15 - THERMAL AND CHEMICAL EFFECTS OF CURRENTS

(Answers at the end of all questions)

1) 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
(a) four times (b) doubled (c) halved (d) one-fourth [AIEEE 2005]

2) 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
(a) $\frac{q}{1+\frac{z_2}{z_1}}$ (b) $\frac{q}{1+\frac{z_1}{z_2}}$ (c) $q\frac{z_2}{z_1}$ (d) $q\frac{z_1}{z_2}$ [AIEEE 2005]

3) Time taken by a 836 W heater to heat one litre of water from 10° C to 40° C is
(a) 50 s (b) 100 s (c) 150 s (d) 200 s [AIEEE 2004]

4) The thermo-emf 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° C. If the cold junction is kept at 0° C, then the neutral temperature is
(a) 700° C (b) 350° C (c) 1400° C (d) no neutral temperature is possible for this thermocouple [AIEEE 2004]

5) The electrochemical equivalent of metal is 3.3×10^{-7} kg per coulomb. The mass of the metal liberated when a three ampere current is passed for 2 seconds will be
(a) 19.8×10^{-7} kg (b) 9.9×10^{-7} kg (c) 6.6×10^{-7} kg (d) 1.1×10^{-7} kg [AIEEE 2004]

6) A 220 volt, 1000 watt bulb is connected across 110 volt mains supply. The power consumed will be
(a) 1000 watt (b) 750 watt (c) 500 watt (d) 250 watt [AIEEE 2003]

7) An electric motor operates at 20 rev / sec. What will be the approximate power delivered by the motor, if it supplies a torque of 75 N-m ?
(a) 1550 W (b) 4040 W (c) 7730 W (d) 9420 W [AIEEE 2003]

8) The negative Zn pole of a Daniell cell, sending a constant current through a circuit, decreases in mass by 0.13 g in 30 minutes. If the electrochemical equivalents of Zn and Cu are 32.5 and 31.5 respectively, then increase in the mass of positive Cu pole in this time is
(a) 0.242 g (b) 0.180 g (c) 0.141 g (d) 0.126 g [AIEEE 2003]

9) 2 litre water kept in a kettle is heated by 1 KW power source. Kettle is open and it loses heat at the rate of 160 J/s. The time taken for the temperature of kettle to change from 27° C to 77° C is
(a) 8 min 20 sec (b) 6 min 20 sec (c) 5 min (d) 7 min [IIT 2005]

10) An ideal gas enclosed in an insulated vessel is heated through a coil of resistance 100 Ω carrying current of 1 A for 5 minutes. Then change in its internal energy will be
(a) 30 KJ (b) 20 KJ (c) 2 KJ (d) 3 KJ [IIT 2005]

(Answers at the end of all questions)

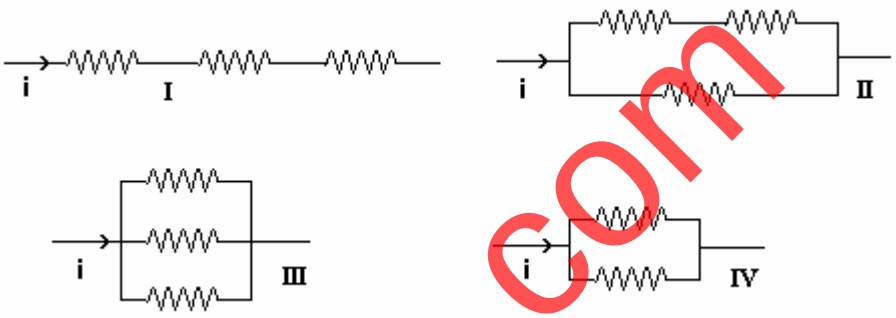
11) The three resistors of equal value are arranged in the different combinations shown below. Arrange them in increasing order of power dissipation.

(a) III < II < IV < I

(b) II < III < IV < I

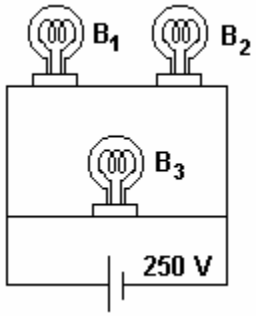
(c) I < IV < III < II

(d) I < III < II < IV



[IIT 2003]

12) 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



(a) $W_1 > W_2 = W_3$ (b) $W_1 > W_2 > W_3$

(c) $W_1 < W_2 = W_3$ (d) $W_1 < W_2 < W_3$

[IIT 2002]

13) A wire of length L and 3 identical cells of negligible internal resistances are connected in series. Due to the current, the temperature of the wire is raised by ΔT in time t. A number N of similar cells is now connected in series with a wire of the same material and cross-section but of length 2L. The temperature of the wire is raised by the same amount ΔT in the same time. The value of N is

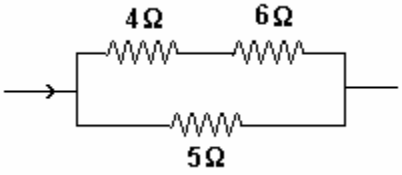
(a) 4 (b) 6 (c) 8 (d) 9 [IIT 2001]

14) A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if

(a) both the length and the radius of the wire are halved
(b) both the length and the radius of the wire are doubled
(c) the radius of the wire is doubled
(d) the length of the wire is doubled [IIT 1980]

15) In the circuit shown in the figure, the heat produced in the 5 Ω resistor due to the current flowing through it is 10 cal / s. The heat generated in the 4 Ω resistor is

(a) 1 cal / s (b) 2 cal / s (c) 3 cal / s (d) 4 cal / s



16) Two resistors R_1 and R_2 when connected across 120 V consume power at the rate of 25 W and 100 W respectively when connected in series and parallel across the same 120 V line. Then the ratio of power consumed by R_1 to that by R_2 is

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

17) Two electric bulbs, one rated P_1 watt at V_1 volt and the other rated P_2 watt at V_2 volt are connected in parallel across V volt mains, V being less than V_1 and V_2, then the total power consumed by them is

(a) $V\left(\frac{P_1}{V_1} + \frac{P_2}{V_2}\right)$ (b) $\frac{1}{V}(P_1 V_1 + P_2 V_2)$

(c) $V^2\left(\frac{P_1}{V_1^2} + \frac{P_2}{V_2^2}\right)$ (d) $\left(P_1 V_1^2 + P_2 V_2^2\right)\frac{1}{V^2}$

18) Find the power wasted in the transmission cables of resistance 0.05 Ω when 10 kW is transmitted at 200 V.

(a) 0.0125 kW (b) 0.125 kW (c) 25 kW (d) 37.5 kW

19) Two electric bulbs, one rated P_1 watt at V_1 volt and the other rated P_2 watt at V_2 volt are connected in series across V volt mains, V being such that no bulb fuses, then the total power consumed by them is

(a) $\frac{V^2 P_1 P_2}{V_1^2 P_2 + V_2^2 P_1}$ (b) $\frac{V_1 V_2 P_1 P_2}{V^2(P_1 + P_2)}$

(c) $\frac{V^2 P_1 P_2}{V_1 V_2 (P_1 + P_2)}$ (d) $\frac{P_1 P_2}{(P_1 + P_2)}$

20) A house is served by a 220 V supply line. In a circuit protected by a fuse marked 9 A, the maximum number of 60 W lamps in parallel that can be turned on is

(a) 44 (b) 22 (c) 55 (d) 33

21) A tap supplies water at 22° C. A man takes 1 litre of water per minute at 37° C from the geyser. The power of geyser is

(a) 2100 W (b) 725 W (c) 1050 W (d) 1575 W

22) A wire of uniform cross-section when connected directly across a 200 volt mains produces x cal / s of heat. If the wire is cut into 10 parts of equal length which are then connected in parallel to 100 volt mains, the heat produced in cal / s will be

(a) 25 x (b) 50 x (c) 75 x (d) 100 x

(Answers at the end of all questions)

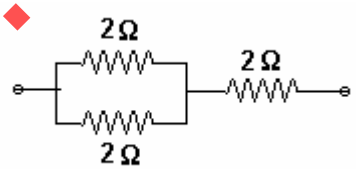
23) A cell sends a current through a resistance R_1 for time t. Then the same cell sends current through another resistance R_2 for the same time t. If the same amount of heat is developed in both the resistances, then the internal resistance of the cell is

(a) $\frac{R_1 + R_2}{2}$ (b) $\frac{R_1 - R_2}{2}$ (c) $\sqrt{R_1 R_2}$ (d) $\frac{1}{2}\sqrt{R_1 R_2}$

24) The power of a heater is 500 W at 800° C. What will be its power at 200° C if $\alpha = 4 \times 10^{-4}$ per ° C ?

(a) 484 W (b) 672 W (c) 526 W (d) 611 W

25) Three resistors are connected as shown in the adjoining figure. The maximum power consumed by each resistor is 18 W. Then the maximum power consumed by the combination is



(a) 54 W (b) 27 W (c) 36 W (d) 18 W

26) The E. C. E. of silver is 1.118×10^{-6} kg / C. Its atomic weight is 108. The Avogadro number is 6.02×10^{23} per gm. mole. The charge on one Ag ion is

(a) 1.6×10^{-19} C (b) 3.2×10^{-19} C (c) 4.8×10^{-19} C (d) 2.4×10^{-19} C

27) Material of heating element of electric heater should have

(a) high resistivity and high melting point (b) high resistivity and low melting point
(c) low resistivity and low melting point (d) low resistivity and high melting point

28) An electric kettle has two coils. When one is switched on, water in the kettle boils in 6 min. With the other it takes 3 min. When they are connected in series and used together, time taken to reach the boiling point is x min. When both are used together in parallel connection, time taken is y min. Then x / y =

(a) 1 (b) 2 (c) 0.5 (d) 4.5

29) Two heating wires have lengths in the ratio 1 : 2. They are used by first connecting in series and then in parallel. The ratio of heat produced in the two cases will be

(a) 2 : 5 (b) 5 : 2 (c) 2 : 9 (d) 9 : 2

30) Resistivity of iron is 10^{-7} Ω-m. The resistance of an iron wire is 1 Ω. If its diameter and length are both doubled, the resistivity in Ω-m will be equal to

(a) 10^{-7} (b) 2×10^{-7} (c) 3×10^{-7} (d) 4×10^{-7}

(Answers at the end of all questions)

31) How much current should pass through acidulated water for 100 s to liberate 0.224 litre of hydrogen ?

(a) 22.4 A (b) 19.3 A (c) 9.65 A (d) 1 A

32) If 100 kWh of energy is consumed at 33 V in a copper voltameter, what is the mass of copper liberated ? Take E. C. E. of copper as 0.33×10^{-6} kg / C.

(a) 3.6 kg (b) 3.3 kg (c) 1 kg (d) 1 mg

33) Which of the following is not reversible ?

(a) Seebeck effect (b) Peltier effect (c) Joule's effect (d) Thomson effect

34) A copper-iron thermocouple is connected to an external battery of emf E. On doubling the emf of the battery, the heat produced at a junction

(a) remains same (b) becomes half (c) doubles up (d) becomes four times

35) What is the nature of graph between temperature and thermo-emf ?

(a) hyperbola (b) straight line (c) parabola (d) some other curve

36) The unit of Peltier coefficient is

(a) J / C (b) J / A (c) J / V (d) None of these

37) The unit of Thomson's coefficient is

(a) J / C (b) J / A (c) J / V (d) None of these

38) Which is a characteristic temperature of thermocouple ?

(a) cold junction temperature (b) hot junction temperature
(c) inverse temperature (d) neutral temperature

39) During electroplating, 1.5 g of silver is deposited in 25 min. The ammeter connected in series reads 1 A. Approximately by what percentage is the ammeter reading incorrect?

(a) 10 % less than correct value (b) 11 % more than correct value
(c) 13 % less than correct value (d) 12 % more than correct value

Answers

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

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
c	a	c	d	b	a	a	d	c	a	b	a	c	c	c	a	d	d	d