13. What is immaterial for an electric fuse wire [MNR 1984; MP PMT 2002; CPMT 1996, 2003]

(a) Its specific resistance

(b) Its radius

(c) Its length

(d) Current flowing through it

14. The electric bulbs have tungsten filaments of same length. If one of them gives 60 *watt* and other 100 *watt*, then [NCERT 1979]

(a) 100 *watt* bulb has thicker filament

(b) 60 *watt* bulb has thicker filament

(c) Both filaments are of same thickness

(d) It is possible to get different wattage unless the lengths are different

15. Three equal resistors connected in series across a source of e.m.f. together dissipate 10 watt. If the same resistors are connected in parallel across the same e.m.f., then the power dissipated will be [CBSE PMT 1998; KCET (Engg.) 1999; MP PMT 2003]

(a) 10 *watt* (b) 30 *watt*

(c) 10/3 *watt* (d) 90 *watt*

16. How much energy in kilowatt hour is consumed in operating ten 50 watt bulbs for 10 hours per day in a month (30 days). [NCERT 1978, 80; CPMT 1991]

(a) 1500 (b) 5,000

(c) 15 (d) 150

17. (1) The product of a volt and a coulomb is a joule.

(2) The product of a volt and an ampere is a joule/second.

(3) The product of volt and watt is horse power.

(4) Watt-hour can be measured in terms of electron volt.

State if [NCERT 1978; MP PMT 2003]

(a) All four are correct

(b) (1), (2) and (4) are correct

(c) (1) and (3) are correct

(d) (3) and (4) are correct

18. A 25 *W*, 220 *V* bulb and a 100 *W*, 220 *V* bulb are connected in parallel across a 440 *V* line [CBSE PMT 2001]

(a) Only 100 *watt* bulb will fuse

(b) Only 25 *watt* bulb will fuse

(c) Both bulbs will fuse

(d) None of the bulbs will fuse

19. Two electric lamps of 40 watt each are connected in parallel. The power consumed by the combination will be [CPMT 1984]

(a) 20 *watt* (b) 60 *watt*

(c) 80 *watt* (d) 100 *watt*

20. Two heating coils, one of fine wire and the other of thick wire of the same material and of the same length are connected in series and in parallel. Which of the following statement is correct

(a) In series fine wire liberates more energy while in parallel thick wire will liberate more energy

(b) In series fine wire liberates less energy while in parallel thick wire will liberate more energy

(c) Both will liberate equally

(d) In series the thick wire will liberate more while in parallel it will liberate less energy

21. An electric bulb is rated 220 *volt* and 100 *watt*. Power consumed by it when operated on 110 *volt* is [CPMT 1986; MP PMT 1986, 94; AFMC 2000]

(a) 50 *watt* (b) 75 *watt*

(c) 90 *watt* (d) 25 *watt*

22. A 25 *watt*, 220 *volt* bulb and a 100 *watt*, 220 *volt* bulb are connected in series across a 220 *volt* lines. Which electric bulb will glow more brightly [MP PET 1999; MP PMT 1999]

(a) 25 *watt* bulb

(b) 100 *watt* bulb

(c) First 25 watt and then 100 *watt*

(d) Both with same brightness

23. A resistor R_1 dissipates the power P when connected to a certain generator. If the resistor R_2 is put in series with R_1, the power dissipated by R_1 [CPMT 1985; MNR 1998]

(a) Decreases
(b) Increases
(c) Remains the same
(d) Any of the above depending upon the relative values of R_1 and R_2

24. An electric fan and a heater are marked as 100 *watt*, 220 *volt* and 1000 *watt*, 220 volt respectively. The resistance of the heater is **[CPMT 1990]**
(a) Zero
(b) Greater than that of the fan
(c) Less than that of the fan
(d) Equal to that of the fan

25. According to Joule's law, if the potential difference across a conductor having a material of specific resistance remains constant, then the heat produced in the conductor is directly proportional to **[MP PMT 1986]**
(a) ρ (b) ρ^2
(c) $\frac{1}{\sqrt{\rho}}$ (d) $\frac{1}{\rho}$

26. Two heater wires of equal length are first connected in series and then in parallel. The ratio of heat produced in the two cases is **[MNR 1987; UPSEAT 1999; MP PMT 1996, 2000, 01; AIIMS 2000; MP PET 1999, 2002; BHU 2004; Pb PET 2004]**
(a) 2 : 1 (b) 1 : 2
(c) 4 : 1 (d) 1 : 4

27. Two bulbs of equal wattage, one having carbon filament and the other having a tungsten filament are connected in series to the mains, then
(a) Both bulbs glow equally
(b) Carbon filament bulb glows more
(c) Tungsten filament bulbs glows more
(d) Carbon filament bulb glows less

28. Two identical heaters rated 220 *volt*, 1000 watt are placed in series with each other across 220 *volt* lines. If resistance do not change with temperature, then the combined power is
(a) 1000 *watt* (b) 2000 *watt*
(c) 500 *watt* (d) 4000 *watt*

29. A 25 *watt*, 220 *volt* bulb and a 100 *watt*, 220 *volt* bulb are connected in parallel across a 220 *volt* line. Which bulb will glow more brightly
(a) 25 *watt* bulb
(b) 100 *watt* bulb
(c) Both will have same brightness
(d) First 25 *watt* then 100 *watt*

30. If two bulbs of wattage 25 and 100 respectively each rated at 220 *volt* are connected in series with the supply of 440 *volt*, then which bulbs will fuse **[MNR 1988]**
(a) 100 *watt* bulb (b) 25 *watt* bulb
(c) None of them (d) Both of them

31. If current in an electric bulb changes by 1%, then the power will change by **[AFMC 1996]**
(a) 1% (b) 2%
(c) 4% (d) $\frac{1}{2}$%

32. Two identical batteries, each of e.m.f. 2 *volt* and internal resistance 1.0 ohm are available to produce heat in an external resistance $R = 0.5$ *ohm* by passing a current through it. The maximum Joulean power that can be developed across *R* using these batteries is **[CBSE PMT 1990; BHU 1997]**
(a) 1.28 *watt* (b) 2.0 *watt*
(c) $\frac{8}{9}$ *watt* (d) 3.2 *watt*

33. A constant voltage is applied between the two ends of a metallic wire. If both the length and the radius of the wire are doubled, the rate of heat developed in the wire **[MP PMT 1996]**
(a) Will be doubled (b) Will be halved
(c) Will remain the same (d) Will be quadrupled

34. The heating coils rating at 220 *volt* and producing 50 *cal/sec* heat are available with the resistances $55\,\Omega, 110\,\Omega, 220\,\Omega$ and $440\,\Omega$. The heater of maximum power will be of **[MP PMT 1985]**
(a) $440\,\Omega$ (b) $220\,\Omega$
(c) $110\,\Omega$ (d) $55\,\Omega$

35. Which of the following statement is false
(a) Heat produced in a conductor is proportional to its resistance
(b) Heat produced in a conductor is proportional to the square of the current

(c) Heat produced in a conductor is proportional to charge

(d) Heat produced in a conductor is proportional to the time for which current is passed

36. On an electric heater 220 *volt* and 1100 *watt* are marked. On using it for 4 hours, the energy consumed in *kWh* will be

(a) 2 (b) 4.4

(c) 6 (d) 8

37. An electric heater kept in vacuum is heated continuously by passing electric current. Its temperature **[MP PET 1993]**

(a) Will go on rising with time

(b) Will stop after sometime as it will loose heat to the surroundings by conduction

(c) Will rise for sometime and there after will start falling

(d) Will become constant after sometime because of loss of heat due to radiation

38. Heat produced in a wire of resistance R due to current flowing at constant potential difference is proportional to **[MP PET 1993]**

(a) $\frac{1}{R^2}$ (b) $\frac{1}{R}$

(c) R (d) R^2

39. The power rating of an electric motor which draws a current of 3.75 *amperes* when operated at 200 *V* is about

(a) 1 H.P. (b) 500 *W*

(c) 54 *W* (d) 750 H.P.

40. An electric bulb of 100 *watt* is connected to a supply of electricity of 220 *V*. Resistance of the filament is **[EAMCET 1981, 82; MP PMT 1993, 97]**

(a) $484\,\Omega$ (b) $100\,\Omega$

(c) $22000\,\Omega$ (d) $242\,\Omega$

41. A cable of resistance $10\,\Omega$ carries electric power from a generator producing 250 *kW* at 10000 *volt*. The current in the cable is

(a) 25 *A* (b) 250 *A*

(c) 100 *A* (d) 1000 *A*

42. In the above question, the power lost in the cable during transmission is

(a) 12.5 *kW* (b) 6.25 *kW*

(c) 25 *kW* (d) 3.15 *kW*

43. The heat generated through 2 *ohm* and 8 *ohm* resistances separately, when a condenser of 200 μF capacity charged to 200 *V* is discharged one by one, will be **[MP PET 1993]**

(a) 4 *J* and 16 *J* respectively

(b) 16 *J* and 4 *J* respectively

(c) 4 *J* and 8 *J* respectively

(d) 4 *J* and 4 *J* respectively

44. Two bulbs are in parallel and they together consume 48 *W* from a battery of 6 *V*. The resistance of each bulb is

(a) $0.67\,\Omega$ (b) $3.0\,\Omega$

(c) $4.0\,\Omega$ (d) $1.5\,\Omega$

45. The heat developed in an electric wire of resistance *R* by a current *I* for a time *t* is **[MP PMT 1993; MP PET 2005]**

(a) $\frac{I^2Rt}{4.2}\,cal$ (b) $\frac{I^2t}{4.2R}\,cal$

(c) $\frac{I^2R}{4.2\,t}\,cal$ (d) $\frac{Rt}{4.2\,I^2}\,cal$

46. Two bulbs, one of 50 *watt* and another of 25 *watt* are connected in series to the mains. The ratio of the currents through them is **[JIPMER 1997]**

(a) 2 : 1

(b) 1 : 2

(c) 1 : 1

(d) Without voltage, cannot be calculated

47. The brightness of a bulb will be reduced, if a resistance is connected in

(a) Series with it

(b) Parallel with it

(c) Series or parallel with it

(d) Brightness of the bulb cannot be reduced

48. A 100 *watt* bulb working on 200 *volt* and a 200 *watt* bulb working on 100 *volt* have

(a) Resistances in the ratio of 4 : 1

(b) Maximum current ratings in the ratio of $1:4$

(c) Resistances in the ratio of 2 : 1

(d) Maximum current ratings in the ratio of 1 : 2

49. There are two electric bulbs of 40 *W* and 100 *W*. Which one will be brighter when first connected in series and then in parallel, **[MP PET 1993]**

(a) 40 *W* in series and 100 *W* in parallel

(b) 100 *W* in series and 40 *W* in parallel

(c) 40 *W* both in series and parallel will be uniform

(d) 100 *W* both in series and parallel will be uniform

50. Two resistances R_1 and R_2 when connected in series and parallel with 120 *V* line, power consumed will be 25 *W* and 100 *W* respectively. Then the ratio of power consumed by R_1 to that consumed by R_2 will be **[EAMCET 1983]**

(a) 1 : 1 (b) 1 : 2

(c) 2 : 1 (d) 1 : 4

51. A 220 *volt* and 800 *watt* electric kettle and three 220 *volt* and 100 *watt* bulbs are connected in parallel. On connecting this combination with 220 *volt* electric supply, the total current will be **[MP PMT 1975]**

(a) 0.15 *ampere* (b) 5.0 *ampere*

(c) 5.5 *ampere* (d) 6.9 *ampere*

52. You are given three bulbs of 25, 40 and 60 *watt*. Which of them has lowest resistance **[NCERT 1982]**

(a) 25 *watt* bulb (b) 40 *watt* bulb

(c) 60 *watt* bulb (d) Information is insufficient

53. The value of internal resistance of an ideal cell is **[EAMCET 1989]**

(a) Zero (b) 0.5Ω

(c) 1Ω (d) Infinity

54. Electric power is transmitted over long distances through conducting wires at high voltage because **[MP PET 1994]**

(a) High voltage travels faster

(b) Power loss is large

(c) Power loss is less

(d) Generator produced electrical energy at a very high voltage

55. A coil develops heat of 800 *cal/sec*. When 20 *volts* is applied across its ends. The resistance of the coil is (1 *cal* = 4.2 *joule*) **[MP PET 1994]**

(a) 1.2Ω (b) 1.4Ω

(c) 0.12Ω (d) 0.14Ω

56. Resistances R_1 and R_2 are joined in parallel and a current is passed so that the amount of heat liberated is H_1 and H_2 respectively. The ratio $\frac{H_1}{H_2}$ has the value **[MP PMT 1994]**

(a) $\frac{R_2}{R_1}$ (b) $\frac{R_1}{R_2}$

(c) $\frac{R_1^2}{R_2^2}$ (d) $\frac{R_2^2}{R_1^2}$

57. The internal resistance of a primary cell is 4 *ohm*. It generates a current of 0.2 *amp* in an external resistance of 21 *ohm*. The rate at which chemical energy is consumed in providing the current is **[MP PMT 1994]**

(a) $0.42\ J/s$ (b) $0.84\ J/s$

(c) $5\ J/s$ (d) $1\ J/s$

58. A heating coil is labelled 100 *W*, 220 *V*. The coil is cut in half and the two pieces are joined in parallel to the same source. The energy now liberated per second is **[CBSE PMT 1995]**

(a) 200 *J* (b) 400 *J*

(c) 25 *J* (d) 50 *J*

59. Which of the following is not a correct statement **[MP PET 1995]**

(a) Resistivity of electrolytes decreases on increasing temperature

(b) Resistance of mercury falls on decreasing its temperature

(c) When joined in series a 40 *W* bulb glows more than a 60 *W* bulb

(d) Resistance of 40 *W* bulb is less than the resistance of 60 *W* bulb

60. Three light bulbs of 40 *W*, 60 *W* and 100 *W* are connected in series with 220 *V* source. Which one of the bulbs will glow brightest **[MP PMT 1995; UPSEAT 2002; BCECE 2005]**

(a) 40 *W*
(b) 60 *W*
(c) 100 *W*
(d) All with the same brightness

61. The energy consumed in 1 *kilowatt* electric heater in 30 *seconds* will be
(a) $6\times10^2\ J$ (b) $4.99\times10^7\ J$
(c) $9.8\times10^6\ J$ (d) $3\times10^4\ J$

62. Two bulbs of 500 *watt* and 200 *watt* are manufactured to operate on 220 *volt* line. The ratio of heat produced in 500 *W* and 200 *W*, in two cases, when firstly they are joined in parallel and secondly in series, will be **[MP PET 1996; DPMT 1999]**
(a) $\frac{5}{2},\frac{2}{5}$ (b) $\frac{5}{2},\frac{5}{2}$
(c) $\frac{2}{5},\frac{5}{2}$ (d) $\frac{2}{5},\frac{2}{5}$

63. A 60 *watt* bulb carries a current of 0.5 *amp*. The total charge passing through it in 1 *hour* is **[MP PMT 1996]**
(a) 3600 *coulomb* (b) 3000 *coulomb*
(c) 2400 *coulomb* (d) 1800 *coulomb*

64. An electric heater of resistance 6 *ohm* is run for 10 *minutes* on a 120 *volt* line. The energy liberated in this period of time is **[MP PMT 1996]**
(a) $7.2\times10^3\ J$ (b) $14.4\times10^5\ J$
(c) $43.2\times10^4\ J$ (d) $28.8\times10^4\ J$

65. Two bulbs are working in parallel order. Bulb *A* is brighter than bulb *B*. If R_A and R_B are their resistance respectively then **[MP PMT 2003]**
(a) $R_A > R_B$ (b) $R_A < R_B$
(c) $R_A = R_B$ (d) None of these

66. Two conductors made of the same material are connected across a common potential difference. Conductor *A* has twice the diameter and twice the length of conductor *B*. The power delivered to the two conductors P_A and P_B respectively is such that P_A / P_B equals to
(a) 0.5 (b) 1.0
(c) 1.5 (d) 2.0

67. A heating coil can heat the water of a vessel from $20°C$ to $60°C$ in 30 *minutes*. Two such heating coils are put in series and then used to heat the same amount of water through the same temperature range. The time taken now will be (neglecting thermal capacity of the coils) **[MP PMT 1997]**
(a) 60 *minutes* (b) 30 *minutes*
(c) 15 *minutes* (d) 7.5 *minutes*

68. If 2.2 *kilowatt* power is transmitted through a 10 *ohm* line at 22000 *volt*, the power loss in the form of heat will be **[MP PMT/PET 1998]**
(a) 0.1 *watt* (b) 1 *watt*
(c) 10 *watt* (d) 100 *watt*

69. Two resistors having equal resistances are joined in series and a current is passed through the combination. Neglect any variation in resistance as the temperature changes. In a given time interval **[MP PMT 1999]**
(a) Equal amounts of thermal energy must be produced in the resistors
(b) Unequal amounts of thermal energy may be produced
(c) The temperature must rise equally in the resistors
(d) The temperature must rise unequally in the resistors

70. A $5°C$ rise in temperature is observed in a conductor by passing a current. When the current is doubled the rise in temperature will be approximately **[CBSE PMT 1998]**
(a) $16°C$ (b) $10°C$
(c) $20°C$ (d) $12°C$

71. *Watt-hour* meter measures **[KCET 1994]**
(a) Electric energy (b) Current
(c) Voltage (d) Power

72. An electric lamp is marked 60 *W*, 230 *V*. The cost of 1 *kilowatt* hour of power is *Rs*. 1.25. The cost of using this lamp for 8 hours is **[KCET 1994]**
(a) *Rs*. 1.20 (b) *Rs*. 4.00
(c) *Rs*. 0.25 (d) *Rs*. 0.60

73. 4 bulbs marked 40 W, 250 V are connected in series with 250 V mains. The total power is **[EAMCET (Engg.) 1995]**
(a) 10 W (b) 40 W
(c) 320 W (d) 160 W

74. Pick out the wrong statement **[AMU 1995]**
(a) In a simple battery circuit, the point of lowest potential is the negative terminal of the battery
(b) The resistance of an incandescent lamp is greater when the lamp is switched off
(c) An ordinary 100 W lamp has less resistance than a 60 W lamp
(d) At constant voltage, the heat developed in a uniform wire varies inversely as the length of the wire used

75. Two resistors of 6Ω and 9Ω are connected in series to a 120 *volt* source. The power consumed by the 6Ω resistor is **[SCRA 1994]**
(a) 384 W (b) 576 W
(c) 1500 W (d) 1200 W

76. Electric room radiator which operates at 225 *volts* has resistance of 50 *ohms*. Power of the radiator is approximately **[SCRA 1994]**
(a) 100 W (b) 450 W
(c) 750 W (d) 1000 W

77. If a power of 100 W is being supplied across a potential difference of 200 V, current flowing is **[AFMC 1993]**
(a) 2 A (b) 0.5 A
(c) 1 A (d) 20 A

78. A current of 2 A passing through conductor produces 80 J of heat in 10 *seconds*. The resistance of the conductor is **[CBSE PMT 1993]**
(a) 0.5Ω (b) 2Ω
(c) 4Ω (d) 20Ω

79. A $4\mu F$ conductor is charged to 400 *volts* and then its plates are joined through a resistance of $1k\Omega$. The heat produced in the resistance is **[CBSE PMT 1994]**
(a) 0.16 J (b) 1.28 J
(c) 0.64 J (d) 0.32 J

80. A 10 *ohm* electric heater operates on a 110 V line. Calculate the rate at which it develops heat in watts **[AFMC 1997]**
(a) 1310 W (b) 670 W
(c) 810 W (d) 1210 W

81. A (100 W, 200 V) bulb is connected to a 160 V power supply. The power consumption would be **[CBSE PMT 1997; JIPMER 2000]**
(a) 64 W (b) 80 W
(c) 100 W (d) 125 W

82. A battery of e.m.f. 10 V and internal resistance 0.5 *ohm* is connected across a variable resistance R. The value of R for which the power delivered in it is maximum is given by **[BHU 1998; JIPMER 2001, 02; CBSE PMT 2001]**
(a) 2.0 *ohm* (b) 0.25 *ohm*
(c) 1.0 *ohm* (d) 0.5 *ohm*

83. A piece of fuse wire melts when a current of 15 *ampere* flows through it. With this current, if it dissipates 22.5 W, the resistance of fuse wire will be **[MNR 1998]**
(a) Zero (b) 10Ω
(c) 1Ω (d) 0.10Ω

84. Two wires 'A' and 'B' of the same material have their lengths in the ratio 1 : 2 and radii in the ratio 2 : 1. The two wires are connected in parallel across a battery. The ratio of the heat produced in 'A' to the heat produced in 'B' for the same time is **[MNR 1998]**
(a) $1:2$ (b) $2:1$
(c) $1:8$ (d) $8:1$

85. A heater draws a current of 2A when connected to a 250V source. The rate of energy dissipation is **[JIPMER 1999]**
(a) 500 W (b) 1000 W
(c) 250 W (d) 125 W

86. A bulb rated at (100W – 200V) is used on a 100V line. The current in the bulb is

(a) $\frac{1}{4}$ *amp* (b) 4 *amp*

(c) $\frac{1}{2}$ *amp* (d) 2 *amp*

87. A steel wire has a resistance twice that of an aluminium wire. Both of them are connected with a constant voltage supply. More heat will be dissipated in **[Roorkee 1999]**

(a) Steel wire when both are connected in series

(b) Steel wire when both are connected in parallel

(c) Aluminium wire when both are connected in series

(d) Aluminium wire when both are connected in parallel

88. A current i passes through a wire of length l, radius of cross-section r and resistivity ρ. The rate of heat generation is

[AMU (Med.) 1999]

(a) $\frac{i^2 l\rho}{\pi r^2}$ (b) $i^2\left(\frac{l\rho}{\pi r^2}\right)^2$

(c) $i^2 l\rho / r$ (d) $il\rho / r$

89. Which of the following is not equal to *watt* **[DPMT 1999]**

(a) $(Amp)^2 \times ohm$ (b) *Amp* / *Volt*

(c) *Amp* × *Volt* (d) *Joule* / *sec*

90. Two wires with resistances R and $2R$ are connected in parallel, the ratio of heat generated in $2R$ and R is

[DCE 1999, 2000]

(a) 1 : 2 (b) 2 : 1

(c) 1 : 4 (d) 4 : 1

91. If a high power heater is connected to electric mains, then the bulbs in the house become dim, because there is a

[BHU 1999; Pb. PMT 2000]

(a) Current drop (b) Potential drop

(c) No current drop (d) No potential drop

92. If three bulbs $60W$, $100W$ and $200W$ are connected in parallel, then

(a) 200 W bulb will glow more

(b) 60 W bulb will glow more

(c) 100 W bulb will glow more

(d) All the bulbs will glow equally

93. An expression for rate of heat generated, if a current of I ampere flows through a resistance of R Ω, is **[Pb. PMT 2000]**

(a) I^2Rt (b) I^2R

(c) V^2R (d) I/R

94. On giving $220V$ to a resistor the power dissipated is $40W$ then value of resistance is

(a) 1210 Ω (b) 2000 Ω

(c) 1000 Ω (d) None of these

95. A 60 *watt* bulb operates on $220V$ supply. The current flowing through the bulb is

(a) 11/3 *amp* (b) 3/11 *amp*

(c) 3 *amp* (d) 6 *amp*

96. If two bulbs of wattage 25 and 30, each rated at 220 *volts*, are connected in series with a 440 *volt* supply, which bulb will fuse

[MP PET 2000]

(a) 25 W bulb (b) 30 W bulb

(c) Neither of them (d) Both of them

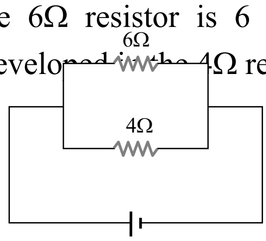
97. Two electric bulbs ($60W$ and $100W$ respectively) are connected in series. The current passing through them is

[AMU (Med.) 2000]

(a) More in $100W$ bulb (b) More in $60W$ bulb

(c) Same in both (d) None of these

98. In the circuit shown below, the power developed in the 6Ω resistor is 6 watt. The power in watts developed in the 4Ω resistor is



(a) 16

(b) 9

(c) 6

(d) 4

99. Two wires A and B of same material and mass have their lengths in the ratio 1 : 2. On connecting them to the same source, the rate of heat dissipation in B is found to be $5W$. The rate of heat dissipation in A is **[AMU (Engg.) 2000]** **[BHU 2000]**

(a) $10W$ (b) $5W$

(c) $20W$ (d) None of these

100. If two electric bulbs have $40W$ and $60W$ rating at $220V$, then the ratio of their resistances will be

[BHU 1999; KCET 2001]

(a) 3 : 2 (b) 2 : 3

(c) 3 : 4 (d) 4 : 3

101. An electric bulb is designed to draw power P_0 at voltage V_0. If the voltage is V it draws a power P. Then [KCET 2001]

(a) $P=\left(\frac{V_0}{V}\right)^2 P_0$ (b) $P=\left(\frac{V}{V_0}\right)^2 P_0$

(c) $P=\left(\frac{V}{V_0}\right) P_0$ (d) $P=\left(\frac{V_0}{V}\right) P_0$

102. Three bulbs of 40W, 60W and 100W are arranged in series with 220V. Which bulb has minimum resistance [AFMC 2001]

(a) 40W (b) 60W

(c) 100W (d) Equal in all bulbs

103. An electric kettle has two heating coils. When one coil is used, water in the kettle boils in 5 minutes, while when second coil is used, same water boils in 10 minutes. If the two coils, connected in parallel are used simultaneously, the same water will boil in time

(a) 3 *min* 20 *sec* (b) 5 *min*

(c) 7 *min* 30 *sec* (d) 2 *min* 30 *sec*

104. An external resistance R is connected to a battery of e.m.f. V and internal resistance r. The joule heat produced in resistor R is maximum when R is equal to [MP PET 2001]

(a) r (b) $\frac{r}{2}$

(c) $2r$ (d) Infinitely large

105. The amount of heat produced in a resistor when a current is passed through it can be found using [Kerala PET 2001]

(a) Faraday's Law (b) Kirchhoff's Law

(c) Laplace's Law (d) Joule's Law

106. Two wires have resistance of 2Ω and 4Ω connected to same voltage, ratio of heat dissipated at resistance is [UPSEAT 2001]

(a) 1 : 2 (b) 4 : 3

(c) 2 : 1 (d) 5 : 2

107. Two electric bulbs rated P_1 watt V volts and P_2 watt V volts are connected in parallel and V volts are applied to it. The total power will be [MP PM

(a) $P_1 + P_2$ *watt* (b) $\sqrt{P_1 P_2}$ *watt*

(c) $\frac{P_1 P_2}{P_1 + P_2}$ *watt* (d) $\frac{P_1 + P_2}{P_1 P_2}$ *watt*

108. n identical bulbs, each designed to draw a power p from a certain voltage supply, are joined in series across that supply. The total power which they will draw is [KCET 2002]

(a) p/n^2 (b) p/n

(c) p (d) np

109. A wire when connected to 220V mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is [AIEEE 2002]

(a) 1 (b) 4

(c) 2 [MP PET 2001] (d) 3

110. An electric bulb marked 40 W and 200 V, is used in a circuit of supply voltage 100 V. Now its power is [AIIMS 2002]

(a) 100W (b) 40W

(c) 20W (d) 10W

111. Electric bulb 50 W-100 V glowing at full power are to be used in parallel with battery 120 V, 10 Ω. Maximum number of bulbs that can be connected so that they glow in full power is

(a) 2 (b) 8

(c) 4 (d) 6

112. A bulb has specification of one kilowatt and 250 *volts*, the resistance of bulb is

(a) 125 Ω (b) 62.5 Ω

(c) 0.25 Ω (d) 625 Ω

113. If a 30 V, 90 W bulb is to be worked on a 120 V line, a resistance of how many ohms should be connected in series with the bulb [MP PMT 2002; KCET 200

(a) 10 *ohm* (b) 20 *ohm*

(c) 30 *ohm* (d) 40 *ohm*

114. A fuse wire with radius 1 *mm* blows at 1.5 *amp*. The radius of the fuse wire of the same material to blow at 3*A* will be **[KCET 2003]**

(a) $4^{1/3}\,mm$ (b) $3^{1/4}\,mm$

(c) $2^{1/2}\,mm$ (d) $3^{1/2}\,mm$

115. Three electric bulbs of rating 60*W* each are joined in series and then connected to electric mains. The power consumed by these three bulbs will be **[MP PET 2003; CBSE PMT 2004]**

(a) 180 *W* (b) 60 *W*

(c) 20 *W* (d) $\frac{20}{3}W$

116. An electric bulb is rated 60*W*, 220*V*. The resistance of its filament is

(a) 708 Ω (b) 870 Ω

(c) 807 Ω (d) 780 Ω

117. A 220 *volt*, 1000 *W* bulb is connected across a 110 volt mains supply. The power consumed will be **[AIEEE 2003]**

(a) 1000 *W* (b) 750 *W*

(c) 500 *W* (d) 250 *W*

118. Two bulbs of 100 *W* and 200 *W* working at 220 *volt* are joined in series with 220 *volt* supply. Total power consumed will be approximately. **[Pb. PET 2003; BHU 2005]**

(a) 65 *watt* (b) 33 *watt*

(c) 300 *watt* (d) 100 *watt*

119. How many calories of heat will be produced approximately in a 210 *watt* electric bulb in 5 minutes **[Pb. PET 2004]**

(a) 80000 *cal* (b) 63000 *cal*

(c) 1050 *cal* (d) 15000 *cal*

120. $A\,5^{o}C$ rise in the temperature is observed in a conductor by passing some current. When the current is doubled, then rise in temperature will be equal to **[BHU 2004]**

(a) $5^{o}C$ (b) $10^{o}C$

(c) $20^{o}C$ (d) $40^{o}C$

121. If a 2 *kW* boiler is used everyday for 1 hour, then electrical energy consumed by boiler in thirty days is **[BHU 2004]**

(a) 15 unit (b) 60 unit

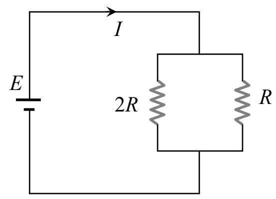
(c) 120 unit (d) 240 unit

122. What will happen when a 40 *watt*, 220 *volt* lamp and 100 *watt*, 220 *volt* lamp are connected in series across 40 *volt* supply **[BHU 2004]**

(a) 100 *watt* lamp will fuse (b)40 *watt* lamp will fuse

(c) Both lamps will fuse (d)Neither lamp will fuse

123. What is the ratio of heat generated in *R* and 2*R* **[DCE 2003]**



(a) 2 : 1

(b) 1 : 2

(c) 4 : 1 **[MP PET 2003]**

(d) 1 : 4

124. In an electric heater 4 *amp* current passes for 1 *minute* at potential difference of 250 *volt*, the power of heater and energy consumed will be respectively **[DPMT 2003]**

(a) 1 *kW*, 60 *kJ* (b) 0.5 *kW*, 30 *kJ*

(c) 10 *kW*, 600 *kJ* (d) None of these

125. Some electric bulbs are connected in series across a 220 *V* supply in a room. If one bulb is fused then remaining bulbs are connected again in series across the same supply. The illumination in the room will **[J & K CET 2004]**

(a) Increase (b) Decrease

(c) Remains the same (d) Not continuous

126. The resistor of resistance '*R*' is connected to 25 *V* supply and heat produced in it is 25 *J/sec.* The value of *R* is **[Orissa PMT 2004]**

(a) 225Ω (b) 1Ω

(c) 25Ω (d) 50Ω

127. Three bulbs of 40 *W*, 60 *W*, 100 *W* are arranged in series with 220 *volt* supply which bulb has minimum resistance **[Pb. PET 2000]**

(a) 100 *W* (b) 40 *W*

(c) 60 W (d) Equal in all bulbs

128. If two electric bulbs have 40 W and 60 W rating at 220 V, then the ratio of their resistances will be **[Pb. PET 2001]**

(a) 9 : 4 (b) 4 : 3

(c) 3 : 8 (d) 3 : 2

129. A 10 V storage battery of negligible internal resistance is connected across a 50Ω resistor. How much heat energy is produced in the resistor in 1 hour **[Pb. PET 2001]**

(a) 7200 J (b) 6200 J

(c) 5200 J (d) 4200 J

130. A hot electric iron has a resistance of 80Ω and is used on a 200 V source. The electrical energy spent, if it is used for two hours, will be **[Pb. PET 2002]**

(a) 8000 Wh (b) 2000 Wh

(c) 1000 Wh (d) 800 Wh

131. The heat produced by a 100 *watt* heater in 2 minute will be equal to **[BCECE 2004]**

(a) $12\times10^3\ J$ (b) $10\times10^3\ J$

(c) $6\times10^3\ J$ (d) $3\times10^3\ J$

132. If two wires having resistance R and $2R$. Both joined in series and in parallel then ratio of heat generated in this situation, applying the same voltage, **[BCECE 2004]**

(a) 2 : 1 (b) 1 : 2

(c) 2 : 9 (d) 9 : 2

133. Two electric bulbs A and B are rated as 60 W and 100 W. They are connected in parallel to the same source. Then, **[KCET 2004]**

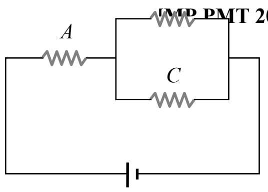
(a) Both draw the same current

(b) A draws more current than B

(c) B draws more current than A

(d) Current drawn are in the ratio of their resistances

134. Three identical resistances A, B and C are connected as shown in the given figure. The heat produced will be maximum **[MP PMT 2004]**



(a) In B (b) In B and C

(c) In A (d) Same for A, B and C

135. If 2.2kW power is transmitted through a 100Ω line at $22{,}000\,V$, the power loss in the form of heat will be **[MP PET 2004]**

(a) 0.1 W (b) 1 W

(c) 10 W (d) 100 W

136. A heater coil connected to a supply of a 220 V is dissipating some power P_1. The coil is cut into half and the two halves are connected in parallel. The heater now dissipates a power P_2. The ratio of power $P_1 : P_2$ is **[AFMC 2004]**

(a) 2 : 1 (b) 1 : 2

(c) 1 : 4 (d) 4 : 1

137. An electric lamp is marked 60 W, 230 V. The cost of a 1 kWh of energy is *Rs*. 1.25. The cost of using this lamp 8 *hrs* a day for 30 day is **[Kerala (Med.) 2002]**

(a) *Rs*. 10 (b) *Rs*. 16

(c) *Rs*. 18 (d) *Rs*. 20

138. An electric iron draws 5 *amp*, a TV set draws 3 *amp* and refrigerator draws 2 *amp* from a 220 *volt* main line. The three appliances are connected in parallel. If all the three are operating at the same time, the fuse used may be of **[ISM Dhanbad 1994]**

(a) 20 *amp* (b) 5 *amp*

(c) 15 *amp* (d) 10 *amp*

139. Match the List I with the List II from the combination shown. In the left side (List I) there are four different conditions and in the right side (List II), there are ratios of heat produced in each resistance for each condition : **[ISM Dhanbad 1994]**

List I	List II
(I) Two wires of same	(A) 1 : 2

	resistance are connected in series and same current is passed through them	
(II)	Two wires of resistance R and $2R$ *ohm* are connected in series and same P.D. is applied across them	(B) 4 : 1
(III)	Two wires of same resistance are connected in parallel and same current is flowing through them	(C) 1 : 1
(IV)	Two wires of resistances in the ratio 1 : 2 are connected in parallel and same P.D. is applied across them	(D) 2 : 1

(a) $I-B; II-A; III-C; IV-D$

(b) $I-C; II-D; III-C; IV-D$

(c) $I-B; II-D; III-A; IV-C$

(d) $I-A; II-B; III-D; IV-C$

140. The electric current passing through a metallic wire produces heat because of **[BHU 1994]**

(a) Collisions of conduction electrons with each other

(b) Collisions of the atoms of the metal with each other

(c) The energy released in the ionization of the atoms of the metal

(d) Collisions of the conduction electrons with the atoms of the metallic wires

141. The maximum current that flows through a fuse wire before it blows out varies with its radius as **[SCRA 1998]**

(a) $r^{3/2}$ (b) r

(c) $r^{2/3}$ (d) $r^{1/2}$

142. What is immaterial for an electric fuse wire **[UPSEAT 1999]**

(a) Specific resistance of the wire

(b) Radius of the wire

(c) Length of the wire

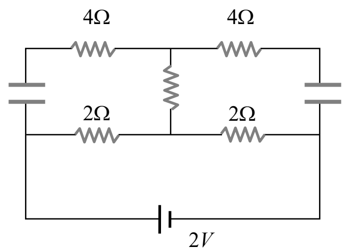
(d) Current flowing through the wire

143. The current flowing through a lamp marked as 50 W and 250 V is **[MH CET (Med.) 2001]**

(a) 5 *amp* (b) 2.5 *amp*

(c) 2 *amp* (d) 0.2 *amp*

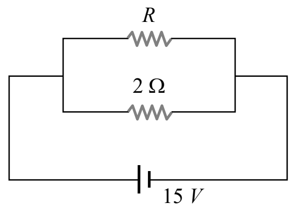
144. Find the power of the circuit



(a) 1.5 W (b) 2 W

(c) 1 W (d) None of these

145. If in the circuit, power dissipation is 150 W, then R is **[AIEEE 2002]**



(a) 2 Ω (b) 6 Ω

(c) 5 Ω (d) 4 Ω

146. Two resistors whose value are in ratio 2 : 1 are connected in parallel with one cell. Then ratio of power dissipated is **[RPMT 2000]**

(a) 2 : 1 (b) 4 : 1

(c) 1 : 2 (d) 1 : 1

147. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be **[AIEEE 2005]**

(a) One fourth (b) Halved

(c) Doubled (d) Four times

148. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp when not in use **[AIEEE 2005]**

(a) 400Ω (b) 200Ω

(c) $40\,\Omega$ (d) $20\,\Omega$

149. A 5.0 *amp* current is setup in an external circuit by a 6.0 *volt* storage battery for 6.0 minutes. The chemical energy of the battery is reduced by **[KCET 2005]**

(a) $1.08 \times 10^4\ J$ (b) 1.08×10^{-4} *volt*

(c) $1.8 \times 10^4\ J$ (d) 1.8×10^4 *volt*

150. A railway compartment is lit up by thirteen lamps each taking 2.1 amp at 15 volts. The heat generated per second in each lamp will be

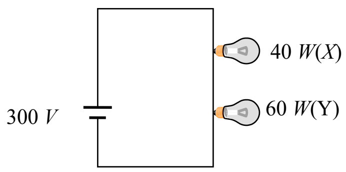
(a) 4.35 *cal* (b) 5.73 *cal*

(c) 7.5 *cal* (d) 2.5 *cal*

151. Two bulbs *X* and *Y* having same voltage rating and of power 40 watt and 60 watt respectively are connected in series across a potential difference of 300 volt, then **[Orissa JEE 2005]**

(a) *X* will glow brighter

(b) Resistance of *Y* is greater than *X*



(c) Heat produced in *Y* will be greater than *X*

(d) Voltage drop in *X* will be greater than *Y*

152. 3 identical bulbs are connected in series and these together dissipate a power *P*. If now the bulbs are connected in parallel, then the power dissipated will be **[DPMT 2005]**

(a) $\frac{P}{3}$ (b) $3P$

(c) $9P$ (d) $\frac{P}{9}$

153. A coil takes 15 *min* to boil a certain amount of water, another coil takes 20 *min* for the same process. Time taken to boil the same amount of water when both coil are connected in series

(a) 5 *min* (b) 8.6 *min*

(c) 35 *min* (d) 30 *min*

Chemical Effect of Current

1. Water can not be made conducting by adding small amount of any of the following except

(a) Sodium chloride (b) Copper sulphate

(c) Ammonium chloride (d) Sugar

2. The electrochemical equivalent Z of any element can be obtained by multiplying the electrochemical equivalent of hydrogen with

(a) Atomic weight (b) Molecular weight

(c) Chemical equivalent (d) A constant

3. A silver and zinc voltameter are connected in series and a current *i* is passed through them for a time *t* liberating *W gm* of zinc. The weight of silver deposited is nearly **[J & K CET 2005]** **[NCERT 1973, 76]**

(a) *W* (b) 1.7 *W*

(c) 2.4 *W* (d) 3.5 *W*

4. To deposit one gm equivalent of an element at an electrode, the quantity of electricity needed is

[IIT 1984; DPMT 1982; MP PET 1998; MP PMT 1998; 2003]

(a) One *ampere* (b) 96000 *amperes*

(c) 96500 *farads* (d) 96500 *coulombs*

5. In an electrolysis experiment, a current *i* passes through two different cells in series, one containing a solution of $CuSO_4$ and the other a solution of $AgNO_3$. The rate of increase of the weight of the cathodes in the two cells will be **[NCERT 1972]**

(a) In the ratio of the densities of *Cu* and *Ag*

(b) In the ratio of the at. weights of *Cu* and *Ag*

(c) In the ratio of half the atomic weight of *Cu* to the atomic weight of *Ag*

(d) In the ratio of half the atomic weight of *Cu* to half the atomic weight of *Ag*

6. To deposit one litre of hydrogen at 22.4 atmosphere from acidulaled water, the quantity of electricity that must pass through is **[DCE 2005]** **[BVP 2003]**

(a) 1 *coulomb* (b) 22.4 *coulomb*

(c) 96500 *coulomb* (d) 193000 *coulomb*

7. The amount of substance liberated on electrodes during electrolysis when 1 coulomb of electricity is passed, is

(a) Chemical equivalent

(b) Electrochemical equivalent

(c) Equivalent weight

(d) One mol

8. For goldplating on a copper chain, the substance required in the form of solution is

(a) Copper sulphate

(b) Copper chloride

(c) Potassium cyanide

(d) Potassium aurocyanide

9. On passing the current in water voltameter, the hydrogen

(a) Liberated at anode (b) Liberated at cathode

(c) Does not liberate (d) Remains in the solution

10. In water voltameter, the electrolysis of ...... takes place

[DPMT 1999]

(a) H_2O (b) H_2SO_4

(c) H_2O and H_2SO_4 both (d) H_2 and O_2

11. For depositing 1 *gm* of *Cu* in copper voltameter on passing 2 *amperes* of current, the time required will be (For copper Z = 0.00033 *gm/C*)

(a) Approx. 20 *minutes* (b) Approx. 25 *minutes*

(c) Approx. 30 *minutes* (d) Approx. 35 *minutes*

12. A battery of e.m.f. 3 volt and internal resistance 1.0 *ohm* is connected in series with copper voltameter. The current flowing in the circuit is 1.5 amperes. The resistance of voltameter will be

(a) Zero (b) 1.0 *ohm*

(c) 1.5 *ohm* (d) 2.0 *ohm*

13. According to Faraday's laws of electrolysis, the amount of decomposition is proportional to

[MP PMT 1993]

(a) $\frac{1}{\text{Time for which curent passes}}$

(b) Electrochemical equivalent of the substance

(c) $\frac{1}{\text{Current}}$

(d) $\frac{1}{\text{Electrochemical equivalent}}$

14. If in a voltaic cell 5 gm of zinc is consumed, then we get how many ampere hours ? (Given that E.C.E. of *Zn* is 3.387×10^{-7} *kg/coulomb*)

(a) 2.05 (b) 8.2

(c) 4.1 (d) $5 \times 3.387 \times 10^{-7}$

15. The current flowing in a copper voltameter is 1.6 *A*. The number of Cu^{++} ions deposited at the cathode per minute are

[MP PMT 1994; MP PET 2000]

(a) 1.5×10^{20} (b) 3×10^{20}

(c) 6×10^{20} (d) 1×10^{19}

16. In a copper voltameter experiment, current is decreased to one-fourth of the initial value but it is passed for four times the earlier duration. Amount of copper deposited will be

[MP PMT 1993]

(a) Same

(b) One-fourth the previous value

(c) Four times the previous value

(d) $\frac{1}{16}th$ of the previous value

17. A certain charge liberates 0.8 *gm* of O_2. The same charge will liberate how many gm of silver **[MP PET 1999]**

(a) 108 *gm* (b) 10.8 *gm*

(c) 0.8 *gm* (d) $\frac{108}{0.8} gm$

18. In charging a battery of motor-car, the following effect of electric current is used **[MP PET 1993; AFMC 2003]**

(a) Magnetic (b) Heating

(c) Chemical (d) Induction

19. The Avogadro's number is 6×10^{23} per gm mole and electronic charge is $1.6 \times 10^{-19} C$. The Faraday's number is

[DPMT 2001]

(a) $6 \times 10^{23} \times 1.6 \times 10^{-19}$ (b) $\frac{6 \times 10^{23}}{1.6 \times 10^{-19}}$

(c) $\frac{2}{6 \times 10^{23} \times 1.6 \times 10^{-19}}$ (d) $\frac{1.6 \times 10^{-19}}{6 \times 10^{23}}$

20. In $CuSO_4$ solution when electric current equal to 2.5 *faraday* is passed, the gm equivalent deposited on the cathode is

(a) 1 (b) 1.5

(c) 2 (d) 2.5

21. The atomic weight of silver and copper are 108 and 64. A silver voltameter and a copper voltameter are connected in series and when current is passed 10.8 *gm* of silver is deposited. The mass of copper deposited will be

(a) 6.4 *gm* (b) 12.8 *gm*

(c) 3.2 *gm* (d) 10.8 *gm*

22. Faraday's laws of electrolysis are related to **[IIT 1983]**

(a) The atomic number of positive ion

(b) The equivalent weight of electrolyte

(c) The atomic number of negative ion

(d) The velocity of positive ion

23. In the process of electrolysis, the current is carried out inside the electrolyte by **[AMU (Engg.) 1999]**

(a) Electrons

(b) Atoms

(c) Positive and negative ions

(d) All the above

24. The mass of ions deposited during a given interval of time in the process of electrolysis depends on **[DPMT 2002]**

(a) The current (b) The resistance

(c) The temperature (d) The electric power

25. The amount of charge required to liberate 9 *gm* of aluminium (atomic weight = 27 and valency = 3) in the process of electrolysis is (Faraday's number = 96500 *coulombs*/*gm* equivalent)

(a) 321660 *coulombs* (b) 69500 *coulombs*

(c) 289500 *coulombs* (d) 96500 *coulombs*

26. In an electroplating experiment, *m gm* of silver is deposited when 4 *ampere* of current flows for 2 *minute*. The amount (in *gm*) of silver deposited by 6 *ampere* of current for 40 *second* will be **[MNR 1991; UPSEAT 2000; MP PET 2002; Pb. PET 2004; Orissa JEE 2005]**

(a) 4 *m* (b) $m/2$

(c) $m/4$ (d) 2 *m*

27. In electrolysis, if the duration of the passage of current is doubled, the mass liberated is **[EAMCET 1979]**

(a) Doubled (b) Halved

(c) Increased four times (d)Remains the same

28. A current of 16 *ampere* flows through molten *NaCl* for 10 *minute*. The amount of metallic sodium that appears at the negative electrode would be **[EAMCET 1984]**

(a) 0.23 *gm* (b) 1.15 *gm*

(c) 2.3 *gm* (d) 11.5 *gm*

29. The mass of a substance liberated when a charge '*q*' flows through an electrolyte is proportional to **[EAMCET 1984]**

(a) *q* (b) $1/q$

(c) q^2 (d) $1/q^2$

30. A steady current of 5 *amps* is maintained for 45 *mins*. During this time it deposits 4.572 *gms* of zinc at the cathode of a voltameter. E.C.E. of zinc is **[MP PET 1994]**

(a) $3.387 \times 10^{-4}\, gm/C$ (b) $3.387 \times 10^{-4}\, C/gm$

(c) $3.384 \times 10^{-3}\, gm/C$ (d) $3.394 \times 10^{-3}\, C/gm$

31. The relation between faraday constant *F*, electron charge *e* and avogadro number *N* is **[MP PET 1995]**

(a) $F = N/e$ (b) $F = Ne$

(c) $N = F^2$ (d) $F = N^2 e$

32. The electrochemical equivalent of magnesium is $0.126\, mg/C$. A current of 5 *A* is passed in a suitable solution for 1 *hour*. The mass of magnesium deposited will be **[MP PMT 1995]**

(a) 0.0378 *gm* (b) 0.227 *gm*

(c) 0.378 *gm* (d) 2.27 *gm*

33. Two electrolytic cells containing $CuSO_4$ and $AgNO_3$ respectively are connected in series and a current is passed through them until 1 *mg* of copper is deposited in the first cell. The amount of silver deposited in the second cell during this time is approximately

[Atomic weights of copper and silver are respectively 63.57 and 107.88]

[MP PMT 1996]

(a) 1.7 *mg* (b) 3.4 *mg*

(c) 5.1 *mg* (d) 6.8 *mg*

34. A current I is passed for a time t through a number of voltameters. If m is the mass of a substance deposited on an electrode and z is its electrochemical equivalent, then

[MP PMT 1997]

(a) $\frac{zIt}{m} = \text{constant}$ (b) $\frac{z}{mIt} = \text{constant}$

(c) $\frac{I}{zmt} = \text{constant}$ (d) $\frac{It}{zm} = \text{constant}$

35. For electroplating a spoon, it is placed in the voltameter at

[MP PMT/PET 1998]

(a) The position of anode

(b) The position of cathode

(c) Exactly in the middle of anode and the cathode

(d) Anywhere in the electrolyte

36. If nearly 10^5 *coulomb* liberate 1 *gm* equivalent of aluminium, then the amount of aluminium (equivalent weight 9) deposited through electrolysis in 20 minutes by a current of 50 *amp* will be [CBSE PMT 1998]

(a) 0.6 *gm* (b) 0.09 *gm*

(c) 5.4 *gm* (d) 10.8 *gm*

37. Electroplating does not help in

[AIIMS 1998]

(a) Fine finish to the surface

(b) Shining appearance

(c) Metals to become hard

(d) Protect metal against corrosion

38. When a current is passed through water, acidified with a dilute sulphuric acid, the gases formed at the platinum electrodes are

[KCET 1994]

(a) 1 vol. hydrogen (cathode) and 2 vol. oxygen (anode)

(b) 2 vol. hydrogen (cathode) and 1 vol. oxygen (anode)

(c) 1 vol. hydrogen (cathode) and 1 vol. oxygen (anode)

(d) 1 vol. oxygen (cathode) and 2 vol. hydrogen (anode)

39. The negative Zn pole of a Daniel cell, sending a constant current through a circuit, decreases in mass by 0.13g in 30 *minutes*. If the electrochemical equivalent of Zn and Cu are 32.5 and 31.5 respectively, the increase in the mass of the positive Cu pole in this time is

[AIEEE 2003]

(a) 0.242 g (b) 0.190 g

(c) 0.141 g (d) 0.126 g

40. When a copper voltameter is connected with a battery of e.m.f. 12 *volts*. 2 *gms* of copper is deposited in 30 *minutes*. If the same voltameter is connected across a 6 volt battery, then the mass of copper deposited in 45 minutes would be

[SCRA 1994]

(a) 1 *gm* (b) 1.5 *gm*

(c) 2 *gm* (d 2.5 *gm*

41. The value of current required to deposit 0.972 *gm* of chromium in 3 *hours* if the E.C.E. of chromium is 0.00018 *gm* per coulomb, is

[SCRA 1994]

(a) 1 *amp* (b) 1.5 *amp*

(c) 0.5 *amp* (d) 2 *amp*

42. The current inside a copper voltameter[Roorkee 1992]

(a) Is half the outside value

(b) Is the same as the outside value

(c) Is twice the outside value

(d) Depends on the concentration of $CuSO_4$

43. The resistance of a cell does not depend on[RPET 1996]

(a) Current drawn from the cell

(b) Temperature of electrolyte

(c) Concentration of electrolyte

(d) The e.m.f. of the cell

44. The electrochemical equivalent of a metal is 3.3×10^{-7} *kg/ coulomb*. The mass of the metal liberated at the cathode when a 3 A current is passed for 2 seconds will be [SCRA 1998; AIEEE 2004; DCE 2005]

(a) $19.8 \times 10^{-7}\ kg$ (b) $9.39 \times 10^{-7}\ kg$

(c) $6.6 \times 10^{-7}\ kg$ (d) $1.1 \times 10^{-7}\ kg$

45. Faraday's 2nd law states that mass deposited on the electrode is directly proportional to

(a) Atomic mass (b) Atomic mass × Velocity

(c) Atomic mass/Valency (d) Valency

46. The relation between Faraday constant (*F*), chemical equivalent (*E*) and electrochemical equivalent (*Z*) is [SCRA 1994; AFMC 2000]

(a) $F = EZ$ (b) $F = \frac{Z}{E}$

(c) $F = \frac{E}{Z}$ (d) $F = \frac{E}{Z^2}$

47. The electrochemical equivalent of a material in an electrolyte depends on

(a) The nature of the material

(b) The current through the electrolyte

(c) The amount of charge passed through electrolyte

(d) The amount of material present in electrolyte

48. On passing 96500 *coulomb* of charge through a solution $CuSO_4$ the amount of copper liberated is [MP PMT 2001]

(a) 64 *gm* (b) 32 *gm*

(c) 32 *kg* (d) 64 *kg*

49. If 96500 *coulombs* of electricity liberates one gram equivalent of any substance, the time taken for a current of 0.15 *amperes* to deposite 20*mg* of copper from a solution of copper sulphate is (Chemical equivalent of copper = 32) [Kerala (Engg.) 2002]

(a) 5 *min* 20 *sec* (b) 6 *min* 42 *sec*

(c) 4 *min* 40 *sec* (d) 5 *min* 50 *sec*

50. How much current should be passed through acidified water for 100 *s* to liberate 0.224 *litre* of H_2 [DCE 2002]

(a) 22.4 *A* (b) 19.3 *A*

(c) 9.65 *A* (d) 1 *A*

51. Who among the following scientists made the statement –"Chemical change can produce electricity" [DCE 2004] [DCE 1999]

(a) Galvani (b) Faraday

(c) Coulomb (d) Thomson

52. If a steady current of 4 *amp* maintained for 40 *minutes,* deposits 4.5 *gm* of zinc at the cathode and then the electro chemical equivalent will be [MH CET 2003]

(a) $51 \times 10^{-17}\ gm/C$ (b) $28 \times 10^{-6}\ gm/C$

(c) $32 \times 10^{-5}\ gm/C$ (d) $47 \times 10^{-5}\ gm/C$

53. The current flowing in a copper voltameter is 3.2 *A*. The number of copper ions (Cu^{2+}) deposited at the cathode per minute is [MP PET 2001] [Pb. PET 2001]

(a) 0.5×10^{20} (b) 1.5×10^{20}

(c) 3×10^{20} (d) 6×10^{20}

54. A copper voltameter is connected in series with a heater coil of resistance 0.1Ω. A steady current flows in the circuit for twenty minutes and mass of 0.99 *g* of copper is deposited at the cathode. If electrochemical equivalent of copper is 0.00033 *gm/C*, then heat generated in the coil is [Pb. PET 2002]

(a) 750 *J* (b) 650 *J*

(c) 350 *J* (d) 250 *J*

55. E.C.E. of *Cu* and *Ag* are 7×10^{-6} and 1.2×10^{-6}. A certain current deposits 14 *gm* of *Cu*. Amount of *Ag* deposited is [Orissa PMT 2004]

(a) 1.2 *gm* (b) 1.6 *gm*

(c) 2.4 *gm* (d) 1.8 *gm*

56. The chemical equivalent of silver is 108. If the current in a silver voltameter is 2 *Amp.*, the time required to deposit 27 *grams* of silver will be [MP PMT 2004]

(a) 8.57 *hrs* (b) 6.70 *hrs*

(c) 3.35 *hrs* (d) 12.50 *hrs*

57. Two voltameters, one of copper and another of silver, are joined in parallel. When a total charge q flows through the voltameters, equal amount of metals are deposited. If the electrochemical equivalents of copper and silver are z_1 and z_2 respectively the charge which flows through the silver voltameter is **[AIEEE 2005]**

(a) $q\frac{z_1}{z_2}$ (b) $q\frac{z_2}{z_1}$

(c) $\frac{q}{1+\frac{z_1}{z_2}}$ (d) $\frac{q}{1+\frac{z_2}{z_1}}$

58. The chemical equivalent of copper and zinc are 32 and 108 respectively. When copper and silver voltameter are connected in series and electric current is passed through for sometimes, 1.6 *g* of copper is deposited. Then, the mass of silver deposited will be **[J & K CET 2005]**

(a) 3.5 *g* (b) 2.8 *g*

(c) 5.4 *g* (d) None of these

59. Ampere hour is the unit of **[Orissa JEE 2005]**

(a) Quantity of charge (b) Potential

(c) Energy (d) Current

Thermo-Electricity

1. The production of e.m.f. by maintaining a difference of temperature between the two junctions of two different metals is known as

(a) Joule effect (b) Seebeck effect

(c) Peltier effect (d) Thomson effect

2. When a current passes through the junction of two different metals, evolution or absorption of heat at the junction is known as **[MP PMT/PET 1998]**

(a) Joule effect (b) Seebeck effect

(c) Peltier effect (d) Thomson effect

3. When a current passes through a wire whose different parts are maintained at different temperatures, evolution or absorption of heat all along the length of wire is known as

(a) Joule effect (b) Seebeck effect

(c) Peltier effect (d) Thomson effect

4. The thermocouple is based on the principle of **[MP PET 1984; AFMC 1998; BCECE 2003]**

(a) Seebeck effect (b) Thomson effect

(c) Peltier effect (d) Joule effect

5. For a thermocouple, the neutral temperature is $270°C$ and the temperature of its cold junction is $20°C$. If there is no deflection in the galvanometer, the temperature of the hot junction should be **[AMU Engg. 2000]**

(a) $210°C$ (b) $540°C$

(c) $520°C$ (d) $209°C$

6. Thermocouple is a device for the measurement of

(a) Absolute temperature of a metal

(b) The temperature difference between two substances

(c) The couple acting on a wire

(d) Thermal conductivity of a substance

7. The true statement for thermo e.m.f. of a thermocouple

(a) Depends on the nature of metals

(b) Depends only on temperature of cold junction

(c) Depends only on temperature of hot junction

(d) Depends on the length of the wires used for thermocouple

8. The direction of current in an iron-copper thermocouple is **[MP PET 1995]**

(a) From copper to iron at the hot junction

(b) From iron to copper at the hot junction

(c) From copper to iron at cold junction

(d) No current will flow

9. Peltier coefficient for the junction of a pair of metals is proportional to **[MP PMT 1993; MP PET 1997]**

(a) T absolute temperature of the junction

(b) Square of absolute temperature of the junction

(c) $\frac{1}{\text{Absolute temperature of the junction}}$

(d) $\frac{1}{\text{Square of absolute temperature of the junction}}$

10. If for a thermocouple T_n is the neutral temperature, T_c is the temperature of the cold junction and T_i is the temperature of inversion, then [MP PET 2001; AIEEE 2002]

(a) $T_i = 2T_n - T_c$ (b) $T_n = T_i - 2T_c$

(c) $T_i = T_n - T_c$ (d) None of these

11. For a thermocouple, the temperature of inversion is that temperature at which thermo e.m.f. is

(a) Zero (b) Maximum

(c) Minimum (d) None of the above

12. For a given thermocouple, the thermo e.m.f. can be

(a) Zero (b) Positive

(c) Negative (d) All of the above

13. When current is passed in antimony-bismuth couple, then

(a) The junction becomes hot when the current is from bismuth to antimony

(b) The junction becomes hot when current flows from antimony to bismuth

(c) Both junctions become hot

(d) Both junctions become cold

14. A thermocouple is made of *Cu* and *Fe*. If a battery is connected in it, then

(a) Both junctions will be at the same temperature

(b) Both junctions will become hot

(c) One junction will be hotter than the other

(d) None of these

15. Thermopile is used for

(a) Collecting the heat energy

(b) The measurement of radiant heat energy

(c) The measurement of current

(d) The change of atomic energy into heat energy

16. When a current of 1 ampere is passed through a conductor whose ends are maintained at temperature difference of $1°C$, the amount of heat evolved or absorbed is called

(a) Peltier coefficient (b) Thomson coefficient

(c) Thermoelectic power (d) Thermo e.m.f.

17. In a thermocouple, the temperature that does not depend on the temperature of the cold junction is called

(a) Neutral temperature (b) Temperature of inversion

(c) Both the above (d) None of the above

18. At neutral temperature, the thermoelectric power $\left(\frac{dE}{dT}\right)$ has the value [MP PET 2003; MP PMT 2004]

(a) Zero (b) Maximum but negative

(c) Maximum but positive (d) Minimum but positive

19. In *Cu-Fe* couple, the flow of current at the temperature of inversion is

(a) From *Fe* to *Cu* through the hot junction

(b) From *Cu* to *Fe* through the hot junction

(c) Maximum

(d) None of the above

20. In Seebeck series *Sb* appears before *Bi*. In a $Sb - Bi$ thermocouple current flows from [MP PET 1994]

(a) *Sb* to *Bi* at the hot junction

(b) *Sb* to *Bi* at the cold junction

(c) *Bi* to *Sb* at the cold junction

(d) None of the above

21. Which of the following statement is correct [MP PET 1994]

(a) Both Peltier and Joule effects are reversible

(b) Both Peltier and Joule effects are irreversible

(c) Joule effect is reversible, whereas Peltier effect is irreversible

(d) Joule effect is irreversible, whereas Peltier effect is reversible

22. For a given temperature difference, which of

the following pairs will generate maximum thermo e.m.f. **[MP PMT 1994]**

(a) Antimony-bismuth (b) Silver-gold

(c) Iron-copper (d) Lead-nickel

23. The cold junction of a thermocouple is maintained at $10°C$. No thermo e.m.f. is developed when the hot junction is maintained at $530°C$. The neutral temperature is **[MP PMT 1994]**

(a) $260°C$ (b) $270°C$

(c) $265°C$ (d) $520°C$

24. Which of the following is not reversible **[Manipal MEE 1995; DPMT 2001]**

(a) Joule effect (b) Peltier effect

(c) Seebeck effect (d) Thomson effect

25. Neutral temperature of a thermocouple is defined as the temperature at which **[MP PMT 1996]**

(a) The thermo e.m.f. changes sign

(b) The thermo e.m.f. is maximum

(c) The thermo e.m.f. is minimum

(d) The thermo e.m.f. is zero

26. As the temperature of hot junction of a thermo-couple is increased (while cold junction is at constant temperature), the thermo e.m.f.

(a) Increases uniformly at constant rate

(b) Increases slowly in the beginning and more rapidly at higher temperatures

(c) Increases more rapidly in the beginning but less rapidly at higher temperatures

(d) In minimum at neutral temperature

27. As the temperature of hot junction increases, the thermo e.m.f. **[MP PET 1999]**

(a) Always increases

(b) Always decreases

(c) May increase or decrease

(d) Always remains constant

28. The e.m.f. in a thermoelectric circuit with one junction at $0°C$ and the other at $t°C$ is given by $E = At - Bt^2$. The neutral temperature is then **[AMU 1995; BCECE 2004]**

(a) $\frac{A}{B}$ (b) $-\frac{A}{2B}$

(c) $-\frac{B}{2A}$ (d) $\frac{A}{2B}$

29. The temperature of cold junction and neutral temperature of a thermocouple are $15°C$ and $280°C$ respectively. The temperature of inversion is **[AMU (Engg.) 1999]**

(a) $295°C$ (b) $265°C$

(c) $545°C$ (d) $575°C$

30. Above neutral temperature, thermo e.m.f. in a thermocouple **[AMU (Engg.) 1999]**

(a) Decreases with rise in temperature

(b) Increases with rise in temperature

(c) Remains constant

(d) Changes sign

31. Consider the following two statements *A* and *B*, and identify the correct choice out of given answers

A. Thermo e.m.f. is minimum at neutral temperature of a thermocouple

B. When two junctions made of two different metallic wires are maintained at different temperatures, an electric current is generated in the circuit. **[EAMCET (Med.) 2000]**

(a) *A* is false and *B* is true (b) *A* is true and *B* is false

(c) Both *A* and *B* are false (d) Both *A* and *B* are true

32. The temperature at which thermal electric power of a thermo couple becomes zero is called **[MP PMT 2001]**

(a) Inversion temperature (b) Neutral temperature

(c) Junction temperature (d) Null temperature

33. Thomson coefficient of a conductor is $10\mu V/K$. The two ends of it are kept at $50°C$ and $60°C$ respectively. Amount of heat absorbed by the conductor when a charge of 10*C* flows through it is **[EAMCET 2001]**

(a) 1000 *J* (b) 100 *J*

(c) 100 *mJ* (d) 1 *mJ*

34. For a thermocouple the neutral temperature is $270°C$ when its cold junction is at $20°C$. What will be the neutral temperature and the temperature of inversion when the temperature of cold junction is increased to $40°C$ **[Kerala PET 2001]**

(a) $290°C, 580°C$ (b) $270°C, 580°C$

(c) $270°C, 500°C$ (d) $290°C, 540°C$

35. Two ends of a conductor are at different temperatures the electromotive force generated between two ends is **[MP PMT 2001; MP PET 2002]**

(a) Seebeck electro motive force (e.m.f.)
(b) Peltier electro motive force (e.m.f.)
(c) Thomson electro motive force (e.m.f.)
(d) None of these

36. The neutral temperature of a thermocouple is $350^{o}C$ when the cold junction is at $0^{o}C$. When the cold junction is immersed in a bath of $30^{o}C$, the inversion temperature is **[Kerala (Med.) 2002]**

(a) $700^{o}C$ (b) $600^{o}C$
(c) $350^{o}C$ (d) $670^{o}C$

37. A thermoelectric refrigerator works on **[JIPMER 2002]**

(a) Joule effect (b) Seeback effect
(c) Peltier effect (d) Thermonic emission

38. If the temperature of cold junction of thermocouple is lowered, then the neutral temperature **[JIPMER 2002]**

(a) Increases
(b) Approaches inversion temperature
(c) Decreases
(d) Remains the same

39. Consider the following two statements A and B and identify the correct choice given in the answers

(A) Duddells thermo-galvanometer is suitable to measure direct current only
(B) Thermopile can measure temperature differences of the order of $10^{-3}\ {}^{o}C$

(a) Both A and B are true (b) Both A and B are false
(c) A is true but B is false (d) A is false but B is true

40. If $E = at + bt^2$, what is the temperature of inversion **[DCE 2003]**

(a) $-\frac{a}{2b}$ (b) $+\frac{a}{2b}$
(c) $-\frac{a}{b}$ (d) $+\frac{a}{b}$

41. Antimony and bismuth are usually used in a thermocouple, because **[MH CET 2003]**

(a) Negative thermal e.m.f. produced
(b) Constant thermal e.m.f. produced
(c) Lower thermal e.m.f. produced
(d) Higher thermal e.m.f. produced

42. The smallest temperature difference that can be measured with a combination of a thermocouple of thermo e.m.f. $30\mu V$ per degree and a galvanometer of 50 *ohm* resistance, capable of measuring a minimum current of 3×10^{-7} *amp* is **[MP PET 2000]**

(a) 0.5 degree (b) 1.0 degree
(c) 1.5 degree (d) 2.0 degree

43. $e = \alpha t - \frac{1}{2}\beta t^2$, If temperature of cold junction is $0^{o}C$ then temperature of inversion is (if $\alpha = 500.0\mu V/{}^{o}C, \beta = 5.0\mu V/\text{Square}\ {}^{o}C$) **[DCE 2001]**

(a) 100 (b) 200
(c) 300 (d) 400

44. If the emf of a thermocouple, one junction of which is kept 0°*C* is given by $e = at + 1/2\ bt^2$ then the neutral temperature will be **[J & K CET 2005]**

(a) *a/b* (b) – *a/b*
(c) *a*/2*b* (d) –1/ *ab*

Critical Thinking

Objective Questions

1. The resistance of the filament of an electric bulb changes with temperature. If an electric bulb rated 220 volt and 100 watt is connected $(220 \times .8)$ *volt* sources, then the actual power would be **[CPMT 1989]**

(a) 100×0.8 *watt* **[EAMCET 2003]**
(b) $100 \times (0.8)^2$ *watt*
(c) Between 100×0.8 *watt* and 100 *watt*
(d) Between $100 \times (0.8)^2$ *watt* and 100×0.8 *watt*

2. An immersion heater is rated 836 *watt*. It should heat 1 *litre* of water from $10^{\circ}C$ to $40^{\circ}C$ in about **[AIEEE 2004]**

(a) 200 *sec* (b) 150 *sec*
(c) 836 *sec* (d) 418 *sec*

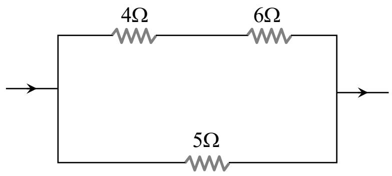
3. In the circuit shown in figure, the heat produced in 5 *ohm* resistance is 10 *calories* per *second*. The heat produced in 4 resistance is **[IIT 1981; UPSEAT 2002]**

(a) 1 *cal / sec*

(b) 2 *cal/sec*

(c) 3 *cal / sec*

(d) 4 *cal/sec*



4. A house is served by 220 *V* supply line in a circuit protected by a 9 *ampere* fuse. The maximum number of 60 W lamps in parallel that can be turned on, is

(a) 44 (b) 20

(c) 22 (d) 33

5. Water boils in an electric kettle in 15 *minutes* after switching on. If the length of the heating wire is decreased to $2/3$ of its initial value, then the same amount of water will boil with the same supply voltage in

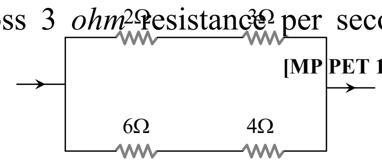
[MP PMT 1994]

(a) 15 *minutes* (b) 12 *minutes*

(c) 10 *minutes* (d) 8 *minutes*

6. In the circuit as shown in the figure, the heat produced by 6 *ohm* resistance due to current flowing in it is 60 *calorie* per *second*. The heat generated across 3 *ohm* resistance per second will be

[MP PET 1996]



(a) 30 *calorie*

(b) 60 *calorie*

(c) 100 *calorie*

(d) 120 *calorie*

7. The resistance of a heater coil is 110 *ohm*. A resistance *R* is connected in parallel with it and the combination is joined in series with a resistance of 11 *ohm* to a 220 *volt* main line. The heater operates with a power of 110 *watt*. The value of *R* in *ohm* is

[ISM Dhanbad 1994]

(a) 12.22

(b) 24.42

(c) Negative

(d) That the given values are not correct

8. A 500 *W* heating unit is designed to operate from a 115 *volt* line. If the line voltage drops to 110 volt, the percentage drop in heat output will be

[ISM Dhanbad 1994]

(a) 10.20% (b) 8.1%

(c) 8.6% (d) 7.6%

9. A heater of 220 *V* heats a volume of water in 5 minute time. A heater of 110 *V* heats the same volume of water in

[AFMC 1993]

(a) 5 *minutes* (b) 8 *minutes*

(c) 10 *minutes* (d) 20 *minutes*

10. An electric kettle takes 4 *A* current at 220 *V*. How much time will it take to boil 1 *kg* of water from room temperature $20°C$? The temperature of boiling water is $100°C$

[RPET 1996]

(a) 6.4 *minutes* (b) 6.3 *minutes*

(c) 12.6 *minutes* (d) 12.8 *minutes*

11. If a wire of resistance 20Ω is covered with ice and a voltage of 210 *V* is applied across the wire, then the rate of melting of ice is

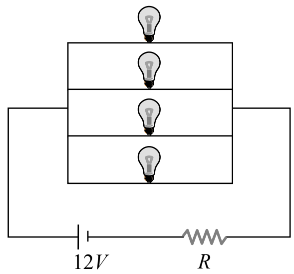
[AFMC 1997]

(a) $0.85\, g/s$ (b) $1.92\, g/s$

(c) $6.56\, g/s$ (d) All of these

12. Four identical electrical lamps are labelled 1.5*V*, 0.5*A* which describes the condition necessary for them to operate at normal brightness. A 12*V* battery of negligible internal resistance is connected to lamps as shown, then

[UPSEAT 2001]



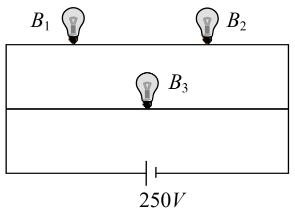
(a) The value of *R* for normal brightness of each lamp is (3/4) Ω

(b) The value of *R* for normal brightness of each lamp is (21/4) Ω

(c) Total power dissipated in circuit when all lamps are normally bright is 24*W*

(d) Power dissipated in *R* is 21*W* when all lamps are normally bright

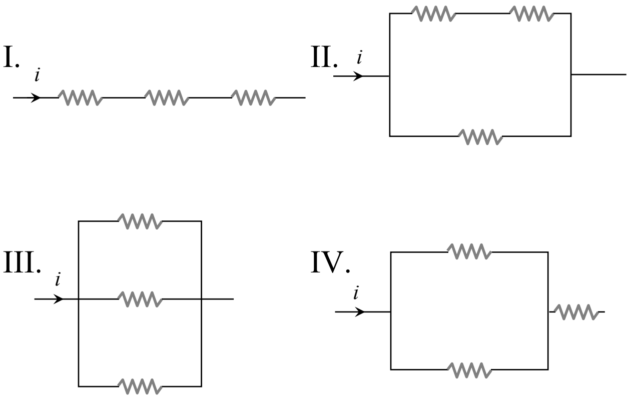
13. A 100 *W* bulb B_1, and two 60-*W* bulbs B_2 and B_3, are connected to a 250 *V* source, as shown in the figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3, respectively. Then **[IIT-JEE (Screening) 2002]**



(a) $W_1 > W_2 = W_3$ (b) $W_1 > W_2 > W_3$
(c) $W_1 < W_2 = W_3$ (d) $W_1 < W_2 < W_3$

14. The three resistance of equal value are arranged in the different combinations shown below. Arrange them in increasing order of power dissipation

[IIT-JEE (Screening) 2003]



(a) III < II < IV < I (b) II < III < IV < I
(c) I < IV < III < II (d) I < III < II < IV

15. Silver and copper voltameter are connected in parallel with a battery of e.m.f. 12 *V*. In 30 *minutes*, 1 *gm* of silver and 1.8 *gm* of copper are liberated. The power supplied by the battery is **[IIT 1975]**
(a) 24.13 *J/sec* (b) 2.413 *J/sec*
(c) 0.2413 *J/sec* (d) 2413 *J/sec*
$(Z_{Cu} = 6.6 \times 10^{-4}\ gm/C$ and $Z_{Ag} = 11.2 \times 10^{-4}\ gm/C)$

16. A silver voltameter of resistance 2 *ohm* and a 3 *ohm* resistor are connected in series across a cell. If a resistance of 2 *ohm* is connected in parallel with the voltameter, then the rate of deposition of silver **[EAMCET 1983]**
(a) Decreases by 25%
(b) Increases by 25%
(c) Increases by 37.5%
(d) Decreases by 37.5%

17. The expression for thermo e.m.f. in a thermocouple is given by the relation $E = 40\theta - \frac{\theta^2}{20}$, where θ is the temperature difference of two junctions. For this, the neutral temperature will be **[AMU (Engg.) 2000]**
(a) $100°C$ (b) $200°C$
(c) $300°C$ (d) $400°C$

18. For copper-iron (*Cu-Fe*) couple, the thermo e.m.f. (temperature of cold junction $= 0°C$) is given by $E = (14\theta - 0.02\theta^2)\mu V$. The neutral temperature will be
(a) $350°C$ (b) 350 *K*
(c) $560°C$ (d) 560 *K*

19. One junction of a certain thermoelectric couple is at a fixed temperature T_r and the other junction is at temperature *T*. The thermo electromotive force for this is expressed by $E = K(T - T_r)\left[T_0 - \frac{1}{2}(T + T_r)\right]$. At temperature $T = \frac{1}{2}T_0$, the thermoelectric power is

[MP PMT 1994]

(a) $\frac{1}{2}KT_0$ (b) KT_0
(c) $\frac{1}{2}KT_0^2$ (d) $\frac{1}{2}K(T_0 - T_r)^2$

20. The temperature of the cold junction of thermo-couple is $0°C$ and the temperature of hot junction is $T°C$. The e.m.f. is $E = 16T - 0.04T^2 \mu$ volts. The temperature of inversion is **[EAMCET 1994]**
(a) $200°C$ (b) $400°C$
(c) $100°C$ (d) $300°C$

21. The temperature of the cold junction of a thermocouple is 0^oC and temperature of the hot junction is T^oC. The thermo e.m.f. is given by the relation $E = AT - \frac{1}{2}BT^2$ (where A = 16 and B = 0.08). The temperature of inversion is

(a) 100^oC (b) 300^oC

(c) 400^oC (d) 500^oC

22. The thermo e.m.f. of a thermo-couple is $25 \mu V/^o C$ at room temperature. A galvanometer of 40 ohm resistance, capable of detecting current as low as $10^{-5} A$, is connected with the thermocouple. The smallest temperature difference that can be detected by this system is **[AIEEE 2003]**

(a) 20^oC (b) 16^oC

(c) 12^oC (d) 8^oC

23. An electric bulb rated for 500 watts at 100 volts is used in a circuit having a 200-volt supply. The resistance *R* that must be put in series with the bulb, so that the bulb draws 500 *W* is

(a) 10Ω (b) 20Ω

(c) 50Ω (d) 100Ω

24. A thermo couple develops $200 \mu V$ between 0^oC and 100^oC. If it develops $64 \mu V$ and $76 \mu V$ respectively between $(0^oC - 32^oC)$ and $(32^oC - 70^oC)$ then what will be the thermo *emf* it develops between 70^oC and 100^oC

(a) $65 \mu V$ (b) $60 \mu V$

(c) $55 \mu V$ (d) $50 \mu V$

25. A thermo couple is formed by two metals *X* and *Y* metal *X* comes earlier to *Y* in Seebeck series. If temperature of hot junction increases beyond the temperature of inversion. Then direction of current in thermocouple will so

(a) *X* to *Y* through cold junction

(b) *X* to *Y* through hot junction

(c) *Y* to *X* through cold junction

(d) Both (b) and (c)

26. Peltier co-efficient of a thermo couple is 2 *nano volts*. How much heat is developed at a junction if 2.5 *amp* current flows for 2 *minute*

(a) 6 *ergs* (b) 6×10^{-7} *ergs*

(c) 16 *ergs* **[AIIMS 2001]** (d) 6×10^{-3} *erg*

27. Resistance of a voltameter is 2Ω, it is connected in series to a battery of 10 *V* through a resistance of 3Ω. In a certain time mass deposited on cathode is 1 *gm*. Now the voltameter and the 3Ω resistance are connected in parallel with the battery. Increase in the deposited mass on cathode in the same time will be

(a) 0 (b) 1.5 *gm*

(c) 2.5 *gm* (d) 2 *gm*

28. A current of 1.5 *A* flows through a *copper* voltameter. The thickness of *copper* deposited on the electrode surface of area $50 cm^2$ in 20 *minutes* will be (Density of *copper* = 9000 kg/m^3 and E.C.E. of *copper* = 0.00033 *g/C*)

(a) $2.6 \times 10^{-5} m$ (b) $2.6 \times 10^{-4} m$

(c) $1.3 \times 10^{-5} m$ (d) $1.3 \times 10^{-4} m$

29. An ammeter, suspected to give inaccurate reading, is connected in series with a *silver* voltameter. The ammeter indicates 0.54 *A*. A steady current passed for one hour deposits 2.0124 *gm* of *silver*. If the E.C.E. of *silver is* $1.118 \times 10^{-3}\ gmC^{-1}$, then the error in ammeter reading is

(a) + 0.04 *A* (b) + 0.02 *A*

(c) – 0.03 *A* (d) – 0.01 *A*

30. If 1 *A* of current is passed through $CuSO_4$ solution for 10 seconds, then the number of copper ions deposited at the cathode will be about

(a) 1.6×10^{19} (b) 3.1×10^{19}

(c) 4.8×10^{19} (d) 6.2×10^{19}

31. A silver and a copper voltmeters are connected in parallel across a 6 *volt* battery of negligible resistance. In half an hour, 1 *gm* of copper and 2 *gm* of silver are deposited. The rate at which energy is supplied by the battery will approximately be (Given E.C.E. of copper $= 3.294 \times 10^{-4}\ g/C$ and *E.C.E.* of silver $= 1.118 \times 10^{-3}\ g/C$)

(a) 64 *W* (b) 32 *W*

(c) 96 *W* (d) 16 *W*

32. A thermocouple of resistance 1.6Ω is connected in series with a galvanometer of 8Ω resistance. The thermocouple develops and e.m.f. of $10\mu V$ per degree temperature difference between two junctions. When one junction is kept at $0^o C$ and the other in a molten metal, the galvanometer reads 8 *millivolt*. The temperature of molten metal, when e.m.f. varies linearly with temperature difference, will be

(a) $960^o C$ (b) $1050^o C$

(c) $1275^o C$ (d) $1545^o C$

33. The *emf* of a thermocouple, one junction of which is kept at $0^o C$, is given by $e = at + bt^2$ the Peltier co-efficient will be

(a) $(t+273)(a+2bt)$ (b) $(t+273)(a-2bt)$

(c) $(t-273)(a-2bt)$ (d) $(t-273)(a-2bt)$

34. A coil of wire of resistance 50Ω is embedded in a block of ice. If a potential difference of 210 *V* is applied across the coil, the amount of ice melted per second will be

(a) 4.12 *gm* (b) 4.12 *kg*

(c) 3.68 *kg* (d) 2.625 *gm*

35. The same mass of copper is drawn into two wires 1 *mm* and 2 *mm* thick. Two wires are connected in series and current is passed through them. Heat produced in the wire is in the ratio

(a) 2 : 1 (b) 1 : 16

(c) 4 : 1 (d) 16 : 1

36. The temperature of hot junction of a thermo-couple changes from $80^o C$ to $100^o C$. The percentage change in thermoelectric power is

(a) 8% (b) 10%

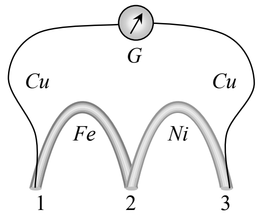
(c) 20% (d) 25%

37. A thermo couple uses Bismuth and Tellurium as the dissimilar metals. The sensitivity of bismuth is $-72\mu\ V/^o C$ and that of the tellurium is $500\mu\ V/^o C$. If the difference between hot and cold junction is $100^o C$, then the maximum output will be

(a) $50\ mV$ (b) $7.2\ mV$

(c) $42.8\ mV$ (d) $57.2\ mV$

38. Three wires of copper, iron and nickel are joined to form three junctions as shown in Fig. When the temperature of junction 1 is kept $50^o C$ with the other two junctions at $0^o C$, the sensitive galvanometer gives a deflection of 14 divisions. When the temperature of junction 3 is kept $50^o C$, with the other two junctions at $0^o C$, the galvanometer gives a deflection of 11 divisions. Then the deflection given by the galvanometer, when temperature of the junction 2 is kept at $50^o C$, with the other two junctions at $0^o C$, will be



(a) 3 *div*

(b) 11 *div*

(c) 14 *div*

(d) 25 *div*

39. The wiring of a house has resistance 6Ω. A 100 *W* bulb is glowing. If a geyser of 1000 *W* is switched on, the change in potential drop across the bulb is nearly **[MNR 1998]**

(a) Nil (b) 23 *V*

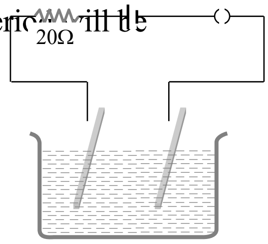
(c) 32 *V* (d) 12 *V*

40. A 12 *V* lead accumulator is being charged using 24 *V* supply with an external resistance 2Ω. The internal resistance of the accumulator is 1Ω. Find the time in which it will store 360 *W*-hour energy.

(a) 1 *hr* (b) 7.5 *hr*

(c) 10 *hr* (d) None of these

41. In a *Ag* voltameter 2.68 *gm* of silver is deposited in 10 *min*. The heat developed in 20Ω resistor during the same period will be



(a) 192 *kJ*

(b) 192 *J*

(c) 200 *J*

(d) 132 *kJ*

42. The thermo e.m.f. of a thermocouple varies with the temperature θ of the hot junction as $E = a\theta + b\theta^2$ in *volts* where the ratio *a*/*b* is $700^o C$. If the cold junction is kept at $0^o C$, then the neutral temperature is **[AIEEE 2004]**

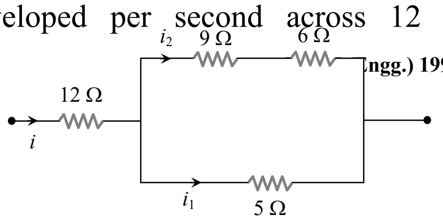
(a) $700^o C$

(b) $350^o C$

(c) $1400^o C$

(d) No neutral temperature is possible for this thermocouple

43. In the following circuit, 5 Ω resistor develops 45 *J*/s due to current flowing through it. The power developed per second across 12 Ω resistor is **ngg.) 1999]**



(a) 16 *W*

(b) 192 *W*

(c) 36 *W*

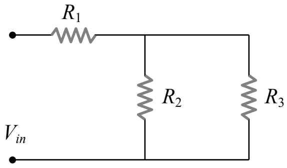
(d) 64 *W*

44. Water of volume 2 *litre* in a container is heated with a coil of 1 *kW* at 27 °*C*. The lid of the container is open and energy dissipates at rate of 160 *J/s*. In how much time temperature will rise from 27°C to 77°*C* [Given specific heat of water is 4.2 *kJ/kg*] **[IIT-JEE (Screening) 2005]**

(a) 8 *min* 20 *s* (b) 6 *min* 2 *s*

(c) 7 *min* (d) 14 *min*

45. For ensuring dissipation of same energy in all three resistors (R_1, R_2, R_3) connected as shown in figure, their values must be related as] **[AIIMS 2005]**



(a) $R_1 = R_2 = R_3$

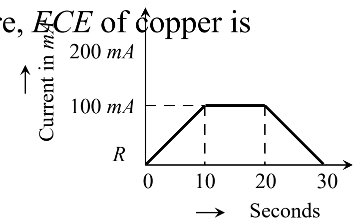
(b) $R_2 = R_3$ and $R_1 = 4R_2$

(c) $R_2 = R_3$ and $R_1 = \frac{1}{4}R_2$

(d) $R_1 = R_2 + R_3$

GQ Graphical Questions

1. In a copper voltameter, mass deposited in 30 *second* is *m gm*. If the time-current graph is as shown in figure, *ECE* of copper is



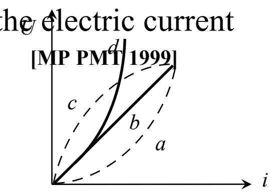
(a) *m*

(b) $m/2$

(c) 0.1 *m*

(d) 0.6 *m*

2. Which of the following plots may represent the thermal energy produced in a resistor in a given time as a function of the electric current **[MP PMT 1999]**



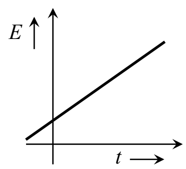
(a) *a*

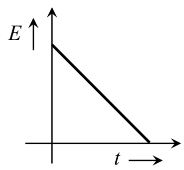
(b) *b*

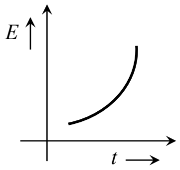
(c) *c*

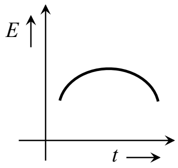
(d) *d*

3. Two different metals are joined end to end. One end is kept at constant temperature and the other end is heated to a very high temperature. The graph depicting the thermo e.m.f. is **[DCE 2000]**

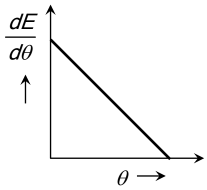
(a)


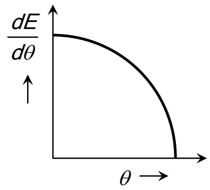
(b)


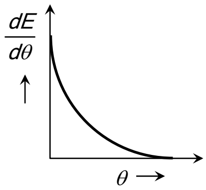
(c) 

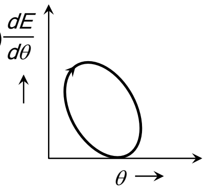
(d) 

4. Which of the following graphs shows the variation of thermoelectric power with temperature difference between hot and cold junction in thermocouples

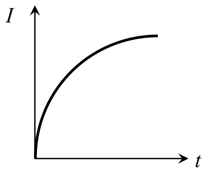
(a) 

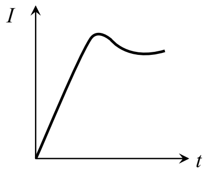
(b) 

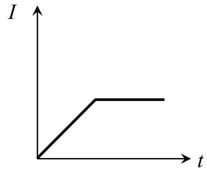
(c) 

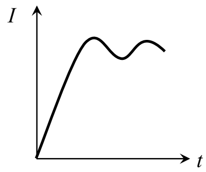
(d) 

5. When an electric heater is switched on, the current flowing through it (i) is plotted against time (t). Taking into account the variation of resistance with temperature, which of the following best represents the resulting curve

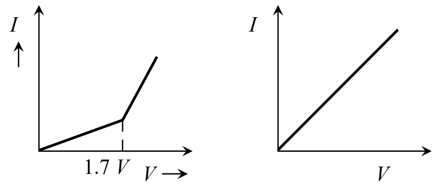
(a) 

(b) 

(c) 

(d) 

6. The V-i graphs A and B drawn for two voltameters. Identify each graph



(A) (B)

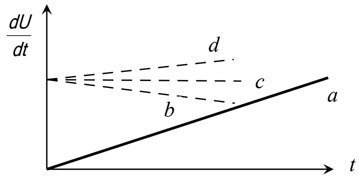
(a) A for water voltameter and B for Cu voltameter

(b) A for Cu voltameter and B for water voltameter

(c) Both A and B represents Cu voltameter

(d) None of these

7. A constant current i is passed through a resistor. Taking the temperature coefficient of resistance into account, indicate which of the plots shown in figure best represents the rate of production of thermal energy in the resistor



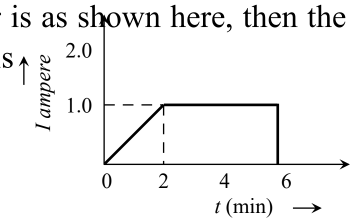
(a) a

(b) b

(c) c

(d) d

8. In a copper voltameter, mass deposited in 6 minutes is m gram. If the current-time graph for the voltameter is as shown here, then the E.C.E of the copper is



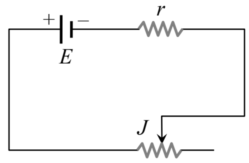
(a) $m / 5$

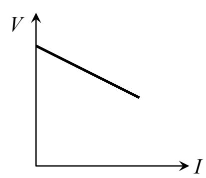
(b) $m / 300$

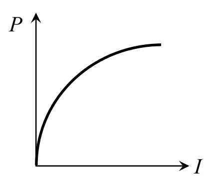
(c) $5\,m$

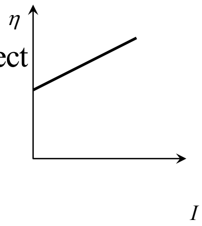
(d) $m / 18000$

9. Battery shown in figure has e.m.f. E and internal resistance r. Current in the circuit can be varied by sliding the contact J. If at any instant current flowing through the circuit is I, potential difference between terminals of the cell is V, thermal power generated in the cell is equal to η fraction of total electrical power generated in it.; then which of the following graph is correct



(a) 

(b) 

(c) 

(d) Both (a) and (b) are correct

Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : The possibility of an electric bulb fusing is higher at the time of switching ON and OFF

Reason : Inductive effects produce a surge at the time of switch ON and OFF **[AIIMS 2003]**

2. Assertion : The 200 W bulbs glows with more brightness then 100 W bulbs.

Reason : A 100 W bulb has more resistance than a 200 W bulb.

3. Assertion : Fuse wire must have high resistance and low melting point.

Reason : Fuse is used for small current flow only.

4. Assertion : Two electric bulbs of 50 and 100 W are given. When connected in series 50 W bulb glows more but when connected parallel 100 W bulb glows more.

Reason : In series combination, power is directly proportional to the resistance of circuit. But in parallel combination, power is inversely proportional to the resistance of the circuit.

5. Assertion : Two bulbs of same wattage, one having a carbon filament and the other having a metallic filament are connected in series. Metallic bulbs will glow more brightly than carbon filament bulb.

Reason : Carbon is a semiconductor.

6. Assertion : An electric bulb is first connected to a dc source and then to a ac source having the same brightness in both the cases.

Reason : The peak value of voltage for an A.C. source is $\sqrt{2}$ times the root mean square voltage.

7. Assertion : Current is passed through a metallic wire, heating it red. When cold water is poured on half of its portion, then rest of the half portion become more hot.

Reason : Resistances decreases due to decrease in temperature and so current through wire increases.

8. Assertion : Through the same current flows through the line wires and the filament of the bulb but heat produced in the filament is much higher then that in line wires.

Reason : The filament of bulbs is made of a material of high resistance and high melting point.

9. Assertion : Neutral temperature of a thermocouple does not depend upon temperature of cold junction.

Reason : Its value is constant for the given metals of the couple.

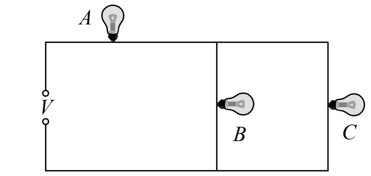
10. Assertion : In practical application, power rating of resistance is not important.

Reason : Property of resistance remain same even at high temperature.

11. Assertion : Leclanche cell is used, when constant supply of electric current is not required.

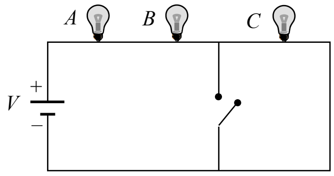
Reason : The e.m.f. of a Leclanche cell falls, if it is used continuously.

12. Assertion : In the given circuit if lamp B or C fuses then light emitted by lamp A decreases.



Reason : Voltage on *A* decreases.

13. Assertion : If three identical bulbs are connected in series as shown in figure then on closing the switches. Bulb *C* short circuited and hence illumination of bulbs *A* and *B* decreases.



Reason : Voltage on *A* and *B* decreases

14. Assertion : Heat is generated continuously is an electric heater but its temperature becomes constant after some time.

Reason : At the stage when heat produced in heater is equal to the heat dissipated to its surrounding the temperature of heater becomes constant.

15. Assertion : Electric appliances with metallic body; *e.g.* heaters, presses etc, have three pin connections, whereas an electric bulb has a two pin connection. **[AIIMS 1996]**

Reason : Three pin connections reduce heating of connecting cables.

16. Assertion : A laser beam 0.2 *W* power can drill holes through a metal sheet, whereas 1000 *W* torch-light cannot.

Reason : The frequency of laser light is much higher then that of torch light. **[AIIMS 1996]**

17. Assertion : A domestic electrical appliance, working on a three pin will continue working even if the top pin is removed. **[AIIMS 1995]**

Reason : The third pin is used only as a safety device.

18. Assertion : In all conductors, for studying the thermoelectric behaviour or metals, lead is taken as a reference metal.

Reason : In lead, the Thomson effect is negative.

19. Assertion : The presence of water molecules makes separation of ions easier in electrolyte.

Reason : The presence of water molecules in electrolyte decreases the resistance of electrolyte.

20. Assertion : Thermocouple acts as a heat engine.

Reason : When two junctions of thermocouple are at different temperature, thermo e.m.f. is produced.

21. Assertion : When temperature of cold junction of a thermocouple is lowered, the value of neutral temperature of this thermocouple is raised.

Reason : When the difference of temperature of two junction is raised, more thermo e.m.f. is produced.

Answers

Heating Effect of Current

1	a	2	b	3	c	4	b	5	b
6	c	7	c	8	a	9	b	10	c
11	a	12	c	13	c	14	a	15	d
16	d	17	b	18	c	19	c	20	a
21	d	22	a	23	a	24	c	25	d
26	d	27	c	28	c	29	b	30	b
31	b	32	b	33	a	34	d	35	c
36	b	37	d	38	b	39	a	40	a
41	a	42	b	43	d	44	d	45	a
46	c	47	a	48	b	49	a	50	a
51	b	52	c	53	a	54	c	55	c
56	a	57	d	58	b	59	d	60	a
61	d	62	a	63	d	64	b	65	b

66	d	67	a	68	a	69	a	70	c
71	a	72	d	73	a	74	b	75	a
76	d	77	b	78	b	79	d	80	d
81	a	82	d	83	d	84	d	85	a
86	a	87	a,d	88	a	89	b	90	a
91	b	92	a	93	b	94	a	95	b
96	a	97	c	98	b	99	c	100	a
101	b	102	c	103	a	104	a	105	d
106	c	107	a	108	b	109	b	110	d
111	c	112	b	113	c	114	a	115	c
116	c	117	d	118	a	119	d	120	c
121	b	122	d	123	a	124	a	125	a
126	c	127	a	128	d	129	a	130	c
131	a	132	c	133	c	134	c	135	b
136	c	137	c	138	c	139	b	140	d
141	a	142	c	143	d	144	c	145	b
146	c	147	c	148	c	149	a	150	c
151	a	152	c	153	c				

Chemical Effect of Current

1	d	2	c	3	d	4	d	5	c
6	d	7	b	8	d	9	b	10	a
11	b	12	b	13	b	14	c	15	b
16	a	17	b	18	c	19	a	20	d
21	c	22	b	23	c	24	a	25	d
26	b	27	a	28	c	29	a	30	a
31	b	32	d	33	b	34	a	35	b
36	c	37	c	38	b	39	d	40	b
41	c	42	b	43	d	44	a	45	c
46	c	47	a	48	b	49	b	50	b
51	a	52	d	53	d	54	a	55	c
56	c	57	d	58	c	59	a		

Thermo-Electricity

1	b	2	c	3	d	4	a	5	c
6	b	7	a	8	a	9	a	10	a
11	a	12	d	13	b	14	c	15	b
16	b	17	a	18	a	19	a	20	b
21	d	22	a	23	b	24	a	25	b
26	c	27	c	28	d	29	c	30	a
31	a	32	b	33	d	34	c	35	c
36	d	37	c	38	d	39	d	40	a
41	d	42	a	43	b	44	b		

Critical Thinking Questions

1	d	2	b	3	b	4	d	5	c
6	d	7	a	8	c	9	d	10	b
11	c	12	b	13	d	14	a	15	a
16	d	17	d	18	a	19	a	20	b
21	c	22	b	23	b	24	b	25	d
26	a	27	b	28	c	29	a	30	b
31	d	32	a	33	a	34	d	35	d
36	d	37	d	38	d	39	b	40	b
41	a	42	d	43	b	44	a	45	c

Graphical Questions

1	b	2	d	3	d	4	a	5	b
6	a	7	d	8	b	9	d		

Assertion and Reason

1	a	2	a	3	c	4	a	5	d
6	e	7	a	8	a	9	b	10	d
11	a	12	a	13	d	14	a	15	c
16	c	17	a	18	c	19	b	20	b
21	d								

Answers and Solutions

Heating Effect of Current

1. (a) 1 $kWh = 1000\ W \times 3600\ sec = 36 \times 10^5\ W\text{-}sec$ (or J)

2. (b) $P \propto \frac{1}{R} \Rightarrow \frac{P_1}{P_2} = \frac{R_2}{R_1} \Rightarrow \frac{200}{100} = \frac{R_2}{R_1} \Rightarrow R_2 = 2R_1$

3. (c) $P = \frac{V^2}{R} \Rightarrow R_1 = \frac{V_1^2}{P_1} = \frac{(200)^2}{40} = 1000\Omega$

   and $R_2 = \frac{V_2^2}{P_2} = \frac{(200)^2}{100} = 400\Omega$

4. (b) When two bulbs are connected in series, the current will be same in both the bulbs. As a result potential drop will be more in the bulb of higher resistance *i.e.,* bulb of lower wattage.

5. (b) When 1 bulb fuses, the total resistance of the circuit decreases hence the current increases. Since $P = i^2 R$, therefore illumination increases.

6. (c)

7. (c) We know that $\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{2}{1}$

8. (a) $P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$ and $R \propto l$ $\therefore P \propto \frac{1}{l} \Rightarrow \frac{P_1}{P_2} = \frac{l_1}{l_2} = \frac{2}{1}$

9. (b) $R_{\text{conductor}} \propto$ Temperature and $R_{\text{semiconductor}} \propto \frac{1}{\text{Temperature}}$

10. (c)

11. (a) In series, current is same in both the bulbs, hence $P \propto R (P = i^2 R)$ $\therefore \frac{P_1}{P_2} = \frac{R_1}{R_2} = \frac{1}{2}$

12. (c) In this case, $P = \frac{V^2}{R}$ or $P \propto \frac{1}{R}$ and R will be minimum, when divided four parts are joints in parallel to the battery.

13. (c) Length is immaterial for an electric fuse wire.

14. (a) $P_{Rated} \propto \frac{1}{R}$ and $R \propto \frac{1}{(\text{Thickness of filament})^2}$

So $P_{Rated} \propto (\text{Thickness of filament})^2$

15. (d) In series $P_S = \frac{P}{n} \Rightarrow 10 = \frac{P}{3} \Rightarrow P = 30\, W$

In parallel $P_P = nP = 3 \times 30 = 90\, W$

16. (d) Energy consumed in $kWh = \frac{Watt \times hour}{1000}$

$\Rightarrow$ For 30 days, $P = \frac{10 \times 50 \times 10}{1000} \times 30 = 150 kWh$

17. (b) $W = qV$ also $P = i \times V = \frac{W}{t}$

18. (c) Because given voltage is very high,

19. (c) $P_p = nP = 2 \times 40 = 80\, W$

20. (a) In series, $P \propto R (\because i$ is same), *i.e.* in series Fine wire (high R) liberates more energy.

In parallel, $P \propto \frac{1}{R} (V$ is same) *i.e.* thick wire (less R) liberates more energy.

21. (d) Resistance of the bulb $= \frac{V^2}{P_{Ratate}} = \frac{220 \times 220}{100} = 484 \Omega$

When connected with 110 V, the power consumed $P_{Consumed} = \frac{V^2}{R} = \frac{110 \times 110}{484} = 25 W$

22. (a) The resistance of 25 W bulb is greater than 100 W bulb. So for the same current, heat produced will be more in 25 W bulb. So it will glow more brightly.

23. (a) Equivalent resistance in the second case $= R_1 + R_2 = R$

Now, we know that $P \propto \frac{1}{R}$

Since in the second case the resistance $(R_1 + R_2)$ is higher than that in the first case (R_1).

Therefore power dissipation in the second case will be decreased.

24. (c) For constant voltage, we know that $P \propto \frac{1}{R}$

So higher the power, lower will be the resistance.

25. (d) $P = \frac{V^2}{R}$ but $R = \frac{\rho l}{A} \Rightarrow P = \frac{V^2}{\rho l / A} = \frac{AV^2}{\rho l}$. Since $\frac{AV^2}{l}$ is constant as per given conditions So $P \propto \frac{1}{\rho}$.

26. (d) Power consumed means heat produced.

For constant potential difference $P_{\text{consumed}} = \text{Heat} \propto \frac{1}{R_{eq}}$

$\therefore \frac{H_1}{H_2} = \frac{R_2}{R_1} = \frac{R/2}{2R} = \frac{1}{4}$

(Since $R_2 = \frac{R.R}{R + R} = \frac{R}{2}$ and $R_1 = R + R = 2R$)