf 12 V and of negligible internal resistance.The reading of a voltmeter is 5V when it is connected between one end of the cell and the coil centre.What is the resistance of the voltmeter?

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22. A certain circuit with resistance R-100Ω is powered by a direct current source. An ammeter with an internal resistance 1Ω is connected to the circuit to measure the current .What was the current in the circuit before the ammeter was connected if the ammeter shows 5A?

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23. 5 Identical cells are connected in series to form a row, 3 such rows are connected in

parallel to form a combination of cells. The combination sends 1A current through an external resistance of 9Ω. But if the resistance of the external circuit be 19Ω then the currents is reduced to half of its previous value. Determine the em and internal resistance of each coil.

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24. The emf of a dry cell is 1.5 V , when an ammeter and a resistance are connected with the series combination of two dry cells in

series,then the ammeter reads 1A,and when the cells are connected in parallel the reading of the ammeter becomes 0.75A What is the internal resistance of the dry cell? Draw the circuit diagrams?

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25. A series combination of n identical cells has two cells P and Q with reverse polarities.IF emf of each cell is e and internal resistance is r, what is the potential difference across each of the cells P and Q?

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Exercise Hot Numerical Problems

1. The ratio of the length of three metallic wires of the same mass and made of the same material is $1:2:3$ when these three wires are connected in parallel and an external source of emf is connected with the combination,what will be the ratio of the current strengths through the wires?

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2. A shunt of resistance r_1 is connected in parallel with a galvanometer of resistance G. A steady source of internal resistance r sends current through the galvanometer.Now, removing the shunt r_1 another resistances r_2 is connected in series with the galvanometer. (i) IF the galvanometer current in either case be the same , show that $rG = r_1 r_2$, (ii) if r=0 and $r_1 = r_2 = \frac{G}{n}$, then show that the ratio of galvanometer currents in the two cases is $\frac{n+1}{n}$.

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3. A wire of uniform cross section has a resistance of 9Ω. It is cut into three equal pieces. Each piece is stretched uniformly to three times its length and all the three stretched pieces are connected in parallel.Assuming that stretching of wire does not cause any change in density of their material ,calculate the total resistance of the combination described.

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4. A 2m long metallic wire is broken into two unequal points P and Q. P part of the wire is uniformly extended into another wire R. Length of R is twice the length of P and resistance of R is equal to that of Q. Find the ratio of resistances of P and R and also the ratio of lengths of P and Q.

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5. PQRS is a square of side l m long and is made up of wire of resistances $r\Omega/m$. Similar wires are connected across the diagonals PQ and QS show that the effective resistance of the framework between the corner P and R is $\left(2-\sqrt{3}\right)lr\Omega$.

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Entrance Corner Assertion Reason Type

1. Statement I:IF a conducting wire is stretched to twice its length, the resistance became twice.
Statement II: For a fixed wire, the resistance is proportional to its length.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is truel Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: D

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2. Statement I: The drift velocity of free electrons is v_d when a current I passes through a copper wire. The drift velocity is halved when the same current passes through another copper wire of double the diameter.

Statement II: For the same current, the drift velocity of free electrons in a metal wire is inversely proportional to the area of cross section of the wire.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is truel Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: C

3. Statement I: The voltmeter reading does not denote the correct emf of an electric cell,when the terminals of the cell are directly connected to the voltmeter.

Statement II: As every electric cell has some internal resistance,the current in the external circuit is reduced to some extent.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is true Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: A

4. Statement I: IF a current flows through a wire of non-uniform cross section, potential difference per unit length of the wire in the direction of current is same at different points.
Statement II:V=IR and the current in the wire is same throughout.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is truel Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: B

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5. Statement I: Out of galvanometer ,ammeter and voltmeter , resistance of ammeter is lowest

and resistance of voltmeter is highest.

Statement II: AN ammeter is connected in series and a voltmeter is connected in parallel, in a circuit.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is truel Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: D

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6. Statement I: A current flows in a conductor only when there is an electric field within the conductor.

Statement II: The drift velocity of electron decreases in presence of electric field.

A. Statement I is true,statement II is true,statement II is a correct explantion for statement I

B. Statement I is true,statement II is truel Statement II is not a correct explanation for statement I.

C. Statement I is true,statement II is false

D. Statement I is false, statement II is true.

Answer: C

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Entrance Corner Multiple Correct Answers Type

1. Brown,black orange and gold are the respective colours of the characteristic rings on a carbon resistor. Which of the following values of its resistance are definitely wrong?

A. $10.6k\Omega$

B. $10.2k\Omega$

C. $9.8k\Omega$

D. $9.4k\Omega$

Answer: A::D

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2. Three 4Ω resistances can be connected in different combinations, The probable values of the equivalent resistance are

A. 12Ω

B. 6Ω

C. $\frac{10}{3}\Omega$

D. $\frac{4}{3}\Omega$

Answer: A::B::D

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3. E_1, E_2 and r_1, r_2 are respectively. The emf's and internal resistances of two cells. The current through an external resistance R when it is connected to the first cell is equal to that when it is connected to the second. Here, the probable relations are

A. $E_1 = E_2, r_1 = r_2$

B. $E_1 > E_2, r_1 > r_2$

C. $E_1 < E_2, r_1 < r_2$

D. $E_1 > E_2, r_1 < r_2$

Answer: A::B::C

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4. A voltmeter and an ammeter are connected in series to an ideal cell of emf E. The voltmeter readings is V and the ammeter reading is I. Choose the correct options.

A. the voltmeter resistance is $\frac{V}{I}$

B. the potential difference across the ammeter is (E-V)

C. $V < E$

D. voltmeter resistance + ammeter resistance $= \frac{E}{I}$

Answer: A::B::C::D

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5. A galvanometer has a resistance of 100Ω and a full scale range of $50\mu A$. It can be used as a voltmeter or as a higher range ammeter, provided a resistance is added to it. Pick the correct range and resistance combination (s).

A. 50V range with $10K\Omega$ resistance in series

B. 10V range with $200k\Omega$ resistance in series

C. 5 mA range with 1Ω resistance in parallel

D. 10mA range with 1Ω resistance in parallel

Answer: B::C

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Entrance Corner Comprehension Type

1. The resistance R of a conducting wire depends on its material , length l and area of cross section A. The resistivity of the material of the wire is $\rho = (RA)l$ the value of ρ is for different materials .It is very low for conducting materials like metals,Besides, the resistance of a conductor also depends on its temperature. IF the resistance of a conductor is R_0 at $0^\circ C$ and

R_1 at $t^\circ C$, then $R_1 = R_0(1 + at)$ where a is called the temperature coefficient of resistance. The resistance increases with temperature for metallic conductors but decreases for graphite,a few metal alloys,and for semiconductors like silicon and germanium.

The resistance of a metal wire increases by 10% when its temperature rises from $10^\circ C$ to $110^\circ C$.The temperature coefficient of resistance of the metal is

A. $0.02^\circ C^{-1}$

B. $0.01^\circ C^{-1}$

C. $0.002^\circ C^{-1}$

D. $0.001^\circ C^{-1}$

Answer: D

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2. The resistance R of a conducting wire depends on its material , length l and area of cross section A. The resistivity of the material of the wire is $\rho = \frac{RA}{l}$ the value of ρ is for different materials .It is very low for conducting

materials like metals,Besides, the resistance of a conductor also depends on its temperature. IF the resistance of a conductor is R_0 at $0^\circ C$ and R_1 at $t^\circ C$, then $R_1 = R_0(1 + at)$ where a is called the temperature coefficient of resistance. The resistance increases with temperature for metallic conductors but decreases for graphite,a few metal alloys,and for semiconductors like silicon and germanium.

The length of this metal wire is doubled by stretching .What will be the change in its resistance?

A. 100% increase

B. 200% increase

C. 300% increase

D. 500% increase

Answer: C

3. The resistance R of a conducting wire depends on its material , length l and area of cross section A. The resistivity of the material of

the wire is $\rho = \frac{RA}{t}$ the value of ρ is for different materials .It is very low for conducting materials like metals,Besides, the resistance of a conductor also depends on its temperature. IF the resistance of a conductor is R_0 at $0^\circ C$ and R_1 at $t^\circ C$, then $R_1 = R_0(1 + at)$ where a is called the temperature coefficient of resistance. The resistance increases with temperature for metallic conductors but decreases for graphite,a few metal alloys,and for semiconductors like silicon and germanium.

The temperature of this new wire is again

raised from $10^{\circ}C$ to $110^{\circ}C$ The percentage increase of his resistance would be

A. 0.05

B. 0.1

C. 0.2

D. 0.4

Answer: B

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4. The resistance R of a conducting wire depends on its material , length l and area of cross section A. The resistivity of the material of the wire is $\rho = \frac{RA}{t}$ the value of ρ is for different materials .It is very low for conducting materials like metals,Besides, the resistance of a conductor also depends on its temperature. IF the resistance of a conductor is R_0 at $0^\circ C$ and R_1 at $t^\circ C$, then $R_1 = R_0(1 + at)$ where a is called the temperature coefficient of resistance. The resistance increases with temperature for metallic conductors but decreases for

graphite,a few metal alloys,and for semiconductors like silicon and germanium.

The temperature coefficient of resistance of a semiconductor is

A. zero

B. positive

C. negative

D. positive or negative depending on the material

Answer: C

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5. If a current passes through a metal conducting wire of area of cross section A, the drift velocity of free electrons inside the metal is $v_d = \frac{1}{neA}$, where the amount of electric charge of an electron =e and the number of free electrons per unit volume of the metal=n. The applied electric field on the wire is $E = \frac{V}{l}$, where a potential difference V exists between two points, l apart, along the length of the wire. IF R is the resistance of the wire between those two points, then the resistivity of its material is

$\rho = \frac{RA}{l}$.Besides the mobility (μ) of the free electrons inside a wire is defined as their drift velocity for a unit applied electric field.

Two copper wires have both lengths and radii in the ratio $1:2$ if the ratio between the electric currents flowing through them is also $1:2$, what would be the ratio between the drift velocities of free electrons?

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: C

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6. If a current passes through a metal conducting wire of area of cross section A, the drift velocity of free electrons inside the metal is $v_d = \frac{1}{neA}$, where the amount of electric charge of an electron =e and the number of free electrons per unit volume of the metal=n. The applied electric field on the wire is $E = \frac{V}{l}$, where a potential difference V exists between

two points, l apart, along the length of the wire. IF R is the resistance of the wire between those two points, then the resistivity of its material is $\rho = \frac{RA}{l}$.Besides the mobility (μ) of the free electrons inside a wire is defined as their drift velocity for a unit applied electric field.

The radii of two wires of the same metal are in the ratio $1:2$ The same potential difference is applied between two points at a distance l on each of the wires.The ratio between the drift velocities of the free electrons in two wires is

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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7. If a current passes through a metal conducting wire of area of cross section A, the drift velocity of free electrons inside the metal is $v_d = \frac{1}{neA}$, where the amount of electric

charge of an electron =e and the number of free electrons per unit volume of the metal=n. The applied electric field on the wire is $E = \frac{V}{l}$, where a potential difference V exists between two points, l apart, along the length of the wire. IF R is the resistance of the wire between those two points, then the resistivity of its material is $\rho = \frac{RA}{l}$.Besides the mobility (μ) of the free electrons inside a wire is defined as their drift velocity for a unit applied electric field.

The radii of two wires ,made of two different metals are in the ratio $1:2$, The number density of free electrons in the first metal is double

that in the second metal. IF the current in the first wire is 1A, then the current in the second wire producing the same drift velocity is

A. 1A

B. 2A

C. 4A

D. 8A

Answer: B

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8. If a current passes through a metal conducting wire of area of cross section A, the drift velocity of free electrons inside the metal is $v_d = \frac{1}{neA}$, where the amount of electric charge of an electron =e and the number of free electrons per unit volume of the metal=n. The applied electric field on the wire is $E = \frac{V}{l}$, where a potential difference V exists between two points, l apart, along the length of the wire. IF R is the resistance of the wire between those two points, then the resistivity of its material is $\rho = \frac{RA}{l}$.Besides the mobility (μ) of the free electrons inside a wire is defined as their drift

velocity for a unit applied electric field.

The current through unit cross section of a conductor,called the electric current density J, is related with the applied electric field E as

A. $J = \rho E$

B. $J = \frac{1}{\rho} E$

C. $J = \mu E$

D. $J = \frac{1}{\mu} E$

Answer: B

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Entrance Corner Integer Answer Type

1. A uniform copper wire of resistance R is halved and the two parts are connected in parallel .IF now the equivalent resistance is R' then what is the ratio of R to R'?

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2. A few day cells have an emf of 1.5V and an internal resistance of 0.5Ω each. How many of these cells connected in series would produce a

current of 0.6A through a resistance of 10Ω in the external circuit.

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3. A metal wire has resistance 4Ω and 12Ω respectively at temperature $20^\circ C$ and $500^\circ C$ .What will be the resistance (in Ω) of the wire at $80^\circ C$?

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4. A cell has an emf of 3V and an internal resistance r. The circuit current is 0.75A when it is connected to an external resistance of 1Ω. IF the poles are connected directly what will be the current (in A)?

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5. 32 cells each of emf 3V are connected in series and kept in a box.But some are connected in reverse manner.Externally , the

combination shows an emf of 84V.How many number of cells are connected reversely?

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1. Establish the relation between drift velocity of electron and current density in metallic conductor.

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2. A conductor of uniform cross-section is carrying a current of 1 ampere. The number of free electrons flowing across the cross section of the conductor per second is

A. 6.25×10^{18}

B. 6.25×10^{17}

C. 6.25×10^{16}

D. 6.025×10^{23}

Answer:

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3. With the help of a circuit diagram explain the function of a shunt used in a galvanometer.

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4. Length,diameter and specific resistance of two wires of different materials are each in the ratio $2:1$.One of the wires has a resistance of 10 ohm. Find the resistance of the other wire.

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5. What should be the value of the shunt to be connected in the parallel to a galvanometer to resistance G, so that $\frac{1}{n}$ part of the main current will pass through the shunt?

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6. Equal number of identical cells are joined in series and again in parallel,Under what conditions,will the currents in both the cases be the same?

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7. Two cells each of emf e but internal resistances r_1 and r_2 are connected in series through an external resistance R. IF the potential difference across the first cell is zero while current flows,the relation of R in terms of r_1 and r_2 is

A. $R = r_1 + r_2$

B. $R = r_1 - r_2$

C. $R = \frac{1}{2}(r_1 + r_2)$

D. $R = \frac{1}{2}(r_1 - r_2)$

Answer:

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8. Draw a graph representing the change in specific resistance with temperature.

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9. Find the equivalent resistance between the two ends A and B of the following circuit:

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10. Define lost volt,State the factors on which the internal resistance of a cell depends.

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11. Two wires are having length , resistivity and their radius in the ratio of 1:3 . Resistance of the thinner wire is 10Ω, then the resistance of the other wire will be

A. 40Ω

B. 20Ω

C. 10Ω

D. 5Ω

Answer: C

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12. A wire of resistance R is stretched till its length becomes n times its original length. What will be its new resistance?

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13. Of ammeter and voltmeter whose resistance is greater and why?

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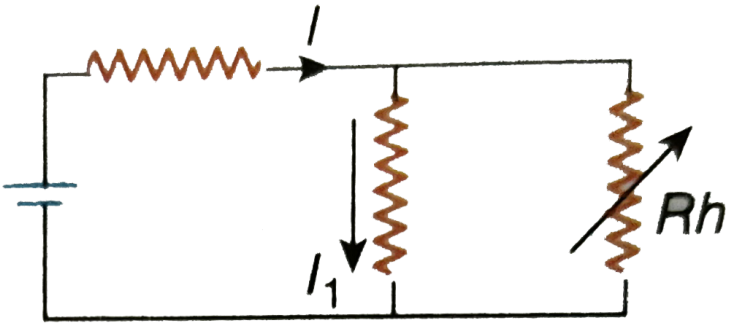
14. What will be the charge on the capacitor is the circuit given below



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15. Find the energy stored to the capacitor.

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16. Two cells of emf $E_1 . E_2$ and internal resistance r_1, r_2 respectively are connected to parallel combination. Determine the equivalent emf of the combination.

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17. Estimate the average drift velocity of conduction electron of a copper wire of cross section $2.0 \times 10^{-3} cm^2$ carrying a current of 2.0A.Assume the density of conduction electrons to be $9 \times 10^{28} m^{-3}$.

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18. Under what condition will the terminal potential difference be more than the emf of a cell?

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1. Four cells each of emf E are internal resistance r, are connected In series across an external resistance R. By mistake one of the cells is connected in reverse. Then the current in the external circuit is

A. $\frac{2E}{4r+R}$

B. $\frac{3E}{4r+R}$

C. $\frac{3E}{3r+R}$

D. $\frac{2E}{3r+R}$

Answer: A

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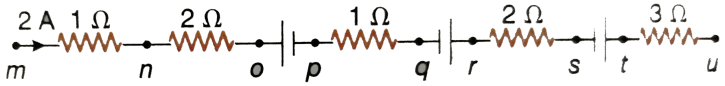
2. A circuit consists of three batteries of emf $E_1 = 1V, E_2 = 2V$ and $E_3 = 3V$ and internal resistances $1\Omega, 2\Omega$ and 1Ω respectively which are connected in parallel as shown in fig.1.106.The potential difference between points P and Q is



A. $1.0V$

B. $2.0V$

C. $2.2V$

D. $3V$

Answer: B

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3. A metal wire of circular cross section has a resistance R_1.The wire is now stretched without breaking so that its length is doubled and the density is assumed to remain the same

IF the resistance of the wire now becomes R_2 then $R_2 : R_1$ is

A. $1:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: C

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4. The equal resistances, 400Ω each are connected in series with a 8V battery. IF the resistance of first one increases by 0.5%, the charge required in the resistance of the second one in order to keep the potential difference across it unaltered is to

A. increase it by 1Ω

B. increase it by 2Ω

C. increase it by 4Ω

D. decrease it by 4Ω

Answer: B

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5. Two wire of same radius having lengths t_1 and t_2 and resistivities ρ_1 and ρ_2 are connected in series. The equivalent resistivity will be

A. $\frac{\rho_1 l_2 + \rho_2 l_1}{\rho_1 + \rho_2}$

B. $\frac{\rho_1 l_1 + \rho_2 l_2}{l_1 + l_2}$

C. $\frac{\rho_1 l_1 - \rho_2 l_2}{l_1 - l_2}$

D. $\frac{\rho_1 l_2 - \rho_2 l_1}{l_1 + l_2}$

Answer: B

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6. The effective resistance between A and B in the figure 1.107 is $\frac{7}{12}\Omega$ if each side of the cube has 1Ω resistances.The effective resistances between the same two points when the link AB is removed is

Column I	Column II
(i) Silver	(A) 2.7×10^{-6}
(ii) Graphite	(B) 1.6×10^{-6}
(iii) Paper	(C) 3×10^{-3}
(iv) Aluminium	(D) 10^{12}

A. $\frac{7}{12}\Omega$

B. $\frac{5}{12}\Omega$

C. $\frac{7}{5}\Omega$

D. $\frac{5}{7}\Omega$

Answer: C

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7. Four resistors $100\Omega, 200\Omega, 300\Omega$ and 400Ω are connected to form four sides of a square. The resistors can be connected in any order.

What is the maximum possible equivalent resistances across the diagonal of the square?

A. 210Ω

B. 240Ω

C. 300Ω

D. 250Ω

Answer: D

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8. What will the current through the 200Ω resistor in the given circuit a long time after the switch K is made on?

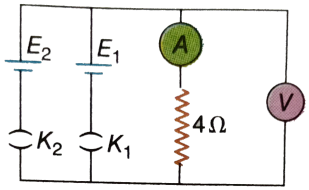

Fig 1.92

Column I	Column II
(i) Ammeter reading (in A) when only the key K_1 is closed	(A) $\frac{2}{5}$
(ii) Voltmeter reading (in V) when only the key K_1 is closed	(B) $\frac{1}{3}$
(iii) Ammeter reading (in A) when both the keys K_1 and K_2 are closed	(C) $\frac{8}{5}$
(iv) Voltmeter reading (in V) when both the keys K_1 and K_2 are closed	(D) $\frac{4}{3}$

A. zero

B. 100mA

C. 10mA

D. 1mA

Answer: C

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Examination Archive With Solutions Jee Main

1. When 5V potential difference is applied across a wire of length 0.1 m, the drift speed of

electron a $2.5 \times 10^{-4} m.s^{-1}$. IF the electron density in the wire is $8 \times 10^{28} m^{-3}$, the resistivity of the material is close to

A. $1.6 \times 10^{-8} \Omega.m.$

B. $1.6 \times 10^{-7} \Omega.m$

C. $1.6 \times 10^{-6} \Omega.m.$

D. $1.6 \times 10^{-5} \Omega.m$

Answer: D

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2. The temperature dependance if resistances of Cu and undoped SI in the temperature range 300-400K, is best described by

A. linear increase for Cu,linear increase for SI

B. linear increase for Cu,exponential increase for SI

C. linear increase for Cu,expontial decrease for SI

D. linear decrease for Cu,linear decrease for SI

Answer: C

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3. In the given circuit the current in each resistance is

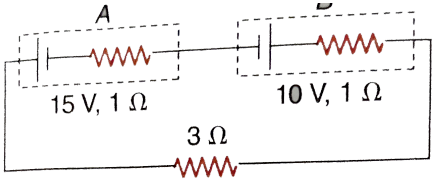

Fig 1.94

Column I	Column II
(i) Potential difference across the battery A (in V)	(A) 1
(ii) Potential difference across battery B (in V)	(B) 14
(iii) Current through A (in A)	(C) 11
(iv) Potential difference across 3 Ω resistance (in V)	(D) 3

A. 1A

B. 0.25A

C. 0.5A

D. zero

Answer: D

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4. In the given circuit diagram when the current reaches steady state in the circuit,the charge on the capacitor of capacitance C will be

A. CE

B. $\frac{CEr_1}{r_2 + r}$

C. $\frac{CEr_2}{r + r_2}$

D. $\frac{CEr_1}{r_1 + r}$

Answer: C

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Examination Archive With Solutions Aipmt

1. A,B and C are voltmeters of resistance R, 1.5R and 3R respectively as shown in the figure 1.113.when some potential difference is applied between X and Y the voltmeter readings are V_A, V_B and V_C respectively. Then

A. $V_A = V_B = V_C$

B. $V_A \neq V_B = \ = V_C$

C. $V_A = V_B \neq V_C$

D. $V_A \neq V_B \neq V_C$

Answer: A

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2. Across a metallic conductor of non-uniform cross section a constant potential difference is applied.The quantity which remains constant along the conductor is

A. current density

B. current

C. drift velocity

D. electric field

Answer: B

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Examination Archive With Solutions Neet

1. In the electrical circuit shown in the fig.1.114 the current I through the side AB is

A. $\frac{6}{25}A$

B. $\frac{10}{33}A$

C. $\frac{1}{5}A$

D. $\frac{10}{63}A$

Answer: A

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2. A cell of emf E and internal resistance r is connected to a variable external resistor R. the graph which gives the terminal voltage of cell V with respect to R is

A. 

B. 

C. 

D. 

Answer: B

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3. A carbon resistor of $(47 \pm 4.7)k\Omega$ is to be marked with rings of different colours for its identification. The colour code sequence will be

A. Yellow-Green-Violet-Gold

B. Yellow-Violet-Orange-Silver

C. Violet-Yellow-Orange-Silver

D. Green-Orange-Violet-Gold

Answer: B

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4. A set of n equal resistors, of value R each, are connected in series to a battery of emf E and internal resistance R. The current drawn is I.

Now, the n resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10I. The value of n is

A. 20

B. 11

C. 10

D. 9

Answer: C

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5. A battery consists of a variable number n of identical cells (having internal resistances r each) which are connected in series.The terminals of the battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n?

A. 

B. 

C. 

D. 

Answer: C

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Cbse Scanner

1. Two wires of equal length, one of copper and the other of manganin have the same resistance .Which wire is thicker ?

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2. Define relaxation time of the free electrons drifting in a conductor.How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

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3. Explain the term drift velocity of electrons in a conductor.Hence obtain the expression for the current through a conductor in terms of drift velocity.

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4. A cell of emf E and internal resistance r is connected across a variable resistor R. Plot a graph showing variation terminal voltage V of the of the cell Versus the current I. Using the plot,show how the emf of the cell and its internal resistance can be determined.

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5. Estimate the average drift speed of conduction electrons in a copper wire of across sectional area $1.0 \times 10^{-7} m^2$ carrying a current of 1.5A.Assume the density of conduction electrons to be $9 \times 10^{28} m^{-3}$.

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6. Two metallic resistors are connected first in series and then in parallel across a dc supply. Plot of I-V graph is shown for the two cases. Which one represents a parallel combination of

the resistors and why?

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7. Define the electric resistivity of conductor.

Plot a graph showing the variation of resistivity with temperature in the case of a (a) conductor (b) semiconductor .Briefly explain, how the difference in the behaviour of the two can be explained in terms of number density of charge carriers and relaxation time.

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8. Define mobility of a charge carrier.What is its relation with relaxation time?

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9. When 5V potential difference is applied across a wire of length 0.1 m, the drift speed of electron a $2.5 \times 10^{-4} m/s$ IF the electron density in the wire is $8 \times 10^{28} m^{-3}$, the resistivity of the material of wire.

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10. Two identical cells of emf 1.5V each joined in parallel supply energy to an external circuit consisting of two resistance of 7Ω each joined in parallel. A very high resistance voltmeter reads the terminal voltage of cells to be 1.4V.Calculate the internal resistance of each cell.

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11. Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law.

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12. A wire whose cross sectional area is increasing linearly from its one end to the other, is connected across of battery of V volts.Which of the following quantities remain constant in the wire?

a) drift speed b) current density c) electric current d) electric field

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13. In the figure.1.119 an ammeter A and a resistor of 4Ω are connected to the terminals of the source. The emf of the source is 12V having an internal resistance of 2Ω. Calculate the voltmeter an ammeter readings.

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14. Define the term 'conductivity' of a metallic wire. Write its SI unit.

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15. Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E.

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16. A 10 V cell of negligible internal resistance is connected In parallel acorss a battery of emf 200 V and internal resistance 38Ω as shown in the fig.1.21 Find the value of current in the circuit.

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