PHYSICS

BOOKS - BINA LIBRARY PHYSICS (ASSAMESE ENGLISH)

CURRENT ELECTRICITY

Example

1. A silver wire of 1 mm diameter has a charge of 90 coulombs flowing in 1 hours and 15

minutes. Silver contains 5.28*10^28 free electrons per cm^3. Find the current in the wire and drift velocity in the electron?

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2. A force of 1000 Newton is applied on a 25 kg mass for 5 seconds. What would be its velocity?

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3. Momentum of an object changes from 100 kg m/s to 200 kg m/s in 2 seconds. What is the force applied to it?

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4. A force of 200 N is applied to a body and its velocity changes from 5m/s to 10m/s in a second. What is the mass of the body?

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5. A copper wire has a diameter of 0.5 mm and a resistivity of 1.6×10^−6 ohm-m. How much of this wire would be necessary to make a resistance of 10 ohm?

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6. If a copper wire is stretched to make 0.1% longer, what is the P.C. change in its resistance?

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7. A wire of one ohm resistance is stretched to three times its original length. Calculate the new resistance if the new radius is one-third the original radius.

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8. If the distance between 2 objects is doubled then how will the gravitational force between them change?

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9. Two resistances of 5 ohm and 10 ohm are connected in parallel and then a current is passed through them from a battery of 6 volt. Calculate the currents drawn from the battery and also the currents flowing through each of the resistances.

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10. Two resistances 99 ohms and 1 ohm are connected in parallel. Find the current in each

when the main current in the circuit is 10 ampere.

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11. Filament of an electric lamp draws a current of 0.4 A, which lights for 3 hours. What is the amount charge passed in coulomb ?

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12. A force of 1200 N acts on the surface of area 10 cm2 normally. What would be the thrust and pressure on the surface?

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13. The elephant weighs 20,000 N stands on one foot of area 1000 cm2. How much pressure would it exert on the ground?

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14. Calculate the pressure produced by a force of 800 N acting on an area of 2.0 m2

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15. The pressure of a gas contained in a cylinder with a movable piston is 300 Pa. The area of the piston is 0.5 m2. Calculate the force that is exerted on the piston.

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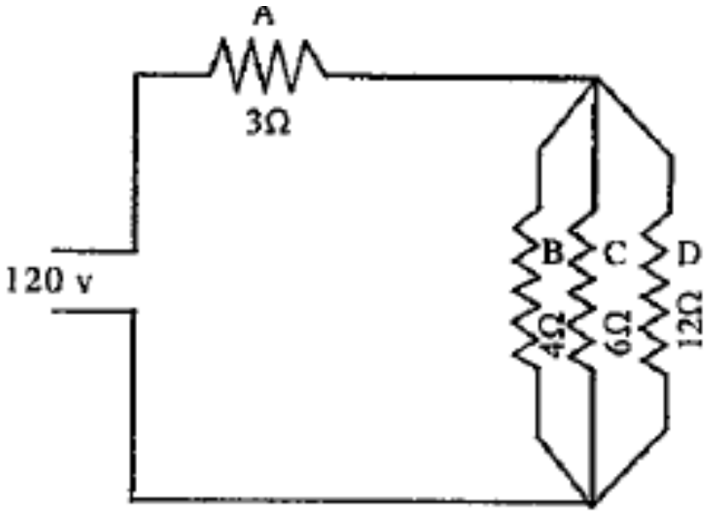
16. With reference to the circuit shown in Fig. find the following:

Potential difference across the parallel.



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17. Two resistances each of value 2 ohm and 4 ohm are connected in parallel and the total

current through the combination is 1 amp. What are the values of current through each resistance?

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18. Calculate the resistivity of a wire having resistance .02 ohm, length = 10 m and area = $1mm^2$

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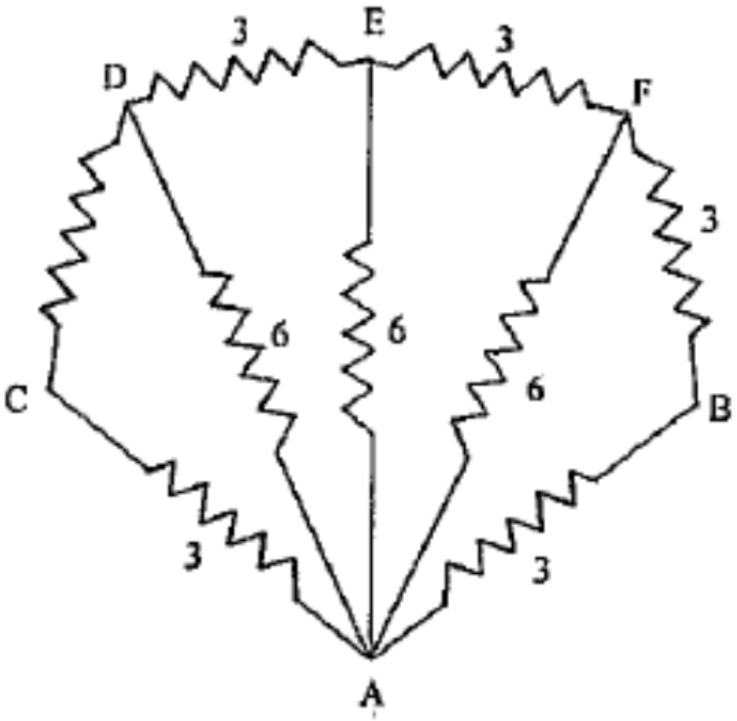
19. All resistances in diagram are in ohm. Find the effective resistance between A and B.



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20. Calculate the value of the shunt resistance necessary to increase the measuring range of an ammeter of internal resistance 0.1 ohm from I ampere to 5 ampere.

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21. A miliammeter of resistance 5 ohms gives a full scale deflection for a current of 15 mA. If the milliammeter is to be used to measure

currents upto 1.5 A the size of the resistance that must be attached to the milliammeter is ?

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22. When a 12V battery is connected across an unknown resistor, there is a current of 2.5 mA in the circuit. Find the value of the resistance of the resistor.

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23. A 25 watt and a 100 watt bulbs are joined in series and connected to mains. Which will glow brighter? What will happen when the bulbs are connected in parallel?

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24. An electric kettle has two coils. When one of these is switched on, the water in the kettle boils in 15 minutes. When the other is switched on, the water boils in 30 minutes.

In how many minutes will water boil if the coils are connected in series and switched on?

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25. Two boys exert force of 40 N and 60 N in opposite direction on an object. What will be the resultant force ?

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26. The potential difference between the terminals of a cell in open circuit is 2.2V. When it is connected through a resistance of $5ohm$, the P.D. falls to 1.8V. Find the internal resistance of the cell.

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27. A box weighing 2 kg exerts a force of 20 N on the ground. The box covers an area of 2 sq.

m on the ground. Find the pressure exerted by the box on the ground.

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28. Find the best arrangement for 36 cells, each of emf 1.5 volt and internal resistance 0.5 ohm when they are connected with 2 ohm resistance. Calculate the maximum current in the arrangement.

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29. What is contact force?

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30. What is the similarity between electrostatic and magnetic forces?

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31. How can we change the speed and the direction of a moving body?

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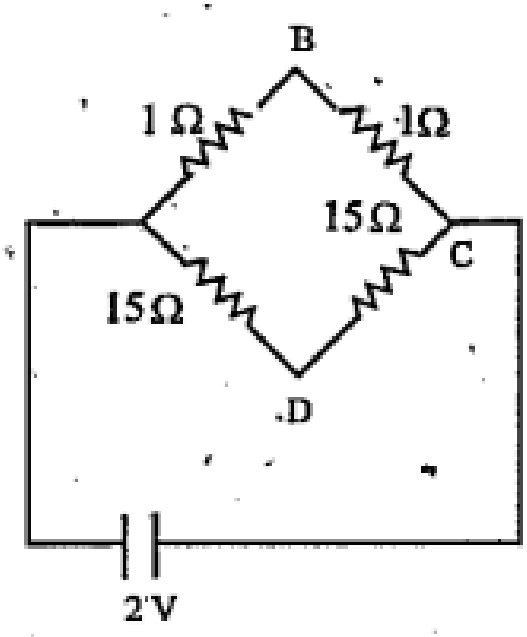
32. Calculate the potential difference between the junction B and D in the Wheatstone bridge.



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33. Give two examples of contact force.

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34. The speed of a car weighing 1500 kg increases from 36 km/h to 72 km/h uniformly. What will be the change in momentum of the car?

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35. What is the unit of measuring the momentum of a moving body ?

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36. Find force required in accelerating a 3 kg mass at 5 m/s2 and a 4 kg mass at 4 m/s2

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37. A bullet of mass 40gm is fired from a gun of mass 8kg with a velocity of 800 m/s,

calculate the recoil velocity of gun.

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38. A potentiometer wire is of length 10 m and has a total resistance of 18 ohm. It carries a current of 120 mA. What length of it will be necessary to balance a cell of emf 1.5 volt ?

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39. Using a potentiometer, balance points are obtained at 60 cm and 10 cm with two cells connected in series first to support one another and then in opposition respectively. Find the ratio of the emfs of the cells.

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40. In a potentiometer experiment, it is found that no current passes through the galvanometer, when the terminals of a cell are

connected across 50 cm of the potentiometer wire. If the cell is shunted by a resistance of 5 ohm, the balance point is found at 40 cm of the wire from the same end. Find the internal resistance of the cell.

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41. A potentiometer wire of length 100 cm has a resistance of 10 ohm. It is connected in series with a resistance and a battery of emf 2V and of negligible internal resistance. A

source of emf 10mV is balanced against a length of 40 cm of the potentiometer wire. What is the value of the external resistance?

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Exercise

1. Define electric current. Is it scalar or vector?

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2. What is the direction of flow of current?

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3. What is needed to cause an electric current?

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4. Define emf of a cell. What is its unit?

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5. Is emf a scalar or a vector quantity?

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6. Define electrical conductivity.

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7. What quantity of a circuit affects the current?

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8. What is meant by drift velocity of electrons ?

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9. How does electric field vary with drift velocity?

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10. What is the order of the drift velocity of electrons?

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11. Why the drift of the positive ions is not considered?

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12. What is Ohm's law? Describe.

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13. Define the resistance of a conductor. What is its unit?

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14. Define the specific resistance of the material of a conductor. What is its unit?

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15. What is conductance? What is its unit?

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16. Define one ohm.

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17. How does resistance of a metal vary with temperature?

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18. What is super conductivity.

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19. Give the dimensional representation of Resistance.

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20. What is a shunt? What is its use?

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21. Will the bends in a wire effect its resistance?

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22. What type of charges are responsible for conduction of electricity in a metallic conductor?

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23. How is current density related to electric field?

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24. Is a current carrying conductor electrically charged?

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25. Is there any electric field inside a current carrying conductor?

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26. What is the basic concept of first law of Kirchhoff?

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27. State Kirchhoff's current law

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28. State Kirchhoff's voltage law and mention its significance.

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29. Name one substance whose resistance decreases with increase of temperature.

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30. What is potential gradient.

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31. What is the principle of a meter bridge.

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32. Is it necessary to keep the length of a metre bridge wire one metre?

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33. Why is a potentiometer named as potentiometer

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34. State two uses of a potentiometer.

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35. Discuss various situations, which describe the failure of Ohm's law,

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

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37. What is meant by drift velocity of electrons ?

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38. State Kirchoff's laws of current electricity.

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39. Apply Kirchhoff's laws to establish the principle of a balanced Wheatstone's bridge.

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40. Establish the following relation for current flowing through a circuit containing an external ressitanace R, a battery of e.m.f E and internal resistance r.

$$I = \frac{E}{R + r}$$

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41. Obtain an expression for the equivalent resistance when n identical resistors each having resistance R are connected in series.

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42. n identical resistors each having resistance R are connected in parallel. Find the value of equivalent resistance.

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43. One low resistance is connected in parallel to a high resistance. Show that their equivalent resistance is of the order of low resistance.

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44. What is a potentiometer? Why is it most accurate device in measuring emf of a cell?

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45. Define rest and motion

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46. What is Ohm's law? Describe.

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47. Give an example of circular motion.

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48. What is meant by rectilinear motion? Give two examples.

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49. Why heat energy is produced, when electric current passes through a resistance wire?

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50. Obtain an expression for the heat produced in a wire, when a current I passes through it against potental difference V.

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51. Write two differences between electromotive force and potential difference.

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52. Give two example of periodic motion.

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53. What is the principle of a meter bridge.

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54. State the principle of working of a potentiometer.

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55. If the length of a wire is doubled and cross-sectional area is halved, what happens to the resistance?

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56. Two ends of a conducting wire of non-uniform cross-section are connected to a battery. Explain why the electric field at the

thinner section is different from the electric field at the thicker section.

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57. The magnitude of drift velocity of free electrons in a conductor is very low, but an electric bulb glows instantly when the current is switched on. Explain the reason.

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58. Why are the car lights dimmed when the starter is operated?

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59. Why is it easier to start a car engine on a warm day than on a chilly day ?

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60. What is rolling friction ?

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61. When is Wheatstone bridge most sensitive ?

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62. Why do we prefer a potentiometer with longer wire?

Watch Video Solution

63. Why do we prefer a potentiometer with longer wire?

Watch Video Solution

64. Why should the balance point be obtained in the middle of the wire of a metre bridge?

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65. Define friction.

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66. A potential difference of 5 V is applied across a conductor of length 10 cm. If drift velocity of the electron is $2.5x10^{-4}$ ms^-1 find the mobility of electron.

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67. Specific resistance of the material of a wire is $44x10^{6}\Omega$ cm. If the resistance of the wire is

14Ω and its diameter 1 mm, calculate the length of the wire.

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68. A cylindircal metallic wire is stretched to increse its length by 5%. Calculate the percentage change in its resistance.

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69. A cell of emf 4V and internal resistance 0.5 is connected across a load resistance (i) 7.52, (ii) 11.50, calculate (i) the ratio of difference in emf of the cell and the potential drop across the load.(ii) the ratio of current in the two cases.

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70. A battery gives a current of 0.5A with an external resistor of 12Ω and.0.25 A with

resistor of 25Ω Calculate the

emf

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71. battery gives a current of 0.5A with an external resistor of 12Ω and.0.25A with resistor of 25Ω Calculate the

internal resistance of the battery.

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72. A cell can be balanced against 110 cm and 100 cm of potentiometer wire respectively when in open circuit and when short circuited through a resistance of 10Ω . Find the internal resistance of the cell.

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73. A resistance wire connected in the left gap of a metre bridge balances a 10Ω resistance in the right gap at a point which divides the

bridge wire in the ratio 3:2. If the length of the resistance wire is 1.5m, then find the length of 1Ω of the resistance wire.

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74. In a potentiometer arrangement, a cell of emf 1.25 V gives a balance point at 35.0 cm length of the wire. If the cell is replaced by another cell and the balance point shifts to 63.0 cm, what is the emf of the second cell?

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75. With a certain cell, the balance point is obtained at 65 cm from the end of apotentiometer wire. With another cell whose emf differs from that of the first by 0.1V the balance point is obtained at 60cm. Find the emf of each cell.

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76. Two wires of same metal have same length, but their cross sections are in the ratio 3 : 1.

They are joined in series. The resistance of the thicker wire is 10Ω The total resistance of the combination is

A. $\frac{5}{2}\Omega$

B. $\frac{40}{3}\Omega$

C. 40Ω

D. 100Ω

Answer: A::D

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77. A wire of resistance R is cut into n equal parts. These parts are connected in parallel. The equivalent resistance of the combination is

A. nR

B. R/n

C. n/R

D. $\frac{R}{n^2}$

Answer: B

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78. The resistance of a 10m long wire is 10 Ω. Its length is increased by 25% by stretching. The resistance of the wire is now

A. 12.5Ω

B. 14.5Ω

C. 15.6Ω

D. 16.6Ω

Answer: A

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79. If there is an increase in length by 0.1% due to stretching the percentage increase in its resistance will be

A. 0.001

B. 0.002

C. 0.01

D. 0.02

Answer: B

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80. How many electrons constitute current of one ampere?

A. $6.25x10^9$

B. $6.25x10^{18}$

C. $6.25x10^5$

D. $6.25x10^6$

Answer: A::B

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81. A car battery has emf 12V and internal resistance $5x10^{-2}\Omega$. it draws 60A current. The terminal voltage of the battery in

A. 3 V

B. 5 V

C. 9 V

D. 15 V

Answer:

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82. The internal resistance of a cell of emf 2V is 0.1Ω. It is connected to a resistance of 3.9Ω. The voltage across the cell is

A. 0.5 V

B. 1.9 V

C. 1.95 V

D. 2 V

Answer: A

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83. The resistance in two gaps of a meter bridge are 10Ω and 30Ω respectively. If the resistances are interchanged the balance point shifts by

A. 33.3 cm

B. 66.67 cm

C. 25 cm

D. 50 cm

Answer: C

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84. What is a potentiometer? Why is it most accurate device in measuring emf of a cell?

A. it uses sensitive galvanometer for null deflection

B. it uses high resistance potentiometer wire

C. it measures the potential in the closed circuit

D. it measures the potential in open circuit.

Answer:

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85. In a potentiometer experiment the balancing length with a cell is 560 cm. When an external resistance of 10Ω is connected in parallel to the cell, the balancing length

changes to 60 cm. The internal resistance of the cell is

A. 3.6Ω

B. 2.4Ω

C. 1.2Ω

D. 0.6Ω

Answer: A::C

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86. Two resistances are joined in parallel whose resultant is 6/5 ohms. One of the resistance wire is broken and the effective resistance becomes 2 ohms. The resistance in ohms of the wire that got broken

A. 2

B. 3

C. $\frac{3}{5}$

D. $\frac{6}{5}$

Answer: B

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87. The smallest resistance obtained by connecting 50 resistance of 1/4 ohm each is

A. $\left(\frac{50}{4}\right)\Omega$

B. $\left(\frac{4}{50}\right)\Omega$

C. 200Ω

D. $\left(\frac{1}{200}\right)\Omega$

Answer: D

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88. How many different combinations of three equal resistors can be made ?

A. three

B. four

C. five

D. six

Answer: B

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89. A steady current flows in a metallic conductor of non uniform cross-section. The quantity quautities constant along the length of the conductor is / are

A. drift speed

B. drift speed and current

C. current and clectric field

D. current only

Answer: D

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90. A metallic wire of resistance 40Ω is stretched to twice its length. The new resistance approximately

A. 20Ω

B. 80Ω

C. 120Ω

D. 160Ω

Answer: D

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91. A metallic wire is drawn to reduce its diameter to half its original value. Its resistance becomes

A. two times

B. four times

C. eight times

D. sixteen times

Answer: D

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92. Three resistances each of 4Ω are connected to form a triangle. The resistance between any two terminals. is

A. 12Ω

B. 2Ω

C. 6Ω

D. $\frac{8}{3}\Omega$

Answer: D

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93. Four wires of equal length and of resistance 10Ω each are connected square. The equivalent resistance between two opposite corners is

A. 10Ω

B. 40Ω

C. 20Ω

D. $\frac{5}{2}\Omega$

Answer: A

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94. Assuming that the charge of an electron is $1.6x10^{-19}$ C. The number of electrons passing through a section of wire per second, when the wire carries a current of 1A is

A. $0.625x10^{19}$

B. $1.6x10^{-19}$

C. $1.6x10^{19}$

D. $0.625x10^{17}$

Answer: A

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95. The electrical resistance of metals

A. increases with increases in temperature.

B. decreases with increase in temperature

C. is independent of temperature

D. sometimes increases, sometimes decreases with temperature

Answer: A

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96. The resistance of a conductor is 5Ω at 50°C and 6Ω at 100°C. What is its temperature at 0°C?

A. 1Ω

B. 2Ω

C. 3Ω

D. 4Ω

Answer: D

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97. A piece of copper and another of germanium are cooled from room temerature to 80K. The resistance of

A. each of them increases

B. each of them decreases

C. copper increases and germanium decreases

D. copper decreases and germanium increases

Answer: D

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98. What is the order of the drift velocity of electrons?

A. few millimeter per second

B. $3x10^{10}m\frac{m}{\sec o}nd$

C. $3x10^{10}m\frac{m}{\sec o}nd$

D. none of the above

Answer: A

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99. A wire of 4Ω resistance is bent at 180° at its mid point and twisted together. Then the resistance between the ends is

A. 8Ω

B. 1Ω

C. 2Ω

D. 5Ω

Answer: B

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100. A and B are two wires of copper of equal cross-section and A is longer than B. The specific resistance of

A. A is greater than B

B. B is greater than A

C. A and B are same

D. none of the above

Answer: C

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101. If a wire of uniform cross sectional area is cut equally into two parts the resistivity part

A. is halved

B. is doubled

C. remains same

D. none of the above

Answer: C

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102. Ampere second is the unit of

A. power

B. energy

C. emf

D. charge

Answer: D

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103. The temperature co-efficient of resistance of a wire is $0.00125^{\circ}C^{-1}$. At 300K its resistance is `1 ohm. The resistance of the wire will be 2 ohm at which temperature?

A. 154 K

B. 1100K

C. 1400K

D. 1127 K

Answer: B

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104. Krichhoff's first law deals with conservation of

A. energy

B. charge

C. momentum

D. angular momentum

Answer: B

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105. The instrument for accurate measurement of emf of a cell is

A. a voltmeter

B. an ammeter

C. a metre bridge

D. a potentiometer

Answer: D

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106. In a metre bridge, the balancing length from the left end is 20 cm. The resistance in the right gap is 1Ω. The value of the unknown resistance is

A. 0.8Ω

B. 0.5Ω

C. 0.25Ω

D. 0.4Ω

Answer: C

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107. The sensitivity of a potentiometer can be increased by

A. increasing the emf of the primary cell

B. increasing the length of the wire

C. decreasing the length of the wire.

D. increasing the potential gradient.

Answer: B

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