مدونة المناهج السعودية

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الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

Chapter: CURRENT AND RESISTANCE

1. A car battery is rated at 80 A · h. An ampere-hour is a unit of:

A. power

B. energy

C. current

D. charge

E. force

ans: D

2. Current has units:

A. kilowatt·hour

B. coulomb/second

C. coulomb

D. volt

E. Ohm

ans: B

3. Current has units:

A. kilowatt·hour

B. Ampere

C. coulomb

D. volt

E. ohm

ans: B

4. The units of resistivity are:

A. ohm

B. Ohm·meter

C. Ohm/meter

D. Ohm/meter2

E. none of these

ans: B

5. The rate at which electrical energy is used may be measured in:

A. watt/second

B. watt·second

C. watt

D. joule·second

E. kilowatt·hour

ans: C

6. Energy may be measured in:

A. kilowatt

B. joule·second

C. watt

D. watt·second

E. volt/ohm

ans: D

7. Which one of the following quantities is correctly matched to its unit?

A. Power – kW·h

B. Energy – kW

C. Potential difference – J/C

D. Current – A/s

E. Resistance – V/C

ans: C

8. Current is a measure of:

A. force that moves a charge past a point

B. resistance to the movement of a charge past a point

C. energy used to move a charge past a point

D. amount of charge that moves past a point per unit time

E. speed with which a charge moves past a point

ans: D

9. A 60-watt light bulb carries a current of 0.5 A. The total charge passing through it in one hour is:

A. 120 C

B. 3600 C

C. 3000 C

D. 2400 C

E. 1800 C

ans: E

10. A 10-ohm resistor has a constant current. If 1200 C of charge flow through it in 4 minutes what is the value of the current?

A. 3.0 A

B. 5.0 A

C. 11 A

D. 15 A

E. 20 A

ans: D

11. Conduction electrons move to the right in a certain wire. This indicates that:

A. the current density and electric field both point right

B. the current density and electric field both point left

C. the current density points right and the electric field points left

D. the current density points left and the electric field points right

E. the current density points left but the direction of the electric field is unknown

ans: B

12. Two wires made of different materials have the same uniform current density. They

carry the same current only if:

A. their lengths are the same

B. their cross-sectional areas are the same

C. both their lengths and cross-sectional areas are the same

D. the potential differences across them are the same E. the electric fields in them are the same

ans: B

13. A wire with a length of 150 m and a radius of 0.15 mm carries a current with a uniform current density of 2.8×10^7 A/m^2 . The current is:

A. 0.63 A

B. 2.0 A

C. 5.9 A

D. 296 A

E. 400 A

ans: B

14. In a conductor carrying a current we expect the electron drift speed to be:

A. much greater than the average electron speed

B. much less than the average electron speed

C. about the same as the average electron speed

D. less than the average electron speed at low temperature and greater than the average electron speed at high temperature

E. less than the average electron speed at high temperature and greater than the average electron speed at low temperature

ans: B

15. Two substances are identical except that the electron mean free time for substance A is twice the electron mean free time for substance B. If the same electric field exists in both substances the electron drift speed in A is:

A. the same as in B

B. twice that in B

C. half that in B

D. four times that in B

E. one-fourth that in B

ans: B

16. The current is zero in a conductor when no potential difference is applied because:

A. the electrons are not moving

B. the electrons are not moving fast enough

C. for every electron with a given velocity there is another with a velocity of equal

magnitude and opposite direction.

D. equal numbers of electrons and protons are moving together

E. otherwise Ohm's law would not be valid

ans: C

17. The current density is the same in two wires. Wire A has twice the free-electron concentration of wire B. The drift speed of electrons in A is:

A. twice that of electrons in B

B. four times that of electrons in B

C. half that of electrons in B

D. one-fourth that of electrons in B

E. the same as that of electrons in B

ans: C

18. Copper contains 8.4×10^{28} free electrons/m^3. A copper wire of cross-sectional area 7.4×10^{-7} m^2 carries a current of 1 A. The electron drift speed is approximately:

A. 3×10^8 m/s

B. 10^3 m/s

C. 1 m/s

D. 10^{-4} m/s

E. 10^{-23} m/s

ans: D

19. If J is the surface current density and A is a cross-sectional of a conductor wire. the product j.A represents:

A. the electric flux through the area

B. the average current density at the position of the area

C. the resistance of the area

D. the resistivity of the area

E. the current through the area

ans: E

20. If the potential difference across a resistor is doubled:

A. only the current is doubled

B. only the current is halved

C. only the resistance is doubled

D. only the resistance is halved

E. both the current and resistance are doubled

ans: A

21. Five cylindrical wires are made of the same material. Their lengths and radius are wire 1: length l, radius r wire 2: length l/4, radius r/2 wire 3: length l/2, radius r/2 wire 4: length l, radius r/2 wire 5: length 5l, radius 2r. Rank the wires according to their resistances, least to greatest.

A. 1, 2, 3, 4, 5

B. 5, 4, 3, 2, 1

C. 1 and 2 tie, then 5, 3, 4

D. 1, 3, 4, 2, 5

E. 1, 2, 4, 3, 5

ans: C

22. Of the following, the copper conductor that has the least resistance is:

A. thin, long and hot

B. thick, short and cool

C. thick, long and hot

D. thin, short and cool

E. thin, short and hot

ans: B

23. A cylindrical copper rod has resistance R. It is reformed to twice its original length with no change of volume. Its new resistance is:

A. R

B. 2R

C. 4R

D. 8R

E. R/2

ans: C

24. The resistance of a rod does not depend on:

A. its temperature

B. its material

C. its length

D. its conductivity

E. the shape of its (fixed) cross-sectional area

ans: E

25. A certain wire has resistance R. Another wire, of the same material, has half the length and half the diameter of the first wire. The resistance of the second wire is:

A. R/4

B. R/2

C. R

D. 2R

E. 4R

ans: D

26. A Nichrome wire is 1 m long and 1×10^{-6} m^2 in cross-sectional area. When connected to a potential difference of 2 V, a current of 4 A exists in the wire. The resistivity of this Nichrome is:

A. $10^{-7}\ \Omega \cdot m$

B. $2 \times 10^{-7}\ \Omega \cdot m$

C. $4 \times 10^{-7}\ \Omega \cdot m$

D. $5 \times 10^{-7}\ \Omega \cdot m$

E. $8 \times 10^{-7}\ \Omega \cdot m$

ans: D

27. Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 1 m. Conductor B is a hollow tube of inside diameter 1 m and outside diameter 2 m. The ratio of their resistance, RA/RB, is:

A. 1

B. $\sqrt{2}$

C. 2

D. 3

E. 4

ans: D

28. Conductivity is:

A. the same as resistivity, it is just more convenient to use for good conductors

B. expressed in Ω^{-1}

C. equal to 1/resistance

D. expressed in $(\Omega \cdot m)^{-1}$

E. not a meaningful quantity for an insulator

ans: D

29. A certain sample carries a current of 4 A when the potential difference is 2 V and a current of 10 A when the potential difference is 4 V. This sample:

A. obeys Ohm's law

B. has a resistance of 0.5 Ω at 1 V

C. has a resistance of 2.5 Ω at 1 V

D. has a resistance of 2.5 Ω at 2 V

E. does not have a resistance

ans: B

30. A current of 0.5 A exists in a 60-ohm lamp. The applied potential difference is:

A. 15 V

B. 30 V

C. 60 V

D. 120 V

E. none of these

ans: B

31. Two wires are made of the same material and have the same length but different radius. They are joined end-to-end and a potential difference is maintained across the combination. Of the following the quantity that is the same for both wires is:

A. potential difference

B. current

C. current density

D. electric field

E. conduction electron drift speed

ans: B

32. For an Ohmic substance the resistivity is the proportionality constant for:

A. current and potential difference

B. current and electric field

C. current density and potential difference

D. current density and electric field

E. potential difference and electric field

ans: D

33. For an Ohmic resistor, resistance is the proportionality constant for:

A. potential difference and electric field

B. current and electric field

C. current and length

D. current and cross-sectional area

E. current and potential difference

ans: E

34. For an Ohmic substance, the resistivity depends on:

A. the electric field

B. the potential difference

C. the current density

D. the electron mean free time

E. the cross-sectional area of the sample

ans: D

35. For a cylindrical resistor made of Ohmic material, the resistance does not depend on:

A. the current

B. the length

C. the cross-sectional area

D. the resistivity

E. the electron drift velocity

ans: A

36. For an Ohmic substance, the electron drift velocity is proportional to:

A. the cross-sectional area of the sample

B. the length of the sample

C. the mass of an electron

D. the electric field in the sample

E. none of the above

ans: D

37. You wish to triple the rate of energy dissipation in a heating device. To do this you could triple:

A. the potential difference keeping the resistance the same

B. the current keeping the resistance the same

C. the resistance keeping the potential difference the same

D. the resistance keeping the current the same

E. both the potential difference and current

ans: D

38. A student kept her 60-watt, 120-volt study lamp turned on from 2:00 PM until 2:00 AM. How many coulombs of charge went through it?

A. 150

B. 3, 600

C. 7, 200

D. 18, 000

E. 21, 600

ans: E

39. A flat iron is marked “120 V, 600W”. In normal use, the current in it is:

A. 2 A

B. 4 A

C. 5 A

D. 7.2 A

E. 0.2 A

ans: C

40. An certain resistor dissipates 0.5W when connected to a 3 V potential difference. When connected to a 1 V potential difference, this resistor will dissipate:

A. 0.5W

B. 0.167W

C. 1.5W

D. 0.056W

E. none of these

ans: D

41. An ordinary light bulb is marked “60W, 120 V”. Its resistance is:

A. 60 Ω

B. 120 Ω

C. 180 Ω

D. 240 Ω

E. 15 Ω

ans: D

42. A current of 0.3 A is passed through a lamp during 2 minutes using a 6-V power supply. The power dissipated by this lamp is:

A. 1.8 watt

B. 12 watt

C. 20 watt

D. 36 watt

E. 18 watt

ans: E

43. A certain x-ray tube requires a current of 7 mA at a voltage of 80 kV. The rate of energy dissipation (in watts) is:

A. 560

B. 5600

C. 26

D. 11.4

E. 87.5

ans: A

44. “The sum of the currents into a junction equals the sum of the currents out of the junction” is a consequence of:

A. Newton’s third law

B. Ohm’s law

C. Newton’s second law

D. conservation of energy

E. conservation of charge

ans: E

45. “The sum of the emf’s and potential differences around a closed loop equals zero” is a consequence of:

A. Newton’s third law

B. Ohm’s law

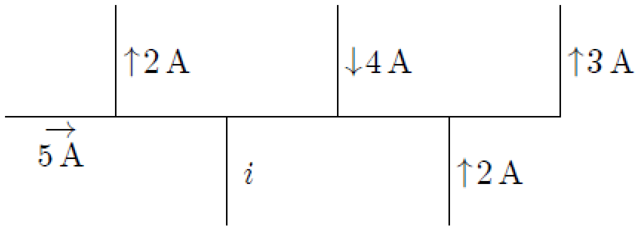
C. Newton’s second law

D. conservation of energy

E. conservation of charge

ans: D

46. A portion of a circuit is shown, with the values of the currents given for some branches. What is the direction and value of the current i?



A. ↓, 6A

B. ↑, 6A

C. ↓, 4A

D. ↑, 4A

E. ↓, 2A

ans: A

47. Four wires meet at a junction. The first carries 4 A into the junction, the second carries 5 A out of the junction, and the third carries 2 A out of the junction. The fourth carries:

A. 7 A out of the junction

B. 7 A into the junction

C. 3 A out of the junction

D. 3 A into the junction

E. 1 A into the junction

ans: D

48. In the context of the loop and junctions rules for electrical circuits a junction is:

A. where a wire is connected to a resistor

B. where a wire is connected to a battery

C. where only two wires are joined

D. where three or more wires are joined

E. where a wire is bent

ans: D

49. A battery is connected across a series combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is i, then:

A. the potential difference across each resistor is V and the current in each resistor is i

B. the potential difference across each resistor is V /2 and the current in each resistor is i/2
C. the potential difference across each resistor is V and the current in each resistor is i/2

D. the potential difference across each resistor is V /2 and the current in each resistor is i

E. none of the above are true

ans: D

50. A battery is connected across a parallel combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is i, then:

A. the potential difference across each resistor is V and the current in each resistor is i

B. the potential difference across each resistor is V /2 and the current in each resistor is i/2
C. the potential difference across each resistor is V and the current in each resistor is i/2

D. the potential difference across each resistor is V /2 and the current in each resistor is i

E. none of the above are true

ans: C

51. A total resistance of 3.0 Ω is to be produced by combining an unknown resistor R with a 12 Ω resistor. What is the value of R and how is it to be connected to the 12 Ω resistor?

A. 4.0 Ω, parallel

B. 4.0 Ω, series

C. 2.4 Ω, parallel

D. 2.4 Ω, series

E. 9.0 Ω, series

ans: A

52. By using only two resistors, R_1 and R_2, a student is able to obtain resistances of 3 Ω, 4 Ω, 12 Ω, and 16 Ω. The values of R1 and R2 (in ohms) are:

A. 3, 4

B. 2, 12

C. 3, 16

D. 4, 12

E. 4, 16

ans: D

53. Four 20-Ω resistors are connected in parallel and the combination is connected to a 20-V emf device. The current in the device is:

A. 0.25 A

B. 1.0 A

C. 4.0 A

D. 5.0 A

E. 100 A

ans: C

54. Four 20-Ω resistors are connected in parallel and the combination is connected to a 20-V emf device. The current in any one of the resistors is:

A. 0.25 A

B. 1.0 A

C. 4.0 A

D. 5.0 A

E. 100 A

ans: B

55. Four 20-Ω resistors are connected in series and the combination is connected to a 20-V emf device. The current in any one of the resistors is:

A. 0.25 A

B. 1.0 A

C. 4.0 A

D. 5.0 A

E. 100 A

ans: A

56. Four 20-Ω resistors are connected in series and the combination is connected to a 20-V emf device. The potential difference across any one of the resistors is:

A. 1 V

B. 4 V

C. 5 V

D. 20 V

E. 80 V

ans: C

57. Nine identical wires, each of diameter d and length L, are connected in parallel. The combination has the same resistance as a single similar wire of length L but whose diameter is:

A. 3d

B. 9d

C. d/3

D. d/9

E. d/81

ans: A

58. Nine identical wires, each of diameter d and length L, are connected in series. The combination has the same resistance as a single similar wire of length L but whose diameter is:

A. 3d

B. 9d

C. d/3

D. d/9

E. d/81

ans: C

59. Two wires made of the same material have the same lengths but different diameters. They are connected in parallel to a battery. The quantity that is not the same for the wires is:

A. the end-to-end potential difference

B. the current

C. the current density

D. the electric field

E. the electron drift velocity

ans: B

60. Two wires made of the same material have the same lengths but different diameters. They are connected in series to a battery. The quantity that is the same for the wires is:

A. the end-to-end potential difference

B. the current

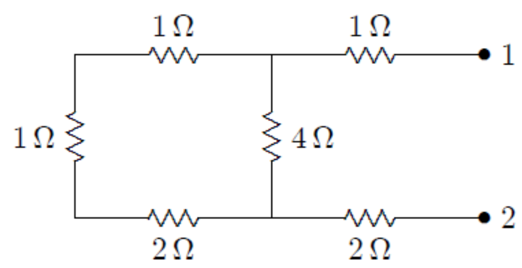
C. the current density

D. the electric field

E. the electron drift velocity

ans: B

61. The equivalent resistance between points 1 and 2 of the circuit shown is:



A. 3 Ω

B. 4 Ω

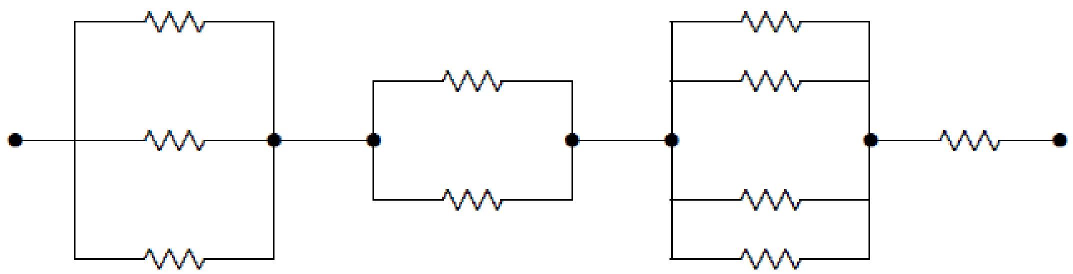
C. 5 Ω

D. 6 Ω

E. 7 Ω

ans: C

62. Each of the resistors in the diagram has a resistance of 12 Ω. The resistance of the entire circuit is:



A. 5.76 Ω

B. 25 Ω

C. 48 Ω

D. 120 Ω

E. none of these

ans: B

63. The resistance of resistor 1 is twice the resistance of resistor 2. The two are connected in parallel and a potential difference is maintained across the combination. Then:

A. the current in 1 is twice that in 2

B. the current in 1 is half that in 2

C. the potential difference across 1 is twice that across 2

D. the potential difference across 1 is half that across 2

E. none of the above are true

ans: B

64. The resistance of resistor 1 is twice the resistance of resistor 2. The two are connected in series and a potential difference is maintained across the combination. Then:

A. the current in 1 is twice that in 2

B. the current in 1 is half that in 2

C. the potential difference across 1 is twice that across 2

D. the potential difference across 1 is half that across 2

E. none of the above are true

ans: C

65. Resistor 1 has twice the resistance of resistor 2. The two are connected in series and a potential difference is maintained across the combination. The rate of thermal energy generation in 1 is:

A. the same as that in 2

B. twice that in 2

C. half that in 2

D. four times that in 2

E. one-fourth that in 2

ans: B

66. Resistor 1 has twice the resistance of resistor 2. The two are connected in parallel and a potential difference is maintained across the combination. The rate of thermal energy generation in 1 is:

A. the same as that in 2

B. twice that in 2

C. half that in 2

D. four times that in 2

E. one-fourth that in 2

ans: C

67. The emf of a battery is equal to its terminal potential difference:

A. under all conditions

B. only when the battery is being charged

C. only when a large current is in the battery

D. only when there is no current in the battery

E. under no conditions

ans: D

68. The terminal potential difference of a battery is less than its emf:

A. under all conditions

B. only when the battery is being charged

C. only when the battery is being discharged

D. only when there is no current in the battery

E. under no conditions

ans: C

69. A battery has an emf of 9 V and an internal resistance of 2 Ω. If the potential difference across its terminals is greater than 9 V:

A. it must be connected across a large external resistance

B. it must be connected across a small external resistance

C. the current must be out of the positive terminal

D. the current must be out of the negative terminal

E. the current must be zero

ans: D

70. A battery with an emf of 24 V is connected to a 6-Ω resistor. As a result, current of 3 A exists in the resistor. The terminal potential difference of the battery is:

A. 0

B. 6 V

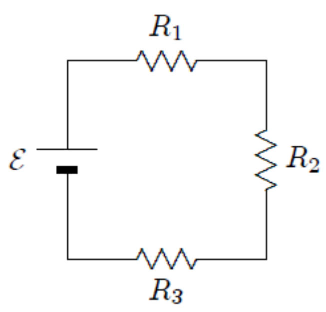
C. 12 V

D. 18 V

E. 24 V

ans: D

71. In the diagram $R_1 > R_2 > R_3$. Rank the three resistors according to the current in them, least to greatest.



A. 1, 2, 3

B. 3, 2, 1

C. 1, 3, 2

D. 3, 1, 3

E. All are the same

ans: E

72. Resistances of 2 Ω, 4 Ω, and 6 Ω and a 24-V emf device are all in parallel. The current in the 2-Ω resistor is:

A. 12 A

B. 4.0 A

C. 2.4 A

D. 2.0 A

E. 0.50 A

ans:A

73. Resistances of 2 Ω, 4 Ω, and 6 Ω and a 24-V emf device are all in series. The potential difference across the 2-Ω resistor is:

A. 4 V

B. 8 V

C. 12 V

D. 24 V

E. 48 V

ans: A

74. A resistor with resistance of 3 Ω is connected to a battery with an emf of 12 V and an internal resistance of 1 Ω. The current in the circuit is:

A. 3 A

B. 4 A

C. 0.4 A

D. 0.25 A

E. 12 A

ans: A

75. In the diagram, the current in the 3-Ω resistor is 4 A. The potential difference between points 1 and 2 is

A. 0.75 V

B. 0.8 V

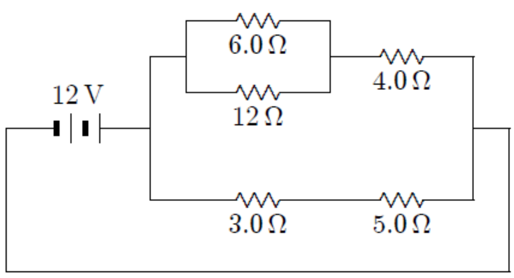
C. 1.25 V

D. 12 V

E. 20 V

ans: E

76. The current in the 5.0-Ω resistor in the circuit shown is:



A. 0.42 A

B. 0.67 A

C. 1.5 A

D. 2.4 A

E. 3.0 A

ans: C

77. A 3-Ω and a 1.5-Ω resistor are wired in parallel and the combination is wired in series to a 4-Ω resistor and a 10-V emf device. The current in the 3-Ω resistor is:

A. 0.33 A

B. 0.67 A

C. 2.0 A

D. 3.3 A

E. 6.7 A

ans: B

77. A 3-Ω and a 1.5-Ω resistor are wired in parallel and the combination is wired in series to a 4-Ω resistor and a 10-V emf device. The potential difference across the 3-Ω resistor is:

A. 2.0 V

B. 6.0 V

C. 8.0 V

D. 10 V

E. 12 V

ans: A

78. A resistor with resistance R_1 and a resistor with resistance R_2 are connected in parallel to an ideal battery with emf E. The rate of thermal energy generation in the resistor with resistance R1 is:

A. E^2/R_1

B. $E^2R_1/(R_1 + R_2)^2$

C. $E^2/(R_1 + R_2)$

D. E^2/R_2

$E^2R_1/R_2{}^2$

ans: A

79. In an antique automobile, a 6-V battery supplies a total of 48W to two identical headlights in parallel. The resistance (in Ohms) of each bulb is:

A. 0.67

B. 1.5

C. 3

D. 4

E. 8

ans: B

80. Resistor 1 has twice the resistance of resistor 2. They are connected in parallel to a battery. The ratio of the thermal energy generation rate in 1 to that in 2 is:

A. 1 /4

B. 1 /2

C. 1

D. 2

E. 4

ans: B

81. A series circuit consists of a battery with internal resistance r and an external resistor R. If these two resistances are equal (r = R) then the power dissipated by the internal resistance r is:

A. the same as by R

B. half that by R

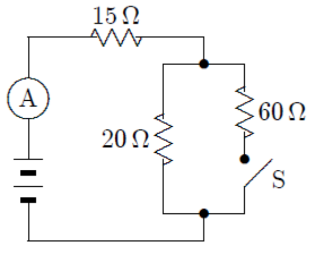
C. twice that by R

D. one-third that by R

E. unknown unless the emf is given

ans: A

82. When switch S is open, the ammeter in the circuit shown reads 2.0 A. When S is closed, the ammeter reading:



A. increases slightly

B. remains the same

C. decreases slightly

D. doubles

E. halves

ans: A

83. A wire carries a steady current of 2 A. The charge that passes a cross section in 2 s is:

A. 3.2×10^{-19} C

B. 6.4×10^{-19} C

C. 1 C

D. 2 C

E. 4 C

ans: E

84. A wire contains a steady current of 2 A. The number of electrons that pass a cross section in 2 s is:

A. 2

B. 4

C. 6.3×10^{18}

D. 1.3×10^{19}

E. 2.5×10^{19}

ans: E

85. An electrical insulator is a material:

A. containing no electrons

B. through which electrons do not flow easily

C. that has more electrons than protons on its surface

D. cannot be a pure chemical element

E. must be a crystal

ans: B

86. A conductor is distinguished from an insulator with the same number of atoms by the number of:

A. nearly free atoms

B. electrons

C. nearly free electrons

D. protons

E. molecules

ans: C

87. The electromotive force of a battery is:

A. The difference potential between its terminals

B. The difference potential between its internal resistance

C. equivalent to the open-circuit voltage

D. The difference potential between its load resistance

E. the power delivered by the battery

ans. C

88. The equation $\vec{\mathrm{j}} = \sigma \vec{\mathrm{E}}$ is called:

A. Ampere's law

B. Newton's law

C. Gauss's law

D. Ohm's law

E. Local Ohm's law

ans. E

89. A conductor is made from platinum, its resistance has two values 50 Ω and 157 Ω at respectively 20°C and 157°C. The value of temperature coefficient of resistance α is:

A. $3.92\ 10^{-3}\ (°C)^{-1}$

B. $4.2\ 10^{-3}\ (°C)^{-1}$

C. $2.1\ 10^{2}\ (°C)^{-1}$

D. $1.8\ 10^{-2}\ (°C)^{-1}$

E. $5.6\ 10^{-3}\ (°C)^{-1}$

ans. A

90. The value of the equivalent resistance of series connection of N resistors which each has a resistance R_i is given by:

A. $R_{eq} = \sum_{i=1}^{N}(\frac{1}{R_i})$

B. $R_{eq} = \sum_{i=1}^{N}(\frac{1}{R_i})^2$

C. $R_{eq} = \sum_{i=1}^{N}(R_i)$

D. $\frac{1}{R_{eq}} = \sum_{i=1}^{N}(R_i)$

E. $R_{eq} = \sum_{i=1}^{N}(R_i + \frac{1}{R_i})$

an. C