17

CURRENT ELECTRICITY

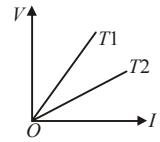
MCQs with One Correct Answer

1. At what temperature will the resistance of a copper wire becomes three times its value at 0°C? (Temperature coefficient of resistance of copper is 4×10^{-3}/°C)

(a) 600°C (b) 500°C

(c) 450°C (d) 400°C

2. The voltage V and current I graphs for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is



(a) $T_1 > T_2$ (b) $T_1 < T_2$

(c) $T_1 = T_2$ (d) $T_1 = \frac{1}{T_2}$

3. A cell of emf E is connected across a resistance R. The potential difference between the terminals of the cell is found to be V volt. Then the internal resistance of the cell must be

(a) $(E-V)R$ (b) $\frac{(E-V)}{V}R$

(c) $\frac{2(E-V)R}{E}$ (d) $\frac{2(E-V)V}{R}$

4. Forty electric bulbs are connected in series across a 220 V supply. After one bulb is fused the remaining 39 are connected again in series across the same supply. The illumination will be

(a) more with 40 bulbs than with 39

(b) more with 39 bulbs than with 40

(c) equal in both the cases

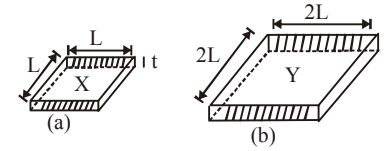
(d) None of these

5. In a Wheatstone's bridge, three resistances P, Q and R connected in the three arms and the fourth arm is formed by two resistances S_1 and S_2 connected in parallel. The condition for the bridge to be balanced will be

(a) $\frac{P}{Q} = \frac{2R}{S_1 + S_2}$ (b) $\frac{P}{Q} = \frac{R(S_1 + S_2)}{S_1 S_2}$

(c) $\frac{P}{Q} = \frac{R(S_1 + S_2)}{2S_1 S_2}$ (d) $\frac{P}{Q} = \frac{R}{S_1 + S_2}$

6. Figure shows two squares, X and Y, Cut from a sheet of metal of uniform thickness t. X and Y have sides of length L and 2 L, respectively.



The resistance R_x and R_y of the squares are measured between the opposite faces shaded in Fig. What is the value of R_x/R_y?

(a) 1/4 (b) 1/2

(c) 1 (d) 2

7. Two different conductors have same resistance at 0°C. It is found that the resistance of the first conductor at t_1°C is equal to the resistance of the second conductor at t_2°C. The ratio of the temperature coefficients of resistance of the conductors, $\frac{\alpha_1}{\alpha_2}$ is

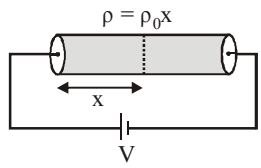
(a) $\frac{t_1}{t_2}$ (b) $\frac{t_2 - t_1}{t_2}$

(c) $\frac{t_2 - t_1}{t_1}$ (d) $\frac{t_2}{t_1}$

8. An electrical cable of copper has just one wire of radius 9 mm. Its resistance is 5 ohm. This single copper wire of the cable is replaced by 6 different well insulated copper wires of same length in parallel, each of radius 3 mm. The total resistance of the cable will now be equal to

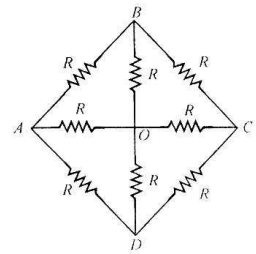
(a) 7.5 ohm (b) 45 ohm
(c) 90 ohm (d) 270 ohm

9. A cylindrical solid of length L and radius a is having varying resistivity given by $\rho = \rho_0 x$, where ρ_0 is a positive constant and x is measured from left end of solid. The cell shown in the figure is having emf V and negligible internal resistance. The magnitude of electric field as a function of x is best described by



(a) $\frac{2V}{L^2}x$ (b) $\frac{2V}{\rho_0 L^2}x$
(c) $\frac{V}{L^2}x$ (d) None of these

10. In the network shown, each resistance is equal to R. The equivalent resistance between adjacent corners A and D is



(a) R
(b) $\frac{2}{3}R$
(c) $\frac{3}{7}R$
(d) $\frac{8}{15}R$

11. A current source drives a current in a coil of resistance R_1 for a time t. The same source drives current in another coil of resistance R_2 for same time. If heat generated is same, find internal resistance of source. [given $R_1 > R_2$]

(a) $\frac{R_1R_2}{R_1+R_2}$ (b) R_1+R_2
(c) zero (d) $\sqrt{R_1R_2}$

12. The length of a wire of a potentiometer is 100 cm, and the e. m.f. of its standard cell is E volt. It is employed to measure the e.m.f. of a battery whose internal resistance is 0.5Ω. If the balance point is obtained at $\ell = 30$ cm from the positive end, the e.m.f. of the battery is

(a) $\frac{30E}{100.5}$ (b) $\frac{30E}{(100-0.5i)}$
(c) $\frac{30(E-0.5i)}{100}$ (d) $\frac{30E}{100}$

where i is the current in the potentiometer wire.

13. 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

(a) $(P_1+P_2)watt$ (b) $\left(\sqrt{P_1P_2}\right)watt$
(c) $\left(\frac{P_1P_2}{P_1+P_2}\right)watt$ (d) $\left(\frac{P_1+P_2}{P_1P_2}\right)watt$

14. In an experiment of potentiometer for measuring the internal resistance of primary cell a balancing length ℓ is obtained on the potentiometer wire when the cell is open circuit. Now the cell is short circuited by a resistance *R*. If *R* is to be equal to the internal resistance of the cell the balancing length on the potentiometer wire will be

(a) ℓ (b) 2ℓ
(c) $\ell/2$ (d) $\ell/4$

15. In a conductor, if the number of conduction electrons per unit volume is 8.5×10^{28} m^{-3} and mean free time is 25 *fs* (femto second), it's approximate resistivity is: ($m_e = 9.1 \times 10^{-31}$ kg)

(a) 10^{-6} Ω m (b) 10^{-7} Ωm
(c) 10^{-8} Ωm (d) 10^{-5} Ωm

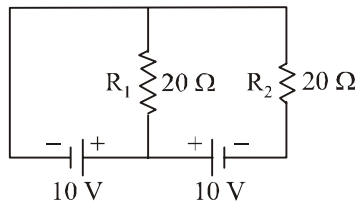
16. Drift speed of electrons, when 1.5 A of current flows in a copper wire of cross section 5 mm^2, is *v*. If the electron density in copper is $9 \times 10^{28}/m^3$ the value of *v* in mm/s close to (Take charge of electron to be = 1.6×10^{-19}C)

(a) 0.02 (b) 3
(c) 2 (d) 0.2

17. A cell of internal resistance *r* drives current through an external resistance R. The power delivered by the cell to the external resistance will be maximum when :

(a) R = 0.001 *r* (b) R = 1000 *r*
(c) R = 2*r* (d) R = *r*

18. In the given circuit the cells have zero internal resistance. The currents (in Amperes) passing through resistance R_1 and R_2 respectively, are:



(a) 1, 2 (b) 2, 2

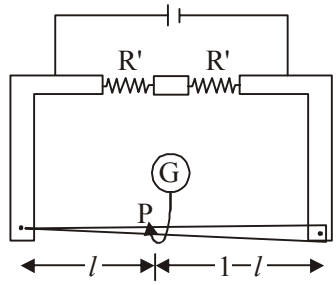
(c) 0.5, 0 (d) 0, 1

19. In a building there are 15 bulbs of 45 W, 15 bulbs of 100 W, 15 small fans of 10 W and 2 heaters of 1 kW. The voltage of electric main is 220 V. The minimum fuse capacity (rated value) of the building will be:

(a) 10 A (b) 25 A

(c) 15 A (d) 20 A

20. In a meter bridge, the wire of length 1 m has a non-uniform cross-section such that, the variation $\frac{dR}{dl}$ of its resistance R with length l is $\frac{dR}{dl} \propto \frac{1}{\sqrt{l}}$. Two equal resistances are connected as shown in the figure. The galvanometer has zero deflection when the jockey is at point P. What is the length AP?

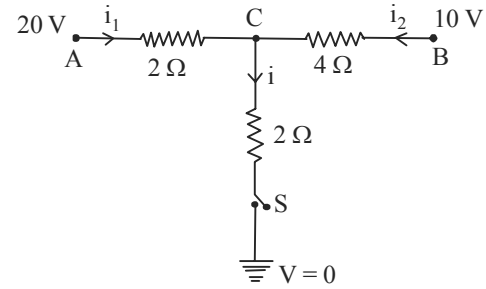


(a) 0.2m (b) 0.3m

(c) 0.25m (d) 0.35m

Numeric Value Answer

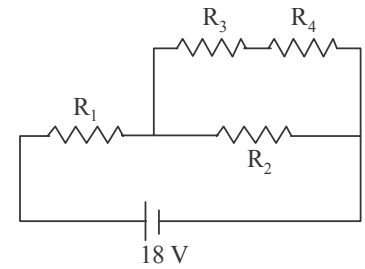
21. When the switch S, in the circuit shown, is closed then the value of current i (in ampere) will be:



22. A 100 watt bulb working on 200 volt has resistance R and a 200 watt bulb working on 100 volt has resistance S. If the R/S is $\frac{8}{x}$. Find the value of x.

23. A copper wire is stretched to make it 0.5% longer. The percentage change in its electrical resistance if its volume remains unchanged is:

24. In the given circuit the internal resistance of the 18 V cell is negligible. If $R_1 = 400\Omega$, $R_3 = 100\ \Omega$ and $R_4 = 500\ \Omega$ and the reading of an ideal voltmeter across R_4 is 5 V, then the value of R_2 (in Ω) will be:



25. A uniform metallic wire has a resistance of 18 Ω and is bent into an equilateral triangle. Then, the resistance (in Ω) between any two vertices of the triangle is:

26. A 2 W carbon resistor is color coded with green, black, red and brown respectively. The maximum current (in mA) which can be passed through this resistor is:

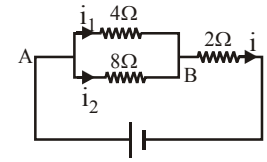
27. A current of 2 mA was passed through an unknown resistor which dissipated a power of 4.4 W. Dissipated power (in watt) when an ideal power supply of 11 V is connected across it is:

28. The amount of charge Q passed in time t through a cross-section of a wire is $Q = (5t^2 + 3t + 1)$ coulomb.

The value of current (in ampere) at time t = 5 s is

29. A current of 1 mA flows through a copper wire. How many electrons will pass through a given point in each second?

30. In the circuit shown in Fig, the current in 4 Ω resistance is 1.2 A. What is the potential difference (in volt) between B and C?



ANSWER KEY																			
1	(b)	**4**	(b)	**7**	(d)	**10**	(d)	**13**	(a)	**16**	(a)	**19**	(d)	**22**	(1)	**25**	(4)	**28**	(53)
2	(a)	**5**	(b)	**8**	(a)	**11**	(d)	**14**	(c)	**17**	(d)	**20**	(c)	**23**	(1)	**26**	(20)	**29**	(6.25×10^{15})
3	(b)	**6**	(c)	**9**	(a)	**12**	(d)	**15**	(c)	**18**	(c)	**21**	(5)	**24**	(300)	**27**	(11×10^{-5})	**30**	(3.6)